Analysing Foreign Direct Investment in Namibia: The Nature and Determinants of Spillovers

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Abstract

This study aims to provide evidence on FDI spillovers for Namibian firms in both the manufacturing and services sector using conventional and new measures of spillovers. The study also aims to identify the foreign firm and host country characteristics that determine these spillovers. The benefits of FDI to domestic firms encompass technology and knowledge diffusion through two main spillover channels; horizontal and vertical. While literature has attempted to measure FDI spillovers, evidence is focused on few horizontal spillover channels such as share of output and employment. However these do not represent the universe of spillover channels and disregard other horizontal spillover channels such as access to export markets, access to technology, innovation and gender differences in employment. The two sectors will largely differ with regards to competitive structures and sales, linkages created in the host country, the type and sophistication of technology they introduce, intensity and characteristics of labour. Moreover, gender differences arise with regards to investment in training and development, knowledge transmission and skill levels which is expected to result in differences in spillovers. Further, there is scarcity of evidence on vertical spillovers. In addition, there are sectoral differences in spillovers due to the different dynamics in the manufacturing and services sector in how they operate, yet existing evidence is dominant for the former. While there is evidence that spillovers vary in size and magnitude between countries, the determining factors of spillovers, such as foreign firm characteristics and host country characteristics are yet to be determined. Namibia provides an insightful context to study due to its unique geographical and economic characteristics as well as its policy environment. Data from the World Bank Enterprises Survey on Namibia for the periods 2006 and 2014 is used to compute relevant indicators on horizontal and vertical spillovers. Both OLS and IV 2SLS regression models are estimated on the determinants of FDI spillovers. The findings reveal strong horizontal spillovers through the female employment, market-access effects, innovation and technology diffusion channels. Backward linkages are stronger than forward linkages yet have declined over the years. Overall, spillovers for the manufacturing sector are stronger than the services sector. Determinants that show consistent relationships with spillover include the sector, firm age, access to finance and transport. Foreign ownership only shows a relationship with the innovation and technology spillovers.

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1. Introduction

Foreign Direct Investment (FDI) is a critical tool for achieving economic growth, especially for emerging countries as it introduces new capital, technology, and know-how. The numerous benefits of FDI towards domestic firms are known as spillovers. This refers to instances where MNCs' advanced technology and superior knowledge spills over to domestic firms, thereby, improving their productivity. In this context, two channels of spillovers are often discussed; horizontal and vertical spillovers. The former refers to spillovers from MNCs to local firms in the same industry. The latter, on the other hand, refers to spillovers through supply chain and distribution channels (customer-supplier relationship) (Konings, 2000; Javorcik, 2004; Moss, et al., 2004; Beugelsdijk, et al., 2008; Gorg, et al., 2009; Hailu, 2010; Gerschewski, 2013; Kinda, 2013; Mebratie & Van Bergeijk, 2013; Farole, et al., 2014).

Despite the theoretically defined benefits, empirical evidence on FDI spillovers is, generally, mixed. A thread of studies show evidence of a strong presence of horizontal spillovers resulting from FDIs (see e.g., Tytell & Yudaeva, 2007; Abraham et al., 2010; Pfeiffer et al., 2014). Others find either weak evidence or no evidence at all (see e.g., Kugler, 2006; Farole & Winkler, 2014). Similarly, the literature examining vertical spillovers document mixed results (see e.g., Alfaro et al. 2004; Blalock & Gertler, 2008; Zuo & Round 2012; and Winkler, 2014). Further, studies testing simultaneously for both horizontal and vertical spillovers also report mixed evidence of both spillovers (Javorcik, 2004; Iyer, 2009; Damijan et al., 2013; and Fatima, 2016).

The mixed results may be a consequence of the empirical measures of spillovers. The proxies used to measure spillovers have evolved from the use of patent and R&D data, and geographical and technological proximity to more direct measures based on innovation survey data. While the majority of studies rely on innovation surveys (see e.g., Javorcik, 2004; Iyer, 2009; Tytell & Yudaeva, 2009; Damijan et al., 2013; Farole & Winkler, 2014; Pfeiffer et al., 2014; Fatima, 2016), they focus on only two horizontal spillover channels, the competition and labour effects. Despite the richness and granularity of innovation survey data, such studies tend to lose sight of spillovers through direct technology diffusion and market-access effect. Thus, it may be inappropriate to assume that the developed proxies capture other spillover effects. The uniqueness and individuality of each spillover channel makes it necessary to separately measure them. This paper, therefore,

investigates the nature and extent of spillovers using an array newly proposed measures of spillovers. The new proposed measures attempt to explain the broader range of spillovers such as innovation, direct technology transfers, the sources of inputs and the gender role in labour spillovers. Instead of incorrectly assuming that all aspects of spillovers are captured in few measures, developing metrics for the specific spillover channels is expected to provide greater clarity on which channels transmit the greatest benefit in order to overcome the inconsistency in evidence.

We find strong horizontal spillovers through the female employment, market-access effects, innovation and technology diffusion channels. Backward linkages are stronger than forward linkages yet have declined over the years. Overall, spillovers for the manufacturing sector are stronger than the services sector. Determinants that show consistent relationships with spillover include the sector, firm age, access to finance and transport. Foreign ownership only shows a relationship with the innovation and technology spillovers.

This paper extends the current literature in three other ways. First, the extant studies have disregarded the different gender dynamics in the labour effects channel. Although, there exists literature which demonstrates that MNCs differ from local firms with regards to female labour intensity and investment in female workers which in return is expected to influence the knowledge transmittable. Hence, this paper provides alternative measures of labour effects to demonstrate this gender distinction, which has not been evident in conventional measures (Joan, 2004; Mosley & Uno, 2007; Neumayer & De Soysa, 2011; Tanaka, 2015).

Also, studies that attempt to measure and provide empirical evidence of horizontal spillover prevail over those that consider vertical spillovers. Despite the fact that multiple studies believe that technology and knowledge diffusion are most likely to occur through vertical spillovers, evidence remains scarce (see e.g., Javorcik 2004; Blalock & Gertler, 2008; Gerschewski, 2013; Farole & Winkler, 2014; Farole, et al., 2014),. We, therefore, provide further evidence of vertical spillovers,

Further, we provide empirical evidence on spillovers in the services industry. The extant literature focuses mainly on the manufacturing sector although the two sectors may vary greatly concerning

their labour- and capital-intensity. The manufacturing sector is likely to have a higher demand for domestic labour and domestic goods thereby enhancing the potential of spillovers. The services sectors serve local consumers and are more likely to create forward linkages. Backward linkages by services MNCs are dependent on parent companies procurement policies and the ability of domestic suppliers to provide the required inputs. The new technology and know-how introduced differ substantially between both sectors, imposing different effects through imitation and labour channels (Iyer, 2009; Farole, et al., 2014; Falk, 2015). Spillovers in the services sector, and how they differ compared to the manufacturing sector, remains an empirical question which this paper attempts to answer.

Finally, the paper provides enhanced understanding on the variability of the size and magnitude of spillovers. This variability is believed to be a result of foreign firms' and host countries' characteristics which may influence the MNCs' familiarity with the host country environment. For example, foreign firms which are partially domestically owned, are formed as Joint Ventures (JVs) or Mergers & Acquisitions (M&As), and/or originate from neighbouring countries have business models are that are adaptable and more likely to create local linkages with a host country. This alludes to a positive relationship with spillovers. Whereas, foreign firms in the form of greenfield projects, fully foreign owned, and/or originate from distant countries may face difficulty integrating into the local economy due to their lack of familiarty. This is expected to have great policy implications in assisting countries to target the correct FDI sources (Iyer, 2009; Irsova & Havranek, 2013; Farole & Winkler, 2014; Pfeiffer, et al., 2014; Falk, 2015).

A country's level of human capital development may influence the workforce's ability to absorb and transmit MNC's knowledge alluding to either a positive or negative relationship with spillovers. A country's infrastructure investment and financial development may influence the degree and nature of MNCs linkages with domestic firms and how easy it is for the latter to imitate the former (Nunnenkamp & Spatz, 2004; Farole, et al., 2014; Irsova & Havranek, 2013; Pfeiffer, et al., 2014). However, such ideologies pretaining to factors that influence spillovers' are merely dominant in theoretical literature and lack empirical support which this paper intends to shed light on. Due to Africa's underdeveloped economic and financial systems, there is a need to investigate FDI spillovers within the African context. Scholars and practitioners estimate that the continent needs an approximate US\$ 210bn per year to fund development, and domestic resources are limited. While FDI flows increased from US\$ 907m in the 1980s to US\$ 9.3bn in the early 2000s, Africa's share of global FDI flows declined from 20% to 5%. However, to fill in the development gap, the continent remains committed towards fixating policies to attract investment and enhance economic equity. The emphasis on structural transformation positions the services industry as key in supporting value-adding activities of other sectors. To achieve this, the services sector is required to attract FDI to spur growth for itself and the sectors it supports (Moss, et al., 2004; Mebratie & Bedi, 2013; UNCTAD, 2015; UNCTAD, 2016; Alley, 2017).

Namibia provides an insightful context to study within Africa. In 2009, the country obtained upper middle-income status, becoming one out of six Sub-Saharan African (SSA) countries to achieve this. According to World Bank, Namibia recorded a real GDP per capita of US\$2055 in 1991, compared to a SSA average of US\$582. Yet, Namibia still suffers from high poverty and inequality rates which are trace back to its historic colonial structure. In 2015, the poverty rates stands at 10.7% from 15.4% in 2009 and the GINI coefficient is estimated at 0.56 from 0.5971 in 2009 (NSA, 2015/2016). Furthermore, the Gender Inequality Index (GII) stood at 0.474 in 2015, lower than the SSA average of 0.572 (World Bank, 2016).

Namibia placed emphasis on attracting FDI for development by first introducing the Foreign Investment Act No. 24 of 1993, which was replaced by the Investment Promotion Act No. 6 of 2016. The country continued to progress by providing incentives to foreign investors such as tax incentives, reduced trade barriers and relaxed repatriation controls. Namibia's geographical location makes it an attractive destination for foreign investment. The country's lengthy coastline and port facilitates trade flows for itself and its neighbouring landlocked countries. Namibia forms part of the Southern African Development Community (SADC), the Southern African Customs Union (SACU), and the Common Monetary Area (CMA), which further strengthen its trade attractiveness and incentives. These memberships led to the creation of the India and China corridors which realized increased trade and investments, in addition to other EU countries. Furthermore, the country's peg to the South African Rand makes it in an attractive investment destination by other Southern African MNCs.

Despite efforts, Namibia's FDI inflows have been on a declining path. According to UNCTAD, FDI inflows reached a peak of US\$ 1.1bn in 2015 from US\$ 432m in 2014, but declined to US\$ 275m in 2016. These FDI flows are concentrated in the mining and financial sectors who have shares of 38% and 37% respectively as at Q1 2018 (BON, 2018). In addition, the true effectiveness of FDI, the return on costly means of attracting FDI such as foregone tax incomes are also unknown. Whether the advocated FDI benefits materialize remains an empirical question. In addition, since Namibian policymakers have identified FDI as a critical tool, it is necessary to understand whether FDI can simultaneously achieve its dual goal of economic and social development. Despite Namibia's great potential and largely stable environment, it remains to be an understudied context in literature.

2. Literature Review 2.1 Spillover Channels

The FDI-growth nexus stipulates that the presence of a MNC in a host country introduces two main benefits, technology and knowledge diffusion. The former occurs when a MNC introduces new technology that was not previously available in the host country and is adoptable by its domestic firms. Some countries initiated policies to target and support technology intensive MNCs under the belief that their production processes and R&D activities will "spill over" across countries. Knowledge spillovers materialize when one inventor learns from another's outcome. This comes with the condition that replication can occur at no cost (Branstetter, 2004; Falk, 2015).

More specifically, the term "spillovers" refers to the impact that a MNC affiliate exerts in a host economy and the value transmittable to domestic firms. The term is also defined as the amount of non-appropriable knowledge produced by firms' innovative efforts. They arise due to failure of mechanisms to completely protect knowledge generated by innovative firms. Spillovers are often referred to as informal, unintentional, uncompensated for transfers between firms that are critical to enhance competitive advantages of firms (Kaiser, 2002; Doytch & Uctum, 2011; Gerschewski, 2013; Falk, 2015; Isaksson, et al., 2016). Verspagen (1997) and Griliches (1991) explain that

knowledge spillovers are important for the development of economies and plays a role in new endogenous growth models.

Sjoholm (1997) adds that MNCs conduct most of the world's R&D and knowledge can be leaked for the benefit of host economies through transfers from parent to affiliate. By definition, foreign investment is associated with the transfer of knowledge and intangible assets from the parent firm to the affiliate. The new technologies embedded in the various products, services or capital goods can be transferred by means of the MNCs' productions for consumptions, imports and exports. In addition, technologies can be transferred through formal cooperative agreements between the foreign and local firms such as acquisitions or project specific JVs (Griliches, 1991; Djankov & Hoekman, 2000).

There exists two forms of spillovers, horizontal (intra-industry) relates to spillovers occurring between firms in the same industry. While, vertical (inter-industry) spillovers encompasses either backward linkages with supplier relationships or forward linkages with customer or distributor relationships (Doytch & Uctum, 2011; Gerschewski, 2013; Falk, 2015). Literature identifies three different channels in which horizontal spillovers can occur. The first channel is the demonstration effect whereby domestic firms attempt to adopt a MNC's advanced technology via imitation or reverse engineering. This is common in countries where machines and technology are obsolete and outdated, and seek strategic restructure. Through trade fairs, advertising and/or patents, domestic firms or are too costly for them to introduce on their own. At times, MNC's may protect their technological advantage by preventing information leakage to competitors thereby also preventing spillovers (Konings, 2000; Gerschewski, 2013; Pfeiffer, et al., 2014).

The second channel of spillovers is the employment effect and is a main source of tacit knowledge diffusion. MNCs invest heavily in their workforce through training and staff development programs. The benefits of this acquired knowledge are realized through labour turnover and mobility from MNCs to domestic firms (Gerschewski, 2013; Farole, et al., 2014). Gerschewski (2013) emphasizes the difficulty in empirically measuring employment effects since accurate

measurement would involve interviewing employees who moved from MNCs to local firms to estimate the knowledge transferred.

The third channel of spillovers is the competition effect. The entry of foreign firms in a domestic market may increase competition in products, labour and credit markets. To remain competitive and maintain market share, local firms are required to enhance their technologies and process efficiencies. The competition and demonstration effects are closely related because as competition increases, the adoption and imitation of new technology enhances. The competition between domestic firms also increases as they compete over supplying MNCs. The competition and labour effects also interlink, whereby firms compete over skilled workforce. If MNCs retain staff due to attractive remuneration, then the transfer of knowledge to domestic firms is constrained (Gerschewski, 2013; Pfeiffer, et al., 2014; Farole, et al., 2014).

Gerschewski (2013) and Stojcic & Orlic (2016) propose a fourth spillover channel, the marketaccess effect. This is mainly relevant to export-oriented MNCs that are able to catalyse the domestic firms' access to international markets. These domestic firms can benefit from MNCs' knowledge on export strategies, international export markets and global distribution and supply chain networks. (Helpman, et al., 2003; Greenway & Keller, 2007; Doytch & Uctum, 2011; Farole, et al., 2014).

As opposed to horizontal spillovers, vertical linkages refers to direct established relationships between a MNC affiliate and local suppliers and/or distributors. These relationships are used to complement the MNC's external activities considered as pure market transactions. When MNCs enter a host economy, they are faced with three strategic options. Firstly, they can choose to import their production materials or obtain from their parent companies. Secondly, they can produce the input material locally by themselves. Finally, they can source the inputs from local suppliers. Backward linkages are created when the last option is opted for. If MNCs use domestic distributors and marketers to channel their finished goods, then forward linkages are created. Upstream and downstream partners are considered an important source of information for innovation to remain competitive. It is easier for such partners to leverage off external sources because of the high cost of the innovation process. There exists incentives to share knowledge through supply chains

because there is mutual dependency and reduced product-market competition (Javorcik, 2004; Karpaty & Lundberg, 2004; Gerschewski, 2013; Farole, et al., 2014; Stojcic & Orlic, 2016; Isaksson, et al., 2016).

2.2 Measuring Spillovers and Previous Evidence

Research has long attempted to measure spillovers, particularly those that result in technology and knowledge advancement. There is a consensus around the difficulty of measuring spillovers and as Krugman (1991. p. 53) reasons, "knowledge flows…leave no paper trail by which they can be measured and tracked". Due to this difficulty, researchers often resort to relying on proxies that more or less capture the intended effects. The inability to measure spillovers implies that testing in a strict sense is unfeasible. Many of the conventionally used proxy variables are based on R&D metrics, geographical and technological proximity. However, the growing availability of innovation survey data provides a new source of measures for researchers (Kaiser, 2002).

Studies conducted in the early millenium use different formations of the spillover proxies. Xu & Wang (2000) study technology diffusion through trade and FDI and their evidence reveals that foreign knowledge spillovers, measured by R&D, is enhanced by trade of capital goods. Subsequently, this exerts positive siginifcant impact on total factor productivity. Branstetter (2004) studies knowledge spillovers from Japanese FDI into USA and back to Japan for a sample of manufacturing firms. The author finds evidence of positive effects of FDI on patents as a proxy for knowledge spillovers which holds for both the host and home countries. Cheung & Lin (2004) study the impact of FDI inflows on Chinese firms' innovation. Their results indicate that FDI inflow has positive spillover effects on the number of domesite patent applications, a proxy for innovation. More recently, Stojcic & Orlic (2016) examine the impact of FDI on export sophistication and find a positive relationship in the long-run. Isaksson, et al., (2016) studies knowledge spillovers by analysing how buying firms' innovation influences the supplier innovation. The authors proxy knowledge spillovers both by a patent count and a R&D expenditure metrics and find that buyer innovation has a positive and significant impact on supplier innovation.

The vast majority of studies reviewed investigate spillovers based innovation surveys data. For a sample of 78 middle- to low-income countries, Farole & Winkler (2014) find that MNCs share of total output averages 26% and varies with a MNC's ownership degree whether it is fully foreign owned (14%) or contains partial domestic ownership (12%). Konings (2000) appiles the same output ratio for a set of firms in Bulgaria, Romania and Poland. The author finds that spillovers are greatest in Poland with an average of 15% compared to Romania (13%) and Bulgaria (9%). Abraham et, al., (2010) find a high horizontal spillover within Chinese firms averaging 48%.

Tyell & Yudaeva (2005) measure horizontal spillovers as the foreign firms share of employment to total sector employment for a group of four emerging EU countries including Poland, Ukraine, Russia and Romania. It is found that spillovers are greater in Poland and Romania that record employment shares of 21% and 22% respectively. Whilst in Russia and Ukraine spillovers reach 6% and 7% respectively. Whereas in Sweden, Karpaty & Lundberg (2004) find that MNCs share of employment average 22.2% among firms. Haskel, et al. (2002) studies horizontal spillover in the context of UK manufacturing firms by using the foreign employment share, the authors find that spillovers are highest among the offices, machinery and chemical sub-sectors. Similarly, Ruane & Ugur (2005) study the context of Irish manufacturing firms and find that the average spillover measure stands at circa 30% according to the employment measure. Pfeiffer, et al., (2014), apply the same employment ratio to measure horizontal spillovers for a set of firms in 10 SSA countries. The authors find that the total MNC's share of employment is 32% with MNCs originating from Europe holding the highest share of 12.4%.

Some studies measure both horizontal and vertical spillovers. Javorcik (2004) finds that foreign firms share of total output average 19.7% for a set of Lithuanian firms. The author divides vertical linkages into two measures for backward and forward linkages separately and are measured as the share of output supplied and consumed by industries. The author finds that backward linkages records a mean of 4.9% with fully foreign owned MNCs recording a mean of 1.9% compared to those that are partially domestic owned, 3%. In addition, forward linkages record an average of 6.9%.

Lu, et al. (2017) apply the same measurements as Javorcik (2004) in the context of Chinese manufacturers and find that horizontal spillovers are greatest with an average of 24%, followed by backward linkages (11%) and forward linkages (8%). Similarly, Newman, et al. (2015) also apply the same measures in the context of Vietnamese manufacturing firms and find that horizontal spillovers averages 41%. Forward linkages averages 39% and when disaggregated by full-foreign ownership or JV the mean is 30% and 10% respectively. Backward linkages averages 42% and when disaggregated by full-foreign ownership or JV, the mean is 29% and 13% respectively.

Suyanto & Salim (2013) study a group of Indonesian firms and find that MNCs' output to total output averages 39.6%. However, the firms' backward linkages records a mere average of 0.3%. Iyer (2009) finds that horizontal spillovers averages merely 14.4% for a set of Indian firms as measured by the output ratio. The author applies the same backward and forward measures as defined above and finds that they record means of 5.8% and 1.9% respectively. However, this time, the author finds that all spillover measures, except forward linkages, are greater for fully foreign owned firms compared to partially domestic owned firms. Fatima (2014) studies the Turkish context and finds that horizontal spillovers, measured by the output ratio, are greater than vertical spillovers, recording an average of 12.1%, Whilst backward and forward linkages, applying the same previously defined measures, record means of 4.3% and 3.2% respectively.

As evident from the above analysis, studies that attempt to measure horizontal spillovers prevail and there is scarce evidence with regards to vertical spillovers. For the few studies that attempt to measure both horizontal and vertical spillovers, it is evident that the former is greater in terms of potential and magnitude. The measures of vertical spillover are criticised for relying on the unrealistic assumption that MNCs' domestic inputs equate their imported inputs. Overall, these measures fail to distinguish between foreign and domestic sourcing and merely assume that the MNCs demand of local inputs equates their sectoral output (Barrios, et al., 2011).

More specifically, the MNCs output compared to total sectoral output as a proxy for horizontal spillovers is dominant over those that utilize the share of employment. The horizontal spillover measure of output is motivated within literature due to its ability to capture the competitive pressure that encourage local firms to upgrade their products to protect their market shares and

adopt new managerial practices. The employment ratio is motivated due to its ability to capture the labour effect (Damijan, et al., 2013; Pfeiffer, et al., 2014). However, since such measures only pretain to the competition or labour channels of horizontal spillovers, they may not be able capture technology adoption as a result of the demonstration effect or increased exporting activity as a result of the market-access effect. For example, the former measure of output does not differentiate between output used for local consumption versus output that is exported. Moreover, the magnitude and potential of spillovers varies between different ownership degrees and origins of MNCs, yet their specific determining nature is unknown.

2.3 Sector Dynamics in Spillovers

The aforementioned empirical studies are all biased towards the manufacturing sector and it would be inaccurate to generalize findings to other sectors due to apparent differences. Different sectors will transfer different technologies and knowledge to the host country. Manufacturing MNCs are expected to transmit equipment and industrial processes. The sector is more labour-intensive and reliant on unskilled production workers. Worker training is more directed towards the facilitation of the new foreign machinery and equipment. The services MNCs are more likely to transmit technical, managerial, organizational and marketing know-how. The sector's workforce is characterized by skilled and blue collar employees. Training and human development is targeted at strengthening cognitive skills and know-how of employees. This means that transferable knowledge differs between both sectors. Labour in the services sector might transmit more tacit knowledge on innovative, scientific information and/or business practices. Knowledge in the manufacturing industry would be embodied in the patents and licenses of the finished goods, machinery and equipment. Whilst the workers may carry tacit knowledge on operating the advanced technology (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014; Ben Hamida, 2011; Hale & Long, 2011).

MNCs in the services sector introduce new services, improve marketing and increase competition levels. The non-tradable nature of the services sector requires close proximity to consumers thereby inducing local linakges. Foreign firms operating in the retail sector have great potential in creating backward linkages as they are able to source food and other perishable items from local producers. However, the expected effects are dependent on the abilities of local suppliers and the host country's policies. In addition, parent policies imposed on affiliates may restrict local sourcing and limit local linkages (Nunnenkamp & Spatz, 2004; Iyer, 2009; Farole, et al., 2014).

The controversy of manufacturing MNC spillover arises in the case where the foreign MNC locates in a host country because of low factor price in order to serve a third market. In this case, the potential of forward linkages is hampered since the MNC will export the majority of their finished goods. However, it can be argued that greater exporting activity by MNCs may assist local exporters in gaining knowledge on global value chains and entering the international markets. If the manufacturing MNC's purpose is to serve the local market, then it can produce products which were not previously available or were costly and can be used by the domestic firms in their productions (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014).

Manufacturing MNCs are likely to introduce new technologies and means of production. Spillovers are generated when this technologies are adopted or imitated by local firms. Furthermore, MNC manufacturers may require intermediate goods and business services which may be sourced locally. The new foreign technologies may also increase competition and local firms are then expected to improve their standards in order to compete. They may also receive assistance from MNCs through supplier initiatives. However, where the production process is advanced and uses superior technology not appropriate for other firms, technology spillovers may be limited (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Tondl & Fornero, 2010; Farole, et al., 2014).

2.4 Gender Dynamics in Spillovers

As apparent in the previous sections, extant research is myopic to gender differences in spillovers. Yet, there is ample research on gender differences in employment and the differential effects that broader globalization and MNCs exert on the different genders. For example, Ouedraogo & Marlet (2008) find that an increase in FDI inflows is likely to increase gender welfare and decrease gender inequality. Whilst Neumayer & De Soysa (2011) find limited evidence that FDI enhances women's economic status. Hence, it can be assumed that spillovers exerted by MNCs will vary among genders. Yet, how spillovers vary between the genders remains empirically undefined. The role of gender differences in transmitting knowledge and technology from foreign firms to local firms is not investigated and there is reason to believe that gender differences are very strong in this regard.

There exists gender differences in labour participation. Female labour tends to be concentrated in labour intensive and export-oriented firms, which are characteristics of the manufacturing sector. Profit-oriented MNCs are attracted to areas with cheap labour to maintain low labour costs and increase competitiveness. Female labour is considered as "nimble and cheap" making them the employment of choice. MNCs also prefer female labour because women are regarded as more obedient and less prone to worker unrest. In addition, women are considered to be more accustomed to tedious work and are considered to be more reliable and susceptible to training than men. This may imply that as the MNCs' share of domestic female labour increases, the likelihood of spillovers generated through the female labour effect are expected (Acosta-Belen & Bose, 1990; Pyle & Ward, 2003; Basinger & Hallerberg, 2004; Joan, 2004; Eisenstein, 2005; Braunstein, 2006; Mosley & Uno, 2007; Colen, et al., 2008; Neumayer & De Soysa, 2011; Latorre, 2016).

There are also gender differences with regards to usage of time. Women are more likely to select occupations and employers that offer flexible working environments in order to balance professional and personal (or care) responsibilities, which is more relevant to services firms. This also means that women are likely to select occupations that do not require large or continuous skills investment unique to a firm or group of firms. Nor, are they likely to choose occupations where skills do not depreciate drastically because of career interruptions. Hence, it is likely that men are to have greater years of experience and bear greater knowledge to be transmitted compared to women (World Bank, 2012; Naomi, et al., 2016).

Gender differences also arise because of market and institutional failures. Market outcomes are determined by the extent to which participants share and transmit information. Failures occur when some participants have more information than others which can then effect employment. It is acknowledged that women generally have less information or are given less information than men. In return, this affects the amount of knowledge that women bear and are able to transmit to local

firms. Further barriers to be part of network limits women's ability to gain and share tacit knowledge which is key to spillovers (World Bank, 2012).

Some studies attempt to investigate the impact of some aspect of MNCs on females, but not specifically within the context of spillovers. Gershenberg (1994) compares differences in training and spreading managerial knowledge between male and female workers and between MNCs and non-MNCs in the Jamaican context. The findings show that more men advance to managerial levels than women and more women in local firms compared to MNCs advance to managerial levels. Moreover, women in MNCs received greater training compared to their other counterparts. Latorre (2016) investigate the effect of MNC entry on female labour in Tanzania. Entry of foreign firms is found to result in increased demand for labour and remunerations. However, this is found to be higher for males and more skilled females. Naomi, et al. (2016) investigate the effect of foreign ownership on gender employment outcomes in Japan. The study finds that in foreign affiliates, female participation in higher levels of management is greater compared to local firms. Moreover, foreign firms are more likely to offer flexible working environments which attracts female employment.

In addition, Tanaka (2015) finds that MNCs promote women's career advancement through worklife balance practices and their promotion to higher positions. This is likely to attract more employment away from the domestic firms and in order for them to remain competitive, they would be required to update their own internal policies. However, as outlined earlier, spillovers may occur if the female labour, that as has acquired greater training and career advancement opportunities, opt to move to domestic firms and share their learnings (Tzeng, 2006; Dolan & Scott, 2009; Neumayer & De Soysa, 2011; Potrafke & Ursprung, 2011; Latorre, 2016; Tang & Zhang, 2017).

2.5 Determinants of Spillovers

As apparent from extant research the size and magnitude of spillovers varies but the reasons behind this variability is not understood. Hence, it can be hypothesized that spillovers are determined by a range of foreign firm and host country characteristics. The transmission of spillovers is not an automatic process but requires a certain level of human capital development that can absorb and apply the foreign learnings in their domestic firms. It is argued that a workforce with a high educational attainment are found to be more efficient. This efficiency translates into the labour's ability to absorb and transmit new technology between firms and along linkages (Blomström, et al., 1999; Javorcik, et al., 2002; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2014)

The level of financial development is also expected to exert some effect on spillovers. A developed financial system induces spillovers by reducing risks inherent in domestic firms' investment to imitate MNCs' technologies. However, if the MNC require extenive funding from the host country banks, there may be less appetite to fund the local firms which limits adoption and imitation by domestic firms. Moreover, a developed financial system facilitates the flow of funds between MNCs and their local suppliers or distributors. If the latter are able to receive credit terms or ease cash flow, it will enhance the quality and timeliness of delivery of goods as well as streamline their internal efficiencies. Infrastructure development, particularly transport, may be important in determining spillovers. Poor road and transportation networks will hamper the transportation of both intermediate and finished goods between MNCs and local firms and strain linkages. This may also influence the mobility of employees and their ability to move and exchange knowledge (Blomström, et al., 1999; Javorcik, et al., 2002; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2014).

Unique foreign firm characterisics, beside their operating secotrs, may influence the diffusion of spillovers to domestic firms. These include the firms' age, size, ownership and MNCs' home origin. A firm's age or length of presence is believed to influence spillovers in the sense that older firms are likely to be more familiar with the local context. Hence, they are likely to know and better understand the labour market, competitors, as well appropropriate local suppliers and distributors. Moreover, firm age can act as proxy for the learning curve, which in return is a source of productivity gains. Older firms are likely to have greater productivity experience that can be diffused to local counterparts. However, newer firms are more probable to adopt new technologies than older firms due to lumpiness of capital and lack of legacy obstacles (Gorodnichenko, et al., 2007; Iyer, 2009; Farole & Winkler, 2014).

In addition, the size of the firm is likely to impact spillovers by several means. Larger firms are likely to be more attractive to potential workforce due to better remuneration and have more competitive power. In addition, they might have greater power over suppliers and distributors thereby influencing the extent and intensity that knowledge and technology is transmitted through linkages. Overall, larger firms are believed to be more productive and able to reap the benefits of spillovers. Particularly, the size of the firm is also sought to positively influence a firm's innovation activity (Damijan, et al., 2013; Mebratie & Van Bergeijk, 2013; Farole & Winkler, 2014).

Ownership of foreign firms encompasses both the degree and structure. The ownership degree refers to whether the MNC is fully foreign owned or includes a partial domestic ownership. Firms with a greater share of foreign ownership are likely to experience greater management control, thereby influencing the firms' incentives to transfer knowledge and technology. Such may take the form of a greenfield or Merger and Acquisition (M&A). Technology transfer may be instantanteous via greenfields. These firms spend more time and effort to cultivate connections with local firms. M&As prefer to adopt the host country's technology, hence any spillover is claimed to be sluggish. Simultaneously, the partial domestic ownership, such as Joint Ventures (JVs), may increase the probability of information leakages to domestic firms. Domestic owners have greater knowledge on the best appropriate suppliers and distributors. Hence, partial domestic ownership in MNCs is likely to induce positive spillovers through linkages. In JVs, the domestic partners are active in the top management hence influence skills development and increase the probability to source locally (Konings, 2000; Javorcik, 2004; Crespo & Fontoura, 2007; Gorg, et al., 2009; Mebratie & Van Bergeijk, 2013; Gerschewski, 2013; Farole & Winkler, 2014; Farole, et al., 2014; Winkler, 2014; Jude & Levieuge, 2017).

The origin or home of the MNC may also influence the transmission of spillovers by influencing workplace culture and managerial practices. Subsequently, this affects attitudes, strategies, training and development which local firms and staff are exposed to. As exposure to a wide array of diverse practices increases, openness to learning and adoption is also likely to increase. In return, this may enhance knowledge flow through supply chain and labour turnover thereby alluding to positive spillovers. In addition, the distance between the home and host countries is likely to

influence MNCs' decisions. MNCs are likely to source locally and reduce any communication or transportation cost if a large distance exists. However, the distance effect is also dependent on sectoral dynamics (Crespo & Fontoura, 2007; Pfeiffer, et al., 2014; Farole & Winkler, 2014; Farole, et al., 2014).

It is also important to differentiate between developed and developing countries source of FDI. Developing countries are similar in terms of their level of economic development, business conditions, business models and skills. Such similarities increase the familiarity with the host country and it will be easier for MNCs to overcome obstacles related to absence of specialised intermediaries and weak contract enforcement. Hence, South-South investment may introduce technology, knowledge and skills that are easily adaptable to the host environment. Therefore, smaller technology gaps exists within South-South investment compared to North-South investment where the absorptive capacity of domestic firms is expected to be higher (Tan & Meyer, 2011; Pfeiffer, et al., 2014; Farole & Winkler, 2014; Farole, et al., 2014).

As outlined previously, there is sufficient research that discusses theoretical reasonings behind the variability of magnitude and size of spillovers, yet the exact determining impact is scarce in empirical literature. Most available research merely show evidence of how spillovers vary between specific firm characteristics, but the nature of the relationship is scarcely investigated. Javorcik, et al. (2002) attempts to identify the determining factors of vertical spillover in Lithuanian manufacturing firms. The authors find that higher foreign ownership, exporting experience and technology gap induce spillovers. Gorodnichenko, et al. (2007) study spillovers and their determinants for 17 emerging economies and while the study does not directly estimate the impact of firm characteristics on spillovers, the findings reveal that horizontal spillovers and linkages are greater for olders firms. Abraham, et al. (2010) and Chen, et al. (2004) find that JVs and export-oriented firms produce greater productivity effects as they are more likely to create local linkages. The latter study further finds that large firms are more active than smaller firms in pursuing local linkages.

Mebratie & Van Bergeijk (2013), employ a less intuitive methodology (meta-analysis) on 30 developing countries, find that firm size and labour quality enhance domestic firm productivity

compared to foreign ownership. Whether or not these factors directly influence spillovers remains an empirical question. The closest study that examines the direct impact of MNCs' characteristics on spillovers is by Winkler (2014). The author finds that MNC ownership, age, technology and origin have significant impacts of FDI spillover potential. However, spillover potential differs significantly from actual spillovers as the former may not materialize. In addition, despite the theoretical impact of host country characteristics on spillovers (Nunnenkamp & Spatz, 2004; Irsova & Havranek, 2013; Farole, et al., 2014), it is not empirically defined.

From the above analysis, it is evident that previous literature has only investigated spillovers using limited measures, despite the vast array of spillovers in literature and the richness of innovation survey data. This is especially pertinent to horizontal spillovers where literature only investigate two measures, labour and competition, despite there being four channels. It is inaccurate to assume that these two measures are enough to capture all dynamics of horizontal spillovers due to their differing mechanisms. Whilst for vertical spillovers, research has identified measures for both forward and backward linkages. However, these measures merely explain inputs shared between industries and fails to explicitly identify the source of inputs whether from local or international (Barrios, et al., 2011). In addition, previous findings are dominant in the manufacturing sector. Generalization to others sectors again becomes in accurate due to their different characteristics in terms of labour and capital intensity and the varying degrees to which they serve the domestic market as opposed to the international market. Moreover, while it is theoretically evident that spillovers may vary among genders, literature has failed to identify the exact differentiation. Subsequent to measuring the nature and extent of spillovers, it is then important to understand what determines their magnitude and direction for accurate policy targeting, which again, lacks in literature. Hence, this essay aims to investigate the nature, extent and deteminants of FDI spillovers in Namibia.

3. Data and Methods

In order to answer the above question, this essay will rely on firm-level data from the World Bank Enterprise Survey (WBES) database for the two survey waves of 2006 and 2014 conducted for Namibia. This database is publicly available and includes data for firms in both the manufacturing and services sectors concerning their performance, employment, capital, innovation, trade, taxes, regulations, financing and other firm characteristics. The sample of firms in this database ranges circa 300 and 500 Namibian firms for the two years respectively. This will be complemented with data from Namibia's input-output tables sourced from the Economic Association of Namibia (EAN). This data is constructed based on the Social Accounting Matrix (SAM) methodology (Lange, et al., 2004). This source includes data on inputs produced and supplied among 28 economic sectors in Namibia including manufacturing and services sectors and is available publicly.

Firstly, the conventional measures of horizontal spillovers are depicted as HS1_{jt} and HS2_{jt} and measure the foreign firms share of sectoral output and employment following previous studies (see Konings, 2000; Karpaty & Lundberg, 2004; Javorcik, 2004; Tytell & Yudaeva, 2005; Iyer, 2009; Abraham, et al., 2010; Suyanto & Salim, 2013; Farole & Winkler, 2014; Pfieffer, et l., 2014; Fatima, 2016).

$$HS1_{jt} = \sum \left(\frac{FDI_{ijt} \times Y_{ijt}}{Y_{ijt}}\right)$$
(1)

$$HS2_{jt} = \sum \left(\frac{FDI_{ijt} \times E_{ijt}}{E_{ijt}}\right)$$
(2)

In both equations, i denotes the firm, j denotes sector whether manufacturing or services and t denotes one of the two specified periods. *FDI* is the foreign equity participation within a firm defined as any firm with 10% or more foreign participation. Output *Y*, is proxied by the firms' sales and *E* represents the foreign firms' share of permanent employment. $HS1_{jt}$ is able to capture the competitive pressure since the higher the foreign share of output, the more market share they are expected to hold thereby exerting pressure on domestic firms to catch-up. Similarly, in $HS2_{jt}$, it is then expected that the higher the share of employment, the more likely that expertise will be transmitted through labour turnover.

This research proposes new measures of horizontal spillovers to capture the unique technology, market-access and female labour gender spillovers which may not be reflected in the two

conventional measures. These spillovers will be measured as $HS3_{jt}$, $HS4_{jt}$, $HS5_{jt}$, $HS6_{jt}$ and $HS7_{jt}$ as follows:

$$HS3_{jt} = \sum FD_{ijt} \times introduction \ of \ new \ or \ improved \ process_{ijt}$$
(3)

$$HS4_{jt} = \sum DD_{ijt} \times \% \text{ of firms using technology licensed from foreign companies}_{ijt}$$
(4)

HS3_{jt} measures the foreign firm's share of process innovation. MNCs introduce new technologies that enhance their internal processes which can be replicated and adopted by local firms. Hence, the greater process innovations that a foreign firm introduces through technology, the more likely the domestic firms are to adopt them. HS4_{jt} directly measures the portion of local firms using technology licensed by foreign firms where DD_{ijt} represents 100% domestic equity participation. This measure is able to identify the extent to which domestic firms are able to adopt foreign firm's technologies alluding to their compatibility and appropriateness for the domestic market.

$$HS5_{jt} = \sum \left(\frac{FDI_{ijt} \times Expts_{ijt}}{Expts_{ijt}} \right)$$
(5)

HS5_{jt} measures the foreign firms' share of total exports as denoted by *Expts*. Theoretical literature has clarified that export-oriented MNCs are likely to assist domestic firms in entering export markets. Hence, the larger the share of MNCs exports, the more likely they are to assist domestic firms in exporting as well.

$$HS6_{jt} = \sum \left(\frac{FDI_{ijt} \times F_{ijt}}{F_{ijt}}\right)$$
(6)

In order to capture the gender aspect, $HS6_{jt}$ is calculated. The former is a measure of the foreign firms' share of permanent female employment, denoted by *F* and can identify the extent through

which female employment can transmit spillovers. A larger share of female employment in foreign firms alludes to their gender attractiveness and positive effects.

The conventional measures of vertical spillovers, both backward and forward linkages, are depicted as BL1_{jt} and FL1_{jt}. This follows the specifications identified by Javorcik (2004), Blalock & Gertler (2008), Suyanto & Salim (2013), Damijan, et al., (2013) and Fatima (2016). BL1_{jt} is a proxy for foreign affiliates that are being supplied by local firms. In this case α_{kj} is the proportion of sector *k*'s output supplied to sector *j* and is weighted by the share of foreign firms' output, which ideally is pre-defined horizontal spillover measure, HS1_{jt}. Therefore, it is assumed that increased foreign presence in sectors supplied by industry *k* means the larger share of goods supplied to sector *y*'s output supplied to capture the extent to which MNCs distribute through. In this case, α_{jm} is the proportion of sector *j*'s output supplied to sector *m*, and is weighted by the foreign firms' share of output (Y_{ijt}) excluding exports (*Exptsijt*). This is because the interest is only on the goods that are provided by the foreign firms to the domestic market (Fatima, 2016; Javorcik, 2004). Supplied by the foreign firms to the domestic market (Fatima, 2016; Javorcik, 2004; Iyer, 2009).

$$BL1_{jt} = \sum \left(\alpha_{kj} \times HS1_{jt} \right) \tag{8}$$

$$FL1_{jt} = \sum \alpha_{jm} \left(\frac{FDI_{ijt} \times (Y_{ijt} - Expts_{ijt})}{(Y_{ijt} - Expts_{ijt})} \right)$$
(9)

However, these conventional measures merely represent the inputs shared between industries and do not explicitly distinguish whether these linkages are of foreign or local sources (Barrios, et al., 2011). Hence, this research proposes new complementary measures for backward and forward linkages that highlight this distinction.

$$BLM2_{t} = \sum FD_{ijt} \times \% \text{ of materials or imputs of domestic origin}_{ijt}$$
(10)

$$BLS2_t = \sum FD_{ijt}$$

 \times % of finished goods or material bought to resell of foreign origin_{ijt}
(11)

$$FL2_{jt} = \sum \left(\frac{FDI_{ijt} \times NS_{ijt}}{NS_{ijt}}\right)$$
(12)

BLM2_{jt}, BLS2_{jt} and FL2_{jt} are the new proposed measures of backward and forward linkages. BLM2_j intends to measure the foreign manufacturing firms' share of inputs (at cost) that are of domestic origin as denoted by DI_{ijt} . Hence, if foreign firms source locally, it would reflect in a higher BLM_{jt} value implying a high intensity of backward linkages for manufacturing firms. BLS2_{jt} intends to measure the foreign services firms' share of inputs. Unlike the prior measure, this measure captures finished goods bought to resell that are of foreign origin as there is no variable for domestic origin the survey. Therefore, a low value of this metric indicates that MNCs are importing inputs and are likely sourcing from domestic sources. *FL2_{ijt}* measures the MNCs share of firms that are selling to domestic parties. A high value of this measure illustrates that MNCs are more likely producing to serve the domestic market and utilize domestic distributors (Javorcik, 2004; Karpaty & Lundberg, 2004; Gerschewski, 2013; Farole, et al., 2014; Stojcic & Orlic, 2016).

In order to identify the nature of the above-mentioned measures, they will be calculated for the above-mentioned periods over the total sample firms. Cross-tabulations between sectors and ownership, as well descriptive statistics are conducted to understand the characteristics of firms and their spillovers in Namibia.

In order to examine the determinants of spillovers, equation (13) is estimated. The nature of the WBES surveys, which is the primary data source for this research, does not constitute repeated observations of the same units or firms and the firms are not repeated in the two time periods. The WBES database is rather characterized by independent cross-section data that covers a short-time series (2006 and 2014 in the case of Namibia.

$$Yjt = \alpha + \beta Fijt + \beta Hijt + \alpha t + \alpha r + \epsilon ijrt$$

Y, alternates as one of the previously defined measures of horizontal and vertical spillovers, α_t and α_r control for time and regional fixed effects respectively. F, is a vector of foreign firm characteristics which includes a firms age, size and firms percentage of foreign ownership (foreign ownership) believed to have an effect on spillovers. Age of a firm is measured as the number of years since the firms operations commenced to date. Older firms are believed to be more familiar the local context of where they operate. The size classes of the firms is captured according to number of employees as suggested by Damijan, et al. (2013). The variable is dividied into three different size classes, either less than 20, between 20 and 99 and above 100 taking the values of 1 to 3 respectively. Firms with lower degrees of foreign ownership (or have partial domestic ownership) are more familiar with the host environment and may influence the development of local linkages. They may also represent firms that are formed as JVs and may also have influence incentives of technology and knowledge diffusion. It is argued that firms with higher percentage or full foreign ownership exert greater control, hence have greater influence over the incentives of knowledge and technology transfers. They are likely to take the form of Greenfields or M&As where spillovers and linkages creation may be sluggish and time consuming (Konings, 2000; Javorcik, 2004; Gorg, et al., 2009; Gerschewski, 2013; Mebratie & Van Bergeijk, 2013; Farole & Winkler, 2014; Winkler, 2014; Farole, et al., 2014; Jude & Levieuge, 2017).

The MNCs' home country is identified as the origin of the majority shareholder and is categorized as either African, Indian, Middle Eastern, Asian, European or other origins. A dummy variable, *African*, is created that takes a value of 1 if the FDI is of an African origin and 0 otherwise. Spillovers are likely to be greater between neighbouring countries (i.e. South-South investments) due to similar environments and compatible technology and managerial culture and knowledge. Whilst spillovers from North-South investments may be hindered due to advanced and incompatible technology and managerial culture and knowledge (Farole & Winkler, 2014; Farole, et al., 2014; Pfeiffer, et al., 2014). According to this theoretical underpinning, the origin of a MNC is expected to influence the magnitude and direction of spillovers.

A third dummy, *Sector*, is developed to represent the sector that the firm operates in whether manufacturing or services. The two sectors differ with regards to labour and capital intensity, as well as governing local and international policies. The manufacturing sector is expected to exert greater spillovers due to the sectors demand for local labour and intermediate goods, as well as the introduction of adoptable technology. If the manufacturing MNC is export-oriented, then it could either improve spillovers through greater access to export markets or hinder spillover through the lack of linkage creation with local distributors. Services MNCs such as retailers may source their inputs from local suppliers, unless parent policies dictate otherwise. Simultaneously, services MNCs increase overall competition leading to the likelihood of horizontal spillovers (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014)

H, is a vector of host country characteristics which include *education*, transport and access to finance. Data for this is also obtained from WBES as all firms are asked whether these country characteristics pose as obstacles to their business. These variables are rated on a scale of 0 to 4 from not an obstacle to a severe obstacle respectively. To represent educational attainment, survey respondents are asked whether an inadequately educated workforce is an obstacle in the host environment. A host country characterized by high levels of human development and adequate education is likely to encompass domestic labour that are able to absorb the MNCs superior knowledge implying an influence on spillovers through the labour effect. Access to finance as an obstacle is used to proxy financial development. As MNCs gain access to local financial services, they are able to channel funds to their local suppliers and distributors who can then invest in product and process improvement. Moreover, MNCs greater access to funds allows them to further introduce new technology and invest in new projects in the host economy. Transport as an obstacle proxies infrastructure development. Greater infrastructure development helps facilitate the relationship between MNCs and domestic firms. Improved transportation enhances the movement of inputs, goods and people between firms and sectors. Although it is apparent that host country factors may influence the magnitude and direction of spillovers, they remain to be purely theoretical assumptions pending empirical support (Nunnenkamp & Spatz, 2004; Irsova & Havranek, 2013; Farole, et al., 2014).

Equation (13) estimated using the both pooled OLS with regional and time-fixed effect as well as Instrumental Variable Two Stage Least Squares (IV-2SLS). The former is motivated in order to control for the unobserved effect of the region the firm is operating in and the year. The latter technique is appropriate to deal with possible endogeneity issues particularly for the human capital (Konings, 2000; Agbloyor, et al., 2014; Pfeiffer, et al., 2014). The instruments used in this case are the education and firm size variables. It is likely that firms will employ labour from their surrounding regions and each region in Namibia has different educational levels and attainment. The firms' perception of whether the workforce is adequately educated or not is also likely to be influenced by the size of the firm in term of number of employees and the amount of interaction they get with a small versus large employment base. Both estimation techniques are likely to avoid biased estimates. Due to the unavailability of the FDI origin data in 2014, the African dummy cannoted be inserted in the OLS regression due to collinearity with the year fixed-effect. Furthermore, due to the categorical nature of the HS3 and HS4 variables, the determinants model will be estimated using the probit estimation technique. This model is appropriate to estimate the probability that the variable will take either of the two outcomes (Javorcik, 2004; Abraham, et al., 2010; Damijan & Kostevc, 2011; Farole & Winkler, 2014; Pfeiffer, et al., 2014).

4. Data Analysis4.1 Characteristics of firms in Namibia

Descriptive statistics analysis is conducted to evaluate the characteristics of Namibian firms in terms of their sectors and ownership (whether domestic or foreign) based on the WBES data for the years 2006 and 2014. Table 1 shows that between 2006 and 2014, the total numbers of firms increased by 64%. In both time periods, domestic firms maintain the dominant share of the total firms. This share increased in 2014 as the total number of domestic firms doubled while the foreign firms reduced by half. In the two time periods, firms in the services sector maintain the dominant share, averaging 68% of total firms. Firms in the services sector increased by a faster rate compared to firms in the manufacturing sector. Within the domestic firms, the services sector has the dominant share of 69% in both years. However, domestic firms in both the services and manufacturing sectors increased by nearly 2-fold between 2006 and 2014. Likewise, the services sector has the dominant share amongst the foreign firms. However, between the two years, both

the total foreign manufacturing and foreign services firms declined, where the reduction rate of the former is greater.

	200	6	201	Variance	
Summary	No. of firms % of total		No. of firms		
Total Firms	329		539		64%
Total Domestic	250	76%	503	93%	101%
Total Foreign	79	24%	36	7%	-54%
Total Manufacturing	106	32%	166	31%	57%
Total Services	223	68%	373	69%	67%
Total Domestic					
Manufacturing	78	31%	154	31%	97%
Services	172	69%	349	69%	103%
	250	100%	503	100%	
Total Foreign					
Manufacturing	28	35%	12	33%	-57%
Services	51	65%	24	67%	-53%
	79	100%	36	100%	

Table 1 Number of firms in Namibia

4.2 Horizontal Spillovers

Tables 2 presents the foreign firms' share of output, employment (total and female), exports as well as the share of foreign firms that innovate new processes or adopt foreign technology. In 2006, the overall foreign manufacturing firms' share of total output stood at 62%. However, as foreign presence decreased, the foreign manufacturers' share of output declined to merely 5% in 2006. Foreign services firms record an aggregate 37% of total output in 2006. In 2014, this also declined greatly to 7%, yet, contributing greater than the manufacturing firms do in the same year. While spillovers through the competition effect are likely to be greater by foreign manufacturing firms in 2006 compared to foreign services, this is reversed in 2014.

In 2006, the aggregate export sales by foreign manufacturers stood at 77%. This indicates that foreign manufacturers are likely to locate in Namibia to serve third markets due to a combination of incentives provided by the host country. While aggregate export activity nearly doubled in 2014, exports by foreign firms declined and record a share of mere 1%. Ideally, the services sector

records lower export activity as the only export activity would be services rendered outside of the country which further reduced in 2014. The higher share of export sales by foreign manufacturers compared to services again indicates that spillovers through the market-access effect may be stronger for the former compared to the latter. Especially since by nature, the services sector is not characterised as an exporting sector.

The aggregate foreign manufacturing firms contributed 40% to total employment in 2006. Similar to output, the foreign manufactures share of total employment decreased drastically to a mere 9% in 2014. Foreign firms in the services sector contributed 27% to total employment in 2006, lower than the manufacturing firms. The contribution of foreign services firms to total employment also declined to a mere 7% in 2014, also lower than their manufacturing counterparts. The higher share of employment by foreign manufacturers compared to services again indicates that spillovers through the labour effect may be stronger for the former compared to the latter.

The foreign share of female labour follows a similar trend to total labour. The aggregate share of foreign manufacturers to female labour stands at 37% in 2006. This is in line with beliefs that such industries prefer female labour for their "nimble and cheap fingers". The share of female labour employed by foreign manufacturers decreased to 12% in 2014. Data for female labour in the services sector is only available for 2014. The aggregate foreign services firms hold a share of 6.5%, lower than the foreign manufacturing firms in the same year despite the latter's low base. The results indicate that spillovers through the female labour effect is likely to be greater by foreign manufacturing firms compared to foreign services.

With regards to innovation, the percentage of manufacturing firms introducing or improving new processes exceeding 50%. This improved in 2014 with 100% of firms being innovative. There is no data for innovation by foreign services firms in 2006. In 2014, the aggregate of foreign services firms indicates an average of 78% having introduced or improved on processes. The 2014 results indicate that innovation and technology spillovers are likely to occur through foreign manufacturers compared to foreign services.

It is evident that domestic firms' overall ability to adopt foreign technology is low, this is more so of an issue for manufacturing firms in 2014 compared to services firms. In 2006, only 17.95% of

domestic manufacturers used technology licensed by foreign firms. In 2014, the aggregate picture did not change much, but slightly deteriorated to 17.65%. The higher share of services firms that adopt foreign technology in 2014 compared to the manufacturing firms alludes to the point the technology in the services sector is more easily adoptable. Technology in the services sector usually encompasses information technology and software which is easier to imitate compared to complex machinery and process systems in the manufacturing sector.

	Manufa	acturing	Serv	/ices	
	2006	2014	2006	2014	
Total Sales	2,076,039,992	5,516,720,976	1,365,600,000	2,672,024,955	
MNC Sales	1,281,700,000	290,000,000	511,900,000	197,169,991	
MNC Share	0.62	0.05	0.37	0.07	
Total Export Sales	1,266,413,238	2,333,029,930	145,303,000	137,946,000	
MNC Export Sales	971,180,000	18,196,430	7,790,000	200,000	
MNC Share	0.77	0.01	0.05	0	
Total Employment	5780	10081	3450	7561	
MNC Employment	2334	905	929	562	
MNC Share	0.4	0.09	0.27	0.07	
Total Female Employment	2421	59	-	3055	
MNC Female Employment	885	7	-	198	
MNC Share	0.37	0.12	-	0.065	
% of MNCs that introduce process	57 1/	100		78.26	
innovations	57.14	100	-	78.20	
% of MNCs that do not introduce process	42.86	0		21 74	
innovations	42.00	Ŭ	-	21.74	
% of domestic firms using foreign	17 95	17 65	-	22.22	
technology	17.55	17.05		~~~~~	
% of domestic firms not using foreign	82.05	82.35		77.78	
technology			-		

Table 2 MNC shares of sales, employment, innovation and technology adoption

Table 3 provides the summary statistics results of horizontal spillover measures. For manufacturing firms in 2006, it is evident that spillovers are strongest through the female labour (HS6) and market-access (HS5) channels as they record the greatest mean values of 37% and 31% respectively. These values succeed the conventional measures of spillovers of output (HS1) and employment measures (HS2) of 21% and 15% respectively. Foreign firms' introduction of new

processes or process innovation (HS3) records a mean 1.43 indicating the greater probability of foreign firms to be innovative. It is also evident that spillovers through access to foreign technology by domestic firms (HS4) are less likely to occur with a mean of 1.82 indicating a lower probability for domestic firms to adopt foreign technology. HS1, HS2 and HS5 are the only comparable spillover measures for the services firms in the same period. While they are evidently lower compared to the manufacturing sector, they all record equal means of 2%. All spillover measures, except HS4, strengthened for the manufacturing firms in 2014. Again, female employment and market-access channels record the largest means, followed by foreign firms' process innovation. Their means remain to exceed that of the conventional measures of output and employment shares. Spillover measures for foreign firms and domestic firms use of foreign technology are comparable with manufacturing. Similarly, spillovers via female employment is the strongest in this sector followed by foreign firms' process innovation.

Manufacturing										
	HS1	HS2	HS3	HS4	HS5	HS6				
2006										
Mean	0.21	0.15	1.43	1.82	0.31	0.37				
Std. Dev.	0.25	0.17	0.5	0.39	0.39	0.28				
Obs	27	28	28	78	21	27				
2014										
Mean	0.37	0.18	1	1.82	0.49	1				
Std. Dev.	0.37	0.21	0	0.38	0.5	0				
Obs	4	12	12	136	4	3				
		9	Services							
	HS1	HS2	HS3	HS4	HS5	HS6				
2006										
Mean	0.02	0.02			0.02					
Std. Dev.	0.04	0.03		•	0.06	•				
Obs	51	51		•	40	•				
2014										
Mean	0.08	0.05	1.22	1.78	0	0.29				
Std. Dev.	0.18	0.14	0.42	0.44	0	0.38				

Table 3 Horizontal spillovers, descriptive statistics

The strong spillovers through the female labour effect aligns with the preferences of the manufacturing MNCs to employ female labour because of their nimble and cheap nature. The high value of the female labour effect in the services sector compared may come as a result of greater investment in female intellect. Hence, the inability of females to access private markets and absorb their information may be ruled out. The higher value of female labour effect compared to aggregate labour effect means that it is more likely that females in MNCs may move to domestic firms and transmit the knowledge they gained (Braunstein, 2006; Mosley & Uno, 2007; Colen, et al., 2008; Neumayer & De Soysa, 2011; Latorre, 2016; World Bank, 2012; Naomi, et al., 2016).

The greater value of HS5 over HS1 implies that manufacturing MNCs are likely to locate in Namibia to serve a third market. While spillovers through the competition effect maybe low, MNCs are likely to assist domestic firms into entering global value chains and sell their own goods in international markets. While the number of foreign services firms exceeds that of foreign manufacturing firms, the value of output of foreign manufacturers prevails. This results in greater spillover through the competition effect (HS1) for manufacturers compared to services firms. This could be due to the greater value addition inherent in the manufacturing process from production to selling the finished goods as opposed to the services which is merely a mark-up factoring in cost of transportation (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014; Ben Hamida, 2011; Hale & Long, 2011).

Strong spillover evidence from process innovation indicates the foreign manufacturers' ability to introduce innovations to the market either because of their ability to leverage off their foreign parents and/or greater R&D intensity, particularly for manufacturers. The greater ability of domestic services firms to adopt foreign technology (HS3) may be because this industry requires soft technology as opposed to heavy machinery and equipment (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014; Solomon, 2008)

4.3 Vertical Spillovers

Table 4 presents the results of the conventional measures of backward and forward linkages as suggested initially by Javorcik (2004) for both sectors. The manufacturing sector shows the evidence of creating both backward and forward linkages in both years. However, the degree of

backward linkages experienced a slight decline falling from a mean of 12% in 2006 to 10% in 2014. This is either due to the declined foreign presence between the two years, increased procurement from outside of Namibia as required intermediate goods may not be available locally or a combination of both. However, the degree of forward linkages increased form 9% to 11% between the two time periods alluding to greater sales to the domestic market possibly on the back of increased awareness and demand or more stringet regulations affecting the export market. The services sector records lower values of both backward and forward linkages compared to the manufacturing sector. However, the linkages improved between the two years. Services firms are characterised as importers of goods to re-sell in the local market. However, foreign services may have increased their procurement from local sources which is becoming an increasing demand by Namibian authorities. The increase in forward linkages by foreign firms in the service sector is primarily due to the construction and transport sectors who mainly served the public sector in Namibia but are increasingly providing services to other private participants (Nunnenkamp & Spatz, 2004; Iyer, 2009; Farole, et al., 2014).

Manufacturing										
	BL1 FL1 BLM2 D06									
2006										
Mean	0.12	0.09	32.68	0.16						
Std. Dev.	0.11	0.08	35.91	0.23						
Obs	20	20	28	27						
2014										
Mean	0.1	0.11	28.57	0.34						
Std. Dev.	0.12	0.16	32.88	0.38						
Obs	7	7	7	4						
	Serv	ices								
	BL1	FL1	BLS2	FL2						
2006										
Mean	0.03	0.02	-	0.02						
Std. Dev.	0.01	0	-	0.05						
Obs	51	51	-	50						
2014										
Mean	0.08	0.05	89	0.08						
Std. Dev.	0.08	0.09	24.84	0.22						
Obs	23	23	17	16						

Table 4 Vertical spillovers, descriptive statistics

Table 4 also provide an analysis of the percentage of material inputs and supplies that are of domestic origin (BLM2) as an alternative measure for backward linkages. This measure indicates the inclination of foreign firms to source locally, meaning the creation of backward linkages. This data is only available for manufacturing firms in 2006 and 2014. In 2006, the aggregate average of materials of domestic origins stood at 33% and declined considerably to 29% in 2014. This decrease indicates that foreign manufacturing firms are increasingly sourcing inputs from outside of Namibia, the lack of local sourcing and hence the lower tendency to create backward linkages. This is in line with the evidence obtained from BL1 which shows that backward linkages by foreign firms in the manufacturing sector declined between the two periods.

Table 4 also shows an analysis of the supply strategies by foreign firms in the services sector. The indicator, BLS2, differs from the manufacturing firms due to the difference in the surveys for the two sectors. For the services sector, supply strategy is measured as the percentage of finished goods/materials bought to re-sell of foreign origin. A higher value indicates the propensity of foreign services to procure inputs of non-Namibian origin, hence the lack of backward linkages. This data is only available for 2014 and shows that on average, foreign services source 89% of their goods from non-Namibian sources. This indicates the unlikelihood of foreign services firms to create backward linkages and is in line with the lower backward linkages measure obtained from BL1 measure compared to the manufacturing firms. This is consistent with the belief that foreign services firms import the majority of their goods in to re-sell in the local market (Nunnenkamp & Spatz, 2004; Iyer, 2009; Farole, et al., 2014).

Tables 4 and 5 provide evidence of FL2, an alternative metric to measure the creation of forward linkages for both sectors. This is based on the foreign firms share of local sales with a higher value meaning a creation of local distribution chains and hence the creation of forward linkages. In 2006, it is evident that the foreign services firms constitute a higher share of sales (40%) compared to manufacturing firms (38%). The MNCs' share of local sales for both sectors declined to 8% in 2014. It is evident that the mean of FL2 increased for both the manufacturing and services firms over the two year period. FL2 is stronger for the manufacturing sector than it is for services sector despite the belief that foreign services firms are likely to locate in a host country to serve that

domestic market (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014)

Namibia 2006									
Manufacturing	832,540,000	315,900,000	38%						
Services	1,265,600,000	506,000,000	40%						
Namibia 2014									
Manufacturing	3,443,838,300	273,500,000	8%						
Services	2,567,105,000	195,520,000	8%						

Table 5 MNC share of local sales

4.4 Determinants of spillovers

As explained previously, the size and magnitude of spillovers can be influenced by a range of firm and host country characteristics. In the WBES survey, respondents are asked to assess these host country factors and indicate to what degree it possess as an obstacle to their business. Table 6 provide the descriptive results of the responses. In 2006, the average firm indicates that an inadequately educated workforce and access to finance can be considered as moderate obstacles with mean values of greater than 1 but less than 2. However, transport records a mean value of less than 1 meaning that it can be considered as a minor obstacle. In 2014, the severity of an inadequately educated workforce as an obstacle decreased (mean=0.8). This possibly suggests to the increasing educational attainment of the Namibian workforce. However, access to finance and transport became increasingly moderate obstacles for firms in Namibia (mean=2 and 2.05 respectively). This may indicate the more stringent regulations for firms to access finance as well as the lack of development in transport infrastructure.

Obstacle	Obs	Mean	Std. Dev.	Min	Max
2006					
Inadequately educated workforce	329	1.419453	1.320702	0	4
Access to finance	329	1.106383	1.380699	0	4
Transport	329	0.702128	1.121857	0	4
2014					
Inadequately educated workforce	569	0.789104	1.062064	0	4
Access to finance	569	1.998243	1.376998	0	4
Transport	569	2.056239	1.46208	0	5

Table 6 Host country characteristics, descriptive statistics

As explained previously, the determinants of spillover measure model is estimated using OLS with time fixed effects and IV 2SLS. However, for HS3 and HS4, the models are estimated using probit estimation technique due to their categorical nature. The results of the regressions are presented in tables 7-9. Models 1 to 4 present the result of the horizontal spillovers under OLS method. In all models, the degree of foreign ownership and size of firm are insignificant and do not show evidence of any influence on the size and magnitude of spillovers. Age of the firm only has a significant positive impact on HS2 and HS5. Meaning that HS2 and HS5 are likely to improve by 0.05% and 0.1% respectively as a firm ages in Namibia. The reason could be the older firms become more familiar with labour market and export market. Employees in older firms are gain greater knowledge and expertise that is transmissible to other firms (Gorodnichenko, et al., 2007; Iyer, 2009; Farole & Winkler, 2014). Moreover, older firms reap the benefits of Namibia's generous exporting policies implemented circa independence. The sector dummy shows a positive significant relationship with all models 1 to 4, with the greatest coefficient being for HS6. The results indicate that firms in the manufacturing sector are more likely to contribute to horizontal spillovers compared to services firms owing to their greater labour intensity, particularly female labour, their exporting tendency and competitive pressures (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014; Ben Hamida, 2011; Hale & Long, 2011).

Access to finance shows a significant and positive relationship with HS1 and HS5 only. While this may seem slightly contradictory, it is likely that firms that have difficulty accessing local finance sources have access to other sources of funds such as cash flow, group or shareholder finance. This then provides them a competitive edge over with greater funding for innovation, development and employee training. Transport shows a negative significant relationship with HS1, HS2 and HS6. As transport is considered more of an obstacle, spillovers through competition effects, labour effect and female labour effect are likely to decline by 1.2%, 0.4% and 2.2% respectively. The lack of both transport infrastructure and services is likely to impact the movement of goods and employees, there by hindering spillovers through output and employment. An inadequately educated workforce only has a significant positive relationship with HS6. It is likely that firms that identify a weakly educated workforce, especially females, invest more in training that workforce, hence equipping them with greater knowledge. (Blomström, et al., 1999; Javorcik, et al., 2002;

Crespo & Fontoura, 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2014).

Table 7 presents evidence models 5 to 8 for the same horizontal spillover measures using IV 2SLS estimation technique. The same result holds for the degree of foreign ownership where there is no significant impact on horizontal spillovers. The age of the firm shows a positive significant relationship with HS2 and HS5, similar to OLS, in addition to HS1. The reasoning holds, that older firms are more familiar with labour and export market, but are also more integrated in the local market with dominating market shares. Like the OLS, the sector dummy shows a positive and significant relationship with horizontal spillovers. HS6 shows the greatest coefficient albeit being slightly less than the model 4. The origin of the firm represented by the African dummy also does not show any significant relationship with the horizontal spillovers. While the positive significant impact of access to finance on HS1 holds, it also shows a positive significant relationship with HS2. In models 5 to 8, the transport variable no longer shows a significant impact on the horizontal spillovers. Moreover, the significance of the Durbin Wu-Hausman tests prove that the null hypothesis that the education variable is exogenous for models 5 to 7 cannot be rejected. Hence, it cannot be assumed that the OLS results are not inconsistent and still hold. However, endogeneity is only evident for model 8 where the education variable shows a negative significant relationship with HS6. As the severity of an inadequately educated workforce increases, the spillover through female labour is likely to decrease by 10%. In Namibia, overall educational attainment for females is low, hence their ability to transmit knowledge may be hindered. This may be compensated by learning and development provided by the firms.

Table 8 present the results of the probit model 9 and 10 for horizontal spillover measures HS3 and HS4. In both models, only the degree of foreign ownership shows a significant relationship. However, the degree of foreign ownership shows a positive influence on HS3 while it shows a negative relationship with HS4. It is likely that greenfield and M&A investments as reflected by higher degrees of foreign ownership increase the probability of process innovation of a firm by 16%. This relates to the belief that foreign firms are generally more innovative than domestic firms owing to their ability to leverage off their parent companies' innovations as well as higher investment in R&D. A higher degree of foreign ownership decreases the probability of domestic

firms to use foreign technology by 12%. This alludes to the belief that firms with partial domestic ownership such as JVs are pertinent to diffusion of technology among firms in Namibia due to their increased familiarity and connection to the domestic market. Fully foreign-owned firms such as greenfields are less likely to create relationships with domestic firms, hence the lower probability to transfer technology. In addition, the size of the firm shows a negative and significant impact on HS4 alluding to that smaller firms are likely to instigate technology diffusion and do not abide to policies that strictly prevent leakage of information and technology (Konings, 2000; Javorcik, 2004; Crespo & Fontoura, 2007; Gorg, et al., 2009; Mebratie & Van Bergeijk, 2013; Gerschewski, 2013; Farole & Winkler, 2014; Farole, et al., 2014; Winkler, 2014; Jude & Levieuge, 2017).

Model	1	2	3	4	Model	5	6	7	8
OLS	HS1	HS2	HS5	HS6	IV 2SLS	HS1	HS2	HS5	HS6
Foreign	0.0000158	0.0000814	0.0000759	-0.0003967	Education	-0.176705	-0.0164846	-0.0045549	-0.1035252**
ownership	(0.00022)	(0.0001155)	(0.0001667)	(0.0004977)	Education	(0.020157)	(0.0199675)	(0.0239229)	(0.0413657)
	0.000479	0.0005936**	0.0010306**	0.0011417	Foreign	0.0000215	0.0000315	0.0000829	0.0000259
Age	(0.0005592)	(0.0002955)	(0.0004046)	(0.0012633)	ownership	(0.0001513)	(0.0001498)	(0.000168)	(0.0004904)
C	-0.0087481	-0.0007722	0.0020467	-0.0038473		0.0014772***	0.0014975***	0.0018364***	0.0011787
Size	(0.0116879)	(0.0061744)	(0.0086824)	(0.0259782)	Age	(0.0004816)	(0.0004771)	(0.0005291)	(0.001359)
Castar	0.1937577***	0.0949794***	0.1158266***	0.4439322***	Conton	0.1335967***	0.130738***	0.106577***	0.3251107***
Sector	(0.0134689)	(0.0071026)	(0.0106106)	(0.0406672)	Sector	(0.137437)	(0.0136144)	(0.0165684)	(0.0381593)
Access to	0.0075582*	0.0064269	0.0101829***	-0.0134781	A 5-1	0.0330295	0.0034689	0.0171617	0.0409186
finance	(0.0042877)	(0.0022657)	(0.0033099)	(0.0094281)	African	(0.0146362)	(0.0144985)	(0.0169732)	(0.0453432)
Transmort	-0.011799***	-0.0041885*	-0.003517	-0.021850***	Access to	0.0103721**	0.0100615**	0.0056706	0.0168057
Transport	(0.0040476)	(0.00214)	(0.0029882)	(0.0082164)	finance	(0.0048302)	(0.0047848)	(0.0055754)	(0.0135144)
Education	-0.0042301	-0.00375	-0.0065124	0.0225449*	Trononort	-0.0033393	-0.0032187	0.0004683	-0.0014047
Education	(0.0052278)	(0.002764)	(0.0040994)	(0.0124031)	Transport	0.0058446	(0.0057896)	(0.0060584)	(0.015738)
Veer	-0.081746***	-0.0037175	-0.0370267*	-0.493255***					
rear	(0.0258069)	(0.0136352)	(0.0201634)	(0.0689112)					
Desien	0.0011328	0.0032783	-0.0010772	0.0988171					
Region	(0.0249514)	(0.0131915)	(0.0196126)	(0.0659098)	R-squared	0.279	0.2796	0.2634	0.1622
					Prob > chi2	0.0000***	0.0000***	0.0000***	0.0000***
R-squared	0.2279	0.1878	0.1719	0.2509	Obs	329	329	246	135
Prob > F	0.0000***	0.0000***	0.0000***	0.0000***	Durbin	0.441392	0.347731	0.001433	7.11941***
Obs	894	896	750	514	Wu-Hausman	0.429894	0.338576	0.001381	7.01472***

Table 7 Determinants regression for HS1, HS2, HS5 and HS6

Standard errors in parenthesis ***p<0.01 **p<0.05 *p<0.1

Table 8 Determinants regression for HS3 and HS4

Model	9	10
Probit	HS3	HS4
Foreign	0.1600015**	-0.1208627***
ownership	(0.0687214)	(0.0411257)
Age	0.0005693	-0.0011854
	(0.0027517)	(0.00215)
Size	-0.7367226	-0.5594053**
	(1.030235)	(0.2540119)
Access to	-0.0546618	0.0797843
finance	(0.4131941)	(0.0902204)
Transport	-0.2703247	-0.2050136
-	(-0.4106319)	(0.1392926)
Education	0.3386752	0.0412996
	(0.6271598)	(0.123935)
Sector	1.630533	-
	(2.510896)	-
Year	1.376077	0.6991722
	(2.041298)	(0.9406639)
Region	-1.483568	1.063101
	(1.799117)	(1.557723)
Pseudo R2	0.9758	0.7476
Prob > chi2	0.0000***	0.0000***
Obs	653	259

Standard errors in parenthesis

***p<0.01 **p<0.05 *p<0.

Table 9 report the results of the OLS and IV 2SLS estimations for the backward and forward linkages measures. Models 11 and 12 report the results for the conventional measures of backward and forward linkages as suggested by Javorcik (2002, 2004). In both models, only the sector dummy shows a positive and highly significant relationship increasing by 8.3% and 8.6% for BL1 and FL1 respectively. The manufacturing firms are found to increase the size of backward linkages with a positive magnitude owing the fact that they are likely to procure intermediate goods locally for production. In addition, only the age variable shows a positive significant relationship with BL1, albeit being only at 10% significance with a small coefficient of 0.12%. Older firms are likely to be well integrated in the local economy with more knowledge and experience on appropriate suppliers. Under the IV 2SLS estimations, model 16 and 17 still show that the sector dummy has a highly significant and positive relationship with BL1 and FL1 with stronger coefficients (11% and 9.3% respectively). However, this time, the education variable shows negative significant relationship for both variables, decreasing BL1 and FL1 by 3.4% and 3.9% respectively. The education of the workforce impacts the efficiency of firms and therefore the transmission and absorptive capacity of new knowledge and technology. Hence, the more a workforce is perceived as inadequately educated, the less likely knowledge and technology are likely to be transferred through backward and/or forward linkages (Gorodnichenko, et al., 2007). The Durbin Wu-Hausman tests are significant indicating that we can reject the null hypothesis that the education variable is exogenous, hence the results of the IV 2SLS can be considered as consistent.

Models 13-15 and 18-20 report the results of determinants of the new measures of backward and forward linkages for both OLS and IV 2SLS respectively. For models 13, 14, 18 and 19, the sector dummy is not entered because BLM2 and BLS2 are already specific measures for the manufacturing and services backward linkages. In addition, the year effect is not entered for BLS2 because the data is only available for 2014. Model 13 indicates the transport variable has significant positive relationships with the backward linkages variables. For the manufacturing sector, as transport becomes more of an obstacle, firms are likely to source inputs from local sources. Poor transport might be more of an issue for international transfers hence, manufacturing firms would be reluctant to import goods due to longer turnaround times and resort to sourcing locally where they can. However, using the IV 2SLS technique, mode 18 shows no significant relationship between the independent variables and BLM2. The Durbin Wu-Hausman tests are

insignificant, hence we cannot reject that the education variable is exogenous, meaning that the results of model 13 still hold.

Under the OLS for model 14, the age variable has a negative significant relationship with the BLS2. This indicates that older firms are less likely to source foreign inputs to re-sell in the domestic markets. Older firms are more familiar with the local context, hence would know appropriate local suppliers. In addition, the transport variable has a positive significant relationship with BLS2. This indicates that as transport becomes more of an issue, then services firms are likely to source foreign inputs. However, under the IV 2SLS regression in model 18, these results all become insignificant. The Durbin Wu-Hausman test shows as significant hence, it the results of model 18 are more likely to hold. It is likely that there are other variables not captured in the model, which influence the backward linkages created services firms.

Under the OLS estimation for model 15, only the sector and transport variables have positive and negative significant relationships with FL2 respectively. As seen from previous analysis, the chemicals and chemical products sub-sector was a new market entrant in 2014 which mainly serves the domestic market with a high value. It is likely that this strong effect influences the overall linkages in the manufacturing sector. The more transport is perceived as an obstacle, FL2 is likely to decrease by 1.2%. Transport infrastructure and services play an important role in the distribution and delivery of final goods. Weak transport then indicates that the distribution and delivery to final local consumers and hence forward linkages are hindered.

Model	11	12	13	14	15	Model	16	17	18	19	20
OLS	BL1	FL1	BLM2	BLS2	FL2	IV 2SLS	BL1	FL1	BLM2	BLS2	FL2
Foreign	0.000252	0.0003529	-0.0525767	-0.0106978	0.0000182	Education	-0.0339911*	-0.0392126**	5.297435	-74.30459	-0.0176796
ownership	(0.0003283)	(0.0003404)	(0.0492926)	(0.0336556)	(0.0002193)	Education	(0.0200329)	(0.0183143)	(5.121016)	(42.77125)	(0.0201567)
Age	0.0011804*	0.0010162	-0.1280587	-0.28201***	0.0004972	Foreign ownership	-0.0001451	-0.0001997	0.0038019	-0.1341942	0.0000216
	(0.0006367)	(0.0006603)	(0.0962271)	(0.0804762)	(0.0005575)	-	(0.0004767)	(0.0004358)	(0.0688432)	(0.6307889)	(0.0001513)
Size	-0.016384	-0.0168801	0.0505702	-1.965444	-0.0089136	African	0.0163548	-0.0004878	8.695393		0.0030342
	(0.011417)	(0.0118406)	(2.067486)	(1.478356)	(0.0116522)		(0.017719)	(0.0161989)	(5.805984)		(0.014636)
Sector	0.083817***	0.0862586***			0.195078***	Age	0.0012945	0.0004024	-0.3101624	0.1114957	0.0014774***
	(0.0197015)	(0.0204325)			(0.0134278)		(0.0008016)	(0.0007329)	(0.1822285)	(0.6069166)	(0.0004816)
Access to	-0.0028613	-0.0034336	0.5249926	-0.4490128	0.0074301*	Sector	0.1103839***	0.0928111***			0.1335577***
manee	(0.0063407)	(0.0065759)	(0.7995131)	(0.4773823)	(0.0042746)		(0.0218729)	(0.0199965)			(0.0137434)
Transport	0.0066965	-0.0004864	2.165454**	0.7879103**	- 0.011947***	Access to finance	0.0085554	0.0073293	-0.2008003	11.21892	0.010372
	(0.0063363)	(0.0065715)	(1.001757)	(0.3607827)	(0.0040352)		(0.0099722)	(0.0091167)	(1.688294)	(7.153749)	(0.0048301)
Education	0.0027549	-0.0015632	-1.086217	1.227535*	-0.0041543	Transport	0.0019481	0.0035345	0.1951715	12.93922	-0.0033374
	(0.0061459)	(0.0063739)	(0.9889986)	(0.6561688)	(0.0052119)		(0.007996)	(0.0073101)	(2.084722)	(9.428547)	(0.0058445)
Year	-0.0563029**	-0.0469514**	-6.739741		-0.08434***						
	(0.0223304)	(0.023159)	(5.404708)		(0.0257282)						
Region	0.0015276	0.0078002	-6.788508		0.0012655						
	(0.0177342)	(0.0183922)	(5.449196)		(0.0248753)	R-squared	0.1516	<0	<0	<0	0.2789
						Prob > chi2	0.0000***	0.0001***	0.3123	0.5847	0.0000***
R-squared	0.2552	0.1767	0.1485	0.0696	0.2325	Obs	71	71	106	140	329
Prob > F	0.0000***	0.0013***	0.0000***	0.0001***	0.0000***	Durbin	6.23789**	10.4068***	1.19603	21.4453***	0.441978
Obs	101	101	283	390	894	Wu- Hausman	5.97184**	10.6485***	1.11839	24.0583***	0.430466

Table 9 Determinants regression for vertical spillovers

Standard errors in parenthesis ***p<0.01 **p<0.05 *p<0.1

5. Conclusion and Policy Implications

FDI is often commemorated for its vast array of potential benefits it brings to a host economy. Such benefits include knowledge and technology diffusion, also known as spillovers, to the local firms. The objective of this research is to investigate spillovers and their determinants within the Namibian context based on the WBES firm level data. Too often, previous research papers only consider two types of horizontal spillover channels only, the competition and labour effects. This research contributes to literature by attempting to measure alternative spillover channels such as direct technology spillover and market-access effect. In addition, studies that attempt to measure the labour effect fail to consider different gender dynamics which is then considered in this study. Theory shows that female labour differs in terms of their skills, time usage, access to information and networks. In addition, while a scarce number of studies attempt to measure vertical linkages, the conventional measures used suffer from several bias. The study overcomes this by introducing new measures to accurately capture the creation of linkages. Previous studies are highly concentrated on studying the manufacturing sector. There are clear differences in how the manufacturing and services sector operate with regards to labour intensity, type of technology and creation of linkages. This study further contributes to literature by investigating spillovers in both sectors. Furthermore, using both the OLS fixed effects and IV 2SLS techniques, this study attempts to investigate the firm and host country characteristics that influence spillovers. Understanding the determining factors of the size and magnitude of spillovers lacks in literature, yet is necessary to devise appropriate policies to attract the correct form of FDI as well as to catalyse the realization of spillovers.

Overall, there is strong evidence to suggest spillovers are stronger through the female labour effect, the market-access effect, innovation and direct technology transfers. Manufacturing MNCs prefer low-skilled female labour due to their lower cost whilst higher-skilled female labour may be attracted to services MNC due to their greater flexibility in time usage. Female labour is an important means in both sectors to transmit tacit knowledge for the benefit of local firms. Whilst it may seem that manufacturing MNCs locate in Namibia to take advantage of incentives, low factor pricing and serve third markets, they simultaneously introduce a channel of spillovers through the market-access effect. Export-oriented MNCs that locate in Namibia may induce knowledge spillovers of broader exporting strategies to local firms. In addition, foreign manufacturers are found to be more innovative, especially regarding process, which domestic firms are likely to leverage off and imitate through leakages. Moreover, adoption of foreign technology by domestic firms in the services sector is found to be greater, which could be attributable to the compatibility and easiness to imitate technology in that sector. Overall, spillovers through the competition and total labour effect as measured by the conventional measures are lower. However, they remain to be higher for the manufacturing MNCs compared to the services firms due to their differing labour intensity and value-adding initiatives (Nunnenkamp & Spatz, 2004; Chakraborty & Nunnenkamp, 2008; Iyer, 2009; Farole, et al., 2014; Ben Hamida, 2011; Hale & Long, 2011; Naomi, et al., 2016; World Bank, 2012).

The results show the presence of both backward and forward linkages for both sectors. Both the conventional and new measure of backward linkages for the manufacturing sector record a decline over the two years. This indicates that foreign manufacturers have been increasingly sourcing inputs from outside Namibia either due the unavailability or low quality of production goods in Namibia. For the services sector, the creation of backward linkages with local firms as measured by the conventional and new measures are lower compared to their manufacturing counterparts. This implies that foreign services inputs are likely to import their goods to re-sell in the Namibian markets which may be dictated by parent company policies or unavailability of supply locally. In addition, both the conventional and new measures show evidence of forward linkages where it prevails also for the manufacturing firms. Even though on aggregate manufacturing MNCs in Namibia are export-oriented, they are likely to sell to local distirbutors to export on their behalf. (Nunnenkamp & Spatz, 2004; Iyer, 2009; Farole, et al., 2014; Chakraborty & Nunnenkamp, 2008)

Foreign firms characteristics that are found to have a significant effect on spillovers include the percentage of foreign ownership, sector and firm age. Firms with greater degrees of foreign ownership are found to induce spillovers through innovation and direct technology channels. Whilst firms with lower foreign ownership degrees and have domestic partners are likely to induce technology transfers. The sector of a firm also has an effect on spillovers whereby manufacturing firms are found to more likely exert stronger spillovers due to their greater value adding nature, labour intensity, particularly female labour, greater competitive pressures and propensity to source

inputs locally. In addition, older firms are likely to be more familiar with the local suppliers, workforce, and are also more likely to have gained market share and competitive power over the years thereby inducing spillovers. There is no evidence to suggest that the origin of MNCs or firm size impact spillovers (Konings, 2000; Javorcik, et al., 2002; Javorcik, 2004; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2007; Gorg, et al., 2009; Mebratie & Van Bergeijk, 2013; Gerschewski, 2013; Farole & Winkler, 2014; Farole, et al., 2014).

There is consistent evidence that access to finance has an impact on is likely to influence horizontal spillovers. Whilst access to local finance may seem as an obstacle, firms will have access to other sources of funds which they can invest providing them a competitive edge. Transport also has a significant impact on spillovers where by poor transport might hinder movement of goods and mobility of people (Blomström, et al., 1999; Javorcik, et al., 2002; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2014). There is also evidence to show that a lesser educated workforce is likely to deteriorate the size of spillovers through the female labour. In addition, poor education attainment is likely to influence the workforce's efficiencies and absorptive capacity, hence hinders diffusion to local suppliers and distributors (Blomström, et al., 1999; Javorcik, et al., 2002; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2014; Farole, et al., 2007; Gorodnichenko, et al., 2002; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2002; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2002; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2004; Crespo & Fontoura, 2007; Gorodnichenko, et al., 2007; Farole & Winkler, 2014; Farole, et al., 2014).

The findings of the analyses present a series of policy implications for Namibia. Investment promotion policies should be focused on attracting the "right" foreign investment. A clear evaluation program should be developed to assess the benefits of potential FDI. This would include assessing the innovation and technology contribution of the potential investment and how likely it is to be adopted by local firms. In addition, localization of equity stake holding in foreign firms is recommended and a bill that Namibia is busy tabling. While finalizing the bill should be expedited, this should not be miscomprehended as forcing foreign investors to engage in JVs with local partners. JVs should also be assessed on case by case basis where potential benefits are carefully considered. In this case, governments and other domestic players can assist in providing information on potential local firms and investors that can best fit in equity acquisitions.

More sector-specific investment policies should be adopted and target value-adding sectors which are more viable in developing the economy through greater competitive pressure and creation of local linkages. Whilst incentives to locate in Namibia should be maintained or enhanced, the government should be weary not to over incentivise and consequentially bid away benefits of spillovers. To expidate spillovers through local linkages governments and banks can facilitate access to information on available suppliers and distributors that MNCs can integrate with. A comprehensive procurement program by the government can include monitoring and evaluation framework to ensure that MNCs are committed to local procurement with the provision of incentives when certain targets are met. The government can also help local firms by equipping them with the necessary skills and inputs in order to make them appropriate vendors and suppliers.

The employment of females should be encouraged in Namibia as it is seen that there is great value in female labour as a channel for knowledge and technology spillovers from MNCs to local firms in both sectors. While the Affirmative Action Act allows for this, better enforcement of the act is required. Namibia should also immensely develop its social policies particularly in terms of education of the workforce. Greater investment and budget allocations should be made to the educational sector. This may be particularly beyond secondary school, such as tertiary education or vocational training, where the workforce could learn more practical skills and knowledge. Alternatively, firms should increase training and development expenditure and invest more in their employees where the national education lacks.

More so, it is evident that transport plays a great role in not only in the mobility of intermediate and finished goods, but also in the mobility of labour. Greater investment is also required in Namibia's domestic transport infrastructure and services, particularly outside of suburban areas. Such investment requires participation from both the public and private sector where the former can off-load some of the risk in order for the former to mobilize resources. Alternatively, firms should consider providing transport services for their employees and to develop the infrastructure in their surrounding areas.

6. References

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