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Foreign affiliates, technological catch-up, and productivity growth: Evidence from MENA oil and non-oil-producing countries☆

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ABSTRACT

Previous studies on Middle East and North Africa (MENA) countries have not investigated the hypothesis that foreign affiliates yield positive productivity spillovers for host countries. This study contributes to the empirical literature by investigating foreign direct investment (FDI) as a channel of productivity growth in MENA oil and non-oil-producing countries. To illustrate the link between FDI, technological catch-up, and host-country labor productivity growth, we present a simple theoretical model. Using a cross-sectionally correlated and timewise autoregressive (CCTA) model, our panel data regression results show that FDI spillovers are *insignificant* in oil and non-oil-producing countries during the period 1992–2008, whereas technological catch-up significantly affects labor productivity growth in these countries. Two aspects can explain these results. First, local firms' competitive capabilities in MENA countries are relatively weak. Second, most FDIs to oil and non-oil-producing countries are low-quality FDI, which flows to extractive and natural resource-based sectors.

1. Introduction

Previous studies show mixed support for the hypothesis that foreign affiliates are the main channel of embodied knowledge flows (Lall, 2001). The share of foreign direct investment (FDI) inflows to the MENA region in global FDI has increased in the past decade (see Table A.1, appendix A). Specifically, 59% of the FDI inflows to MENA countries in 2010 were for four countries: Saudi Arabia (37%), Egypt (8%), Israel (7%), and Qatar (7%). Most FDI to the MENA region does not flow to the manufacturing and information and communications technology (ICT) sectors, which are more relevant to technology diffusion than other sectors are (e.g., natural resources or tourism).[1]

Barro and Sala-i-Martin (1997) indicate the importance of technology diffusion as a channel of economic growth in developing countries. Fransman (1985) indicates that international technology diffusion uses two different types of transactions. The first is "formal" transactions, which include joint ventures, licensing, and goods trade. The second is "informal" transactions, which include linkages between multinational enterprises (MNEs) and local firms as well as scientific exchange. In both modes, MNEs are the main source of technology diffusion (Lall, 2001).

Blomstrom and Sjoholm (1998) argue that foreign affiliates may affect the productivity of local firms in two aspects. First, MNEs have strong technological and financial capabilities that allow them to compete with local firms. Second, the entry of MNEs

☆ MENA Countries: According to World Bank (2013), the Middle East and North Africa (MENA) region includes 21 countries: Algeria, Bahrain, Djibouti, Egypt, the Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Malta, Morocco, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, the United Arab Emirates, Palestine, and the Republic of Yemen.

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[1] This point is discussed in detail in UNCTAD (2006) and OECD (2004)

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encourages local firms to improve their capabilities to become competitive with foreign affiliates. This may force local firms to change their production techniques and their managerial skills. With these two aspects in mind, this study investigates the ability of MENA countries to absorb technology diffusion from foreign affiliates. Specifically, this study contributes to the empirical literature by investigating the impact of FDI on labor productivity (not economic growth)[2] in MENA countries. Previous studies have focused on the determinants of FDI and the impact of FDI on economic growth in MENA countries (see Ahmadi & Ghanbarzadeh, 2011, for a review). In addition, this study develops a simple theoretical model to illustrate the link between foreign affiliates, technological catch-up, and host-country labor productivity growth.

The remainder of this study is organized as follows. Section 2 discusses the main theoretical approaches and empirical difficulties in testing the technology diffusion from FDI. Section 3 provides the empirical specifications. Section 4 discusses the data sources. Section 5 indicates the empirical findings. Section 6 offers a conclusion and policy implications.

2. Theoretical background

Economic theory provides two approaches to studying the effects of FDI (Blomström & Kokko, 1998). The first approach, based on the work of Macdougall (1960), stems from the theory of international trade. The second approach, based on the work of Hymer (1960), stems from the theory of industrial organization. More specifically, industrial organization theory indicates that foreign affiliates should have nontangible productive assets in order to successfully compete in international markets (Aitken & Harrison, 1999). Findlay (1978) uses the following ratio to reflect the role of FDI in technology diffusion:

$$FCR = \frac{\mathrm{KF}\ (\mathrm{t})}{\mathrm{KD}\ (\mathrm{t})} \tag{1}$$

where KF (t) is the capital stock of foreign firms, KD (t) is the capital stock of domestic firms, and *FCR* is the ratio of capital stock of foreign firms in the developing economy. Findlay argues that the technological efficiency growth rate in developing economy is a function of both FDI and its technology level:

$$\frac{\dot{E}}{E} = f(FCR\ \ ,\mathrm{TEC}) \tag{2}$$

where $\frac{\dot{E}}{E}$ is the growth rate of technological efficiency in a developing economy and TEC is the technology gap between this developing economy and another developed economy (e.g., USA):

$$TEC = \frac{\mathrm{E}\ (\mathrm{t})}{\mathrm{D}\ (\mathrm{t})} \tag{3}$$

where *TEC* measures the gap between the technological efficiency level of a developing economy E (t) and the technological efficiency level in another developed economy D (t). To link the approach of Findlay (1978) to growth accounting, we can write the Cobb–Douglas technology function for country *i* at time *t*,

$$\cdot Y_{it} = A_{it}(K_{it})^{\beta}(L_{it})^{1-\beta}. \tag{4}$$

By dividing both sides by $L_{it,}$ we obtain Eq. (5):

$$Y_{it}/L_{it} = A_{it}(K_{it}/L_{it})^{\beta} \tag{5}$$

Let output per worker $\mathrm{y_{it}} = \mathrm{Y_{it}/L_{it}}$ and capital per worker $\mathrm{k_{it}} = \mathrm{K_{it}/L_{it}}$. Then,

$$y_{it} = A_{it}(k_{it})^{\beta} \tag{6}$$

By taking the logs, repeating for time t + 1 and taking the differences, we obtain Eq. (7):

$$\Delta\, y_{it} = \Delta\, a_{it} + \beta\, \Delta\, k_{it} \tag{7}$$

Following Benhabib and Spiegel (2002) and Sadik and Bolbol (2001), the growth rate of total factor productivity (TFP) depends on technological catch-up and FDI.

$$\Delta\, a_{it} = c + \quad \mu(ymax_t - y_{it})/y_{it} + \rho\ FDI \tag{8}$$

[2] Stiglitz and Walsh (2009) shows that output growth = growth of hours worked + productivity growth per hour. The productivity per hour (labor productivity) growth derives from the change in human capital and technological change (see also Elmawazini et al., 2013).

Specifically, $(ymax_t - y_{it})/y_{it}$ measures the technological catch-up (i.e., the deviation from the frontier technology function). In addition, the labor productivity gap is used as a measure of the technology gap as well as the absorptive capacity of the host country in previous studies (Kokko, 1994; Benhabib & Spiegel, 2002). By substituting (8) into (7), we obtain Eq. (9):

$$\Delta y_{it} = c + \mu(ymax_t - y_{it})/y_{it} + \rho\, FDI + \beta\, \Delta k_{it} \tag{9}$$

Eq. (9) justifies our empirical model that is discussed in the empirical specification section.

2.2 Empirical studies

Early empirical literature suggests that the effects of foreign affiliates on host-country productivity are positive. Caves (1974) provides evidence of a positive relationship between labor productivity and the employment share of foreign firms for 23 Australian manufacturing industries in 1966. Similar results can be found in Globerman (1979), Blomstrom and Persson (1983), and Blomstrom (1986). Blomstrom (1986) provides an outstanding study that focuses on the nature of the efficiency of spillovers.

Aitken and Harrison (1999) examine two hypotheses: (1) There is a relation between foreign equity participation and the increase in a firm's productivity. (2) Foreign ownership in an industry affects the productivity of local firms in the same industry. They indicate that negative spillovers stemming from foreign affiliates may crowd out local firms, which may cause a decline in the demand for the local firm's products and force them to reduce their production. This result contrasts the cross-sectional studies by early literature. Specifically, the positive and significant relationship between industry productivity and foreign ownership reported in the early literature implies that those FDIs likely flow into high-productivity industries rather than that FDI raises host-country productivity (Hanson, 2001). Similar results are obtained by Haddad and Harrison (1993).

Therefore, firm-level and single-country studies generate results that contradict those of industry-level studies and early literature. Some recent studies then use the absorptive capacity approach (e.g., Elmawazini, Gamal Atallah, Nwankwo, & Dissou, 2013; Elmawazini, 2008; Xu, 2000; Borensztein, Gregorio, & Lee, 1998) to explain why some countries have higher technology spillovers from FDI than others.

2.2.a. Technology diffusion channels from foreign affiliates

Recent studies have examined the channels of technology diffusion from FDI (see Lipsey, 2002, for a survey). Blomström and Kokko (1998) discuss five channels, namely, restrictions on foreign ownership, linkages between foreign affiliates and domestic firms, R&D expenditures of foreign affiliates, training of local employees, and demonstration effects. These channels are discussed in the remainder of this section.

2.1. First channel: Restrictions on foreign ownership

The empirical results regarding the ownership sharing of foreign affiliates yield contradictory results. Some governments in host countries may impose restrictions on foreign ownership, which forces MNEs into a joint venture and provides the local firm a chance to be closer to foreign technology and facilitate technology diffusion. Some previous studies (e.g., Blomstrom & Zejan, 1991) have found that MNEs may prefer a joint venture even without host-country restrictions because local firms have a better understanding of local market conditions. Blomstrom and Zejan (1991) found that most Swedish firms preferred to form joint ventures when investing abroad in the 1980s and 1970s.

2.2. Second channel: Backward and forward linkages between foreign affiliates and local firms

Empirical evidence suggests that local content in foreign affiliate production is the key determinant of the linkages between foreign affiliates and local firms. Reuber, Crookell, Emerson, and Gallais-Hamonno (1973) found that in 1970, a third of the purchases of foreign affiliates in all developing countries were from local firms. In addition, they found that the differences in the local content ratio imposed by governments is the main factor that explains why foreign affiliates in Latin America and India purchased more from local suppliers than foreign affiliates in the Far East did. Forward linkages increased in the same direction as backward linkages in the Irish economy between 1952 and 1974 (McAleese & McDonald, 1978). Similar results on the backward and forward linkages can be found in Lall (1980) and Harris and Robinson (2004).

2.3. Third channel: R&D expenditure of foreign affiliates

Empirical studies contradict the claims of the significance of R&D spillovers from FDI. Catherine (2000) examines the significance of the effects of FDI on R&D intensity using US panel data from 1981 to 1991, finding that only non-greenfield FDI firms significantly affect industry R&D intensity. On the other hand, Xu and Wang (2000) investigate FDI as a source of international technology diffusion using a sample of 13 OECD countries over the period 1983–1990 and find that R&D spillovers from both inward and outward FDI have no impact on host-country productivity.

2.4. Fourth channel: Training of local employees

Studies on MNE affiliate training of local employees focus on developing countries (see Caves, 1996, for a survey). The training may include all levels of employees. Gerschenberg (1987) shows that the foreign affiliates generally provide more training for local employees than do local firms in Kenya. Gerschenberg uses data for 72 top and middle managers in 41 manufacturing firms, finding that managers sometimes move from foreign affiliates to other local firms, which leads to more spillovers of know-how. As a result, MNEs give their employees higher wages as an incentive for them to stay with the company. A similar result can be found in Gangti and Ding (1998) and Djankov and Hoekman (2000).

2.5. Fifth channel: Demonstration effects.

The demonstration effect is often considered a consequence of competition. Mansfield and Romeo (1980) use a sample of US-based multinationals from 1960 to 1978. They show that domestic firms imitate the behavior of foreign affiliates in order to remain competitive in the market. In addition, Mansfield and Romeo show that the average time to transfer technology from the US parents to their foreign affiliates in developed countries is 6 years compared to 10 years for those developing countries. A similar result can be found in Jenkins (1990) and Wang and Blomstrom (1992).

3. Empirical specification

Our model is based on Eq. (9), which is derived in Section 2. The application of Eq. (9) to our panel data setting can be specified using the following dynamic panel data regression:

$$LPg_{it} = \sum_{J=1}^{N} \beta_{0j}\, D_{jt} + \beta_1\, FDI_{1,it} + \beta_2\, GAP_{2,it} + e_{it} \qquad (.\ 3.1)$$

where LPg variable is the growth rate of GDP per worker (constant 1990 PPP $). Eq. (3.1) can be justified by the existing models in the literature as follows. FDI variable is the foreign direct investment, net inflows (% of GDP). The impact of FDI on host-country productivity is investigated in many previous studies (see, for example, Elmawazini, 2014a). GAP variable is the technological catch-up, measured by labor productivity gap between MENA and Organization for Economic Co-operation and Development (OECD) countries. The GAP variable calculation is based on Li and Liu (2005). Some previous studies (e.g. Kokko, 1994; Elmawazini and Nawnkwo, 2012; Elmawazini, 2014b) used labor productivity gap as a measure of technology gap. The use of labor productivity gap is also justified in the previous section.

4. Data

Owing to the unavailability of data, the dataset contains data for 10 MENA countries: Bahrain, Egypt, Jordan, Kuwait, Malta, Morocco, Oman, Saudi Arabia, Syria, and Tunisia. Other MENA countries are excluded (World Bank, 2013). LPg and FDI are collected from World Bank (2013). Here, "GDP per person employed is gross domestic product (GDP) divided by total employment in the

Table 4.1
FDI, net inflows (% of GDP).

Year	BAH	EGY	JOR	KUW	MAL	MOR	OMA	SAU	SYR	TUN
1992	18.28	1.10	0.77	0.18	1.31	1.48	0.84	−0.06	0.43	3.39
1993	−5.29	1.06	−0.60	0.06	2.08	1.83	1.14	1.03	0.80	3.85
1994	3.74	2.42	0.05	0.00	5.06	1.82	0.59	0.26	2.48	2.76
1995	7.36	0.99	0.20	0.02	3.61	0.28	0.34	−1.32	0.88	1.47
1996	33.57	0.94	0.22	1.10	7.98	0.21	0.40	−0.71	0.65	1.22
1997	5.19	1.14	4.98	0.07	2.26	0.01	0.41	1.84	0.55	1.79
1998	2.90	1.27	3.92	0.23	7.43	0.03	0.72	2.94	0.54	3.28
1999	6.85	1.17	1.94	0.24	21.94	0.01	0.26	−0.48	1.66	1.68
2000	4.56	1.24	10.79	0.04	15.44	0.60	0.41	−1.00	1.40	3.87
2001	1.01	0.52	3.05	−0.32	6.24	0.38	0.03	0.01	0.52	2.43
2002	2.56	0.74	2.49	0.01	−10.16	0.20	0.54	−0.33	0.53	3.91
2003	5.30	0.29	5.36	−0.14	20.16	4.64	0.12	−0.27	0.71	2.35
2004	7.70	1.59	8.21	0.04	7.05	1.38	0.45	−0.13	1.10	2.28
2005	7.79	5.99	15.76	0.29	11.39	2.72	4.98	3.84	1.75	2.50
2006	18.38	9.34	22.65	0.12	28.98	3.60	4.34	5.14	1.97	10.56
2007	9.51	8.87	14.76	0.10	13.45	3.73	7.95	6.32	3.06	4.30
2008	8.19	5.83	12.45	0.00	10.75	2.77	3.91	8.28	2.69	6.46

Source: World Bank (2013).

economy. Purchasing power parity (PPP) GDP is GDP converted to 1990 constant international dollars using PPP rates. An international dollar has the same purchasing power over GDP that a U.S. dollar has in the United States" (World Bank, 2013). Furthermore, FDI is "the net inflows of investment to acquire a lasting management interest (10% or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP" (World Bank, 2013). Table (4.1) shows net FDI inflows (% GDP) in MENA countries used in this study from 1992 to 2008.

5. Empirical findings

In panel data models, economic data are a composition of time series and cross-sections. Modeling the panel dataset calls for some complex stochastic specifications. When we estimate panel data, we should consider two basic points: first, the differences in behavior across cross-sectional units, and second, the differences in behavior within cross-sectional units over time.

Because our panel dataset has periods with relatively large cross-sections, the least-squares dummy variable (LSDV) model generates *very similar results* to the random-effects model (Kmenta, 1986). In general, both LSDV and the random-effects models may lead to inefficient results (Greene, 2000). To avoid this limitation, we use the Parks (1967) method, which also allows for contemporaneous cross-section correlations. Using Parks (1967), the following table shows the empirical findings of Eq. (3.1).

Table (5.1) reports the results of Parks (1967) and the LSDV method. The assumptions of the Parks method (1967) generate the cross-sectionally heteroskedastic and timewise autoregressive (CHTA) model, which is described in Elmawazini (2012). Regressions (5.3) and (5.4) present robustness checks of the empirical results of regression (5.2) by dividing the sample into two subsamples, oil-producing and non-oil-producing countries. Specifically, regressions (5.3) and (5.4) confirm the results of regressions (5.1) and (5.2) and show *insignificant* spillovers from FDI. In addition, panel data regressions show that technological catch-up (GAP) affects labor productivity growth in MENA countries. One explanation of this result is that MENA countries in our full sample cannot absorb the spillovers from FDI possibly owing to the weakness of technological and human capabilities of local firms in MENA countries (Elmawazini and Nawankwo, 2012). This explanation is consistent with some previous studies. For example, the technology level of these countries is one of the lowest levels among developing countries (UNDP, 2006). Therefore, governments in MENA countries should increase their spending on R&D, which may shift the level of technology in MENA countries.

6. Conclusion and policy implications

This study investigates the ability of MENA countries to benefit from productivity spillovers from FDI. This goal is achieved through two stages. In the first stage, empirical literature and theoretical approaches on spillovers from FDI are reviewed. In the second stage, we estimate the panel data regression models to test the impact of FDI on productivity.

Our results showed that FDI productivity spillovers in MENA countries seem insignificant. This result may arise for two reasons. First, the technological capabilities of local firms are very weak in all MENA countries. This weakness may lead to negative spillovers from FDI and prevent MENA countries from obtaining benefits from the technology diffusion from FDI. Second, most FDI inflows to MENA region goes to sectors (e.g., natural resources) that are less relevant to technology transfer than the manufacturing sector is. In consequence, governments in MENA and other developing countries should focus on improving the technological capabilities of local firms and deepen the linkages between local firms and foreign affiliates (Elmawazini, Manga, & Saadi, 2008). Governments should also increase their spending on R&D and innovation activities, which may increase the level of technological capacity in MENA countries. Elmawazini (2010) found that host-country R&D spending could significantly increase the magnitude of technology spillovers from FDI.

This study has three implications for foreign affiliates. First, the growing technology gap between MENA and OECD countries may lead to negative technology spillovers stemming from the difference in capabilities between foreign affiliates and local competitors (Aitken & Harrison, 1999).

Second, a large technological gap between foreign affiliates and local firms may discourage foreign affiliates from obtaining inputs from local firms in MENA countries (Elmawazini, 2011). Third, the weak capabilities of local firms may discourage foreign affiliates to choose joint ventures as a mode of entry.

Table 5.1
presents the panel data regression results for the *LPg* variable. Values in parentheses are the t-statistics.

Regression method	LSDV model (regression 5.1) full sample	Parks method (regression 5.2) full sample	Parks method (regression 5.3) non-oil-producing countries	Parks method (regression 5.4) oil-producing countries
FDI standardized coefficient	0.0565 (0.6405)	0.0013 (0.03446)	0.0038 (0.4724)	0.0441 (0.7236)
GAP standardized coefficient	−1.0408 (−2.563)	−1.5248 (−5.106)	−1.2915 (−2.344)	−1.3823 (−4.069)
R2	0.1236	0.5054*	0.4032*	0.5343*
Geary (RUNS) test	62 RUNS, 94 POS, 76 NEG	88 RUNS, 86 POS, 84 NEG	48 RUNS, 53 POS, 0 ZERO, 49 NEG	31 RUNS, 33 POS, 0 ZERO, 35 NEG
Number of observations	170	170	102	68

* BUSE RAW-MOMENT R2.

There are two limitations of this study. The first limitation is the poor quality of FDI data. FDI flows have three components: equity capital, reinvested earnings, and intra-company loans. However, UNCTAD (1999) indicates that some countries do not record all of these components. Second, the dataset contains only 10 MENA countries, which is mainly because of the unavailability of data. The availability of firm-level data and technology indicators may allow future research to use direct and accurate measures of the technology gap and host-country absorptive capacity.

Appendix A. Appendix A

Table A.1
FDI inflows ($ millions).

Host country/region	2000	2010
World	1 402 680	1 185 030
Developing countries	257 617	573 586
MENA countries	13 621	84 234
Developing country share in World FDI	18.4%	46.1%
MENA share in world FDI	1%	6.1%
MENA share in FDI inflows to developing countries	5.3%	13.3%

Source: Author's calculations based on UNCTAD, World Investment Report, various issues.

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