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Knowledge Transfer in MNEs in Africa

A Network Approach of Firm Survey Data from Ghana

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PRELIMINARY DRAFT

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1 Introduction

Knowledge transfer and local capability building is crucial for sustainable industrial development in developing countries. This has significant implications for income growth, job creation and hence poverty reduction. Cross border direct investment by multinational enterprises (MNEs) and human mobility are important channels for international knowledge transfer (Fu et al. (2012); Lall (1997); Dunning (1998)).

While there is substantial literature on knowledge transfer by MNEs, the research on managerial knowledge transfers is rare with only a few exemptions (e.g. Child et al. (1999); Fu (2012); Auffray and Fu (2015)), especially in the context of low income countries in Africa.

Moreover, the existing literature on FDI and knowledge transfers mostly focused on inter-organisation transfer and spillover at the firm, regional or national level (e.g. Kokko et al. (1996); Fu and Gong (2011); Javorcik and Saggi (2003)). Individuals are important agents in the economy who undergo the learning, creation and production activities. Despite this, how knowledge is transferred at an individual level is under researched. Existing research in this area is mostly case study based. Large survey data based statistical analysis and evidence is rare.

In addition to this, MNEs in Africa from other emerging economies (EEMNES) such as China have grown rapidly in the past century. Large investments have been made in Africa by such EEMNES. Do these new EEMNES have different characteristics, and hence a different impact on host economies, especially in terms of knowledge transfers to the local communities? These are new research questions that await exploration. The new literature in this area mainly focuses on the determinants of FDI, and the political or environmental effects of these FDI. The impact of Chinese FDI in Africa, especially on local managerial capabilities is limited. We are not aware of any study on this question using large survey data.

Using a new unique employee and manager survey in 8 MNEs in Ghana in 2015, this study analyses the transfer of knowledge at individual level using social network analysis. This study systematically examines the various work and social links between employees at these MNEs, and the channels for the diffusion of knowledge. We mapped out the network structure and calculated the network properties for the firms and individuals. We then tested whether the knowledge transfer within the MNEs is influenced by the social network structure and compared the social network and the knowledge transfer in MNEs of different backgrounds, i.e. the European and Chinese MNEs.

The research finds that decentralized networks of the MNEs enhance knowledge transfer in the firm. In addition, more channels of communication mean more knowledge transfer. We also find that the Chinese MNEs and European MNEs have no significant difference in knowledge transfers except that sub-ordinates in Chinese MNEs benefit more from knowledge transfers. The rest of the report is structured as follows: the next section reviews the literature on FDI, social network and knowledge transfer. The third section introduces the economy in Ghana and Chinese FDI in Ghana and Africa. After this we introduce the data, including the survey and sampling methods, the main variables and descriptive statistics. Section five presents the quantitative analysis and Section six concludes the report.

2 Literature Review

Most papers on the spillover effect of FDI are about technological knowledge diffusion. The empirical evidence of managerial knowledge spillovers from FDI is limited (Fu (2012)). The literature review part reviews the papers about the FDI and knowledge transfer, especially managerial knowledge transfer, as well as the literature on social network and knowledge transfer.

2.1 FDI and Knowledge Transfer

In academic research, there are traditions of studying the diffusion and spillover of knowledge in different areas, focusing especially on technology, innovation and growth (see Jaffe (1986), Barro and Sala-i Martin (1997), and a review for international technology diffusion Keller (2004)). Recent studies include Bloom et al. (2013), studying technology spillover using US firm panel data, Aghion and Jaravel (2015), studying the *R&D* and knowledge spillover in economic growth process. The FDI impacts the development and economic growth of the host developing countries in many aspects. As stated in Fu and Buckley (2015), the Chinese FDI impacts the host developing countries in the following ways: development financing, knowledge transfer and spillover, competition and crowding out effect.

This paper focuses on the knowledge transfer and spillover. Literature on the knowledge spillover always focuses on the technology diffusion. Glass and Saggi (2002) model the technology transfer. They assume that workers employed by the MNEs acquire knowledge of superior technology and find that host country would attract FDI due to technology transfer to local firms. Singh (2007) use patent citation data and study the knowledge spillover between MNEs and host country firms. They find that knowledge inflows from foreign MNEs to host country organisations, and also knowledge outflows back from the host countries to foreign MNEs. Liu (2008) use a panel data of Chinese manufacturing firms to study the FDI externalities in the form of technology transfer. He finds a positive increase in the productivity of domestic firms in the long run. Driffield et al. (2010) study FDI and the knowledge flows in Italy. They conclude that investment in *R&D* and capital-embodied technology plays a significant role in intra-firm technology flows. Some specially studies the conditions for knowledge transfer. Fu et al. (2011) find that emerging countries can only benefit from international technology diffusion with parallel indigenous innovation, modern institutional and governance structures and conducive innovation systems.

However, some studies find different results. Aitken and Harrison (1999) find that the net gain from FDI is quiet small and FDI negatively affects the productivity of domestically owned firms in Venezuela. García et al. (2013) find that FDI inflows into Spain are negatively associated with the ex post innovation of local firms.

Some papers address the worker's mobility as an important channel of knowledge transfer from MNEs to local firms. For instance, Fosfuri et al. (2001) study the technological spillover through worker's mobility and find that spillover from FDI happens when the previously MNEs trained worker is hired by the local firms. Poole (2013) finds that in Brazil, when workers leave MNEs and are rehired in local firms, the wages increase. High skilled former MNE workers are better able to transfer information, and high skilled incumbent local workers are better able to absorb knowledge. Görg and Strobl (2005) empirically investigate the spillover from FDI via worker mobility and find that firms run by owners with previous MNE experience in the industry are more productive than other local firms.

Some papers study the mechanism of knowledge transfer. For example, [Park and Choi \(2014\)](#) study what accounts for acquisition of knowledge from MNEs in subsidiaries. They find absorptive capacity in learning firms and daily interactions with knowledge possessors are essential to learning from parent MNE firms. More importantly, support from parent firms is particularly important for knowledge acquisition. [Park et al. \(2016\)](#) study the mechanisms of intra-industry knowledge spillovers in South Korea. They find that demonstration effect is an efficient channel of knowledge transfer from MNE subsidiaries to local firms, and also worker mobility and local firms' absorptive capacity are important roles in learning foreign knowledge.

Some studies focus especially on the managerial knowledge transfer. [Fu et al. \(2012\)](#) study the impact of management capabilities of foreign firms on management capabilities and performance of domestic firms using UK survey data. They find that overall, the management capabilities of local firms have a significantly positive effect on their own productivity while foreign management capabilities has no direct efficiency effect on local firm. [Fu \(2012\)](#) study the nature and extent of managerial knowledge spillovers from FDI through the diffusion of management practices. She finds evidence of the existence of the intra-industry, linkage and non-linkage based inter-industry managerial knowledge transfer from foreign to local firms using US firm level panel data.

The same as [Fu \(2012\)](#), this paper uses a unique survey data about managerial knowledge in Ghana to study the managerial knowledge transfer in MNEs. The difference is that this study uses a social network approach.

2.2 Social Network and Knowledge Transfer

Social network is important in knowledge diffusion. However, real network data of MNEs is rare. This paper uses a survey data of 231 individuals in 8 multinational firms based in Ghana to implement the social network analysis of managerial knowledge and practices diffusion.

A social network in the firm is a structure of individuals (workers, managers and CEO) of the firm and connections and interactions among the individuals. Social network has been popular across disciplines, such as economics, psychology, computer sciences. The studying of the impact of individual level ties within MNEs is rare in economics, business and management studies. This study examines how do social networks affect knowledge transfer of MNEs and contributes to the field by providing evidence that decentralized social network of MNEs improves the knowledge transfer.

Some papers in economics, business and management explore the social network study. [Banerjee et al. \(2013\)](#) study how participation in a micro-finance loan programme diffuses via social network in Indian villages. [Ellis \(2000\)](#) finds that the inter-personal links are important for foreign market opportunities. [Ghoshal and Bartlett \(1990\)](#) especially conceptualize the MNE as an interorganizational network which is embedded in an external network consisting of organizations such as customers, suppliers and so on. [Joshi et al. \(2003\)](#) use a social network of a MNE to study the workflow, communication patterns and the informal social interactions within the firm.

Some papers particularly focus on the social network and knowledge transfer. [Reagans and McEvily \(2003\)](#) study how different features of informal network affect knowledge transfer. [Inkpen and Tsang \(2005\)](#) study three different network types: intracorporate network, strategic alliances and industrial districts. They examine how the social capital dimensions of different networks affect the transfer of knowledge. [Capaldo \(2007\)](#) look at how the network ties impact the innovative capability of firms. [Kaše et al. \(2009\)](#) develop a conceptual model and examine the relationship among human resource (HR) practices, interpersonal relations, and intrafirm knowledge transfer in knowledge-intensive firms. [Fritsch and Kauffeld-Monz \(2010\)](#) study how network structure

influences the knowledge transfer using German regional innovation networks with about 300 firms. A recent paper which focuses on the network and knowledge transfer of MNEs is [Haas and Cummings \(2015\)](#). They analyse a large social network of a MNE to examine the barriers to knowledge seeking between MNE team members.

Adding the social network into the analysis of knowledge diffusion of FDI is a major innovation of this paper. More specifically, we study the diffusion of a typical knowledge: managerial knowledge, which is important for MNEs but has not been given much academic attention over the years. To our knowledge, this is the first paper studying the diffusion of managerial knowledge in MNEs using detailed social network data. The information of 61 managers and 170 workers would give us the opportunity to construct social networks the MNEs. Thus we can examine how managerial knowledge diffuses within firms and how knowledge diffusion process differs across firms of various network structures, different background such as industry, nationality and other dimensions. Do the centralised or decentralised/ hierarchical organizations communicate more effectively and the knowledge diffuses quickly and sufficiently? The empirical evidence from this study would have direct implications for MNEs to reshape their organisational structural.

The interpretation of the social network analysis needs some attention because the social network in our data is quite incomplete. The whole networks of the firms are not available. Given the large size of some firms in the survey, it is difficult to infer the whole network based on the incomplete network we observed. Thus the network analysis would mainly rely on part of the network characteristics. Part 5.2 has a detailed discussion.

3 Background

The economy of Ghana, like other emerging economy in African, has been growing. Ghana is a good case for our study. “Chinese investors view Ghana as a good hub to export to neighbouring West African countries. Ghana’s attractiveness stems from its record of political stability, relatively higher level of development and lower customs duties and clearing taxes” , [Tsikata et al. \(2010\)](#). This part introduces the background of our study, consists the Ghana economy, the Chinese FDI in Ghana and in Africa. The aim is to give an in-depth description of FDI, especially COFDI in Ghana and Africa.

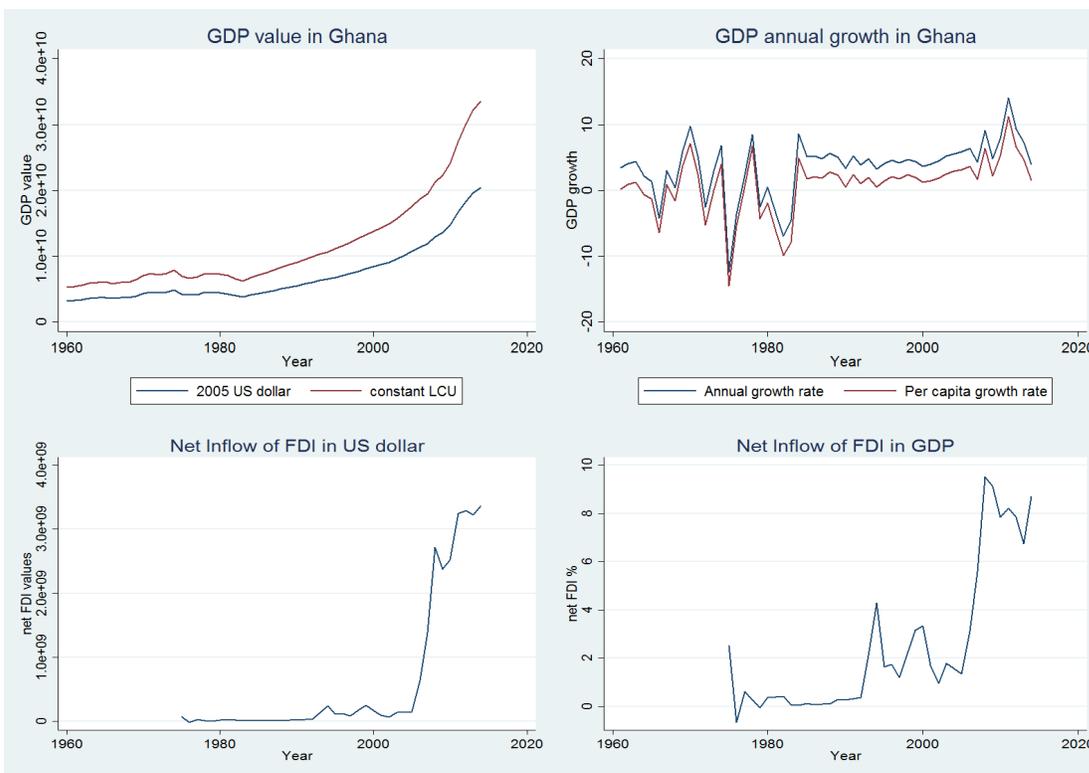
3.1 Ghana Economy

The following figures show the big picture of the Ghana economy for the past 3 decades. The GDP value of Ghana is growing steady and the growth rates remain positive since the 1990s. The net inflow of FDI in Ghana saw a huge jump around 2005, the same as the share of net FDI inflow in GDP. Figures in appendix A also shows the development aspects of Ghana economy, such as the change in mobile phone and internet subscription as well as patent and trademark applications.

Along with studies investigating the impact of FDI in developing countries, there are papers studying the impact of FDI in Ghana. For example, [Antwi and Zhao \(2013\)](#) state that “Foreign direct investment has been an important source of economic growth for Ghana, bringing in capital investment, technology and management knowledge needed for economic growth”. [Insah \(2013\)](#) finds FDI has a positive and significant impact on the economic growth of Ghana. [Fosu et al. \(2014\)](#) find that in the short run, FDI have a positive effect on the GDP growth in Ghana.

However, [Klobodu and Adams \(2016\)](#), using data from 1970 to 2014 find there is a negative effect of FDI on economics growth in Ghana. [Waldkirch and Ofori \(2010\)](#) find that FDI in a sector has a negative effect on domestically owned but a positive effect on foreign-owned firms. Different datasets, and different methods may lead to different empirical findings. Overall, most studies find a positive and significant effect of FDI on Ghana economy.

Some papers focus particularly on the FDI and knowledge transfer in Ghana. [Luther Os-abutey and Debrah \(2012\)](#) study the FDI and government policies in Ghana and recommend the Ghanaian government would want to integrate human capital and technology transfer polices with FDI policies.



3.2 Chinese FDI in Ghana and Africa

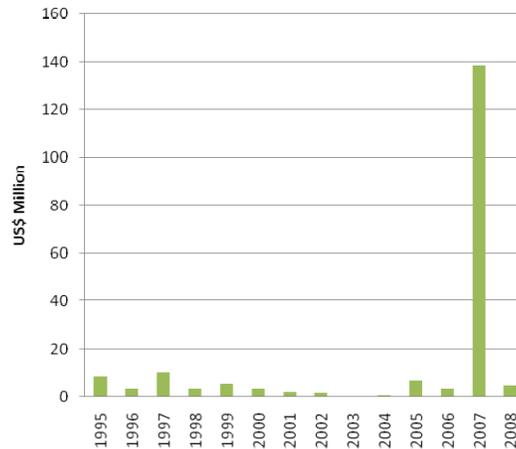
Figures 1 and 2 from [Tsikata et al. \(2010\)](#) shows Chinese FDI in Ghana, with Figure 1 shows the Chinese FDI in manufacture and general trade while figure 2 shows Chinese FDI in us dollars. Chinese FDI has influences in Ghana Economy in many aspects. [Tsikata et al. \(2010\)](#)

Figure 1: Chinese OFDI, Manufacture and General Trade. Tsikata, D., A. P. Fenny, and E. Aryeetey (2010).

	Manufacturing			Gen Trade		
	Chinese FDI	Total FDI	%	Chinese FDI	Total FDI	%
2001	1.83	9.70	18.9	0.63	17.29	3.6
2002	1.43	20.19	7.1	0.75	7.36	10.2
2003	0.13	21.91	0.6	1.35	12.02	11.3
2004	0.42	28.25	1.5	2.29	17.55	13.0
2005	6.56	37.41	17.5	9.93	34.56	28.7
2006	1.99	2172.78	0.1	7.48	35.94	20.8
2007	137.25	4826.92	2.8	13.21	61.04	21.6
2008	2.62	236.41	1.1	7.30	836.20	0.9

analysis the impact of COFDI in Ghana qualitatively and descriptively, they find that Chinese FDI, “help reduce import dependency, contributes to export expansion, contributes in terms of value addition and helps improve the competitiveness of local industries”. [Auffray and Fu \(2015\)](#) implement a case study of Chinese FDI on the managerial knowledge transfer in Ghana and suggest that the progressive replacement of Chinese managers by local ones can help to overcome the culture and linguistic barriers of managerial knowledge spillovers. [Kernen and Lam \(2014\)](#) study the work localization in Chinese state-owned enterprises in Ghana, saying “Chinese SOEs have gradually localized workforce, and the localization experience is similar to those of Western companies.”

Figure 2: Chinese OFDI to Ghana. Tsikata, D., A. P. Fenny, and E. Aryeetey (2010).



Like in Ghana, Chinese MNEs have been playing a role in African Economy. According to [Fu and Buckley \(2015\)](#), “the emergence of macro flows of OFDI from China takes place within the context of global commodity ...and within systematic organization of the ‘global factory’”. COFDI is mutual beneficial, as pointed out in [Renard \(2011\)](#), “China’s increased engagement with Africa could generate important gains for African economies.”

In 2009, China surpassed the United States as Africa’s largest trade partner and the Sino- Africa trade volume hit a new historical high to USD 221.88 billion in 2014. According to statistics of the Chinese Ministry of Commerce, the outflow of China’s FDI to Africa reached USD 3.5 billion in 2014, making the total stock nearly USD 30 billion with a yearly average growth rate of 46 per cent over the last decade. China has also become Africa’s second largest overseas project contracting market, with a total turnover of USD 46 billion project contracting completed in 2014, and more than 2500 Chinese enterprises operate their business in Africa across a broad range of sectors such as agriculture, telecommunications, energy, manufacturing, etc.¹

Chines FDI penetrates into different layers of Africa’s economy with diverse strategies. State-owned enterprises mainly invest in strategic sectors such as infrastructure, oil, or ores sectors. The improvement of infrastructure, as one of the fundamental needs in Africa’s path to achieve industrialization, directly serves and stimulates economic development. Large- sized Chinese enterprises from the private sector are mainly involved in non-infrastructure projects such as manufactured goods, telecommunications and wholesale trade. Through linking local partners, their presence is expected to induce positive spillovers that enhance the technological and managerial capability of local industries. Some SMEs are dominant in the light industry and superior technologies mastered by them are acknowledged to be more appropriate for African engineers to learn, compared to the technologies initiated in advanced countries.

¹Data obtained from Ministry of Commerce of the People’s Republic of China (2015). Website: <http://www.mofcom.gov.cn/article/i/dxfw/gzgd/201503/20150300910506.shtml>

Knowledge spillovers are determined by multi-dimensional complementarities and host country-specifics such as basic technology capability and supportive institutional settings, all of which are crucial Fu (2013). Followers in Africa are urged to build up certain level of strategic capacity that would empower them to effectively acquire the appropriate technologies from Chinese MNEs. Furthermore, Chinese FDI may also create immense challenges. Without adequate resources and efforts to build up competitiveness, African countries may rather be pushed out from both domestic and global markets. The competition brought by Chinese competitors is likely to force the African companies to improve their strategic capability. Meanwhile, compared to FDI from advanced countries, China's FDI brings relatively more appropriate technologies for the African followers. Through various channels, local actors are able to access advanced technologies, management practices, and entrepreneurial orientation during the interaction with Chinese multinationals.

Despite some existing studies on the impact of FDI on Ghana and African economy, the studies of Chinese OFDI in Ghana are rare and most are qualitative studies. Although some studies have done quantitative analysis, they use the aggregate data. Compared with existing studies, this paper focuses on the Chinese OFDI in Ghana, and examines quantitatively the knowledge transfer using individual level social network data.

4 Data

The MNEmerge survey in Ghana focuses on the impact of MNEs on development and poverty reduction through local managerial capabilities building. By conducting individual survey, we intend to uncover the linkages through which knowledge is transferred to local firms and people, how this contributes to capabilities building at firm and individual level, and how this empowers local employees and changes their personal skills, career future and aspirations in life.

4.1 Survey and Sampling

The collection of data was collectively carried out by researchers from Oxford University and CSIR-STEPRI during the period of March to June 2015. A pilot survey was firstly conducted in two Pharmaceutical MNEs (EU and Chinese MNEs respectively) and then feedbacks were used for refining the questionnaires and interview techniques. Before carrying out the individual interviews in each MNE, we obtained a name list that helped us ensure variation in terms of education, age, gender, any physical disability and department. In total we have carried out 30 interviews per MNE which will provide in-depth understanding of the linkages and interactions. Therefore, the sample size covers about 8 MNEs with about 30 interviews each, mounting to 231 observations (170 workers and 61 managers) in total.

Management knowledge is likely to spill over from MNEs to indigenous firms through several channels. One of the key channels is through demonstration effect induced by regular interaction among employees within the organization. The concept and routines of explicit management practices embedded in MNEs' culture can be observed and learned by their

workers through demonstration-by-implementation and word-of-mouth. These will not only allow industry-specific managerial knowledge to diffuse, but also provide local employees to.

Firm level sampling method is purposive sampling. Purposive sampling was used to select eight companies, according to: nationality, technology intensity, sector and market size and power. We choose eight multinational enterprises (4 Chinese, 4 EU), where there are 2 high tech (ICTs, pharmaceuticals) firms and 2 low tech (textiles, construction) firms; 4 EU firms are Vodafone (ICT) , GoKals Laborex (pharma), Textiles Ghana Ltd (Vlisco being the main company) (textiles), Acticon (construction) and 4 Chinese firms : Huawei (ICT), Sanbao (pharma), Akosombo (textiles), Top International (construction).

The aim was to include the major players in each of the four low tech and high tech sectors. Nationality was split in Chinese and EU. MNEs were compared along this dimension and the technology intensity dimension to draw conclusions as to whether transfer of knowledge differed according to investors' nationality or technological intensity of activities. Sectors such as the oil, gas, and mining were excluded as they are prevalently extractive and less representative of the 'transfer of knowledge' model.

Individual level sampling is as following, for managers, in each firm we aimed to interview between 5 and 10 managers, plus the CEO or deputy CEO. Among the managers we tried to always include at least one manager for the main coordination functions such as HR and marketing managers; for workers, in each firm, we aimed to interview around 20 workers, and a mix of skills and ability (which varied sector by sector). The following table shows the sampling frame of the data.

Company	Ghanaian	Non-Ghanaian	Managers	Workers	Chinese Firm?	High-Tech Firm?
Acticon	20	7	7	20	0	0
Akosombo	27	2	6	23	1	0
Gokals	23	2	5	20	0	1
Huawei	22	8	9	21	1	1
Sanbao	26	3	8	21	1	1
Texstyle	28	4	11	21	0	0
Topint	21	8	5	24	1	0
Vodafone	29	1	10	20	0	1
Total	196	35	61	170	4	4

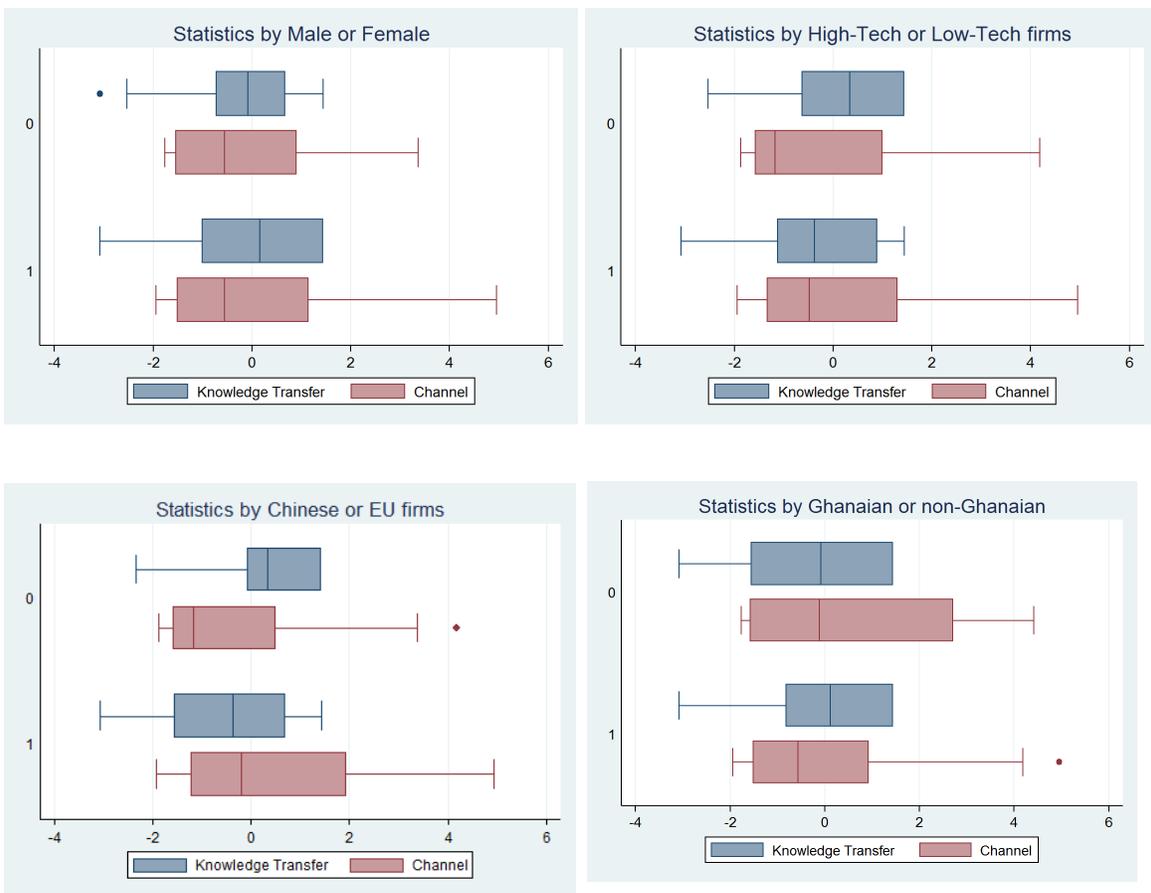
4.2 Measurement of Variables

The main information this paper exploit is the survey on knowledge transfer, as well as the channels of communication. The knowledge transfer comes from the following questions:

I learn from and (or) transfer my personal knowledge to subordinate workers; I learn from and (or) transfer my personal knowledge to managerial staffs at super level; I learn from and (or) transfer my personal knowledge to colleagues of same level. This paper firstly uses the principle component analysis (PCA) technique to combine the information into a knowledge transfer index. Then it uses the detailed information in knowledge transfer with subordinate workers, managers or colleagues.

The channels of communication can be various and comes from following information: I learned, tutored and (or) supervised within the firm through telephone; I learned, tutored and (or) supervised within the firm through emails; I learned, tutored and (or) supervised within the firm through manuals; I learned, tutored and (or) supervised within the firm through technical advice; I learned, tutored and (or) supervised within the firm through training sessions; I learned, tutored and (or) supervised within the firm through external expert; I learned, tutored and (or) supervised in the firm through joint team work; I learned, tutored and (or) supervised within the firm through industry association; I learned, tutored and (or) supervised within the firm through social events.

4.3 Descriptive Statistics



The 4 box figures show the descriptive statistics of the knowledge transfer and channels of communication. In the box figures, the blue boxes are for the knowledge transfer and the red boxes are for channels of communication. The comparison of males and females; high technology and low-technology firms; Chinese and EU firms; Ghanaian and non-Ghanaian are presented. The vertical lines in the boxes are the mean statistics while other lines are the quantiles.

The box figures show the distribution of the average knowledge transfer. It's noted that average, males have more knowledge transfer compared with females, but the channels of communication are similar. High tech firms have more channels of communication while less knowledge transfers than low tech firms. Chinese firms have more channels of communication but less knowledge transfer compared with EU firms. Ghanaian individuals have few channels of communication but more or less the same knowledge transfer with non-Ghanaian.

5 Analysis

The analysis of the paper starts with the traditional econometric analysis as a bench mark results. After this, we construct the network work from the survey data, analysis how social network characteristics works in the knowledge transfer in the MNEs. We also apply the propensity score matching methods to find out the treatment effects.

5.1 Benchmark model

Considering the following linear model:

$$Know_{ij} = \alpha + \beta_1 Ghana_i + \beta_2 Channel_i + \beta_3 X_{ij} + \varepsilon_{ij}$$

with $Know_{ij}$ is the knowledge transfer of individual i in firm j , $Ghana_i$ is a dummy variable indicating whether individual i is Ghanaian or not. $Channel_i$ is the number of communication channels of individual i . and X_{ij} is a set of controls of individuals and firms. The lists of the dependent and independent variables and their meanings and measurements are presented respectively in table 14 and table 15 in appendix part B, together with the correlation coefficients of the control variables in table 16.

Table 1: Benchmark model

	(1)	(2)
	Knowledge-Transfer	Knowledge-Transfer
Ghanaian	0.5076* (0.2321)	0.5369** (0.2250)
Channel	0.2181** (0.0823)	0.2208** (0.0834)
ChinaMNE	-0.2706 (0.3004)	-0.3087 (0.3114)
Worker	-0.1675 (0.2586)	-0.1026 (0.2305)
Reward	-0.0716 (0.0680)	-0.0601 (0.0653)
MNEs Exp		-0.0106** (0.0039)
Field Exp		0.0191** (0.0080)
<i>N</i>	231	231
r ²	0.3270	0.3330

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The regression results in table 1 show the estimation of the model in three specifications. Model 1 and Model 2 are different as model 2 have extra control variables, which both model include the firm fixed effects and robust standard errors are clustered at firm level. The R squares of the models are about 0.3, which suggests the linear model fits well with the data. There are 231 observations in total, which may be challenged that small sample size would hardly have good statistical reference for the population. However, we argue that firstly, the objective sampling that allows us to study typical and representative firms would make our findings more meaningful in this case of MNEs in Ghana. Second, the sample size is not actually small. Macro economist always do carry out regression analysis for about 200 observations, for example, in economic growth, papers choose some countries as their study sample. Finally, we tried many different specifications to show that the findings are consistent, these include the study of different outcomes, different sub-sample and different methods. Overall, the sample size is not an issue in this study and should not lead to major bias of the estimators.

Model 1 and Model 2 suggests the more channels of knowledge transfer would have more knowledge transfer in the MNEs, this result is straightforward and expected. The channels,

which are described in part 3.2, are important ways for individuals in the MNEs to get information and knowledge. Model 1 and model 2 both show that Chinese MNEs have no significant difference with traditional EU MNEs with regarding to knowledge transfer within the firm. Considering the fact that managerial knowledge in the Chinese and EU firms are both high and both transfer knowledge to local firms and individuals, they may perform similar in knowledge transfer. Model 2 shows that being a Ghanaian would have significantly more knowledge transfer. This shows that the knowledge in MNEs would spread to local individuals. The direction of the knowledge flow goes from the expatriates to local workers or managers. Model 2 also shows that the work experience in the relevant sector would enhance the knowledge transfer while work experience in the MNEs would have a negative effect on knowledge transfer. It may be the cases that individuals who have longer experience in the similar field would have stronger absorb ability such that they adapt to the managerial knowledge in MNEs. As for the experience in MNEs, it can be possible that people who have had enough exposure to knowledge in the MNEs would have obtained a certain level of managerial knowledge, such that they would be reluctant to learn and transfer new knowledge.

From the baseline results, we find evidence that Ghanaian individuals benefit from knowledge transfer and the channels of knowledge flow would increase the knowledge transfer in the firm. We will treat model 2 as the benchmark. Network analysis and matching would be based on model 2, which includes more relevant controls and dummy variables and provides evidence that local individuals benefit from knowledge transfer in MNEs, while Chinese MNEs have no difference in knowledge transfer compared with EU MNEs. The results show that there is no culture difference as for knowledge transfer in Chinese and EU MNEs, while the knowledge in both types of MNEs goes from the expatriates to the local workers or managers. The other specifications and robustness checks in this study would also support the findings. These include analysis with 2 other methods, the network analysis, the propensity score matching and 3 robustness checks.

5.2 Social Network

Network analysis is a growing modelling method in many subjects: sociology, computer science, epidemiology among others. In economics, some model the learning behaviour in social networks, spread of innovation in social network and the network effect of job searching, migration and micro-finance in development and labour economics. However, there is a lack of empirical evidence about the effect of network structure on the knowledge transfer.

Information of social network in the MNEs comes from the following information in the survey: Name of first person you interact most often with. Name of second person you interact most often with. Name of third person you interact most often with. Other information of the contacts, such as the position, department of the three contacts is also obtained. We firstly construct network for each MNE based on the above information and computer the network properties for firms and individuals. A network, or a graph is a collection of vertices jointed by edges. Vertices are nodes, sites, actors denoted by i . Edges are links, bonds, ties denoted ij between vertices i to vertices j . Number of vertices is n and number of edges is m . $A_{ij} = 1$ if there is an edge between i and vertices j . The construction of social network of managers,

workers and firms comes from work and relationship questionnaires of managers and workers where they are asked to paper their 3 most important linkages in the firm. Each individual is treated as a node, and an arrow directed linkage shows the information path amongst individuals. We combine the workers and managers, directed and undirected network, and construct the network adjacency matrix. For instance if individual i papers individual j as a contact, the ij entry in the matrix is then donated as 1, otherwise it is 0. After constructing the typology of social network structure, we can then calculate the network characteristics of the individuals and firms following Jackson (2008). Given the networks are incomplete, we focuses on the degree centrality of the individual and firms (position of individual with in the networks, overall network characteristics). However, other characteristics of the network are also presented in the results for robustness reasons.

The network graphics of the 8 firms are presented in appendix C: Network. The nodes are surveyed individuals while the links shows the contacts of the individuals and the structure of the firm network. The blue nodes are Ghanaian while the pink nodes are for non-Ghanaian individuals. This study include the network properties of the firm and individuals as extra control variables in model 2 in the benchmark model, and study how the network structure impact the knowledge flow in the MNEs.

The network analysis results are presented in Table 2 and Table 3. The results show that the firm network matters and the firm network structures have a significant impact on the knowledge transfer in the MNEs. The firm network characteristics, such as centralisation index, average degree of connections, eigenvector degree and betweenness, have a significantly negative impact on the knowledge transfer. As the networks are not complete, these results should be explained with caution. However, the degree centrality, e.g. shows the number of connections, which reveal the average degree or the eigenvector degree connection of the firm, is more trustable.

The results suggest that the decentralised firm network would enhance the knowledge transfer. Different from the bureaucratic organisations, the decentralised firms are easier and flexible to communicate, among workers and between workers, managers and CEO.

Table 2: Firm network

	(1)	(2)	(3)	(4)
	Knowledge-Transfer	Knowledge-Transfer	Knowledge-Transfer	Knowledge-Transfer
Ghanaian	0.5369** (0.2250)	0.5369** (0.2250)	0.5369** (0.2250)	0.5369** (0.2250)
Channel	0.2208** (0.0834)	0.2208** (0.0834)	0.2208** (0.0834)	0.2208** (0.0834)
ChinaMNE	-0.5256* (0.2661)	-0.4629 (0.2981)	-0.2439 (0.1432)	-0.5050 (0.2703)
Worker	-0.1026 (0.2305)	-0.1026 (0.2305)	-0.1026 (0.2305)	-0.1026 (0.2305)
Central Index	-0.1136*** (0.0293)			
Average Degree		-0.4048*** (0.0474)		
Eigen Degree			-0.0139*** (0.0019)	
Between				-0.0862*** (0.0222)
<i>N</i>	231	231	231	231
<i>r</i> ²	0.3330	0.3330	0.3330	0.3330

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Firm network for worker sample

	(1)	(2)	(3)	(4)
	Knowledge-Transfer	Knowledge-Transfer	Knowledge-Transfer	Knowledge-Transfer
Ghanaian	0.8118* (0.3559)	0.8118* (0.3559)	0.8118* (0.3559)	0.8118* (0.3559)
Channel	0.1718* (0.0841)	0.1718* (0.0841)	0.1718* (0.0841)	0.1718* (0.0841)
ChinaMNE	-0.0999 (0.3539)	0.0676 (0.4037)	0.1277 (0.1288)	-0.0755 (0.3600)
Central Index	-0.1340*** (0.0357)			
Average Degree		-0.2325*** (0.0570)		
Eigen Degree			-0.0131*** (0.0025)	
Between				-0.1017*** (0.0271)
<i>N</i>	170	170	170	170
<i>r</i> ²	0.3539	0.3539	0.3539	0.3539

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The decentralised firms are also more open and friendly to new ideas and managerial knowledge. Decentralised does not mean not organised. However, it means that the firms are organised in a more flat and flexible way other than the traditional bureaucratic and hierarchical firms.

Thus it makes sense that the more decentralised MNEs in Ghana would help to transfer knowledge in the firm.

Table 2 provides consistent results with the baseline model, which shows that Ghanaian individuals benefit from knowledge transfer, there is no culture difference in knowledge for Chinese and EU firms and more channels of communication means more knowledge transfer.

Decentralised structure of the firm helps the knowledge transfer within the firm. This evidence is also provided in Table 3, the same models but for worker sample only, thus the number of observations is restricted to 170.

The findings on network structure of the MNEs have good implications, especially to China, where we could predict more outward FDI in the future. Traditionally Chinese firms are centralised. They have multiple levels of management and various company rules that may restrict the productivity of the workers or employees. Chinese firms would like to reform their organisation structure so as to embrace the enhancement of knowledge flow in the firm and thus the increase of productivity of the firm. Chinese MNEs in African, such as the 4 observed in this study in Ghana, would also consider this reformation of the firm improve their knowledge and adapt more to local economy, this is also important to international development as human capital is important to economics growth for African countries.

5.3 Matching

After conducting the baseline modelling and the network analysis, this study would want to presents another strand of analysis, which is the propensity score matching. There are many ways of matching, the idea behind is for each observation in the treatment group, look for one or more (based on matching method applied) observations in the control group that are of same characteristics based on observables in the data. This study apply the propensity score matching, for each Ghanaian individual, we find a similar non-Ghanaian individual based on the firm, age, education, gender, position, experience, communication channels and so on. We calculate the propensity score for each individual and then match the observations to find out the average treatment effect.

The result is presented in Table 4, which shows that on average, compared with the non-Ghanaian, Ghanaian individual have about 0.6 unit more knowledge transfer. This result is significant at 1% level. Compared with the results in the baseline and the network analysis (0.54), the matching method shows slightly larger coefficients. The little change of the magnitude of the coefficients may due to some factors that may lead to a bias in the estimation is eliminated by the fixed effect, but not in the matching method. However, the propensity score matching method show a slight different but consistent result with the previous analysis and shows that local individuals in MNEs would benefit from the knowledge transfer.

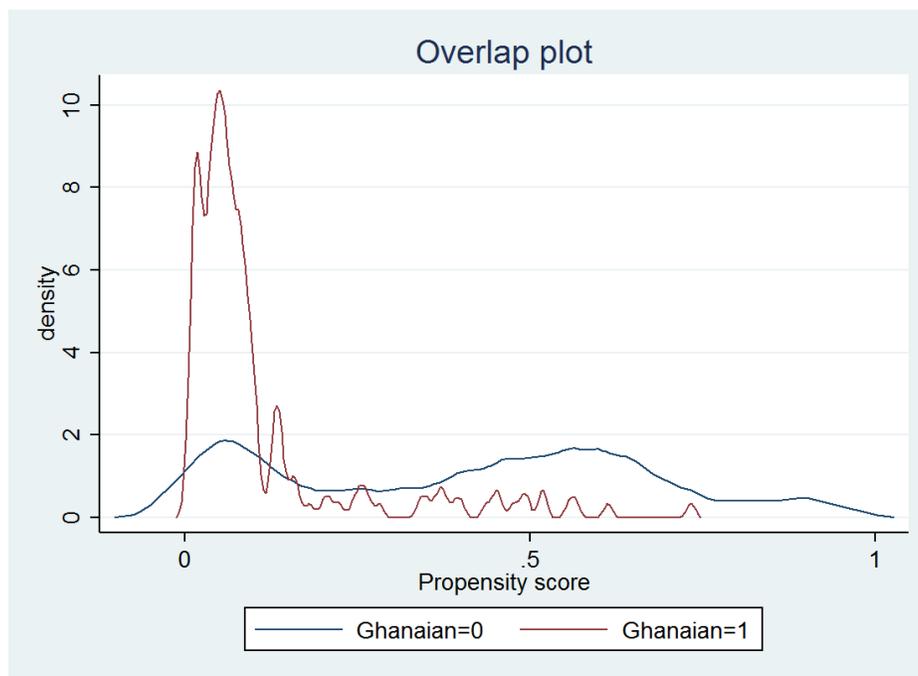
One important assumption about matching method is the “common support”. We draw the overlap graph for the propensity scores for the treatment and control group. Although the treatment and control group do not overlap perfected (they are of course very different and hard to match), their propensity scores both expand from 0 to 1. This study does also implement two other set of propensity score matching by matching not only the individual and firm characteristics, but also the firm and individual network properties.

The results are presented in the Table 12 and Table 13, which are consistent with the findings in this part.

Table 4: Propensity Score Matching

	(1) Knowledge Transfer
Average Treatment Effect Ghanaian vs Non-Ghanaian	0.6417*** (0.2444)
<i>N</i>	231
<i>r</i> ²	

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$



5.4 Robustness Checks

5.4.1 Detailed outcomes

This part conducts the robust that make more detailed study on the knowledge transfer. We divide the knowledge transfer into three types: knowledge transfer with subordinate, manager and colleagues.

The Table 5 to Table 7 shows the baseline results for the detailed outcomes. The results show that MNEs, especially Chinese MNEs, the knowledge transfer happens with subordinate workers, but not managers and colleagues. Thus table 9 and table 10 would look more in depth at the knowledge transfer with subordinate. Table 8 is a regression table, we look at the knowledge learn from managers. It is interesting to find that in Chinese MNEs, workers do not report significant learning from managers.

Table 9 and table 10 show the detailed outcomes for knowledge transfer with subordinate, combing the network structure of firms in table 9 and individual network properties in table10. Firstly it shows that in both Table 9 and Table 10, more channels would mean more knowledge transfer. In Chinese MNEs, there are significant knowledge transfer to subordinate, the effect is large and very significant (1.3 in magnitude and significant at 1% level). This result is in accordance with our claim that the knowledge goes from expatriates to local workers, considering especially in Chinese firms, the local are mostly workers while expatriates are mostly managers.

Table 5: Detailed outcome: Subordinate

	(1)	(2)
	D2a CKT-Subordinate	D2a CKT-Subordinate
Ghanaian	0.2272 (0.1986)	0.2598 (0.1844)
Channel	0.1146*** (0.0298)	0.1136*** (0.0295)
ChinaMNE	0.9236*** (0.2460)	0.7603*** (0.2106)
Worker	-0.3801 (0.3009)	-0.3215 (0.2719)
Reward	-0.0347 (0.0435)	-0.0323 (0.0439)
MNEs Exp		0.0009 (0.0060)
Field Exp		0.0195** (0.0074)
<i>N</i>	231	231
<i>r</i> ²	0.2688	0.2880

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Detailed outcome: Manager

	(1) D2b-CKT-Managerial	(2) D2b-CKT-Managerial
Ghanaian	0.2661* (0.1381)	0.2767* (0.1372)
Channel	0.0928* (0.0489)	0.0942* (0.0496)
ChinaMNE	-0.4076** (0.1513)	-0.4096** (0.1450)
Worker	-0.0792 (0.0804)	-0.0543 (0.0839)
Reward	0.0031 (0.0257)	0.0083 (0.0258)
MNEs Exp		-0.0051* (0.0027)
Field Exp		0.0071 (0.0076)
<i>N</i>	231	231
<i>r</i> ²	0.2949	0.2978

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Detailed outcome: Colleagues

	(1) D2c-CKT-Colleagues	(2) D2c-CKT-Colleagues
Ghanaian	0.1503 (0.1878)	0.1521 (0.1778)
Channel	0.1175* (0.0526)	0.1177* (0.0533)
ChinaMNE	-0.5221*** (0.1270)	-0.5227*** (0.1263)
Worker	0.1776 (0.1384)	0.1819 (0.1487)
Reward	-0.0696 (0.0496)	-0.0687 (0.0496)
MNEs Exp		-0.0009 (0.0068)
Field Exp		0.0012 (0.0077)
<i>N</i>	231	231
<i>r</i> ²	0.3456	0.3457

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Detailed outcome: Learn from Manager

	(1)	(2)
	Know-ML	Know-ML
Ghanaian	0.0563 (0.0525)	0.0517 (0.0476)
Channel	0.0172 (0.0248)	0.0181 (0.0250)
ChinaMNE	-0.2971*** (0.0623)	-0.2506** (0.0738)
Worker	0.0078 (0.1046)	0.0022 (0.1038)
Reward	-0.0151 (0.0133)	-0.0134 (0.0125)
MNEs Exp		-0.0026 (0.0019)
Field Exp		-0.0024 (0.0023)
<i>N</i>	231	231
<i>r</i> ²	0.4714	0.4784

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Detailed outcome with firm network: Subordinate

	(1)	(2)	(3)	(4)
	D2a CKT-Subordinate	D2a CKT-Subordinate	D2a CKT-Subordinate	D2a CKT-Subordinate
Ghanaian	0.3131 (0.3042)	0.3131 (0.3042)	0.3131 (0.3042)	0.3131 (0.3042)
Channel	0.1253** (0.0424)	0.1253** (0.0424)	0.1253** (0.0424)	0.1253** (0.0424)
ChinaMNE	1.2015*** (0.2613)	1.3557*** (0.2917)	1.3209*** (0.1190)	1.2135*** (0.2651)
Worker	-0.5154 (0.4107)	-0.5154 (0.4107)	-0.5154 (0.4107)	-0.5154 (0.4107)
Central Index	-0.0660** (0.0266)			
Average Degree		0.0740 (0.0652)		
Eigen Degree			-0.0151*** (0.0019)	
Between				-0.0501** (0.0202)
<i>N</i>	231	231	231	231
<i>r</i> ²	0.2920	0.2920	0.2920	0.2920

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Detailed outcomes with individual network: Subordinate

	(1)	(2)	(3)	(4)
	D2a CKT-Subordinate	D2a CKT-Subordinate	D2a CKT-Subordinate	D2a CKT-Subordinate
Ghanaian	0.2896 (0.2878)	0.3117 (0.3148)	0.3154 (0.2952)	0.2830 (0.2874)
Channel	0.1230** (0.0411)	0.1254** (0.0422)	0.1256** (0.0427)	0.1214** (0.0429)
ChinaMNE	1.2827*** (0.3108)	1.3274*** (0.3036)	1.3245*** (0.2932)	1.3704*** (0.2909)
Worker	-0.5168 (0.3611)	-0.5152 (0.4117)	-0.5177 (0.4115)	-0.4530 (0.4275)
eigen	-0.9661* (0.4891)			
betw		-0.0005 (0.0043)		
outclose			-0.6195 (3.1875)	
inclose				4.0669** (1.7090)
<i>N</i>	231	231	231	231
<i>r</i> ²	0.3033	0.2920	0.2920	0.3002

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.4.2 Worker Sample

This part of robustness check is conducted by implementing the base line model with work sample and detailed outcomes for the knowledge transfer to subordinate. The two models in Table 11 show similar results. First, the number of communication channels would enhance the knowledge transfer in the MNEs. Second, compared with EU MNEs, the Chinese MNEs transfer more knowledge to local subordinate workers. The effect is strong and significant. This result is a significant evidence to support our claim that Chinese MNEs would transfer more knowledge from expatriate managers to local subordinate.

Table 11: Worker sample subordinate knowledge transfer

	(1)	(2)
	D2a CKT-Subordinate	D2a CKT-Subordinate
Ghanaian	0.1368 (0.2353)	0.1618 (0.2401)
Channel	0.1188** (0.0382)	0.1155** (0.0401)
ChinaMNE	0.9689** (0.2955)	0.9027** (0.2870)
Reward	0.0087 (0.0514)	0.0043 (0.0478)
MNEs Exp		-0.0016 (0.0056)
Field Exp		0.0136 (0.0092)
<i>N</i>	170	170
<i>r</i> ²	0.3956	0.4016

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.4.3 Matching with Network

The matching with network is a robust check for the propensity score matching. It is built on the matching method of section 4.3. What we have done for this robustness check is to introduce the network properties as extra matching criterion. The results are presented in table 12 and 13, where table 12 uses firm network structure and table 13 uses individual network properties. The models are different as different network characteristics are included separately in the models.

The results in the two tables are consistent with the main matching results in table 4.

The average treatment effects are around 0.5 to 0.6. Most of the coefficients are significant. The results show that the average treatment effect by matching method is robust to different matching criterion of social network.

Table 12: Matching with firm network

	(1)	(2)	(3)
	Knowledge-Transfer	Knowledge-Transfer	Knowledge-Transfer
Average Treatment Effect			
Ghanaian vs Non-Ghanaian	0.3106 (0.3357)	0.7246** (0.3542)	0.5062** (0.2003)
<i>N</i>	231	231	231
<i>r</i> ²			

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Matching with individual network

	(1)	(2)	(3)	(4)
	Knowledge-Transfer	Knowledge-Transfer	Knowledge-Transfer	Knowledge-Transfer
Average Treatment Effect				
Ghanaian vs Non-Ghanaian	0.4397* (0.2422)	0.5545** (0.2481)	0.6421** (0.2909)	0.6134** (0.2779)
<i>N</i>	231	231	231	231
<i>r</i> ²				

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 Conclusion

This study uses a unique firm survey data to study the knowledge transfer in MNEs in Ghana which is a typical country in West African that welcome FDI for development. This paper is the first empirical paper using the network approach to study the managerial knowledge diffusion in MNEs, and contribute to the literature on the impact of FDI on the knowledge diffusion in host countries, and to the emerging literature that uses social network in international business studies.

The baseline model which controls for the firm fixed effects shows that first, the local individuals benefit from the knowledge transfer compared with the expatriates. This makes a lot of sense and shows that the knowledge in the MNEs flow from the expatriates to local people. Second, the more channels of communication mean more knowledge transfer. Finally, overall the Chinese MNEs and EU MNEs have no significant difference in knowledge transfer.

The network analysis shows that the firm network structure influence the knowledge transfer in the firm. The more decentralized MNEs would perform better in knowledge transfer. The decentralized organizations would be more flexible and flat, and more friendly to new ideas and knowledge. The flow of information and knowledge in these firms would be smoother and quicker, within the firms and between different departments and positions.

The propensity score matching method provides evidence that the local individuals would benefit more from the knowledge compared with expatriates, who are supposed to have more managerial knowledge and sent to MNEs overseas branch in Africa to help the establishment, maintenance and enlargement the local business of the MNEs. The finding suggests that the FDI does not only bring the capital and technology that are needed for Ghana economy growth, but also the human capital, particularly the managerial knowledge embedded in the expatriates coming together with capital and technology. This evidence shows the FDI would help improve the local development in the case of knowledge spillover to local workers.

In the more detailed outcomes, we find evidence to show that sub-ordinate workers in Chinese MNEs get more knowledge transferred from their managers. This is in line with the finding that knowledge in the MNEs flow from the expatriates to local people. As for detailed role and position of the local people, local sub-ordinates in Chinese MNEs benefit more in knowledge transfer. This is the only culture difference we observed in the knowledge transfer in MNEs in Ghana.

This study has interesting policy implications. MNEs would like to reform their organizational form in order to enhance the knowledge transfer with in the firm. At macro level, developing countries would like to consider the FDI not only for technology and capital, but also the human capital, which is important to the economics growth. Also the human capital level of a developing country is strongly associated with the modern technology absorb and adapt ability. The African countries should have considered more about the human capital policy together with policies of FDI.

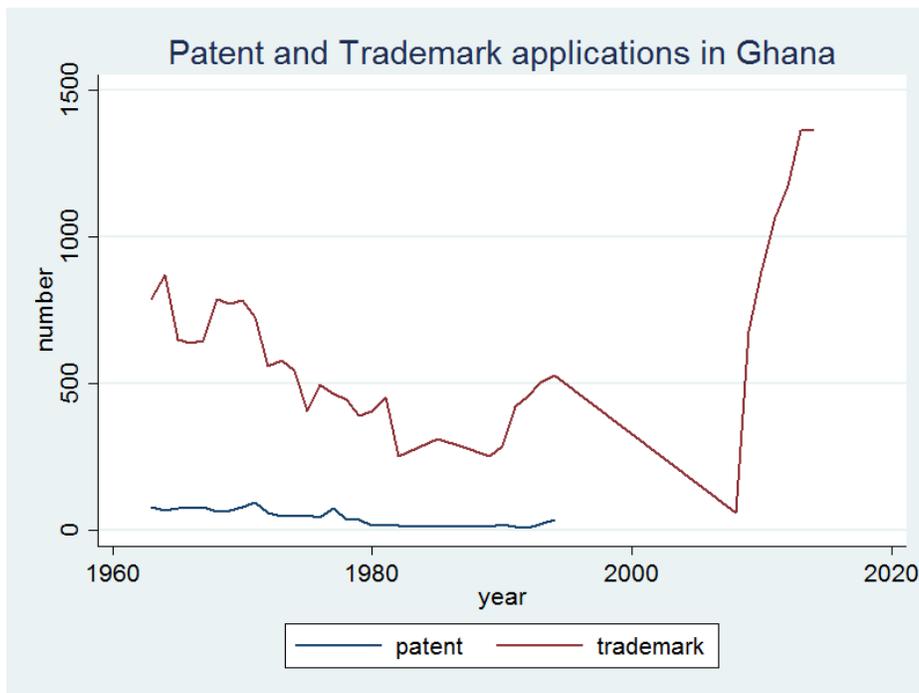
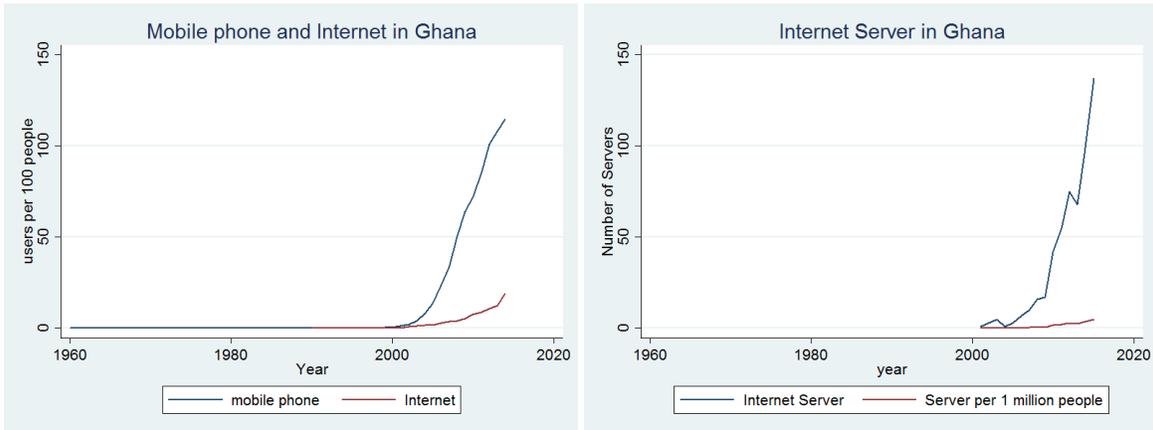
The findings contribute to academic literature and also have important policy practical implications to policy makers and managers of the MNEs. Firstly, local employees do benefit from the managerial knowledge transfer from the MNEs through various channels.

Therefore trade policies should continue to encourage the inflow of FDI into the country. Moreover, if network structure and based individual characteristics are controlled for, there is no significant difference between Chinese and European MNEs in terms of managerial knowledge transfer in general. The culture difference appears mainly in the knowledge acquired by the subordinates in the Chinese MNEs who reported to have learned more from their managers. Finally, decentralized MNEs subsidiary structure appears to be more conduit to the knowledge transfer. Therefore, adopting a more decentralized structure will facilitate more knowledge transfer between foreign and local employees in the MNE subsidiaries.

This study bears some limitation. We have only the cross-sectional data for 8 firms. A follow-up survey to create a panel data to study the dynamic properties of knowledge transfer of individuals in the firms would be a significant increase of the analysis. Moreover, the survey can be possibly extended to cover local individuals employed in local firms, such as to have a more interesting counterpart for the study.

A

Ghana Economy



B Variables

Table 14: Dependent variables

Variable Name	Meaning	Measure
Knowledge Transfer	Knowledge transfer between individuals	PCA to combine the 3 variables
D2a.CKT Subordinate	Knowledge transfer to or with subordinate	0 for no transfer, 1 for learn, 2 for tutor, 3 for both
D2b.CKT Managerial	Knowledge transfer to or with manager	0 for no transfer, 1 for learn, 2 for tutor, 3 for both
D2c.CKT Colleagues	Knowledge transfer to or with colleagues	0 for no transfer, 1 for learn, 2 for tutor, 3 for both
Know ML	Whether transfer with managers	Binary

Table 15: Independent variables

Variable Name	Meaning	Measure
Ghanaian	Whether the individual is Ghanaian or not	Binary
Channel	Number of channels for knowledge transfer	PCA to combine the 9 channels
China MNE	Whether the firm is Chinese MNE	Binary
Worker	Whether the individual is a worker	Binary
Male	Whether the individual is male	Binary
Education	The education level of individual	Education level for basic, secondary, tertiary
Age	The age level of individual	Age level for <30, 30 to 40, 41 to 50, >50
Ht MNE	Whether the firm is a high technology MNE	Binary
MNEs Exp	Individual's years of experience in current MNE	Number of years in current MNE
Field Exp	Individual's years of experience in the relevant field	Number of years in relevant field

Table 16: Correlation among controls

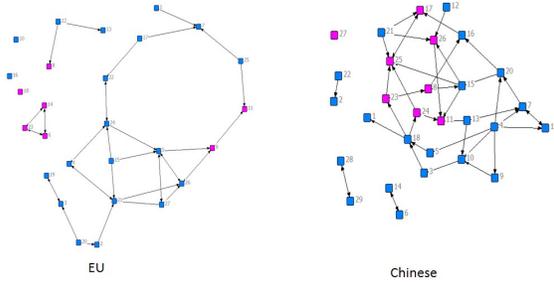
	Ghanaian	Channel	ChinaMNE	Worker	Male	ht MNE	Age	Education	MNEs Exp	Field Exp	Reward
Ghanaian	1										
Channel	-0.0981	1									
China MNE	-0.079	0.2617	1								
Worker	0.4316	-0.0797	0.0569	1							
Male	-0.0512	0.0336	0.2048	0.0595	1						
Ht MNE	0.079	0.0947	0.0218	-0.0372	-0.1166	1					
Age	-0.1759	0.219	0.5256	-0.0676	0.1634	-0.238	1				
Education	-0.1657	0.3012	-0.1307	-0.3961	-0.2355	0.3973	-0.1346	1			
MNEs Exp	0.0306	0.1982	0.2312	0.0715	0.1887	-0.1597	0.5768	-0.109	1		
Field Exp	-0.122	0.119	0.0995	-0.149	0.1921	-0.259	0.6026	-0.0833	0.6963	1	
Reward	0.0496	0.2197	0.114	-0.0521	0.0387	0.1588	0.1565	0.2073	0.2738	0.1402	1

C

Network

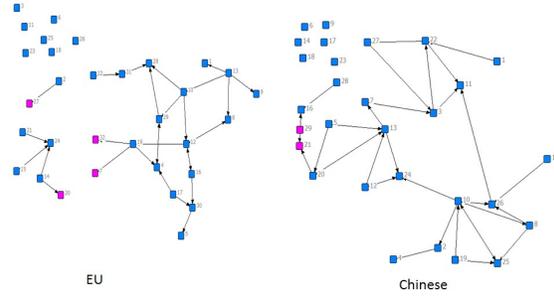
Acticon & Top International

pink for Non-Ghanaian, blue for Ghanaian



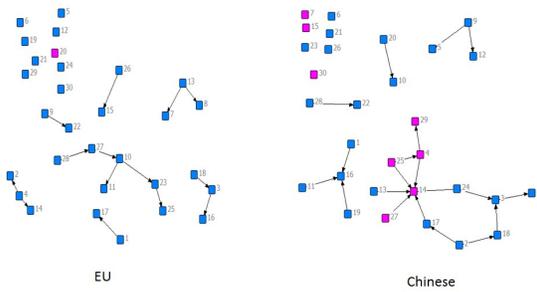
Textile and Akosombo

pink for Non-Ghanaian, blue for Ghanaian



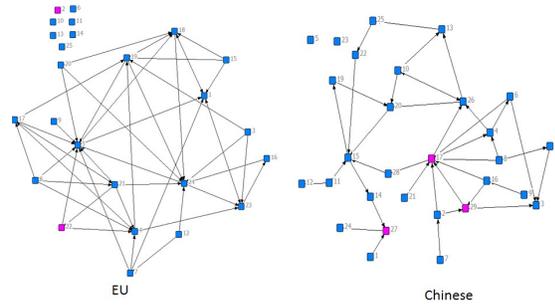
Vodafone & Huawei

pink for Non-Ghanaian, blue for Ghanaian



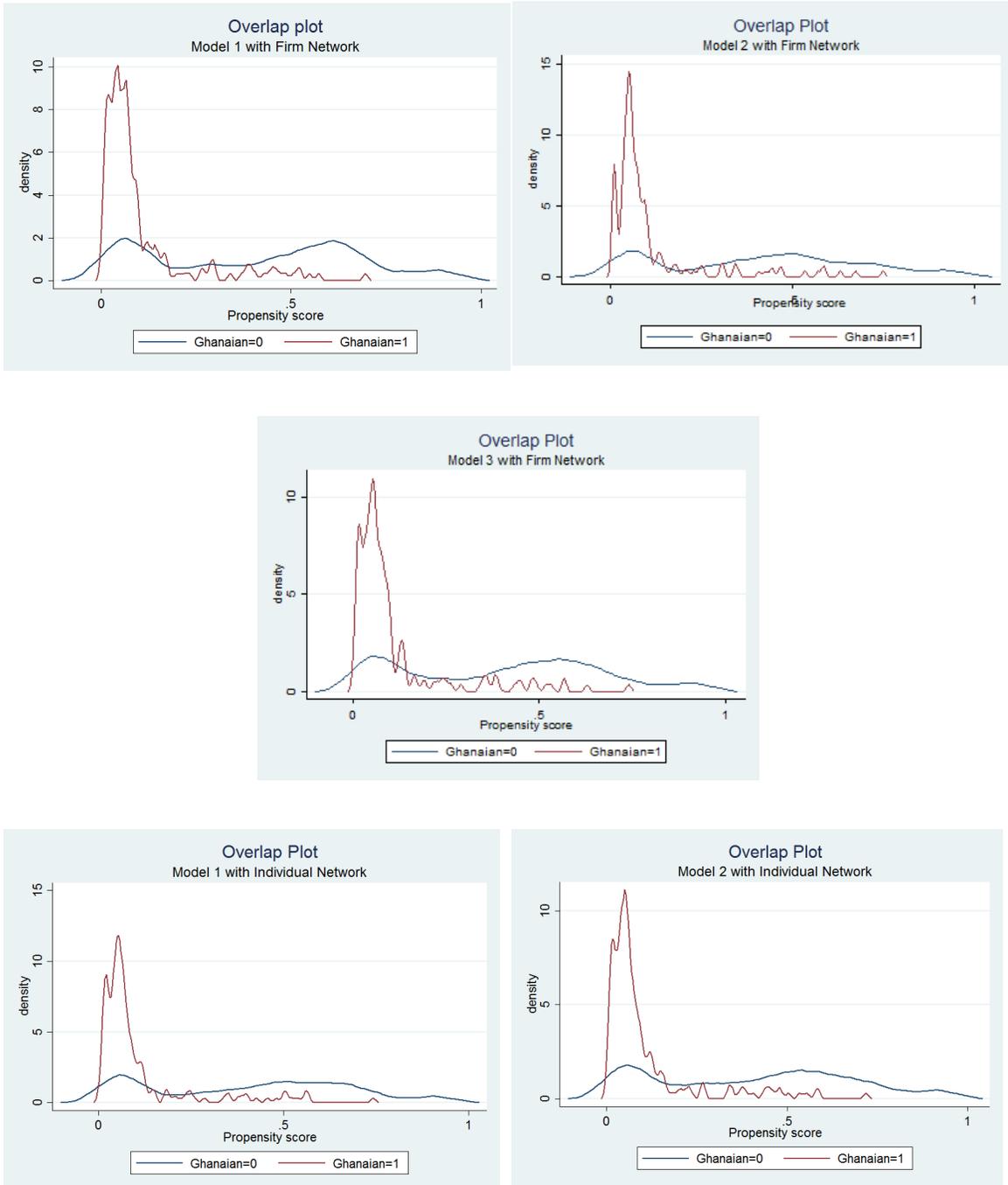
GoKals Laborex & Sanbao

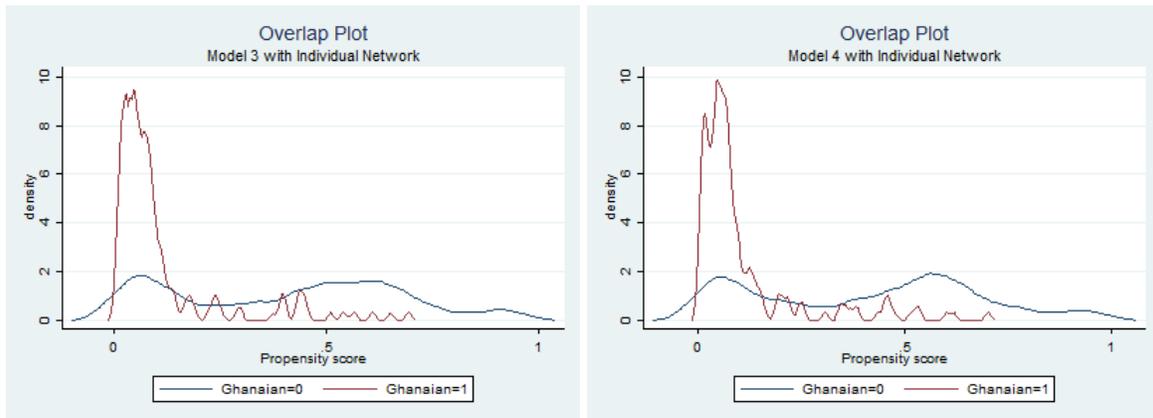
pink for Non-Ghanaian, blue for Ghanaian



D

Matching: Overlap Plot





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