

ECONOMIC  
RESEARCH  
F O R U M



مِنْتَدَى  
الْبَحْوثِ  
الاقتصادية

2013

# working paper series

**TRADE, TRANSACTION COSTS AND TFP:  
EVIDENCE FROM TUNISIA AND EGYPT**

**Sofiane Ghali, Habib Zitouna,  
Zouhour Karray and Slim Driss**

**Working Paper No. 807**

**TRADE, TRANSACTION COSTS AND TFP:  
EVIDENCE FROM TUNISIA AND EGYPT**

Sofiane Ghali, Habib Zitouna, Zouhour Karray and Slim Driss

**Working Paper 807**

**December 2013**

**Send correspondence to:**  
Sofiane Ghali  
ESSECT, University of Tunis  
[sofiane.ghali@gnet.tn](mailto:sofiane.ghali@gnet.tn)

First published in 2013 by  
The Economic Research Forum (ERF)  
21 Al-Sad Al-Aaly Street  
Dokki, Giza  
Egypt  
[www.erf.org.eg](http://www.erf.org.eg)

Copyright © The Economic Research Forum, 2013

All rights reserved. No part of this publication may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without permission in writing from the publisher.

The findings, interpretations and conclusions expressed in this publication are entirely those of the author(s) and should not be attributed to the Economic Research Forum, members of its Board of Trustees, or its donors.

## Abstract

Increases in total factor productivity (TFP) are commonly associated with accumulation of knowledge through technological innovation and investment in R&D. However, organizational innovations also improve productivity through the reduction of transaction costs. The main purpose of the paper is to assess the effect of trade innovations (aiming at decreasing transactions costs related to trade), labor qualification levels (or R&D) on the growth rate of TFP in Tunisian and Egyptian manufacturing industries. Empirical results show that trade innovations reduce transactions costs and lead to increases in TFP. Trade innovations and labor qualifications are more significant than investments in R&D. However, for the case of Tunisia, this growth rate is positively associated to trade innovations when the reduction of transaction costs is important enough.

**JEL classification:** F10, F43, O47

**Keywords:** Trade Innovations, Total Factor Productivity, Transaction Costs.

## ملخص

ترتبط الزيادات في الإنتاجية الكلية لعوامل الإنتاج عادة بتراكم المعرفة من خلال الابتكار التكنولوجي والاستثمار في البحث والتطوير. ومع ذلك، فإن الابتكارات التنظيمية أيضا تحسن الإنتاجية من خلال الحد من تكاليف المعاملات. والغرض الرئيسي من هذه الورقة هو تقييم تأثير الابتكارات التجارية (التي تهدف إلى خفض تكاليف المعاملات المتعلقة بالتجارة)، ومستويات التأهيل العمل (أو R & D) على معدل نمو الإنتاجية الكلية للعوامل في الصناعات التحويلية التونسية والمصرية. تظهر النتائج التجريبية أن تكاليف المعاملات في التجارة الأقل تؤدي إلى الابتكارات مما يؤدي إلى نمو الإنتاجية الكلية للعوامل. تمثل الابتكارات التجارية ومؤهلات العمل أكثر أهمية من الاستثمار في البحث والتطوير. ومع ذلك، وفي حالة تونس، يرتبط هذا المعدل بنمو إيجابي لتجارة الابتكارات عند خفض تكاليف المعاملات مهم بما فيه الكفاية.

## 1. Introduction

In the modern growth theory, the usual measure of performance is the growth in total factor productivity (TFP). Conventionally TFP is defined as the ratio of an output index to an input index (Diewert 1992). The increase of TFP covers many determinants of output growth that goes beyond those explained by the growth of the inputs. On the other hand, increases in TFP are commonly associated either with technological innovations measured by the stock of Research and Development (R&D) or with trade liberalization. MENA countries have engaged in a large number of Free Trade Agreements (FTAs) either with each other or with developed countries (the Association Agreements of individual MENA countries (Algeria, Egypt, Jordan, Lebanon, Morocco, Palestinian Territories and Tunisia) with the EU.

Let's note that in the case of Egypt and Tunisia—on which our study will be focused—structural transformation driven by export promotion policies is highly relevant; countries where several trade strategies and export promotion policies have been undertaken but are yet to take full advantage of their export led-growth strategies. Moreover, in countries that hardly invest in R&D, and adopted like Tunisia and Egypt an open door policy, productivity increases can also be the result of innovations in the way transactions are managed<sup>1</sup>. These innovations could have an important impact on the transaction costs which directly affect their level of trade and competitiveness particularly in an open economy like Tunisia (which is a small economy) and Egypt (which is the second largest economy in both the continent of Africa and the Arabic speaking World) where exports represent respectively around 57% and 33% of the GDP<sup>2</sup>. Whether markets work well or not, is a question of central importance for countries adopting an open door policy. This issue is basically related to the problems and costs of adjustment due to the transitional path to trade liberalization.

But the debate about “What are transaction costs?” and “How to measure them?” is far from being settled. According to Wang (2003) transaction costs have been measured and interpreted in many different ways. The author reports that in some empirical studies, a direct measurement of transaction costs is simply the economic value of resources used in locating trading partners and executing transactions. Another common measurement of transaction costs is the difference between the prices paid by the buyer and received by the seller. Some studies focus more on indirect costs than direct costs. Traditional direct costs of trade transactions include transportation costs, quotas, tax and tariffs barriers, etc. On the other hand indirect costs cover the costs of searching for a trading partner, of conducting transactions, and of negotiation, monitoring and enforcement, i.e. trade transaction costs. Some are concerned with the cost of government regulation imposed on market entry and transactions, which either reduces the size of the market or eliminates the market altogether. And finally some studies find that transaction costs can be agent-specific, that is, the identity of trade partner matters for the cost of conducting transactions.

However, some synthetic indicators like the World Bank's “Doing Business” (DB) or the World Economic Forum's “Index of Economic Freedom” (IEF) were developed to give a measure of the prevailing investment climate and business environment. Yet the two indicators report contradictory results about the Tunisian economy for example. In Doing Business 2009, Tunisia enjoyed an improvement in the business climate while in IEF 2009 Tunisia moved from a moderately free to mostly unfree economy.

---

<sup>1</sup> According to the Trade Facilitation Project (USAID, 2010), around the world a single customs transaction typically involves more than 30 different parties, 40 documents, 200 data entries, much of which is repetitive and all of which increases cost – on average by as much as 10% according to studies. Innovations in the way transactions will be conducted reduce these costs and improve competitiveness of countries.

<sup>2</sup> African Development Bank (2012).

The main purpose of this paper is to try to answer to the following questions: How much does reduction in transaction costs in trade contribute to increase TFP in Tunisia and Egypt? Are innovations in the way transactions are managed contributing more to increases in productivity than labor qualification in Tunisia and Egypt?

The structure of the paper is as follows. The next section gives a short overview of theoretical considerations about transactions costs and their impact on trade and increases of productivity. Section 3 presents the models to be estimated and the databases considered. The results and interpretations of estimates are presented and discussed in section 4. In the last section, we conclude the paper.

## 2. Theoretical Considerations

Traditionally, in the neo-classical growth theory, capital and labor inputs are assumed to explain the increases of production in a production function. Technological change is assumed to be exogenous and considered as “*mana from heaven*”. However, endogenous growth theory treats technological progress and accumulation of knowledge as endogenous (Lucas 1988; Romer 1986) in explaining economic growth and TFP. Endogenous growth theories have introduced the basis of several empirical studies aimed at explaining how innovations, technical change and accumulation of knowledge contribute to improvements in productivity. However, there is an additional factor that could explain productivity increase and that is transaction costs. As noted by Den Butter et al. (2008), lowering these costs leads to further specialization and division of labor and consequently to increased levels of productivity (Amable 2000).

Transaction costs, in the original formulation of Coase (1937), refer to “the cost of using the price mechanism” or “the cost of carrying out a transaction by means of an exchange on the open market”. Arguably, transaction cost reasoning became most widely known through Williamson (1975/1979/1985) which primarily focuses on the secondary cost of negotiation and enforcement, i.e., the cost of participating and reducing the cost of negotiation and enforcement. Transaction costs provide the key to understanding alternative forms of economic organization and contractual arrangement. In economics, there are three kinds of transaction costs. Firstly, *search and information costs* are costs such as those incurred in determining that the required good is available on the market, which has the lowest price, etc. Secondly, *bargaining costs* are the costs required to come to an acceptable agreement with the other party in the transaction, drawing up an appropriate contract and so on. Finally, *policing and enforcement costs* are the costs of making sure the other party sticks to the terms of contract, and taking appropriate action (often through the legal system) in case of problems arising.

Lowering transaction costs enhances trade and increases productivity. A growing literature has argued the negative impact of trade costs on the volume of trade. Regional integration has reduced costs of transportation in particular and other infrastructure services in general. Direct evidence on border costs shows that tariff barriers are now low in most countries. However, poor institutions and poor infrastructure as sources of transaction costs penalize trade, differentially across countries. Therefore, today’s trade strategy goes beyond the traditional mechanisms of tariffs and quotas and includes “behind-the-border” issues, such as the role of infrastructure and governance in supporting a well-functioning trading economy (Prabir 2006). As noted by Wang (2003), non-marketed transaction costs such as resources spent in waiting, getting permits to do business, cutting through red tape, bribing officials, and so on, are rampant in developing and transition economies, though the size of the official transaction sector is small.

On the other hand, if transaction costs decrease, fewer resources are required for doing the same transactions. These resources will be used to increase total output. Lowering transaction

costs will lead also to division of labor and further specialization, and therefore to productivity growth. Although the relationship between transaction costs and productivity is significant, the empirical work on the topic is scarce because transaction costs are difficult to measure consistently across firms, industries and countries. Transactions costs of trade include direct and indirect costs of exchange. Direct costs are observable and include traditional costs of trade such as transportation costs, taxes and tariffs whereas indirect costs are unobservable and therefore difficult to measure. Examples of indirect transaction costs are the costs of searching prices, potential trading partners, soliciting information about the reliability of the partner, the costs of negotiating, contracting and monitoring, and finally costs of supervising the execution of the commitment. Because of the variety of transactions costs related to trade and exchange of goods and services, there are difficulties in measuring these costs.

How are these transaction cost lowering? In developing countries, organizational innovations in the way transactions are managed lower transaction costs related to trade. In line with Den Butter et al. (2008) we labeled these innovations as *trade innovations*. These innovations reduce transaction costs and improve therefore the size of trade which has a direct effect on increases of productivity through the international division of labor and the international specialization mechanisms. Although technological innovations improve productivity through both spillover effects from investment in new technologies and accumulation of knowledge, organizational innovations provide more efficient management of transaction, and therefore reduces transactions costs and lead to increases in TFP. Investments in organizational innovation have an effect on productivity as well as investment in traditional inputs like physical capital, human capital and R&D. Trade innovations include all measures that reduce the time and cost of importing or exporting goods. These innovations involve also reducing and simplifying procedures, automating routine processes, while also clarifying and complying with international standards.

However, in developing countries these processes could be slow because of problems related to bureaucracy and corruption. Two sequential effects explain the impact of trade innovation on productivity. At first regional integration and free trade agreements with the European Union provide a suitable framework to introduce more flexible procedures for managing trade transactions. However, because of resistance to change, bureaucracy and corruption, these trade innovations require more investment and learning efforts related to human capital and accumulation of knowledge. So at this first stage, the effect could be negative, i.e. the reduction of transaction cost could reduce the productivity. At the second stage of the process, the learning effect related to trade innovation exerts a stronger impact on reduction of transaction costs which could improve the productivity.

### **3. Model Specification**

As mentioned in the theoretical review, many types of transaction costs are unobservable and cannot be quantified. There is absence of consensus about the measurement of transaction costs and innovations lowering these costs, particularly in trade. An earlier effort in measuring transactions is provided by North and Wallis (1986) who consider the size of the transaction sector as a proxy for the aggregate size of transaction costs in the economy. Following the same methodology, Polski (2001) quantifies the transaction costs at the level of the commercial banking business. These measures raise problems as we have to come to an operational definition of the transaction sector. On the other hand, the transaction sector doesn't capture transaction costs that don't flow through the market (de Soto 1989) whereas these non-marketed transaction costs are important to consider in developing countries. Organizational innovations in developing countries are essentially lowering these kinds of transaction costs such as: resources spent in waiting, getting permits to do business, cutting through red tapes, bribing officials, searching for trading partners, and so on. However,

measuring non-marketed transactions costs requires either qualitative survey data to collect information on the cost of doing business or the proxy variable specific to each industry, which is critical.

Empirical analysis related to transaction costs in developing countries remains limited. The scope of this work is to introduce a measure of these costs at the manufacturing level. Traditionally, there are two main channels of transaction costs related to trade, i.e. imports and exports. Whereas Es-Saghir (2012) uses only export intensity as a proxy for trade innovation, we also consider imports because of their importance to developing countries. We consider therefore the measure introduced by Den Butter et al. (2008) considering the difference between the growth of trade and the growth of output as a proxy for trade innovations (TI). More recently, Den Butter (2011) defines transaction management as “the ability to keep the costs of trade transactions as low as possible so that the value creation from these transactions is optimized.” Considering these definitions, we investigate this framework at a finer level of analysis. More precisely, we measure trade innovations at the manufacturing industries levels. We consider a stock variable for trade innovations by making an index with the base year. Equation (1) defines the growth rate of this stock variable ( $TI_t / TI_{t-1}$ ) for each industry as follow:

$$\frac{TI_t}{TI_{t-1}} = 1 + 0,5 \left( \frac{Import_t}{Import_{t-1}} + \frac{Export_t}{Export_{t-1}} \right) - \frac{Added Value_t}{Added Value_{t-1}} \quad (1)$$

The basis of this proxy is the assumption that the limits to trade are caused by transaction costs. The implicit assumption is that without trade innovations, the costs of trading would not decrease and the growth of trade would be equal to output growth. Lowering transaction costs increases productivity in two different ways. First, when transaction costs decrease, less resources are needed for making the same amount of transactions. These resources can be used for other purposes which increases total output. Second, productivity is increased because the size of trade increases which allows for more specialization. More precisely, trade innovations refer to trade facilitation, i.e. removal of obstacles to the movements of goods across borders. Trade innovations involve a wide range of activities lowering trade transaction costs.

Figures 1a and 1b show the evolution of the trade innovations index in Tunisia and Egypt during the period of analysis (from 1983 to 2010 for Tunisia and from 1975 to 2006 for Egypt). For the two countries we mark a slight downward trend involving an increase of transaction costs. This result could be explained by the fact that the signature of the free trade agreements (mainly with the European Union and the World Trade Organization) allowed a liberalization of the exchanges through the progressive abolition of tariff barriers. On the other hand, this open door economic policy was not accompanied by enough adequate measures to allow for the reduction of transaction costs related to foreign trade. According to North (1997), these measures refer to different procedures of facilitation and strengthening of trade at the institutional level. For Tunisia, the analysis by sector of the evolution of the TI shows that transaction costs are lowered only for the chemical industry. However, in the case of Egypt, TI increased for chemical and food & beverages industries which means that transaction costs are lower.

The theory suggests also that R&D spillovers play an important role in explaining productivity growth. Reliable data on innovation and R&D is generally lacking for developing countries. Data on labor qualification are an alternative measure that we shall explore here for the case of Tunisia. We assume that qualified workers play an important role in introducing “transactions innovations” through the organizational innovations and the absorptive capacity. As R&D capital stock in developing countries—and more precisely for



Tunisia and Egypt—is insignificant, we assume that productivity depends on the quality of a country's labor force, i.e. on its human capital.

For the case of Egypt, unfortunately, we faced major constraints linked to data availability. The R&D approximation by human capital is not possible since data on labor qualifications does not exist at a disaggregated level. We therefore chose to calculate TFP for the manufacturing sector taken as a whole and used time-series instead of panel econometric techniques for the estimations. However, an additional constraint linked to the human capital measure is that it does not exist for a period long enough to run time-series regressions. Then, we approximate R&D expenditures by the number of patent applications.

Here we must draw attention that Jorgenson and Griliches (1967), Jorgenson et al. (1987) and Barro (1999) have shown the importance of disaggregating factors of production by type or quality to reduce measurement errors and to understand the impact of each category on growth. In line with their work, we investigate determinants of productivity in a two-step procedure.

In the first step we derive TFP as the unexplained part of a standard production function. Most empirical studies on TFP use a simple Cobb-Douglas production function. We adopt the growth accounting methodology in line with the work of Jorgenson and Griliches (1967), Barro (1999) and Liang and Mei (2005). Given our goal, and in the case of Tunisia, we opt for a breakdown of labor according to three different types over the period 1983-2010: primary, secondary and high graduate. On the other hand, we are aware that in some cases there is a mismatch between education and the types of skills. The second factor of production, physical capital is defined as the sum of structures and equipment capital stocks.

In the second step we explain TFP by our proxy for R&D and our proxy for trade innovations representing environmental variables. In order to gain insight into specific effects of different Tunisian manufacturing industries we perform a panel series analysis where we look at the relative explanatory power of labor qualification as a proxy for R&D capital stock and our proxy for trade innovations (TI) on TFP. Six manufacturing industries are considered in the analysis: chemical, agri-food, building materials, ceramic and glass, mechanics and electrics; textile, clothing and leather.

Figure 2a shows that the growth rate of TFP in the Tunisian manufacturing sector varies between 2.118 % (2003) and 11.351 % (1988). This figure also shows that there is a global upward trend of the TFP growth rate. During the first decade (1983-1994) we note that there is a more important divergence between sectors with regard to the TFP growth rate. Specific effects related to each industry are consequently required in econometric estimation.

The analysis of the evolution of the TFP growth rate by sector shows the existence of:

- A downward trend for the textile, clothing and leather industries;
- A strong upward trend for the mechanical engineering and electric industries which is explained by innovation efforts in product and in process. This sector has a great expansion potential;
- A slight upward trend for the other sectors namely agri-food, building materials, ceramic and glass, the chemical industry and the others industries.

In Egypt's case, figure 2b shows that the growth rate of the TFP in the manufacturing sector varies between -4.38 % (2003) and nearly 25 % (1987). This figure also shows that there is a global downward trend of the TFP growth rate.

For Tunisia, the first specification explains the growth rate of TFP by the level of the explanatory variables and represents the long-run relationship. Logarithms are taken for independent variables:

$$TFP_{it}^G = \beta_0 + \beta_1 \ln(Labor\_prim_{it}) + \beta_2 \ln(Labor\_secd_{it}) + \beta_3 \ln(Labor\_high_{it}) + \beta_4 \ln(TI_{it}) + \varepsilon_{it} \quad (2)$$

where  $TFP_{it}^G$  is the growth rate of the TFP in industry  $i$  at year  $t$ ,  $Labor\_prim_{it}$ ,  $Labor\_secd_{it}$  and  $Labor\_high_{it}$  are primary, secondary and high graduate levels in industry  $i$  at year  $t$ .  $TI_{it}$  is the measure of trade innovation in industry  $i$  at year  $t$ .  $\beta_0, \beta_1, \beta_2, \beta_3$  and  $\beta_4$  are the coefficients to be estimated.

For Egypt, we investigate whether the series (TFP, R&D and TI) are cointegrated. We use the maximum likelihood estimation procedure developed by Johansen (1988) and Johansen and Juselius (1990). They provide a methodology that allows distinguishing between the short run and the long run.

Before investigating the cointegration vector, the study of the stationarity properties is necessary. Two tests [Augmented Dickey-Fuller (Dickey and Fuller 1979/1981) and KPSS (Kwiatkowski et al. 1992)] (see Appendix A) are implemented to conclude that our variables in levels are non-stationary and their first-differences are I(1). Then, the Johansen's likelihood ratio tests for cointegration rank do not reject the null hypothesis that there is one cointegrating relation between the variables. The presence of one cointegrating vector suggests an inherent movement in the system to revert towards long-run equilibrium path subsequent to a short-run shock.

Figures 3a and 3b show for the two countries the existence of a relationship between the TFP growth rate and the TI index. But this relation could not be linear. The econometric specification should therefore take into account this type of relationship.

For Tunisia, the second specification considers a quadratic relationship between trade innovation and TFP<sup>3</sup>. As mentioned in Figure 4, increases in productivity could not be linearly connected to reductions in transaction costs. Moreover, as explained above, lowering transaction costs in developing countries requires a higher learning effort through trade innovation to have the expected effect on productivity.

$$TFP_{it}^G = \alpha_0 + \alpha_1 \ln(Labor\_prim_{it}) + \alpha_2 \ln(Labor\_secd_{it}) + \alpha_3 \ln(Labor\_high_{it}) + \alpha_4 \ln(TI_{it}) + \alpha_5 \ln(TI_{it})^2 + \varepsilon_{it} \quad (3)$$

Finally, we use the database provided by the Quantitative Economic Institute (IEQ (2012)) and the National Institute of Statistics (INS) for the case of Tunisia, and the World Development Indicators (World Bank (2013)) for Egypt. The period considered for our study is 1983-2010 for Tunisia and 1975-2006 for Egypt.

#### 4. Empirical Results

Tables 1 and 2 present the results of the empirical investigation of the impact of labor qualification and trade innovation on TFP in Tunisia according to the two specifications presented above. Regressions M1-M4 of table 1 use the entire panel sample for the six industries over the period 1983-2010 whereas regressions of table 2 consider the quadratic specification (which is the better one) for each industry separately. More precisely, regressions M1 and M3 present results related to equation (2) using respectively OLS and fixed effects estimator while M2 and M4 present results related to equation (3) using respectively OLS and fixed effects estimator as well.

Table 1 presents the results of the four regressions: M1 and M3 estimate the first specification of the model whereas M2 and M4 consider the quadratic specification. The quality of adjustment of the model is globally satisfactory for regressions M3 and M4 using panel fixed effects method. The labor qualification has a significant and positive effect on the

<sup>33</sup> For Egypt, such non-linear relation was tested, with no convincing results.

growth rate of the TFP only for the secondary level. The fact that the highest level of qualification has no significant impact on the productivity can appear as a surprising result.

In the developing countries and more particularly in Tunisia, the production model is characterized by the dominance of sectors intensive in low-skilled labor and where value-added rates are significantly low. This situation, partly explain the fact that the high skilled labor had no significant effect on the growth rate of TFP. This result is in line with those of Ghali and Mohnen (2004/2010).

For all regressions, the variable trade innovations has a significant but negative effect on the TFP which means that a reduction in the transaction costs reduces the productivity, what can seem as a surprising result. While by considering the quadratic specification, the coefficient associated with the square of the variable trade innovation presents a significant and positive effect on the TFP. These results mean that the relationship between the TFP and TI can be represented by the curve depicted in figure 4.

These results suggest that trade innovations that lower transaction costs increase the size of trade and consequently improve accumulation of the production factors (labor and capital). The level of output (production) will therefore increase but less proportionally, i.e. the TFP will decrease. It is the *investment effect*. As the organizational innovations will be spread the *learning effect* will take place. A relatively more important reduction of the transaction costs increases the TFP. It means that the learning effect exceeds the investment effect.

Table 2 presents the results of estimations according to the quadratic specification (equation 3) for each of the six Tunisian manufacturing sectors. The quality of adjustment of the different regressions is sharply improved compared to the results reported in table 1. The coefficient of determination varies between 12.5 % for the agri-food industry and 59.1 % for the chemical industry. The level of secondary qualification for the employment has a significant and positive effect on growth rate of the TFP only for the chemical industry. For this last one, contrary to expectations, the higher level of qualification for the employment has a significant and negative effect on the TFP. For the five other industries, the absence of a significant effect for all levels of qualification of labor on the TFP can be explained by the fact that these explanatory variables do not take into account specificities of the industries.

According to the results we obtain for the panel of six industries, the quadratic specification shows that, for the chemical and the textile / clothing industries, the trade innovations variable has a significant and positive effect on the TFP in the presence of the learning effect.

For Egypt, the estimated  $\alpha$  and  $\beta$  parameters are displayed in table 3, where  $\beta$  is presented in normalized (by TFP) form. They show respectively the speed of adjustment towards the long-term equilibrium and the coefficients of the cointegrating vector. The cointegration vector reveals a positive link between TFP, TI and R&D. While the TFP/TI long-term relation is highly significant, the relation between R&D expenditures and TFP is not. This result is consistent with those found for Tunisia: innovations and productive efficiency are driven by international trade. These results are in line with those of Den Butter et al. (2008) and Es-Saghir (2012) who consider the relationship between TI and productivity growth respectively for Netherland and OECD countries. Unfortunately, we can't test for the role played by labor qualifications for the case of Egypt, but our results show that local R&D expenditures (measured by patent registrations) are not a source of TFP improvements. Let's note that studies for developed countries conducted by Den Butter et al. (2008) and Es-Saghir (2012) show that investment in R&D is an important determinant of productivity and has been beneficial for the productivity level of trade-oriented countries. However, R&D investment remains limited for developing countries like Egypt and can't improve productivity.

The estimated  $\alpha$  parameters provide information about the speed of adjustment coefficients towards the long-term equilibrium (pulling and pushing forces). The results show that TI adjust more rapidly than TFP. The coefficient on TI adjusts by 32% per year, thus taking only 3 years to reach its long-run equilibrium.

In the case of Egypt, Elshennawy (2007) shows that market failure—due to high transaction costs on the transitional path to trade liberalization—reduces the speed of adjustment to free trade and contributes to higher adjustment costs. According to the author, the magnitude of these costs depends on the nature of the economic environment—existing market arrangements, the institutional setting, macroeconomic policies etc.—within which trade liberalization is implemented. Considering a qualitative analysis based on a survey addressed to samples of both producers of manufactured exports and trading intermediaries in Egypt, Nugent and Abdel-Latif (1995) identify the sources and nature of these costs. In practice, Egypt's laws and procedures (especially in securing export permits and shipment times) often work quite differently than in theory and in other cases (information costs remain high and even grow over time). They are also differences in environments across the different foreign markets to which Egypt exports. Considering these findings, the authors recommend policies related to improving the institutional quality that are capable of helping developing exporting countries in overcoming these transaction cost-based obstacles to exports. In a more recent study, Nugent and Abdel-Latif (2010) try to quantify trade creation and trade diversion in Egypt and Jordan, and then to explain why the effects, especially in Jordan, have been much larger than one might have expected and seemingly larger than those in Egypt even though Egypt may have had a stronger comparative advantage in such exports than Jordan. The differences are likely to be related to the importance of transaction costs.

## **5. Conclusion**

With respect to the issues on which this paper focuses—as presented in the introduction—the empirical results of this study report the following findings. Firstly, for the Tunisian case, the secondary qualification level of the labor has a significant and positive effect on the growth rate of TFP at the manufacturing industry level. We should note that the Tunisian manufacturing sector uses a low qualified labor because most of the industries are low value-added. The nature of the activity does not require a workforce with high qualifications. For these reasons, the unemployment rate of the higher education graduates exceeds the 30 %. Moreover, the high qualification of labor has a significant and negative effect on the TFP in chemicals industry. Secondly, trade innovations lowering transaction costs related to trade have a significant effect on the TFP of the Tunisian and the Egyptian manufacturing industries. However, the empirical analysis on the Tunisian industry shows that the quadratic specification is more suitable to estimate the relationship between TFP growth rate and trade innovation. Trade innovation has a positive and significant effect on the TFP only when reduction of transaction costs is significant. Finally, R&D expenditures are not a source of TFP improvement in Egypt. This result may be due to the very low levels of such activities in developing countries and/or the lack of reliability in measuring them.

The empirical analysis of this paper has economic policy implications. The results give some insights for policymakers about the costs and benefits of trade facilitation undertaken in Tunisia and Egypt in their transition to a market economy. More specific measures should be implemented in order to facilitate foreign trade procedures. On the other hand, the training or higher education graduates should be more adequate to meet the requirements of companies. Last, but not least, encouraging and stimulating R&D activities should be at the forefront of the economic policies' priorities as they are a major source of productive efficiency; yet they are still at their embryonic stage in the MENA region.

## References

- African Development Bank. 2012. Comparative study on export policies in Egypt, Morocco, Tunisia and South Korea.
- Amable, B. 2000. International specialization and growth. *Structural Change and Economic Dynamics* 11, 413–31.
- Barro, R. J. 1999. Notes on growth accounting. *Journal of Economic Growth* 4, 119–37.
- Coase, R.H. 1937. The nature of the firm. *Economica* 4, 386–405.
- Coe, D.T., and E. Helpman. 1995. International R&D spillovers. *European Economic Review* 39, 859–87.
- Coe, D.T., E. Helpman, and A. W. Hoffmaister. 1997. North-South R&D spillovers. *Economic Journal* 107, 134–49.
- COMTRADE. 2013. Commodity Trade Database. United Nations.
- De Soto, H. 1989. *The other path: The invisible revolution in the Third World*. New York: Harper & Row.
- Den Butter, F.A.G. 2011. Transaction management: value creation by reducing transaction costs. In *Advances in business management*, ed. W.D. Nelson, 1–34. Nova Science Publishers.
- Den Butter, F.A.G., J.L. Möhlmann, and P. Wit. 2008. Trade and product innovations as sources for productivity increases: An empirical analysis. *Journal of Productivity Analysis* 30, 201–11.
- Dickey, D.A., and W.A. Fuller. 1979. Estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*. 74, 427–31.
- Dickey, D.A., and W.A. Fuller. 1981. The likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica* 49, 1057–72.
- Diewert, W. E. 1992. The measurement of productivity. *Bulletin of Economic Research* 44(3): 163–98.
- Elshennawy, A. 2007. Egypt: The environment for adjustment to trade liberalization. *International Business & Economics Research Journal* 6(7): 45–58.
- Es-Saghir, A. 2012. Innovative in trade: An empirical analysis of the relationship between trade innovation and productivity. Thesis MSc. Economics, Vrije Universiteit Amsterdam, The Netherlands.
- Ghali, S., and P. Mohnen. 2004. *The Tunisian path to development: 1961-2001*. Washington DC: The World Bank.
- Ghali, S., and P. Mohnen,. 2010. Economic restructuring and total factor productivity growth: Tunisia over the period 1983-2001. CIRANO Scientific Paper 2010-26, Montréal.
- Grossman, G.M., and E. Helpman. 1991. Trade, knowledge spillovers, and growth, NBER Working Paper 3485.
- Heritage Foundation, 2009, *Index of Economic Freedom*, Heritage Foundation, United States.
- IEQ. 2012. *Données de Comptabilité Nationale*. Institut d'Etudes Quantitatives, Tunisie.
- Johansen, S. 1988. Statistical analysis of cointegrating vectors. *Journal of Economic Dynamics and Control* 12, 231–54.

- Johansen, S., and K. Juselius. 1990. Maximum likelihood estimation and inference on cointegration with application to the demand for money, *Oxford Bulletin of Economics and Statistics* 52, 169–210.
- Jorgenson, D. W., and Z. Griliches. 1967. The explanation of productivity change, *Review of Economic Studies* 34(3): 308–50.
- Jorgenson, D. W., F.M. Gollop, and B.M. Fraumeni. 1987. *Productivity and U.S. economic growth*. Cambridge, MA: Harvard University Press.
- Kwiatkowski, D., P. Phillips, P. Schmidt, and Y. Shin. 1992. Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root? *Journal of Econometrics* 54(1-3): 159–78.
- Liang, Chi-yuan, and J-Y. Mei. 2005. Underpinnings of Taiwan's 41: 1978-1999 productivity study. *Economic Modelling* 22, 347–87.
- Lucas, R.E. 1988. On the mechanics of economic development, *Journal of Monetary Economics* 22, 3–42.
- Minor, P., and M. Tsigas. 2008. Impacts of better trade facilitation in developing countries, *Research Report, GTAP*.
- North, D.C. 1997. Transaction costs through time. In *Transaction cost economics: Recent developments*, ed. C. Menard, 149–160. Cheltenham, UK: Edward Elgar.
- North, D.C., and J.J. Wallis. 1986. Measuring the transaction sector in the American economy. In *Long term factors in American economic growth*, ed. S.L. Engerman and R.E., Gallman, 95–161. Chicago: University of Chicago Press.
- Nugent, J.B., and A.M. Abdel-Latif. 1995. Export promotion policies: Transaction costs and export channel choices in Egypt, the 70th Western Economic Association International Conference in San Diego, California, July 5-9.
- Nugent, J.B., and A.M. Abdel-Latif. 2010. A quiz on the net benefits of trade creation and trade diversion in the Qizs of Jordan an Egypt. *ERF Working Paper Series* 514.
- Polski, M. 2001. Measuring transaction costs and institutional change in the U.S. commercial banking industry. Mimeo. Indiana University.
- Prabir, D. 2006. Why trade costs matter? Asia-Pacific Research and Training Network on Trade, Working Paper Series no. 7, April.
- Romer, P.M. 1986. Increasing returns and long-run growth. *Journal of Political Economy* 94, 1002–37.
- Wang, N. 2003. Measuring transaction costs: An incomplete survey. Ronald Coase Institute, Working Paper 2.
- UNIDO-INDSTAT.2013. *Industrial Statistics Database*. United Nations Industrial Development Organization
- USAID. 2010. Trade Facilitation Project, United States Agency, International Development, Report on Egypt.
- Williamson, O.E. 1979. Transaction-cost economics: The governance of contractual relations. *Journal of Law and Economics* 22(2): 233–61.
- Williamson, O.E. 1975. *Markets and hierarchies: Analysis and antitrust implication*. New York: Free Press.

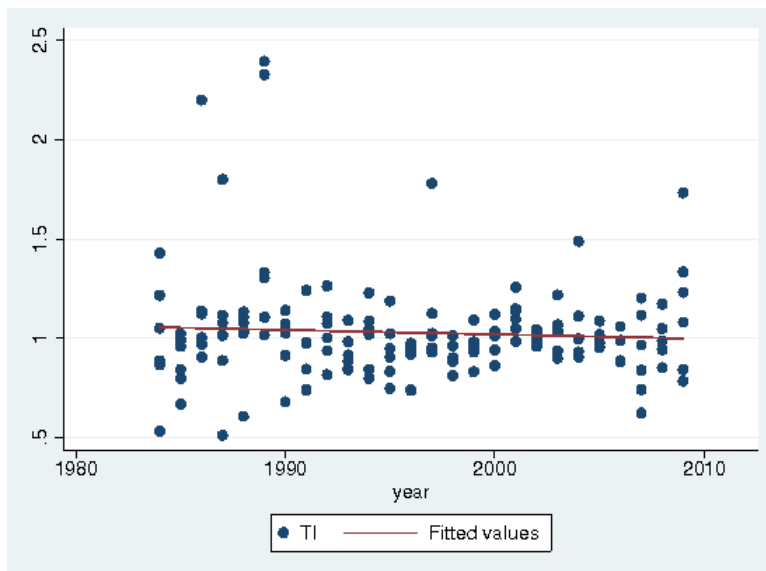
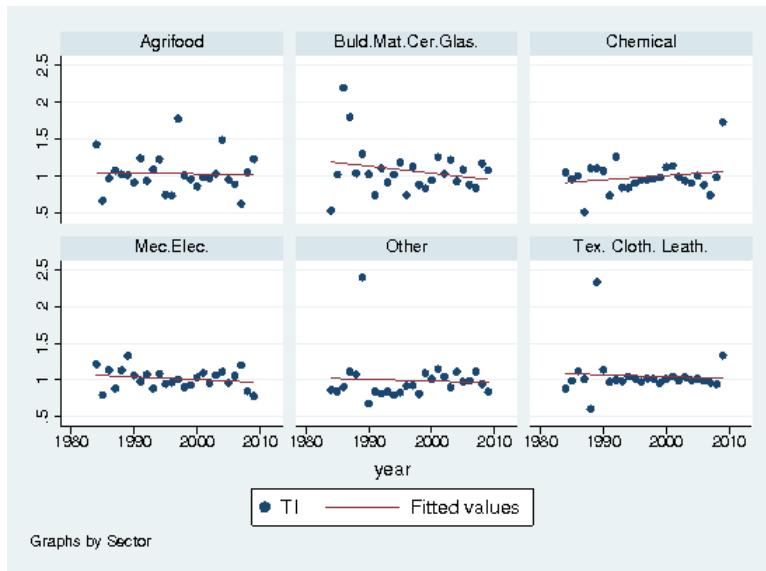
Williamson, O.E. 1985. The economic institution of capitalism: Firms, markets and vertical contracting, New York: Free Press.

World Bank. 2013, World Development Indicators, World Bank, Washington.

World Bank. 2009, Doing Business, World Bank, Washington.

World Trade Organization. 2007. World Trade Report, Six decades of multilateral trade cooperation: What have we learnt?, Geneva

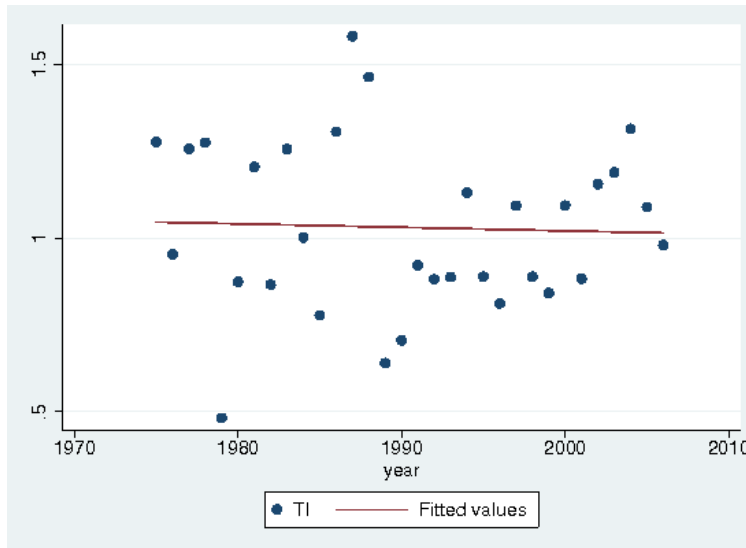
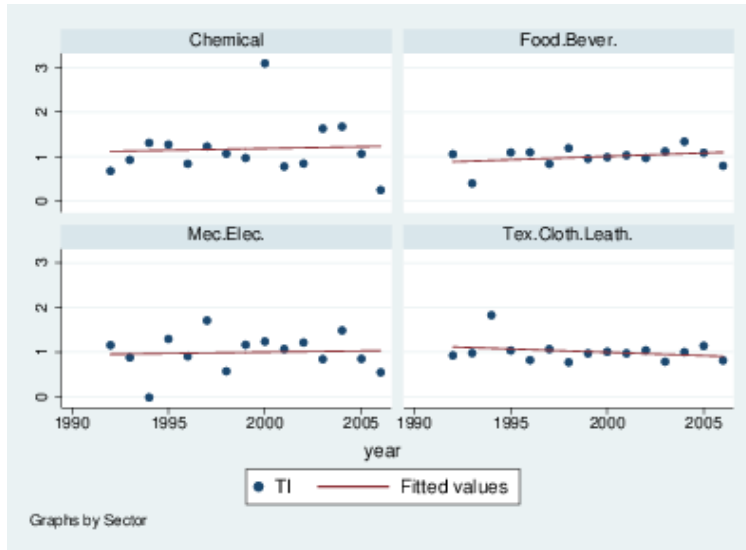
**Figure 1a: Evolution of Trade Innovations in Tunisia 1983-2010**



Source: Authors' calculations based on IEQ (2012)



**Figure 1b: Evolution of Trade Innovations in Egypt<sup>4</sup> 1975-2006**



Source: Authors' calculations from UNIDO-INDSTAT (2013) and COMTRADE (2013)

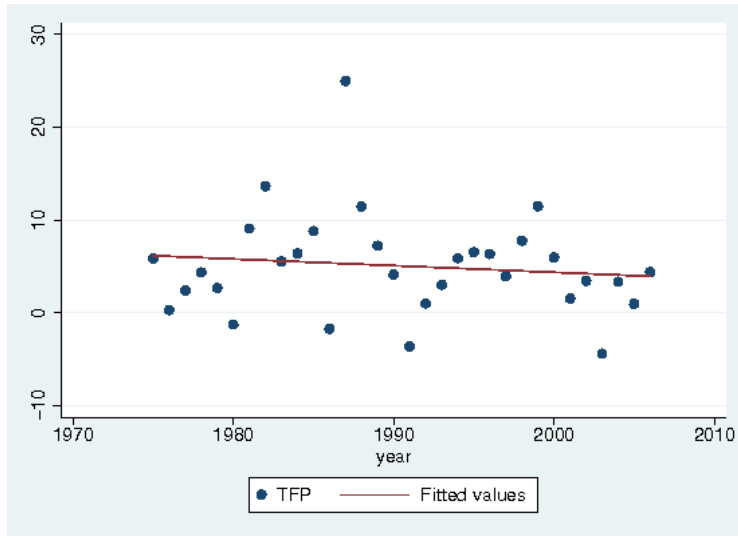
<sup>4</sup> Data used to compute TI at the sectoral level are extracted from UNIDO-INDSTAT (2013) for the added value and COMTRADE database (2013) for trade data.

**Figure 2a: Evolution of TFP in Tunisia 1983-2010**



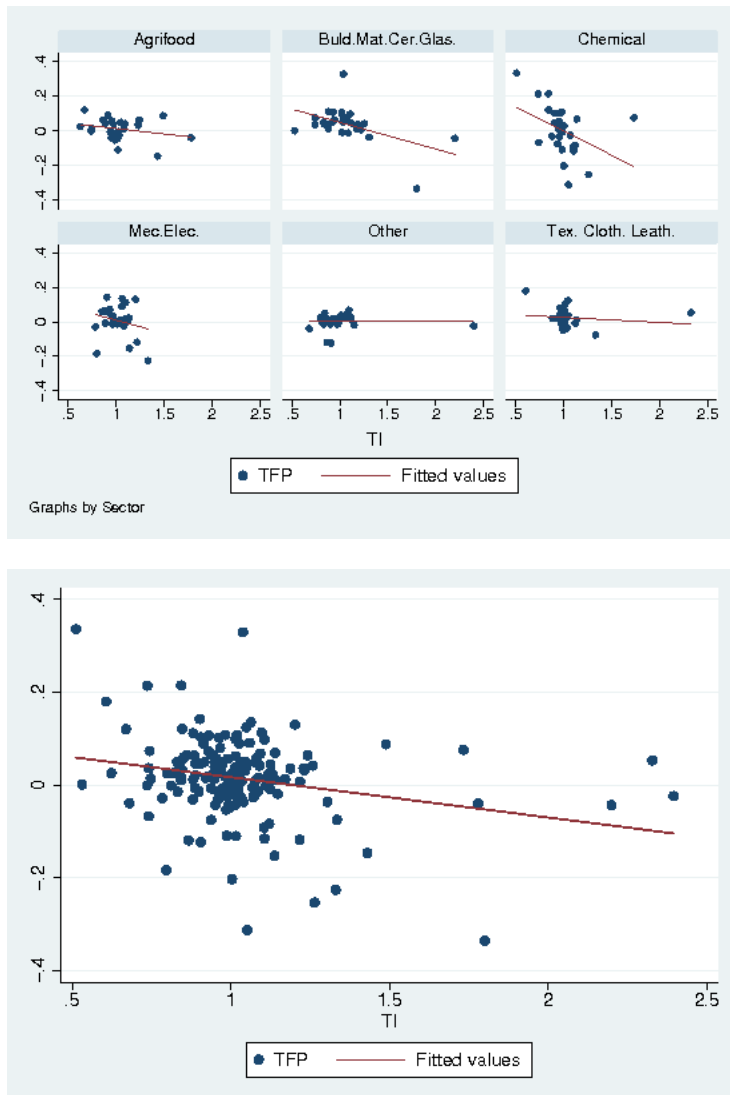
Source: Authors' calculations based on IEQ (2012)

**Figure 2b: Evolution of TFP in Egypt 1975-2006**

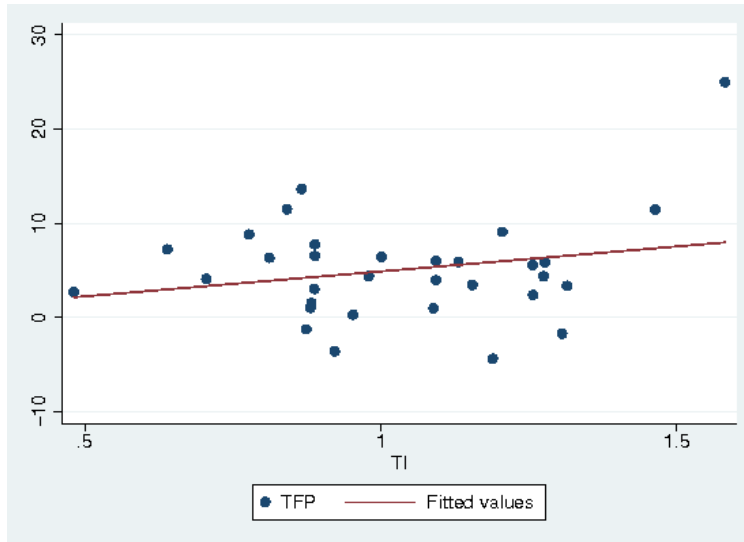


Source: Authors' calculations based on World Bank (2013)

**Figure 3a: Relationship between TFP and TI in Tunisia 1983-2010**

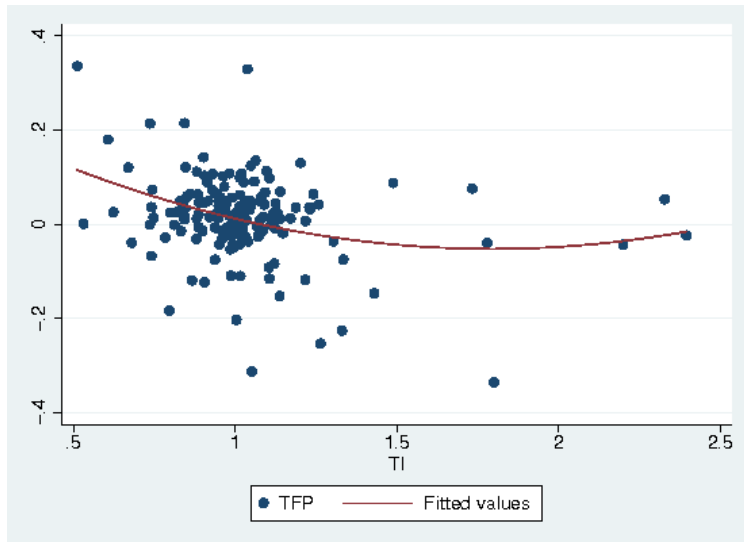


**Figure 3b: Relationship between TFP and TI in Egypt 1975-2006**



Source: Authors' calculations based on World Bank (2013)

**Figure 4: Quadratic Relationship between TFP and TI in Tunisia**



Source: Authors' calculations based on IEQ (2012)

**Table1: Determinants of TFP in Tunisia – Dependent variable: Growth rate of TFP**

Variables	M1	M2	M3	M4
ln(Labor_prim)	0.0145 (0.506)	0.0116 (0.407)	0.0972 (1.4)	0.0989 (1.44)
ln(Labor_sec)	-0.0112 (-0.244)	-0.00642 (-0.14)	0.113* (1.66)	0.122* (1.8)
ln(Labor_high)	0.0135 (0.461)	0.0146 (0.502)	-0.0624 (-1.58)	-0.0635 (-1.62)
ln(TI)	-0.12*** (-3.72)	-0.14*** (-4.09)	-0.126*** (-4)	-0.149*** (-4.47)
ln(TI <sup>2</sup> )		0.11* (1.69)		0.124* (1.95)
Intercept	-0.014 (-0.44)	-0.024 (-0.746)	-0.599*** (-2.81)	-0.635*** (-3)
R-squared	0.094	0.111	0.157	0.179
r2_o			0.0156699	0.0178375
Observations	156	156	156	156
Estimator	OLS	OLS	Fixed effects	Fixed effects

Notes: Standard errors are reported in parenthesis. Statistical significance levels at 10%, 5% and 1% are indicated by \*, \*\* and \*\*\*.

**Table2: Determinants of TFP by industry in Tunisia – Dependent variable: Growth rate of TFP**

Variables	Chem	Agri	Others	Buld	Mec	Tex
ln(Labor_prim)	-0.262 (-1.03)	0.0435 (0.193)	0.18 (1.49)	-0.0461 (-0.134)	0.359 (0.983)	0.0671 (0.637)
ln(Labor_sec)	0.905*** (2.93)	0.0231 (0.139)	0.0224 (0.222)	0.0626 (0.374)	-0.105 (-0.444)	0.0251 (0.199)
ln(Labor_high)	-0.408** (-2.76)	-0.0061 (-0.0768)	-0.0185 (-0.352)	-0.0774 (-0.677)	0.0481 (0.411)	-0.0308 (-0.392)
ln(TI)	-0.342*** (-3.23)	-0.0744 (-1.34)	0.064 (1.08)	-0.101 (-1.34)	-0.057 (-0.5)	-0.176*** (-3.02)
ln(TI <sup>2</sup> )	0.488** (2.15)	0.0599 (0.383)	-0.0905 (-0.968)	-0.354* (-2)	-2.12** (-2.65)	0.233** (2.58)
Intercept	-1.12** (-2.43)	-0.2 (-0.425)	-0.726* (-1.8)	0.0984 (0.0915)	-0.888 (-1.09)	-0.387 (-0.608)
R-squared	0.591	0.125	0.247	0.355	0.558	0.453
Nb Obs	26	26	26	26	26	26
Estimator	OLS	OLS	OLS	OLS	OLS	OLS

Notes: Standard errors are reported in parenthesis. Statistical significance levels at 10%, 5% and 1% are indicated by \*, \*\* and \*\*\*.

**Table3: Normalized Cointegration Relations between TFP, R&D and TI in Egypt**

$$\alpha = \begin{pmatrix} -0.004 \\ (-0.256) \\ 0.326*** \\ (5.201) \\ 0.017 \\ (0.343) \end{pmatrix} \text{ and } \beta' = \begin{pmatrix} 1.000 & -3.896*** & -0.246 \\ & (-5.942) & (-0.402) \end{pmatrix} \times \begin{pmatrix} \text{TFP} \\ \text{ITI} \\ \text{IRD} \end{pmatrix} + \begin{pmatrix} 0.021 \\ (1.087) \end{pmatrix} \times \text{trend}$$

\*\*\*1% level of statistical significance; Figures in parenthesis are t-values.

## Appendix A

**Table A1: Results of the Stationary Results from Unit Root Tests**

Intercept	Trend	ADF test		KPSS test	
			l=1		l=3
<b>Level form</b>					
Yes	No	TFP	-1.023	2.177*	1.160*
		ITI	-3.461**	2.096*	1.121*
		IRD	-1.361	1.9012*	1.011*
Yes	Yes	TFP	-1.827	0.362*	0.199**
		ITI	-1.896	0.519*	0.292*
		IRD	-1.398	0.435*	0.245*
<b>First difference form</b>					
Yes	No	TFP	-6.632*	0.174	0.175
		ITI	-8.680*	0.532**	0.547**
		IRD	-5.305*	0.139	0.164
Yes	Yes	TFP	-6.637*	0.109***	0.112*
		ITI	-9.899*	0.041	0.058
		IRD	-5.622*	0.052	0.067

Notes: \*\*\* \*\* and \* indicate, respectively, the rejection of the null hypothesis at 1, 5 and 10% levels of statistical significance. The maximum number of lags is set to 3.

**Table A2: Results of Cointegration Tests**

H0	LR	pval	90%	95%	99%
r=0	51.02	0.0053	39.73	42.77	48.87
r<1	23.00	0.1092	23.32	25.73	30.67
r<2	6.50	0.4100	10.68	12.45	16.22

r is the number of cointegrating vectors.