Productivity Growth and Technological Progress in the Palestinian Economy: Empirical Evidence from the West Bank

Kenichi Kashiwagi[1]

Abstract

This study investigates firm-level productivity to identify factors determining the level of total factor productivity (TFP) for firms in the West Bank. By using a sample of 129 enterprises, the Cobb-Douglas production function and the TFP equation are estimated. Results suggest the accumulation of human capital and adoption of innovative management are determining factors associate with higher TFP for firms in the West Bank. The limited access to export market under the asymmetric trade relation with Israel has a negative impact on technological progress. Owing to the scarcity of multinational enterprises, domestic firms in the West Bank are deprived of the benefits of the spillover effects of technological transfer. While the human capital accumulation is significant, the increasing wage levels of Palestinian workers due to the continuous migration to the Israeli labor market may have a negative impact by eroding the competitiveness of domestic firms in the West Bank.

1   Introduction

It is generally recognized that the Palestinian economy under an Israeli occupation

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[1] Associate Professor, Faculty of Humanities and Social Sciences, Alliance for Research on North Africa, University of Tsukuba

has been structurally integrated with the Israeli economy. Because of their high dependence on the Israeli economy, production and employment in the West Bank and Gaza is shaped by the nature of economic relations with Israel. A majority of Palestinian exports are directed at Israel, and there is considerable flow of Palestinian labor to the Israeli labor market. Most industrial entities in the West Bank and Gaza are subordinated to the Israeli economy. This structural dependency has generally continued even after the Oslo I and II Accords, Paris Protocol, and Wye River Memorandum. The economy has stagnated because of the separation of the occupied territories into Area A, B, and C. The term "de-development," as defined by Roy (1999), continues to be relevant to describe the economic situation of the occupied territories. The adoption of a disengagement plan and the construction of a separation wall by the Israeli civil administration have been detrimental to the Palestinian economy. In particular, the Israeli border control that restricts the movement of Palestinians has had a huge negative impact on economic activities.

Regardless this situation being expressed as de-development, the Palestinian economy has shown modest economic performance even under Israeli occupation. According to the World Bank (2002), the average GDP growth rate in the West Bank and Gaza was estimated at 5.4% from 1968 to 2000. The current Global Economic Prospects by World Bank (2005) reported that real GDP growth of the West Bank and Gaza from 2010 to 2013 was 5.9% on average. It is predicted to rebound to more than 4.0% in 2016 and 2017, as the economy recovers from the negative effect of the Israel-Gaza conflict in 2014. Although the growth performance has been modest, the productivity growth is worth examining. Applying the growth accounting method, the World Bank (2002) estimated the total factor productivity (TFP) of the West Bank and Gaza from 1969 to 2000 and concluded that the contribution of TFP to GDP growth was marginal and thus disappointing as the estimated growth rate remained between 0.3% and 0.4%. Despite the negative outlook based on slow TFP growth, these empirical results suggest two points. First, although the TFP growth has stagnated, it has not become negative. Several empirical studies that compared TFP by regions found a negative TFP growth rate in the Middle East and North Africa (MENA) from the 1960s to the 1980s (Nehru and Dhareshwar, 1993). Although MENA showed a small recovery in TFP growth in the 1990s, its annual growth rate remained in the 0.2%-0.8% range (Pissarides and Véganzonès-Varoudakis, 2008). Second, compared with other developing economies, the relative contribution of TFP to output growth in Palestinian economy was not significantly low, ranging from 13% to 20%. Although the relative contribution of TFP to Palestinian GDP growth is lower than in the newly industrialized countries in Asia (Kim and Lau, 1994), the Palestinian productivity growth is comparable. In most empirical studies of MENA economies, the accumulation of physical capital emerges as the major determinant of modest growth rather than TFP growth (Abu-Qarn and Abu-Bader, 2007). Similar to the experience of other economies in the MENA, the Palestinian economy can be regarded as a transitional period from input-driven to

technological progress.

Given these facts, it is worth examining the productivity growth and sources of technological progress in the Palestinian economy. Hence, this study seeks to investigate firm-level productivity measured by TFP and to identify the factors determining the level of TFP, focusing on the West Bank industries. We estimate the Cobb-Douglas production function and the TFP equation by using a sample of 129 enterprises located in the West Bank. This study uses firm-level data collected by the World Bank in the "West Bank and Gaza: Enterprise Survey 2013".[2]

With regard to empirical application of growth accounting methods to the Palestinian economy, Metzer (1992) compared growth and productivity between the period under British mandate (1922–1947) and that under Israeli occupation (1968–87). Metzer (1992) found TFP stagnation under occupation despite the substantial rise of TFP during the mandatory period. For the period after the Oslo Accords, the World Bank (2002) measured the TFP growth rate of the West Bank and Gaza using time series data from 1970 to 2000. The author concluded that Palestinian growth had been transitional rather than sustainable because it was driven by capital accumulation, with TFP growth contributing only marginally to GDP growth.

Regarding the decomposition of TFP growth, international experience suggests that the degree of openness to international trade is a key determinant of technological progress (Dessus, Fukasaku and Safadi, 1999; Miller and Upadhyay, 2000). On the other hand, accumulation of human capital, which represents the ability to absorb advanced technology, is seen as an important source of TFP growth (Benhabib and Spiegel, 1994; Islam, 1995; Miller and Upadhyay, 2000; Liu and Wang, 2003; Vandenbussche, Aghion and Meghir, 2006). As for the Palestinian economy, Metzer (1992) argues that the Jewish economy provided an expanding market for Arab final goods and services and for factor services during the mandatory period; this period introduced production technologies and methods, primarily in agriculture, from which the Arabs could potentially gain by way of demonstration effects and technological spillovers. Kleiman (1999) suggests that access to Israeli jobs for Palestinian labor and Israeli employers' access to a large, inexpensive Palestinian labor force were the main factors explaining this income convergence between Israel and Palestine.

On the contrary, the World Bank (2002) points to the underutilization of human capital in the West Bank and Gaza, resulting from the distorting effects of the Palestinian labor flows to Israel, unilateral trade relations with Israel, and limitations on third-party trade. Low productivity growth suggests that Palestinian economic integration with Israel since 1967 has not benefited from significant technology transfers. Naquib (2003) found that Israeli policies have distorted and weakened the Palestinian economy, particularly in the areas of trade and taxation

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[2] The micro-data, questionnaires, methodology for data collection are available at: http://www.enterprisesurveys.org/

as well as in the labor market and in Palestinian access to land. The World Bank (2002) attributes the slow growth of TFP for accumulation of capital to an unproductive construction sector, dormant manufacturing, underutilization of human capital, the Dutch disease, lack of integration into global markets, and limited technology transfer from Israel. However, there have been few empirical studies to identify the determinants of slow TFP growth. The impact of exports and human capital on TFP growth has not been empirically tested. Most studies use time series data; however, as far as we know, micro-level analysis of growth is merely absent.

In line with the experience of developing economies, this study assumes that the accumulation of human capital, adoption of innovative activities, and openness to international trade are factors that contribute to the technological progress of firms in the West Bank. However, continued structural dependency with limited access to export markets under an asymmetric trade relationship with Israel is seen as having an adverse impact on technological progress. The spillover effect of the activities of multinational enterprises (MNEs) is also scarce. Based on empirical evidence, this study emphasizes that even under continued structural dependency, the contribution of human capital and innovation to technological progress are significant.

This paper is organized as follows. Section 2 provides an overview of performance of the Palestinian economy post-Oslo Accords. Section 3 explains the model used in this study. Section 4 explains the data used in the estimations and Section 5 extends the empirical results and discussions. Section 6 gives conclusions.

2   Performance of Palestinian Economy after Oslo Accords

These are the main results of the paper. Following the implementation of the Paris protocol, the growth of the Palestinian economy has been modest in the post-Oslo period. Although the economy experienced a negative shock after the Al-Aqusa Intifada in 2000 and the Israel–Hezbollah War in 2006, real GDP grew at 4.67% annually from 1994 to 2013. After 2002, real GDP recovered remarkably, growing annually at 7.05%. During the same period, the annual real GDP growth rate of the manufacturing sector was rapid at 8.72%, while that of the services sector was modest at 4.45%.

Table 1 presents the output, number of employees, productivity, and incremental capital output ratio (ICOR) of industrial activities in Palestine. Along with the recovery of GDP, manufacturing output has also been growing since 2002. It should be noted that both output and labor productivity have been increasing since 2002. The number of employees has increased since 2006. This is partially due to the construction of the separation wall. This disengagement policy and tighter border control by the Israeli civil administration has resulted in a decrease in labor

flows to Israel. However, despite the difficult economic situation, labor productivity has been rising, absorbing workers at 1.16% annually on average. Although ICOR has fluctuated, it has remained at around 0.018. This means that the rate of investment in manufacturing is stable. Recovery of gross fixed capital formation has also been observed since 2003. This increase in industrial productivity has contributed to the recovery of overall economic growth. The improvement in productivity implies that the industrial sector in Palestine may have induced technological progress during this period.

Table 1: Output, number of employees, gross fixed capital formation labour productivity and ICOR of industrial activities in Palestine

	Output	Number of Employees	Gross fixed capital formation	Labour productivity	ICOR
1997	1,391,361.0	66,113	45,497.0	21.0	0.033
1998	1,285,996.0	65,099	23,029.2	19.8	0.018
1999	1,613,737.0	72,660	34,241.7	22.2	0.021
2000	1,708,694.0	76,918	27,247.3	22.2	0.016
2001	1,270,345.0	69,569	15,589.5	18.3	0.012
2002	976,900.4	65,526	10,016.0	14.9	0.010
2003	1,058,365.0	60,185	8,933.1	17.6	0.008
2004	1,460,142.0	58,979	31,693.3	24.8	0.022
2005	1,457,236.0	58,242	18,048.2	25.0	0.012
2006	1,474,364.0	49,990	22,360.7	29.5	0.015
2007	1,808,282.0	61,690	44,848.6	29.3	0.025
2008	2,056,157.0	59,641	35,667.9	34.5	0.017
2009	2,293,632.0	67,052	38,646.9	34.2	0.017
2010	2,700,320.0	65,538	69,823.1	41.2	0.026
2011	2,819,353.0	72,022	66,632.1	39.1	0.024
2012	3,798,059.6	78,724	84,659.5	48.2	0.022
2013	4,021,524.7	79566	53,508.2	50.5	0.013

Source: Palestinian Central Bureau of Statistics (PCBS), Number of Enterprises, Persons Engaged and Main Economic Indicators in Palestine For Industrial Activities 1997-2013. <http://www.pcbs.gov.ps /site /lang__en/507/default.aspx> (accessed: 12 November, 2015).

Table 2 presents changes in the volume of manufacturing exports, imports and their percentages in total exports as well as FDI inflows and their percentage in GDP. The volumes of manufacturing exports and imports dropped from 2000 to 2002, but they have been recovering. This recovery is consistent with the growth of GDP and improvement in manufacturing productivity. The rapid expansion of exports may have contributed to GDP growth. While the percentage to total exports has been stable at approximately 70%, it has been declining since 2009. This decrease implies that manufacturing exports have been losing their

competitiveness in recent years. While the volume of manufacturing imports is growing, its percentage to total imports has been decreasing. This may be the result of increases in domestic manufacturing supplies. However, from the point of view of technology imports, this decrease may negatively affect technology transfer in the manufacturing sector.

The volume of FDI inflows decreased in 2002 and 2006. This was likely the result of the negative effect of the *Al-Aqusa* Intifada and Israel-Hezbollah War. Despite these negative shocks, FDI inflows recovered and jumped from 2009 to 2011; however, they declined again thereafter. The average percentage of FDI to GDP remained approximately 1.29% during the observed period. Indeed, the number of foreign establishments in 2012 stood at 53, while the number in 2007 was 72.[3] The reduced inflows of FDI and limited number of foreign firms show that the spillover effects of MNE activities were less effective for domestic firms.

Table 2: Export and import of manufacturing goods and FDI inflow

	Export of manufacturing goods		Import of manufacturing goods		Inflow of FDI	
	USD in millions	Percentage to total	USD in millions	Percentage to total	USD in millions	Percentage to total
2000	277,480	69.2	1,304,529	54.7	62	1.4
2001	221,483	76.3	1,091,208	53.7	19.2	0.5
2002	177,093	73.5	702,851	46.4	9.4	0.3
2003	202,349	72.4	871,755	48.4	18	0.5
2004	228,041	72.9	1,065,474	44.9	48.9	1.1
2005	241,821	72.1	1,294,905	48.5	46.5	1.0
2006	282,380	77.0	1,094,799	39.7	18.6	0.4
2007	388,695	75.8	1,321,546	40.2	28.3	0.5
2008	442,221	79.2	1,317,855	38.0	51.5	0.8
2009	410,553	79.2	1,639,331	45.5	300.5	4.1
2010	443,140	77.0	1,780,769	45.0	206.3	2.3
2011	489,939	65.7	1,954,524	44.7	349.3	3.3
2012	496,224	63.4	2,081,190	44.3	58.4	0.5
2013	560,340	62.2	2,213,677	42.9	175.7	1.4

Source: PCBS, Total Value of Registered Palestinian Exports and Imports by SITC- Rev.3 Sections in 1996- 2012; Major National Accounts Variables by Region for the Years 1994-2013 at Current Prices; The Preliminary Results of the Annual Balance of Payments for Palestine. <http://www.pcbs.gov.ps/site/lang__en /507/default.aspx> (accessed: 12 November, 2015).

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[3] See PCBS, Number of Operating Establishments in the Private Sector, Non Governmental Organization Sector and Government Companies in Palestine* by Governorate and Legal Status, 2012 <http://www.pcbs.gov.ps/Portals/_Rainbow/ Documents/EST_legal_English_2012.htm> (accessed: 12 November, 2015).

Table 3 presents the distribution of employment, wage, and wage differentials. While more than 60% of employment is provided by the private sector, it should be noted that around 10% of the workforce migrates and works in the Israeli sector and Jewish settlements. Before the Oslo Accords, the West Bank exported around 30% of its labor force. The Israeli labor market absorbed 35% to 40% of the total active labor force from Gaza (Farsakh, 1998). In the post-Olso period, however, the numbers from the West Bank working in Israel decreased to 25%-30% and from Gaza to less than 15% in mid-2000.[4] Although the construction of the separation wall has had a negative impact, more than 10% of labor from the Palestinian side is absorbed by Israel. The majority of Palestinians employed in Israel are less educated than those who work in the West Bank and Gaza. Nearly 80% of Palestinians working in Israel have preparatory education or less while around 26% of workers in this region have tertiary education (World Bank, 2002). Despite the continuous migration of Palestinian workers to the Israeli labor market, the wage differential between Israel and Palestine has persisted. In the West Bank and Gaza, the nominal wage level has been increasing in both public and private sectors; however, its differentials with the wages in Israel and the settlements are expanding. After 2010, the differential between Israel and the settlements and the private sector was more than double. The higher wage in Israel does not clear the labor market since the supply of Palestinian labor is limited by Israeli border policy and security controls (World Bank, 2002). The high wages in Israel and the settlements has continued to attract Palestinian workers to the Israeli labor market. It should be noted that real wages have been falling, reflecting an excess supply of Palestinian workers. According to PCBS, the Palestinian unemployment rate increased dramatically from 13.0% to 28.4% from 1999 to 2011. This increase may be partially owing to restrictions on the movement of Palestinian workers to the Israeli side. The real wage is decreasing but the current wage level is higher than the market clearing level. Although the labor supply to Israel is constrained by permit requirements, uncertain access owing to security measures and border closures, and high transportation and search costs, the prospect of earning significantly higher wages leads Palestinians to seek jobs in Israel (World Bank, 2002). Thus, high wages in Israel and the settlements raises the wage level in the West Bank and Gaza by reducing its level of employment. Despite the abundance of human capital, the induced higher labor cost may erode competitiveness as well as negatively impact foreign companies considering investment decisions in the West Bank.

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[4] See PCBS, Percentage Distribution of Employed Person in the Palestinian Territory by Sector and Region, 2000-2011<http://www.pcbs.gov.ps/Portals/_Rainbow/Documents /Employed%20Person%20by%20sector.htm> (accessed: 12 November, 2015).

Table 3: Distribution of employment, real wage and wage differential

	Percentage Distribution of Employed Person			Average Daily Wage in NIS for Wage Employees			Wage differential	
	Public Sector	Private Sector	Israel and Settlements	Public Sector (W_{pu})	Private Sector (W_{pr})	Israel and Settlements (W_{is})	W_{is}/W_{pu}	W_{is}/W_{pr}
2000	19.3	61.9	18.8	59.0	66.8	110.5	1.87	1.65
2001	22.9	64.6	12.5	59.3	67.9	106.5	1.80	1.57
2002	23.3	67.4	9.3	59.6	69.6	116.0	1.95	1.67
2003	20.5	70.8	8.7	61.4	66.9	122.8	2.00	1.84
2004	22.1	69.8	8.1	66.2	67.3	125.3	1.89	1.86
2005	22.5	68.2	9.3	70.4	67.4	125.6	1.78	1.86
2006	23.2	68.2	8.6	78.5	69.7	129.8	1.65	1.86
2007	22.7	68.4	8.9	79.3	69.0	130.0	1.64	1.88
2008	24.2	65.7	10.1	79.2	74.7	138.3	1.75	1.85
2009	25.2	64.6	10.2	84.4	77.0	148.1	1.75	1.92
2010	24.0	65.5	10.5	85.2	74.3	158.0	1.85	2.13
2011	22.5	67.5	10.0	89.1	72.6	162.2	1.82	2.23

Source: PCBS, Percentage Distribution of Employed Person in the Palestinian Territory by Sector and Region, 2000-2011; Average Daily Wage in NIS for Wage Employees in the Palestinian Territory by Sector and Region, 2000-2011; Annual Consumer Price Index Number and Percent Change by Region for: 1996 – 2014, Base Year (2010 = 100). <http://www.pcbs.gov.ps/site/lang__en/507/default. aspx> (accessed: 12 November, 2015).

Note: The nominal wage is deflated by CPI (2010=1.0) to calculate real value.

3   Model

Based on the review of performance of production, employment and export focusing on manufacturing sector after the Oslo Accords, it is found that the growth of production and exports is recovering with the improvement in manufacturing sector productivity. Hence, the manufacturing sector in Palestine may have induced technological progress during this period. In this section the growth accounting method is employed to investigate the level of technological progress by estimating TFP.

The measurement of TFP requires the estimation of production function. Parameters of the production function are estimated to calculate TFP at first, and then the TFP function is estimated to identify the factors to determine level of TFP. Following Miller and Upadhyay (2000, 2002), and Liu and Wang (2003), we specify the production function of *i*th firm for the cross-section analysis. Assuming a Cobb-Douglas form, a standard production function can be written as

follows:

$$Y_i = A K_i^{\beta_k} L_i^{\beta_l} , \tag{1}$$

where Y_i denotes gross output value, K_i and L_i represent the physical capital stock and the labor input of the ith firm, respectively. A denotes an index of TFP representing technological progress. β_i ($i = k, l$) is an unknown parameter to be estimated. The possibility of non-constant returns to scale is allowed by not restricting ($\beta_k + \beta_l$) to equal one.

As Miller and Upadhyay (2000; 2002) argued, whether or not to include human capital as an input in the production function is debatable. While Mankiw, Romer, and Weil (1992) suggest that human capital contributes significantly to output growth, other studies, such as those by Islam (1995) and Liu and Wang (2003), assumed that human capital is insignificant in explaining output growth. Benhabib and Spiegel (1994) incorporated human capital into the growth rate estimation of the production function but found the coefficients of the human capital variable to be insignificant and negative. Miller and Upadhyay (2000) estimated two production functions (with and without the stock of human capital) and found that human capital contributed to TFP. In this study, human capital is not included in the production function as an input; we assume that human capital influences growth through its effect on TFP.

Taking natural logarithms of equation (1), the following equation is obtained:

$$\ln Y_i = \ln A_i + \beta_k \ln K_i + \beta_l \ln L_i . \tag{2}$$

This production function displays increasing, constant, or decreasing returns to scale depending on whether ($\beta_k + \beta_l$) is greater than, equal to, or less than one, respectively.

Regarding the decomposition of TFP, human capital is assumed to be an important source of TFP growth (Benhabib and Spiegel, 1994; Miller and Upadhyay, 2000; Liu and Wang, 2003; Vandenbussche, Aghion, and Meghir, 2006). As Miller and Upadhyay (2000) suggested, access to export markets is also a significant factor in inducing TFP growth. In addition, as an intangible investment, accumulation of management experience is also important. Adoption of innovation positively affects TFP.

Based on the estimation of the production function, we estimated the following equation to isolate the factors influencing TFP:

$$\ln TFP_i = \lambda_0 + \lambda_1 \ln EDU_i + \lambda_s \ln MNE_i + \lambda_s \ln EXA_i + \lambda_4 D_{INi} + \lambda_5 \ln OPY_i$$
$$+ \lambda_6 \ln LS_i + \lambda_7 DS_{Mi} + \lambda_8 DS_{Si} + u_i , \tag{3}$$

where *EDU* denotes accumulation of human capital represented by years of schooling of an employee; *MNE* denotes years of managerial experience; *EXA* denotes access to export markets captured by the rate of export to total sales; and D_{IN} represents innovation activities. The parameters of years of schooling, managerial experience, rate of export, and innovation are expected to have a positive sign and contribute to an increase in TFP. We include variables representing a firm's years of operation, size, and sectors to control the firm characteristics; thus, *OPY* stands for the number of years the firm has been in operation; *LS* denotes a variable of firm size; DS_M is a dummy variable for the manufacturing sector; and DS_S is a dummy variable for the services sector. λ_i ($i = 0…8$) is an unknown parameter to be estimated, and u_i represents the error term.

The possible statistical issue to be resolved in this model is endogenity of adoption of innovation. This variable is likely to be correlated with the error term. Moreover, in this model a relationship between D_{IN} and *TFP* is not argued clearly: adoption of innovation in marketing methods is presumed to have a positive impact on TFP. Conversely, TFP level in a firm may also be a significant factor influencing the decision to adopt innovation. If a reverse causality exists, the estimation of a single equation for TFP using the OLS method will result in inconsistent results. Considering the possibility of endogeneity of D_{IN}, we employ the instrumental variable method, following Wooldrige (2002), and Davidson and MacKinnon (2004). Applying the Durbin–Wu–Hausman test for endogeneity, we specify the following equation:

$$D_{INi} = \delta_0 + \delta_1 D_{TRi} + \delta_2 D_{RDi} + \delta_3 \ln TFP_i + e_i \tag{4}$$

where δ_i ($i = 0…3$) is an unknown parameter to be estimated and e_i represents the error term. Equation (4) shows that the decision to adopt innovation in marketing in the *i*th firm is affected by three instrumental variables: a dummy variable of employee training (D_{TR}), a dummy variable of research and development (D_{RD}), and the level of TFP. These instruments are chosen for their high correlation with the possibly endogenous variable, D_{IN}, but not with the error term of equation (3).

To test the endogeneity of D_{IN}, we first estimate the following reduced form of equation (4), which includes the right-hand-side (RHS) variable of equation (3) as well as a set of instrumental variables:

$$D_{INi} = \gamma_1 + \gamma_2 \ln EDU_i + \gamma_3 \ln MNE_i + \gamma_4 \ln EXA_i + \gamma_5 \ln OPY_i + \gamma_6 \ln LS_i$$
$$+ \gamma_7 SD_{Mi} + \gamma_8 SD_{Si} + \gamma_9 D_{TRi} + \gamma_{10} D_{RDi} + \varepsilon_i, \tag{5}$$

where γ_i ($i = 0…10$) is an unknown parameter to be estimated and ε_i represents the error term. The estimation of equation (5) gives the residuals (*v*). Next, we estimate equation (3), including the residuals obtained as an additional RHS variable. Under the null hypothesis of no endogeneity, the coefficient of this

additional residual term, denoted as ϕ, equals zero. If the null hypothesis is rejected — if the coefficient is statistically different from zero — D_{IN} is endogenous. If the coefficient of the residual term is not statistically significant, we are justified in using the OLS method to estimate equation (3).

4 Data

The data for this study is drawn from the World Bank Enterprise Survey (2013). It represents a cross-section of 434 enterprises located in both the West Bank and Gaza Strip. The survey includes information on a variety of characteristics such as total annual sales, number of workers, value of assets, cost structure et cetera. We used a sub-sample of 209 enterprises from the full sample that had data on value of total assets (150 West Bank; 59 Gaza Strip). The empirical estimation focused on enterprises located in the West Bank because of its geographical separation from the Gaza Strip. From the data of West Bank, 11 samples were omitted because data on the variables to be estimated were missing. In addition, 10 observations were dropped as identified as outlier, since their values being larger than the mean plus three times the standard deviation. This left us with a sample size of 129 for our empirical analysis.

The summary statistics of the variable are presented in Table 4. The dependent variable of the production function, Y, is captured by total annual sales of all products and services. The value of total assets is used as a proxy for stock of physical capital (K). Labor input, L, is represented by total annual cost of labor including wages, salaries, bonuses, and social security payments. Regarding the independent variables in the TFP equation, EDU represents employees' years of schooling and MNE represents years of managerial experience. As a variable of access to export, the ratio of direct exports (including to Israel) to total sales, EXA, is also added as an independent variable. Moreover, D_{IN} captures adoption of innovation if the firm introduced new or significantly improved marketing methods in the past three years. To control for firms' characteristics, we include a variable for years of operation of the firm, OPY; a dummy variable for medium-sized firms, D_M, which equals 1 if the number of employees is more than 20 and less than 99 and zero otherwise; and a dummy variable for large firms, D_L, which equals 1 if the number of employees is more than 100 and zero otherwise. As for sector dummies, we add a dummy variable for manufacturing, SD_M, which equals 1 if the firm belongs to the manufacturing sector and zero otherwise, and one for services, SD_S, which equals 1 if the firm belongs to the services sector and zero otherwise.

Table 4: Summary statistics of the variables

Variables and measurement	Mean Values	Standard Deviation	Maximum	Minimum
Y : Total annual sales of all products and services (INS)	4729.1	8899.8	53000.0	30.0
K : Value of total assets (INS)	1752.0	3015.3	15000.0	2.0
L : Total annual cost of labour including wages, salaries, bonus and social security payments (INS)	330.1	563.9	4000.0	4.5
EDU : Years of schooling of employee (years)	138	228.9	1512	1
MNE : Years of experience of top manager (years)	18	11.2	60	2
EXA : Percent of direct export heading abroad including Israel to total sales (%)	15.6	30.5	100.0	0.0
OPY : Years under operation (years)	16	14.6	92	1
D_{IN} : Dummy variable of adoption of innovation (1: introduced new or significant improvements in marketing method, 0: otherwise)	0.264	0.442	1	0
D_M : Dummy variable of medium size firm (1: number of employee is 20-99, 0: otherwise)	0.163	0.371	1	0
D_L : Dummy variable of large size firm (1: number of employee is more than 100, 0: otherwise)	0.031	0.174	1	0
SD_M : Dummy variable of manufacturing sector (1: manufacturing sector, 0: otherwise)	0.372	0.485	1	0
SD_S : Dummy variable of services sector (1: services sector. 0: otherwise)	0.333	0.473	1	0
D_{TR} : Dummy variable of training (1: have formal training programs for employee, 0: otherwise)	0.132	0.340	1	0

D_{RD} : Dummy of research and development (1: spent on formal research and development activities, 0: otherwise)	0.147	0.356	1	0

Note: INS indicates Israeli new shekel.

As for the instrumental variables in equation (4), D_{TR} represents a dummy variable of training, which equals 1 if the firm has formal training programs for employees and zero otherwise; D_{RD} denotes the dummy for research and development, which equals 1 if the firm spends on formal research and development activities, either in-house or contracted with other companies during the past three years, and zero otherwise.

5 Empirical Results and Discussions

Table 5 presents the empirical results of the estimation of the Cobb-Douglas production function. One common problem encountered while using cross-section data is heteroscedasticity. Thus, White's heteroscedasticity estimators collected the standard errors and t-statistics to generate robust standard errors in the OLS estimation. The test of Breusch-Pagan/Cook-Weisberg does not reject the null hypothesis of the presence of heteroscedasticity. We also apply the Weighted Least Squares (WLS) and the Generalized Least Squares (GLS) methods to the data and find there is no significant difference among the estimated values of parameters and robust standard errors under OLS, WLS, and GLS.

Table 5: Estimated coefficients of the production function

Dependent variable: $\ln y$	OLS		WLS		GLS	
	Coefficient	Robust t-value	Coefficient	Robust t-value	Coefficient	Robust t-value
Constant	3.518 ***	4.589	3.567 ***	4.507	3.627 ***	4.256
$\ln K$	0.167 ***	2.935	0.156 ***	2.670	0.147 **	2.517
$\ln L$	0.715 ***	8.627	0.722 ***	9.025	0.727 ***	8.813
R^2	0.550		0.554		0.557	
No. of observations	129		129		129	

Note: *, **, *** indicate significant at the 10% level, 5% level, 1% level, respectively.

The estimated parameters of capital stock and labor are positive and statistically significant in all estimations. These results suggest that both capital stock and

labor are significant factors in determining a level of output. A higher value of the coefficient of labor implies that the contribution of labor is more elastic compared with that of capital stock. The statistical test of the null hypothesis of constant returns to scale was rejected at 10% level. This result and the size of coefficients suggest that the production technology showed diminishing returns to scale.

The results of estimating the TFP equation are shown in Table 6. Because of the statistical characteristics of the dependent variable, equation (5) was estimated using Probit regression. The endogeneity test showed that the coefficient (ϕ) is statistically insignificant even at the 10% level. This result implies there is no evidence of endogeneity. The possibility of reverse causality between D_{IN} and $\ln TFP$ was also rejected. Thus, it is appropriate to apply the OLS method to estimate equation (3). As the Breusch-Pagan/Cook-Weisberg test identified the presence of heteroscedasticity, we correct the *t*-statistic of equation (3) using White's heteroscedasticity estimators, and employ WLS and GLS in the estimation.

After controlling for the firms' characteristics, including sector, size, and years of operation, we find that three major factors contributed to an increase in the TFP of firms in the West Bank. First, the estimated coefficient of years of schooling (*EDU*) is positive and statistically significant at the 10% level. This result shows that human capital accumulation is associated with higher TFP and is consistent with international experience that accumulation of human capital has a positive effect on TFP growth (Benhabib and Spiegel, 1994, 2005; Vandenbussche, Aghion and Meghir, 2006). Second, the estimated coefficient of managerial experience (*MNE*) also shows a positive and significant result. That is, other things being equal, a 1% increase in managerial experience raise TFP by 0.34%. Thus, we find that accumulation of human capital in the form of managerial experience is associated with higher productivity. Third, the dummy variable for innovation in management (*DI*) has a significant and positive effect at the 5% level. The number of firms that adopted innovation in marketing in the sample is 34 (26.4%). Alternatively, following the categorization of innovation activities by the Organization for Economic Cooperation and Development (OECD), we tested the variables for product innovation, process innovation, and organizational innovation. However, only the variable for marketing innovation showed a positive and significant result. The positive effect of innovation activities on TFP is consistent with predictions. This result suggests that firms that adopt innovation in marketing realize higher TFP. Benhabib and Spiegel (1994) suggested that human capital levels directly influence the rate of domestic technological innovation. In the case of the West Bank, human capital is seen as affecting growth through this mechanism.

On the contrary, the estimated coefficient of export access (*EXA*) was negative and statistically insignificant. The effect of access to export markets on TFP is inconsistent with the theoretical predictions. Regardless of the international experience of the positive effect of trade openness as a determinant of TFP growth (Miller and Upadhyay, 2000), this result could not confirm its robustness for firms

of the West Bank. The possible reasons for the negative sign of access to export markets are as follows: Access to export markets, including Israel, is limited. Only 40 firms (31% of the sample) had access to export markets. Moreover, the main destination for exports was Israel. Trade volumes with Israel were large, as 96% of Palestinian exports went to Israel (World Bank, 2002). Twenty-eight of the 40 firms exported their products to Israel while only 12 had access to international markets such as Jordan and the US. According to the World Bank (2002), trade relations between Palestine and Israel were largely asymmetric, with imports from Israel far exceeding the exports. The taxation of Palestinian businesses was such that they had to pay value-added tax (VAT) on all their imports of raw materials from Israel. The customs union arrangement, which Israel imposes on the occupied territories, was asymmetric as it prevented the entry of Palestinian products into Israel while allowing Israel's own heavily subsidized products free entry into Palestinian markets (Naquib, 2003). The large outflow of Palestinian workers to Israel reduced the Palestinian industry's capacity to export (Astrup and Dessus, 2001). The competitiveness of Palestinian trade was adversely affected by the transmission of inflationary trends in the Israeli economy, such as rising price and wage levels (Abugamea, 2010). In keeping with international experience, Miller and Upadhyay (2000) suggested that the positive effect of human capital on TFP is related to the level of openness. In equation (3), we test the effect of an interaction of human capital and export on TFP; however, the interaction term was found to be insignificant. Although the positive effect of accumulation of human capital was confirmed for firms in the West Bank, our empirical results imply the impact of openness on international trade was ambiguous.

Table 6: Estimated coefficients of the TFP equation

Dependent variable: lnTFP	OLS			WLS			GLS		
	Coefficient		Robust t-value	Coefficient		Robust t-value	Coefficient		Robust t-value
Constant	2.513	***	5.610	2.537	***	6.113	2.550	***	6.029
lnEDU	0.121		1.592	0.143	*	1.948	0.160	**	2.219
lnMNE	0.348	**	2.022	0.358	*	1.965	0.370	*	1.857
lnEXA	-0.099		-1.627	-0.107		-1.643	-0.118	*	-1.666
DI	0.448	**	1.990	0.393	*	1.760	0.324		1.416
lnOPY	-0.301	**	-2.064	-0.317	*	-1.845	-0.344	*	-1.698
ln$L$	0.053		0.341	0.031		0.179	0.027		0.137
DS_m	0.348	*	1.672	0.329		1.518	0.297		1.280
DS_S	0.343		1.382	0.304		1.140	0.273		0.932
R^2	0.157			0.138			0.129		
No. of observations	129			129			129		

Note: *, **, *** indicate significant at the 10% level, 5% level, 1% level, respectively.

Technological transfers from Israel to the West Bank remained extremely scarce (World Bank, 2002). The Israeli authorities did not permit Palestinian firms to import machines and tools incorporating the latest technology. Instead, Palestinian firms were compelled to buy second-hand machines from Israel (Naquib, 2003). These facts suggest transfer of technology through imports was less effective. In addition, technological transfers from MNEs were also limited. According to PCBS, The number of foreign establishments in the West Bank was 50 in 2012. Indeed, the number of firms categorized as MNEs was merely five in the full sample of the Enterprise Survey. The sub-sample used in the estimation comprised domestic firms. Many empirical studies show that spillovers of idea and technological transfers from MNEs are an important source of technology change (Wang and Blomström, 1992; Markusen and Venables, 1999; Xu, 2000). Benhabib and Spiegel (1994) argued that human capital stock affects the speed of adoption of technology from abroad, following Nelson and Phelps (1966); however, empirical evidence shows that the effect technological transfer through the activities of MNEs has been limited despite the contribution of human capital.

The variable of years of operation showed a significant and negative effect on TFP. This result suggests that newly established firms, rather than older ones, are associated with higher TFP. The average number of years of operation was 16. Ninety-six firms (74.4% of the sample) were established after the Oslo Accords, implying that new firms tend to exhibit higher productivity.

Our empirical results show that limited export access and asymmetric trade relations with Israel have negative consequences for TFP growth. The scarcity of MNEs in the West Bank and their limited spillover effect negatively impact on productivity growth. Although human capital has been rapidly accumulated by the Palestinians, it has not been utilized to modernize productive capacities because of the distorted incentives for Palestinian workers to migrate to the Israeli labor market (World Bank, 2002). Angrist (1995) argued that the returns to schooling for Palestinians declined during the 1980s while remaining stable for Israeli Jews. These declining returns to schooling pushed educated male workers to the Israeli labor market and encouraged migration to other markets. These conditions hinder the transfer of technology through export promotion, import of goods, and the inflow of FDI, which many developing countries benefited from during their catching-up years.

Regardless of such conditions, our empirical results suggest human capital accumulation and adoption of innovation by new firms with experienced managers contribute to productivity growth. Abugamea (2010) found an improvement in the trade competitiveness because of the decrease in the number of Palestinian workers in Israel. This suggests that the lower dependence of educated Palestinian workers on the Israeli labor market could affect productivity improvements adversely. Astrup and Dessus (2001) suggested that large outflows of Palestinian workers to Israel tend to reduce the capacity of the Palestinian industry to export goods. The World Bank (2002) found that expanding trading activities and reducing distorted incentives for Palestinian labor flowing to Israel could enhance

the use of available human capital in growth-generating activities. In this regard, consistent with international experience, even as the structural dependency continues, openness to export should be encouraged and the spillover effect of FDI and transfer of technology should be realized. Their effect is limited under the current situation.

6 Conclusion

This paper investigates productivity growth and sources of technological progress in Palestinian economy. Using a sample of 129 enterprises in the West Bank, first, the Cobb-Douglas production function was estimated to examine firm level TFP. Second, TFP equation was estimated to identify the factors associate with higher productivity.

Empirical results from the estimation of the production function suggest that physical capital and labor input are significant factors in determining the level of output. The production technology saw diminishing returns to scale, and the contribution of labor to output was more elastic than that of physical capital. Regarding the decomposition of TFP, the results suggest that years of schooling, managerial experience, and adoption of innovation in marketing were significantly associated with higher TFP. We rejected the possible endogeneity of the variable of adoption of innovation and found no evidence of reverse causality of the variable with TFP. In line with international experience, these results imply the accumulation of human capital and adoption of innovation contributed to technological progress in the West Bank. A large body of literature supports the idea that outward orientation favors TFP growth; however, this has had a limited impact on the firms in the West Bank. The limited and even negative impact of export can be explained by the adverse effect of an asymmetric trade relationship with Israel and the repercussions of a customs union that has resulted in lower Palestinian competitiveness. The asymmetric trade relationship and decreasing FDI inflows led to a degradation of the effect of technological transfer from Israel and abroad.

Even under continuing structural dependence on the Israeli economy, there was a positive effect of the accumulation of human capital on TFP growth. This empirical result implies that decreasing dependence on the Israeli labor market and, consequently, increasing the contribution of human capital to Palestinian industries would result in productivity improvement. Second, adoption of innovation results in TFP growth. It is worth noting that the effect of marketing innovation rather than product, process, and organizational innovation was effective. The empirical evidence points to the importance of developing marketing such as product promotions, improving product design, and opening up new markets. Third, the accumulation of managerial experience is effective in inducing innovation and new firms, rather than older ones, exhibit higher

productivity. Fourth, while the effect of FDI and spillovers from the activities of MNEs could not be examined, limited access to export markets and the asymmetric trade structure hinder productivity growth preventing technology transfers. Hence, in line with the experience of developing economies, removing distorted incentives for trade and encouraging exports not only to Israel but also to other trading partners, and a lower dependence on the Israeli labor market would contribute to promoting productivity growth.

Acknowledgement

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