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DOTTORATO DI RICERCA IN ECONOMIA

Three essays on the Egyptian economy

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Introduction

In the present work, we show the results of three empirical studies conducted on the Egyptian economy. Our aim is to add a contribution to some fields of research where the debate is still open and the results are yet inconclusive.

Indeed, according to the economic theory, higher levels of education and openness should have a positive effect on GDP. Surprisingly, the econometric studies do not always support the theory and furthermore give contradictory results. The implementation of more sophisticated econometric techniques sheds lights to the limits of previous works, thus suggesting that one of the main causes for unconvincing results may be the choice of an inappropriate econometric approach.

Following such critics, Chapter 2 and Chapter 3 of this work deal with the effects of openness on GDP and implement two recent approaches to cointegration developed by Luetkepohl and by Pesaran *et al* respectively. In Chapter 1 we have instead studied the effects of education on GDP within the framework of a standard production function, though including an error correction term to account for long term effects.

This work belongs to the field of studies conducted on time series, and therefore focuses on a single country with the purpose of accounting for country-specific variables or events that otherwise could not be included when dealing with cross-country data.

Although Egypt and the neighbouring countries belonging to the so-called MENA region are quite ignored, in the recent decades they have implemented significant reforms, also with the support of international organization such as the IMF. Thus, we think that Egypt is an excellent case study to assess the effectiveness of the policies recommended by the economic theory.

Part 1 Education and growth: an error correction approach for Egypt

Summary

In this study an error-correction model has been applied to a standard Cobb-Douglas production function, in order to assess the contribution of human capital to economic growth in the case of Egypt.

To our knowledge, the empirical evidence in this field comes mostly from cross-country studies, while the works focused on a single country time series are still very few. This paper aims at contributing to the research on a single-country approach.

Moreover, the case of Egypt is of particular interest since it experienced a fast growth in human capital expressed in terms of average years of education. At the same time, the Government introduced a system of incentives to higher education that led to distortions in the labour market and revealed to be unsustainable in the long-run.

In line with expectations, the results show a negative impact of schooling on GDP per worker and a positive effect of physical capital, once a trend and some dummies are introduced in the model.

1.1 The theoretical framework: an overview of the Solow model and growth accounting exercises

In the latest decades, economists have tried to model the determinants of growth, in order to understand how to boost an economy: why some countries are rich and many others are still poor and how the poor can catch up with the rich were the questions to be answered.

In the Solow textbook model, developed in the late 1950s, output is a function of two inputs, capital (K), labour (L) and of the exogenous technological change (A); this latter variable also reflects how efficiently labour and capital are used in the economy, therefore it represents productivity. The production function may be described in the Cobb-Douglas form as:

$$Y = AL^{\alpha} K^{1-\alpha} \tag{1}$$

The model assumes constant returns to scale, so that the rate of growth of output is explained by the rate of growth of the inputs; what remains unexplained is the Solow residual, that (in the long run) represents the rate of growth of technology and can be interpreted as a measure of technological change: the total factor productivity (TFP). Recall that this interpretation is not believed to hold in the short run, when the Solow residual just reflects the effects of the business cycle.

$$\ln (TFP) = \ln (Y) - \alpha \ln (L) - (1-\alpha) \ln (K) \tag{2}$$

The results of the first growth accounting exercises were rather disappointing, in fact they came out with a residual as high as 50%, which is too large to explain technological change only.

In an attempt to improve the estimating power of the explaining variables, scholars have introduced the concept of quality-adjusted labour input, computed as the weighted average of the educational level of the workforce; under the assumption that more educated workers are more productive and that wage differentials reflect such productivity differences, one of the most used weights is the relative wage by educational level, computed with respect to a reference educational group.

Of course, wage differentials may also reflect the so-called learning-by-doing (Lucas, 1988), that is the ability gained through a number of years of work in the same sector; in this case the contribution of education would be overestimated; furthermore, the human capital stock is usually computed as the formal educational attainment of a population: in cross-country comparisons this may be a limit to the significance of the results, since these measures may vary between countries.

An alternative specification of the augmented Solow model includes a specific variable for human capital (H) - instead of merely adjusting the labour input - as stated in Mankiw, D. Romer and Weil (1992):

$$Y = K^{\alpha} \; H^{\beta} \; (AL)^{(1-\alpha-\beta)} \qquad (3)$$

In their model, they apply the same production function to all the input variables and assume decreasing returns to all capitals, thus they do not treat human capital differently from the other goods; the proxy for the rate of human capital accumulation is the percentage of the working-age population in the secondary school. They run an OLS regression on their cross-country data set, that consists of 98 countries from the Summers-Heston database and covers the period 1960-1985. According to their results, the adjusted Solow model improves its predicting power: adding human capital, the coefficients on investment and population growth “seem reasonable”, either assuming the steady-state or not. Residual cross-country differences in income per capita may be explained by factors like tax policies, education policies and political stability.

Furthermore, in their study Mankiw, D. Romer and Weil test the Solow model’s prediction of conditional convergence as stated in Barro (1989), that is, the level of per capita incomes across countries should converge, controlling for the differences in the initial level of human capital, growth of the working-age population and investment. The results of the OLS regression are satisfactory, since the data support the hypothesis of convergence predicted by the augmented Solow model.

Other studies use the same approach as Mankiw, D. Romer and Weil, but in general the results of these regressions are disappointing, since they fail to find a strong positive association between

education and growth: on the contrary, the relationship may also be negative and the results depend on the choice of the human capital indicators and on the specification of the model.

For example, Lau, Jamison and Louat (1982) use the BESD database of the World Bank to analyse a set of 58 developing countries in five regions of the world from 1960 to 1987. They use the number of years of schooling as a proxy for human capital and assume that the production function is the same for all the countries in the sample. In their regression, the coefficients explaining the effect on growth of one more year of education change significantly over the regions, ranging from negative (Africa) to 5% per year (East Asia). Similar results, spread over a wide range, are also obtained considering primary and secondary education separately. Moreover, they find a positive relationship between the size of the effect of primary education (on growth) and the level of attainment: this may indicate that a minimum attendance of 4 years in the primary school is needed to have a significant impact of education on economic growth.

On the other side, Islam (1995) starts from the work by Mankiw, D. Romer and Weil, but instead of a cross-country regression, he uses a panel data approach: the period 1960-1985 is divided into five-years time intervals in order to obtain a panel cleaned by the business cycle disturbances that may arise with shorter time intervals.

In Islam's view, OLS cross-country regressions are not suitable to take into account the country effect: in fact, differences in technologies and preferences are not observable or cannot be properly measured, therefore, in order to apply OLS, one needs to assume that the error term (the unobservable country effect) is independent from the other variables in the regression. If this assumption does not hold, a problem of unobservable variables bias arises, and it can be eliminated only applying the econometrics for panel data. However, in their cross-section exercise, Mankiw, D. Romer and Weil tried to take into account the country effect clustering the countries of the sample into homogeneous groups. The results in Islam's approach show that the rates of conditional convergence are higher than in a cross-section analysis. Panel data allow to account not only for differences among clusters but also for differences across individual countries.

Regarding human capital, Islam uses the variable constructed by Barro and Lee (1993), that includes all levels of schooling, while the proxy in Mankiw, D. Romer and Weil was only related to secondary school enrolment. The cross-section analysis with the new variable on human capital shows that the results are qualitatively in line with Mankiw, D. Romer and Weil's work. The panel data approach results instead in a very different outcome: the human capital variable becomes insignificant or takes the wrong sign, like in the case when a cross-country regression is run without adjustments for human capital.

One of the reasons for the discrepancies between the predictions of the theory and the empirical results is that enrolment is not a suitable approximation for human capital: it is rather a measure of the investment in human capital and anyway it does not account for actual differences in quality. Furthermore, for the less developed countries the enrolment rates tend to grow very fast since the 1960s, when big efforts were made to increase the literacy rate of the population. However, the "real" levels of human capital did not rise so much; this temporal effect introduced with pooled data results in a negative relationship between human capital and output growth that overcomes the positive effect of education in the cross-section framework.

Secondly, Islam points out the necessity to improve the specification of the production function in its human capital variable in the direction of the Benhabib and Spiegel's approach (1994), where human capital has a direct influence on productivity, or in line with the endogenous growth model pioneered by Romer (1989). Sure enough, in his analysis Islam finds that there may be no direct relationship between human capital and growth, as explained by the production function with human capital as an input. On the contrary, human capital may somehow influence the variable technological change and therefore indirectly impact on the output growth.

The soundness of this latter intuition is proved in Benhabib and Spiegel (1991). Covering the period 1960-1985, they run an OLS cross-country regression modelling the production function with alternative explanatory variables for human capital and accounting for political instability and initial wealth. They find that once physical capital is properly represented in the regression, "human capital accumulation rates may not add much" and their explanation for this result is that human capital helps attracting physical capital, thus it works as an indirect input in the production function. Similarly, political instability affects the quality of the economic environment, therefore making a country more or less attractive for new flows of physical capital.

1.2 The theoretical framework: an overview of the models of endogenous growth

The failure in finding a positive effect of human capital on growth when it is treated as an input in the production function, has induced scholars to seriously consider the models of endogenous growth pioneered by Lucas (1988) and P. Romer (1986). The intuition that more educated workers may introduce new technologies in the economy, or use them easily and that they adapt faster to changes seems sound: thus, education helps attracting physical capital or it leads to growth through higher productivity.

In his early works, Romer (1986, 1989) departs from the framework of the Solow model and builds a model with increasing returns to scale for all the inputs. The long-run growth is primarily driven

by the variable new knowledge, a non-rival good that is a product of research expenditure of the firms and generates positive externalities, since it cannot be perfectly kept secret or patented (partially excludable good). In turn, the research technology exhibits diminishing returns to scale. Since technological change is (at least in part) the result of the decisions taken by profit-maximizing agents, then it may be considered endogenous.

The general formulation for the output of firm j is:

$$(4) \qquad Y_j = A(R)\, F(K_j, R_j, L_j)$$

where L and K are the labour and physical capital inputs, R represents the research expenditure of the firms and A is the endogenous, non-rival new knowledge as a function of the aggregate stock of research expenditure.

Romer (1989) points out that growth accounting exercises call for rates of change of all inputs, included human capital, whereas it is the level of the human capital variables that may explain the rate of growth of output; in fact, investments play a role in the growth of output and are in turn explained by the change in human capital. Such predictions are supported by the empirical results of OLS regressions on a data set covering the period 1960-1985, where human capital is measured alternatively by literacy, consumption of newsprint per capita and number of radios per capita.

Although literacy is often considered a bad measure for human capital, Romer's choice is due partly to the fact that it is easily available for a large set of countries and more comparable than other measures of education. The most important reason however is that the level of literacy is easily measured at any time, and this allows to emphasize the different impact of levels and rates of growth.

Lucas (1988) outlines the foundations for a model of endogenous growth and international trade, where human capital may be accumulated either through schooling and on-the-job training, or learning-by-doing, as two extreme cases: thus human capital is just the skill level of each worker and it is assumed that each worker's productivity increases proportionally with the acquired skill level. Human capital has also an external effect, since it improves the productivity of all the inputs in the production function:

$$(5) \qquad Y_j = A(H)\, F(K_j, H_j, L_j) \qquad ,$$

where K_j is the physical capital, H_j is the human capital, L_j is labour at firm level and A is the level of technology as a function of the aggregate stock of human capital.

This model does not depart very much from Romer's, except for a different definition given to human capital. Moreover, in a free trade framework, with mobility of workers allowed, the model is also consistent with the observed flows of migration from poor to rich countries, that is from countries with lower levels of human capital to countries with higher levels, since in the latter environment people are more productive.

A comparison of the results obtained with growth accounting and the endogenous growth approach is offered in the work by Benhabib and Spiegel (1994), where they examine the alternative channels through which education may affect growth: as in Mankiw, Romer and Weil (1992), they model a Cobb-Douglas production function where human capital enters an input like physical capital and labour, finding an insignificant and usually negative effect of human capital on growth. In a further step, they adapt the Nelson and Phelps model (1966) to account for the "catch-up" of technology to the technology of the leading country.

Nelson and Phelps are critical about the interpretation of education as a mere input in the production function; they suggest instead that "education speeds the process of technological diffusion", a concept further developed by Romer (1986). In other words, they model a world where there exist a gap between the theoretical level of technology and the level of technology in practice; the speed at which the newly discovered technique is applied in practice depends both on the technological gap and on the level of educational attainment of the labour force.

In both regressions, Benhabib and Spiegel find a positive relationship only between the initial level of education and the subsequent productivity growth. Rates of growth for education never enter with the expected positive sign and they tend to be insignificant. This is in line with Romer's prediction (1989) that the initial level of a variable related to education, such as literacy, "does help predict the initial level of investment, and indirectly, the rate of growth".

Finally, they find empirical support to the hypothesis pointed out by Lucas (1990) of why physical capital does not flow to poor countries despite their less productive stock of capital should imply a higher marginal product. On the contrary, in reality one can see that capital flows exactly in the opposite direction, toward richer economies: according to Lucas, what matters is the difference in human capital stocks, or the quality of the labour force. Benhabib and Spiegel's results show a positive and significant correlation between human capital stocks and physical capital accumulation.

One more critical point in cross-country regressions is the problem of sample selection: since schooling displays its effects differently in each country, an OLS regression may result in an undetermined relationship between education and growth.

Temple (1999) copes with this problem using the same database as in Benhabib and Spiegel (1994): applying the least trimmed squares technique (Temple, 1998), allows him to progressively eliminate up to 14 observations; hence, the OLS regression run with the "clean" database results in a clear evidence of a positive relationship between education and growth.

Finally, other scholars model the effects of the Government's intervention in education, either in the widespread form of public expenditures and under some other incentives, like for example public sector employment. All of this points will be treated in the following section.

1.3 Incentives and the allocation of talent

The effect of schooling depends on each country's economic environment or, recalling Easterly's words[1], according to the "incentives" to education. In other words, if educated people do not expect to find suitable jobs for their skills, they will not have any incentive to invest in their future; as a result, they will probably attend school only when compulsory and they will not care much about the quality of their education.

People, although talented, are forced to choose low-profile jobs, thus schooling is wasted, or they migrate abroad to countries where more advanced technologies are adopted and therefore there is a demand for educated workers. To this end, recall the model by Nelson and Phelps (1966), where education is the engine of technological progress and the returns to education are positive only when technology is always improving; Lucas's model itself (1988), with human capital exhibiting external effects, is consistent with flows of migrations from the poorer to the richer countries.

Murphy, Schleifer and Vishny (1991) deal with the problem of the allocation of talents and the implications for growth: they assume that high talented people choose occupations with increasing returns to ability, where the returns on being the best (or a "superstar") are the highest. According to the different economic environment, they may become an entrepreneur, who hires less talented workers and introduces new technologies in its business sector. Alternatively, they may become rent-seekers, joining the army, the government bureaucracy, working in the sector of law or financial services.

Of course, in reality the difference between the two kinds of jobs is not so sharp. However what matters in the model is that entrepreneurship can positively influence economic growth, while rent-seeking jobs simply redistribute incomes and may affect growth negatively. This latter jobs become attractive either when the rent-seeking sectors are powerful and big, hence they deal with a large amount of resources, and when they allow for "unofficial" activities like briberies.

It is often suggested that the public sector, with its powerful bureaucracy and little public accountability, is detrimental both for economic growth and for private incomes and fair wealth

[1] William Easterly: The elusive quest for growth. Page 82.

distribution, particularly in the less developed countries. For example, Gelb, Knight and Sabot (1991) support the hypothesis that surplus labour in the public sector, rather than international trade policies, may explain why some developing countries have yet not succeeded in growing fast. They list a number of countries where the behaviour of the public sector in the field of employment is subject to political pressures: India, Turkey, Indonesia, or where the government is explicitly committed in hiring high-skilled workers: Ivory Coast, Mali, Mauritius, Sri Lanka, Egypt.

The most direct way for a government to play a role in human capital accumulation is to provide funds for education. In fact, in many countries education is mostly financed by government spending, especially at primary and secondary level. Therefore, scholars have formalized the link between public education expenditures and economic growth in models of endogenous growth where public spending in education affects growth through human capital accumulation.

Once again, empirical evidence is ambiguous: Blankenau and Simpson (2004) claim that the direct effect of public expenditures on human capital accumulation may be diminished or even overcome by the general equilibrium adjustments of other inputs to human capital. In their model, the size of the general equilibrium adjustments depends mainly on the level of expenditures and the method of finance. Blankenau and Simpson then show that with low levels of expenditures the direct effect is dominating, while with higher levels of expenditures it is the method of finance that determines the size of the crowding-out effect: in particular, additional expenditures lead to an increase in growth when they are financed with a tax on consumption.

In conclusion, the statement that human capital accumulation has a positive impact on economic growth is often not supported by the empirical evidence; such a disappointing result induced Pritchett (2001) to ask where all the education has gone. Three possible explanations are offered in his paper, acknowledging that the impact of education on growth varies across countries: the first one is that at least a part of the high-skilled workers have been hired in socially unproductive, although individually remunerative, activities, as discussed before. The second reason is that the demand of educated workers did not expand as rapidly as the supply. Finally, the quality of education may be so low that it does not actually drive to an increase in productivity; in this latter situation, education plays a role in signalling to employers some characteristics like, for example, ambition.

In this paper I will follow Pritchett's intuition that education may have different effects in different countries, and I will first analyse the consequences of an impressive investment in education like the schooling programme launched in Egypt in the mid-1950s. The purpose is to assess the macro effects of the schooling programme applying the economic models available at present, rather than to test the general validity of a theory.

However, in order to better appreciate the results, the Egyptian case will then be compared with the experiences of similar countries in a panel regression framework: Morocco, Tunisia, Jordan and Syria.

The purpose of this paper is not to give an opinion on the schooling programme launched in Egypt, but rather to analyze it exclusively from the economic point of view.

In the following section I will outline the main characteristics of the Egyptian schooling programme; in section 1.5 I will describe the data available for the time series regression and the econometric model; section 1.6 presents the results for the Egyptian case. Section 1.7 and 1.8 are dedicated, respectively, to the description of the panel data and the econometric model and to the analysis of the results after comparison.

1.4 The Egyptian education system

It is universally acknowledged that education is a basic human right that should be granted to all the individuals, independently of their social status or economic conditions. This is particularly true if one refers to the basic skills given by elementary education: writing, reading and arithmetic, with all the implications for the individuals' social life.

It is also well known that schooling has beneficial effects on the quality of life and is a determinant of health care choices.

All the Egyptian rulers have perceived the importance of education and have invested in it a significant share of the public budget, already in the first part of the twentieth century[2]. Compulsory primary education was established already in 1923. In spite of this, the literacy rates at mid-century were still disappointing. According to Issawi[3], the expenditures on education rose from 1% to 12% between the First World War and 1950. Nevertheless, the 1937 census showed that 82% of the individuals over 5 years was illiterate, after ten years the percentage had declined to 77%, while in 1957-58 the results of a survey indicated a rate of 72%. There were remarkable differences between towns and villages and between men and women, with villages and women being the most disadvantaged categories. Finally, the enrolment rate and attendance were also very low: in fact in 1952 only 45% of the children at elementary school age attended school.

The men who ruled Egypt since 1952 believed that free universal education, together with other social and economic reforms, could be the right way to democracy[4]. In 1950, as a Minister of

[2] For a review of the most important reforms in the Egyptian education system see Harby and El-Hadi Affifi, 1958.

[3] C. Issawi. *Egypt in Revolution*. Page 91.

[4] "Gamal Abdel-Nasser believed that through such programmes as agrarian reform, industrialisation, the Aswan High Dam, free universal education, universal health insurance etc., we could set the necessary groundwork for the building of democracy." *Al-Ahram Weekly On-line, issue 151/2000; Mohamed Haikel interviewed by Hosny Guindy and Hani Shukrallah. Special Supplement Liberating Nasser's legacy.*

Education, the Egyptian writer Taha Hussein[5] provided free education for all the students at the secondary level, while free primary education was granted since 1944. The law in 1956 reformed the education system and organized it in four steps: Primay (6 years), Preparatory (3 years), Secondary general or vocational (3 years) and Higher education (3 years). A few years later, President Nasser embarked in a programme of school construction throughout the country, in order to realize in concrete terms the purpose of increasing the enrolment rate and the literacy rate.

At that time, the number of schools was clearly insufficient to hold the huge number of students, even with two or three shifts a day. Data from the Ministry of Education show that in the time period 1951-52 to 1955-56 the number of students at the primary education level expanded from 1,000,000 to 1,860,000, corresponding to a growth of 86%, while the number of schools increased from 5,654 to 8,366 corresponding to a growth of only 46%. With such numbers, the Government was forced to plan at first in terms of quantity rather than quality.

A special fund was established since 1954-55, in order to finance school construction: according to a World Bank report[6], for the year 1954-55 only, the budget of the fund was fixed at LE 4.82 million ($13.8 million in 1955).

The following Table 1.1 shows the significant increase in the number of classes and of students over the time period 1953/54 – 1969/70. The figures are my elaboration from data of the Egyptian Ministry of Education. The growth rate of the number of classes is little less than the growth rate of the number of students enrolled at the primary level, where the Government effort was probably higher, but seems too low at the secondary level. In both cases, the students per class ratio deteriorates. In general the female students took the greatest advantage from the Government schooling programme and its incentives to enrolment: despite their number is always lower than male students in absolute terms, the growth rate is actually remarkable, especially at the secondary level.

[5] Taha Hussein (1889-1973) has been the most important modern arab writer. He used to say that "Education is like the air we breathe and the water we drink".

[6] The World Bank, 1955. *The economic development of Egypt.* Page 23 and 26.

Table 1.1 Number of classes, number of students enrolled at the primary and secondary level of education, and students per class ratio, for selected years.

	PRIMARY						
Years	Classes	Increase (%)	Students: male	Increase (%)	Students: female	Increase (%)	Students per class
1953-54	35,461		872,074		527,095		
1958-59	59,965	69.1%	1,442,400	65.4%	873,718	65.8%	39
1963-64	73,727	23.0%	1,941,737	34.6%	1,240,461	42.0%	43
1968-69	82,313	11.6%	2,141,962	10.3%	1,353,806	9.1%	42
1953-69		132.1%		145.6%		156.8%	
	SECONDARY						
Years	Classes	Increase (%)	Students: male	Increase (%)	Students: female	Increase (%)	Students per class
1953-54	13,874		385,850		100,275		
1958-59	15,984	15.2%	358,493	-7.1%	115,004	14.7%	30
1963-64	21,846	36.7%	522,239	45.7%	206,341	79.4%	33
1968-69	32,787	50.1%	824,861	57.9%	369,169	78.9%	36
1953-69		136.3%		113.8%		268.2%	

Source: Egyptian Ministry of Education

Table 1.2 Population and attainment by age group in 1976.

age-group	population	no schooling Read and write	first level incomplete Primary	second level entered Primary and Preparatory	post-second level entered Secondary complete
15-19	3,901,918	57.80%	37.10%	5.10%	0.00%
20-24 (*)	3,003,384	66.20%	10.10%	21.30%	2.40%
25-34 (**)	4,726,235	77.90%	6.30%	10.20%	5.50%
35-44	3,877,335	86.80%	4.70%	5.10%	3.40%
45-54	2,944,076	91.30%	4.00%	2.70%	2.00%
55-64	1,828,053	92.70%	3.20%	2.60%	1.50%
65+	1,266,041	95.40%	1.70%	1.90%	0.90%

20-24 (*)	Earlier age-group involved in the schooling program
25-34 (**)	Earlier age-group involved in the policy of guaranteed employment in the public sector

Source: UNESCO. Statistics of educational attainment and illiteracy 1970-1980.

The first results of the schooling programme are shown in Table 1.2.

For the age group 20-24, including the first cohorts involved in the schooling programme, the percentage of *no schooling* declines significantly with respect to the age group 35-44, excluded from the program for age reasons. The age-group 15-19 performs even better, either in terms of the percentage of *no schooling* and in terms of *first level incomplete*: an additional 27% of the pupils attended primary school, in comparison with the earlier group.

The percentage of *second-level entered* is not significant for the age-group 15-19, since the youngest cohorts may not have yet completed the preparatory school, due to repetitions.

Finally, it is noteworthy the increase in the percentage of entrants at the post-secondary level among the students of the age-group 25-34, who finished the secondary school in the years when the policy of guaranteed employment in the public sector was introduced.

Thus, the Government achieved his goal of universal education from the quantitative point of view, granting the presence of buildings throughout the country, but quality would be the challenge for the following decades.

If one regards the students per class ratio as similar to the pupil/teacher ratio, and considers it as a proxy for quality, it is possible to compare the data provided by the UNESCO for different countries in 1970: at the primary level, Egypt has a pupil/teacher ratio of 38, not very different from to the ratio scored by other Arab countries, like Tunisia (47), Jordan (39), Syria (37), Morocco (35), but very far from the results of some developed countries like France (23), United Kingdom (25), Japan (26).

In the 1980s, the three main problems affecting the Egyptian education system were related to quality: big classes and shifts, the shortage of (trained) teachers and low wages, that have driven to a fast growth of the market for private lessons, and the use of outdated textbooks and old teaching methods, that induce students to memorize rather than develop personal concepts and ideas (Hansen and Radwan, 1982; Harik, 1998).

Besides the elementary level, that was compulsory, the Egyptian Government also greatly expanded access to higher education. Not only it abolished fees for higher education institutions in 1963, but it also introduced a strong incentive to attend secondary schools and universities through guaranteed public employment for all university graduates (since 1961-62) and for the graduates of vocational secondary schools and technical institutes (since 1964).

At first, this measure had the effect of absorbing educated young men and women, that otherwise may have been unemployed, but as the number of graduates rapidly increased in the following years, the commitment became unsustainable for the public budget. In their 1982 report on the employment opportunities in Egypt, Hansen and Radwan called for a wage reform to solve the problem of overstaffing in the public sector and reduce the over-expansion of the education system's highest level.

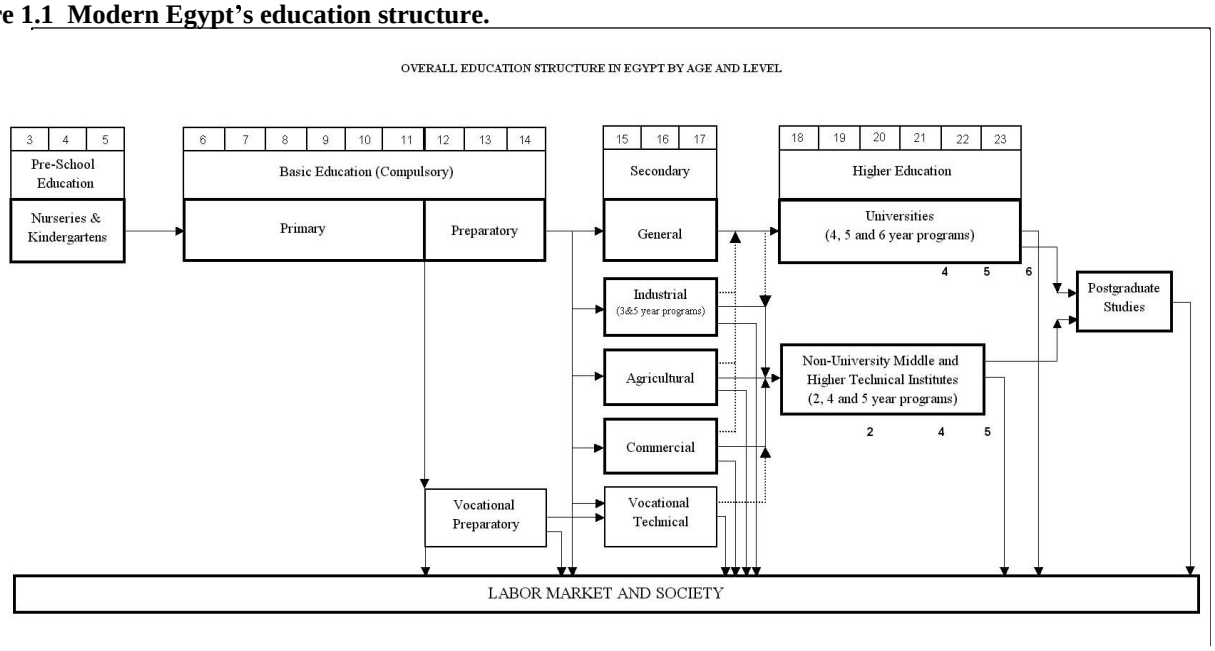
In the 1980s the Egyptian government established a policy to reduce the rate of growth in the number of university graduates in favour of the secondary vocational level or the postsecondary

technical institutes[7] and modified the law on public employment increasing the waiting period for a government appointment up to thirteen years. The aim was to change the composition of the graduates and to shift their preferences toward the private sector. In fact, between 1983 and 1991 the share of university graduates declined from 33% to 27% and the share of vocational secondary school graduates increased from 59% to 63%. However, when the government attempted to remove from the registry the graduates who had obtained a job in the private sector, they reacted with a mass resignation from these firms, indicating how valuable the public employment still is (Assaad, 1997). Indeed, it is not only a matter of social status. The average weekly wages in the public sector are at least in line with, and in many cases higher than, the average of the private sector corresponding economic activity. According to the CAPMAS Statistical Yearbook 2008, the average weekly wage in the public sector was LE 171 in 2001 and LE 303 in 2006, with an increase of about 77%, while in the private sector the average weekly wage amounted to LE 138 in 2001 and LE 172 in 2006, with an increase of a mere 25%.

In two sectors only the wages in the private sector were higher: brokerage (LE 327 for the public sector and LE 465 in the private one in 2006; and mining, LE 337 in the public sector and LE 650 in the private one).

Figure 1.1 below shows the structure of the education system adopted in Egypt.

Figure 1.1 Modern Egypt's education structure.



Source: Dr. Mohsen Elmahdy Said, An Overview of the Higher Education Enhancement Project (HEEP).

[7] In Egypt the natural path to university was to attend a general secondary school. Graduates from vocational secondary institutes only had access to postsecondary institutes or to a limited range of university faculties. Access to university was driven by the score obtained in the secondary school final exam.

In conclusion, the schooling programme had the effect of improving the literacy rate and the average number of years of schooling at the elementary level. An increasing number of students chose to attend school at the secondary or tertiary level, in this certainly stimulated by the guaranteed public employment policy.

In more recent years, Egypt was supported by the World Bank in a reform of the higher education system.

The first phase of the project (Engineering and Technical Education Project, ETEP) that lasted from 1989 to 1998, was focused on the technical faculties: the Ministry of Higher Education (MoHE) established two new technical colleges for the graduation of technical education teachers and provided all the faculties of engineering with labs and workshops to improve their performance.

In the next four years, from 1998 to 2002, the MoHE coordinated a number of studies to set up a comprehensive methodology and determine the guiding principles for the reform of the higher education system as a whole.

The final phase, called Higher Education Enhancement Project (HEEP) aimed at "creating a positive environment to improve the quality and efficiency of the higher education system in Egypt through legislative reform, organizational restructuring, the creation of tools for quality assurance, and the establishment of monitoring and evaluation systems".[8] The reform is mainly focused on improving the quality of teaching, in order to provide the students with the skills required in a modern job market and to overcome the limits of the present teaching methods already stressed in Hansen and Radwan (1982).

Table 1.3 allows to have a glance on the progresses made by some Arab countries belonging to the same geographical area ad Egypt. It is interesting to see how some countries like Syria had good results already in the 1970s in terms of primary completion rate (56.2%) and school enrolment (82.0% for primary and 36.0% for secondary level) although the public spending on education was quite low - only 9.3% of total government expenditures – if compared with 23.2% of Tunisia and about 16.0% of Egypt and Morocco.

However, the latter countries improved their indices significantly over the next decades, increasing dramatically the primary completion rate (now near 100%) and the secondary school enrolment ratio.

[8] Further details on the programme developed with the World Bank are available at the official website www.heep.edu.eg

Table 1.3 Indices on education for some MENA countries in selected years.

	Primary completion rate		Primary school enrollment (gross)		Secondary school enrollment (gross)		Public spending on education (% gov.expend.)		Pupil/teacher ratio, primary		Pupil/teacher ratio, secondary	
	1971	2007	1971	2007	1971	2007	1970	2006	1971	2007	1971	2004
Egypt	52.9	98.5	67.9	104.7	28.5	87.8	15.8	12.6	38.0	27.1	24.4	17.1
Morocco	28.4	83.4	51.5	107.2	12.6	55.8	16.6	26.1	34.7	27.4	20.4	18.7
Tunisia	55.3	99.9	100.4	104.7	22.7	88.0	23.2	20.5	47.5	18.2	27.7	17.6
Jordan	...	101.8	102.1	95.7	46.4	89.3	9.3	...	38.8	19.9	23.0	17.9
Syria	56.2	114.3	82.0	126.2	36.0	72.1	9.4	...	36.8	25.3	22.1	18.1

Source: The World Bank – World Development Indicators 2009.
In some cases, the indices were not available in the same year: Egypt's secondary school enrolment refers to 2004; Egypt's public spending on education refers to 1971 and 2007 respectively; both pupil-teacher ratios refer to 2003 for Jordan and 2002 for Syria.

In the next section I will focus on the macro effects of the schooling programme, trying to assess whether highest levels of attainment positively affected GDP.

In terms of literacy rates, presented in Table 1.4, progress is clear for both genders, but especially for women, as expected. Jordan ranks at the top with a literacy rate of young females at 84.8% already in 1979.

Table 1.4 Literacy rates for some MENA countries in selected years.

	Adult female (15+)		Adult male (15+)		Adult total (15+)		Youth female (15-24)		Youth male (15-24)		Youth total (15-24)	
	1980s	2000s	1980s	2000s	1980s	2000s	1980s	2000s	1980s	2000s	1980s	2000s
Egypt	31.4	57.8	57.0	74.6	44.4	66.4	54.0	81.8	71.4	87.9	63.3	84.9
Morocco	17.5	43.2	43.7	68.7	30.3	55.6	31.0	66.5	58.1	83.8	44.1	75.1
Tunisia	35.8	65.3	60.4	83.4	48.2	74.3	62.5	92.2	85.7	96.4	74.3	94.3
Jordan	52.1	87.0	80.5	95.2	66.8	91.1	84.8	99.0	95.8	98.9	90.5	99.0
Syria	37.1	76.5	73.6	89.7	55.7	83.1	59.0	92.0	88.8	95.4	74.3	93.7

Source: The World Bank – World Development Indicators 2009. The literacy rate is "the percentage of people who can, with understanding, read and write a short, simple statement on their everyday life".
Since the indices are not available in the same years, the heading of the columns indicating the years mean "around 1980" and "around 2000" respectively.

1.5 Model, data and results

In this paper the effects of schooling on GDP are estimated starting with an aggregate Cobb-Douglas production function, specified by the three input factors labour L_t, physical capital K_t, and human capital H_t and improved by the level of technology A_t, not differently from Benhabib and Spiegel (1994), Krueger and Lindhal (2001), and Mankiw *et al* (1992):

$$(6) \qquad Y_t = A_t \cdot K_t^{\alpha} \cdot L_r^{\beta} \cdot H_t^{\gamma}$$

To avoid multicollinearity between capital and labour, the output and the capital stock are standardised by labour units. In logarithmic form, the production function can be estimated as

$$\log y_t = \log A_t + \alpha \log k_t + \beta \log h_t + \varepsilon_t, \quad (7)$$

where y_t and k_t represent the output per worker and capital per worker respectively, h_t is the average human capital and ε_t is the error term.

Since we are dealing with time series, we have to account for possible unit roots that are usually contained in macroeconomic time series and that are likely to deliver spurious results. We have conducted the Augmented Dickey Fuller test (ADF) and the KPSS test to check for unit roots on the levels of the variables. The problem is usually overcome by first differencing.

The results of the tests are presented in Table 1.5, showing the presence of unit roots in the levels of the variables. The time series goes from 1960 to 2007, delivering 46 observations.

Table 1.5 ADF and KPSS tests for unit roots and AIC and BIC tests for lag length.

Variables	Levels		Levels	
	ADF t-stat	KPSS t-stat	AIC	BIC
log_gdp	-1.50	2.16	-136.59 (1)	-132.89 (1)
log capital	-1.95	1.58	-161.25 (2)	-155.76 (2)
log education	-1.79	1.66	-285.03 (2)	-279.54 (2)
log milex/gdp	0.18	2.20	-26.39 (1)	-22.69 (1)
log trade/gdp	-2.36	0.26	-11.00 (1)	-7.30 (1)

Lag lengths in parenthesis according to AIC and BIC criteria.
The McKinnon critical values are -3.58 and -2.93 at the 1 and 5 percent significant level with constant only.
The KPSS critical values are 0.739 and 0.463 at the 1 and 5 percent significant level with constant only.

After first differencing the ADF or the KPSS tests prove the variables to be stationary, or I(1), except for the case of education, that instead is I(2). The t-statistics do not improve when the tests are run adding a trend. Table 1.6 shows the results of the tests for the variable education in its second difference (log diff-diff education).

Table 1.6 ADF and KPSS tests for unit roots in first differences of the variables.

Variables	With constant only		With constant and trend	
	ADF t-stat	KPSS t-stat	ADF t-stat	KPSS t-stat
log difference gdp	-4.35	0.16	-4.36	0.08
log difference capital	-2.71	0.92	-3.28	0.10
log difference education	-1.26	1.15	-2.00	0.31
log diff-diff education	-4.28	0.01	-4.34	0.06
log difference milex/gdp	-3.43	0.39	-3.59	0.18
log difference trade/gdp	-3.39	0.08	-3.36	0.08

McKinnon critical values are -3.58 and -2.93 at the 1 and 5 percent significant level with constant only; -4.17 and -3.51 at the 1 and 5 percent significant level with constant and trend.
KPSS critical values are 0.739 and 0.463 at the 1 and 5 percent significant level with constant only; 0.216 and 0.146 at the 1 and 5 percent significant level with constant and trend.

Since differencing implies the risk of losing the information related to the long-run relationship among the variables, recent studies (Nehru and Dhareshwar, 1994 for cross-country studies; Loening, 2004 and Morales, 1998 for time series) make use of the error-correction approach. This model combines the long-run information expressed in the levels of the variables (error correction term) with the short-run adjustment mechanism expressed in the first differences:

$$\begin{aligned} \Delta \log y_t &= \gamma_1 \cdot \Delta \log k_t + \gamma_2 \cdot \Delta \log k_{t-1} + \gamma_3 \cdot \Delta \log h_t + \gamma_4 \cdot \Delta \log h_{t-1} + \\ &- \gamma_5 \cdot \left(\log y_{t-1} - \alpha \log k_{t-1} - \beta \log h_{t-1} - \log A_{t-1} \right) + \varepsilon_t \end{aligned} \tag{8}$$

However, if we use the variable education in its first differences we will obtain biased results, because the error correction model requires stationarity for all the variables in the short run term. Alternatively, we could introduce the second difference of the variable education in the short run part of the model, and the first difference in the long run term.

Though, this would make the interpretation of the coefficients more difficult. Sure enough, the log difference of a variable has the economic meaning of percent change, while the second difference represents acceleration, that is hard to interpret in the case of education.

For this reason, we have split the database into two sub-periods: from 1960 to 1985 and from 1986 to 2007. In the mid-1980s Egypt introduced deep reforms that in a direct or indirect way affected school: they established compulsory education at the preparatory level (the law was set up in 1981), they reformed the law that granted a job in the public sector to the graduates of secondary and tertiary level of education and tried to address the choices of the students towards vocational or technical institutes. All these reforms have been discussed in Section 1.2.

The results of the KPSS test in Table 1.7 confirm that the sub-periods allow us to work with stationary variables in their first differences.

Table 1.7 ADF and KPSS tests for unit roots in sub-period 1 and sub-period 2.

Variables	With constant only: levels Sub-period 1: 1960 - 1985		With constant only: levels Sub-period 2: 1986 - 2007	
	ADF t-stat	KPSS t-stat	ADF t-stat	KPSS t-stat
log gdp	-0.81	1.30	-0.42	0.74
log capital	-0.29	1.32	-2.39	0.97
log education	1.00	0.95	-1.58	0.83
Variables	With constant only: first differences Sub-period 1: 1960 - 1985		With constant only: first differences Sub-period 2: 1986 - 2007	
	ADF t-stat	KPSS t-stat	ADF t-stat	KPSS t-stat
log difference gdp	-3.28	0.07	-3.70	0.33
log difference capital	-2.29	0.12	-2.59	0.24
log difference education	-1.55	0.50	0.65	0.63

McKinnon critical values are -3.75 and -3.00 at the 1 and 5 percent significant level with constant only.
KPSS critical values are 0.739 and 0.463 at the 1 and 5 percent significant level with constant only.

The dataset uses data from the IMF International Financial Statistics 2009, the World Bank's World Development Indicators 2009 and the Barro and Lee statistics on education available on line. The data refer to the time period 1960 – 2007 and are expressed in Egyptian pound. The ratio military expenditures to GDP has been kindly provided by Aamer Abu Qarn.

Further details on the database are given in the Appendix.

Tables 1.8 and 1.9 show the results of a simple production function for sub-period 1 and sub-period 2 respectively, with the technology level proxied by a constant and a series of dummies. The following Table 1.10 contains the results for a model where the technology level is proxied by measures of trade and military expenditures.

Table 1.8 Production function for Egypt, sub-period 1: technology as a function of dummy variables.

EXPLANATORY VARIABLES	Dependent variable: percent change of gdp per worker Sub – period 1:1960 - 1985							
	Model 1		Model 2		Model 3		Model 4	
constant	2.613	**	2.828	**	2.290	*	1.512	
	(2.348)		(2.335)		(2.068)		(1.61)	
percent change of capital per worker	0.882	***	1.025	***	0.940	***	1.024	***
	(5.84)		(8.854)		(6.312)		(6.387)	
percent change of capital per worker (-1)	0.043		0.128		0.088		0.119	
	(0.223)		(0.696)		(0.438)		(0.707)	
percent change of human capital	0.803	***	1.485	***	0.899	***	0.487	
	(2.987)		(4.156)		(3.63)		(1.36)	
percent change of human capital (-1)	0.925	*	0.626		1.006	**	2.675	**
	(2.061)		(1.381)		(2.196)		(2.912)	
log capital per worker (-1)	0.372	**	0.343	**	0.493	**	0.522	***
	(2.279)		(2.798)		(2.412)		(3.279)	
log schooling (-1)	-0.003		0.093		-0.06		-0.03	
	(-0.027)		(1.006)		(-0.571)		(-0.317)	
log gdp per worker (-1)	-0.676	***	-0.674	***	-0.77	***	-0.72	***
	(-3.527)		(-3.688)		(-3.551)		(-4.396)	
step dummy infitah 1975			-0.078	***				
			(-3.354)					
impulse dummy oil 1973-74					0.033			
					(1.533)			
step dummy break 1977							-0.127	*
							(-2.13)	
long-run elasticity of capital	0.550		0.510		0.642		0.724	
long-run elasticity of schooling	-0.004		0.137		-0.084		-0.041	
Adjusted R-squared	0.780		0.822		0.785		0.808	
F-statistic	145.383		205.503		315.650		439.104	
Durbin-Watson	1.754		1.916		1.621		1.700	

Table 1.9 Production function for Egypt, sub-period 2: technology as a function of dummy variables.

EXPLANATORY VARIABLES	Dependent variable: percent change of gdp per worker Sub – period 2:1986 - 2007							
	Model 5		Model 6		Model 7		Model 8	
constant	3.065		6.286	***	2.574		6.277	***
	(1.749)		(3.667)		(1.449)		(3.525)	
percent change of capital per worker	0.937	**	0.904	**	1.176	***	1.310	***
	(2.776)		(2.363)		(3.449)		(4.014)	
percent change of capital per worker (-1)	0.359		0.416		0.385		0.476	
	(1.232)		(1.321)		(1.456)		(1.707)	
percent change of human capital	-1.656		0.422		-2.436		-0.387	
	(-0.885)		(0.230)		(-1.028)		(-0.209)	
percent change of human capital (-1)	1.026		2.360		0.608		1.983	
	(0.540)		(1.35)		(0.328)		(1.14)	
log capital per worker (-1)	0.110		-0.202		0.192		-0.143	
	(0.795)		(-1.301)		(1.079)		(-0.951)	
log schooling (-1)	0.455	***	0.80	***	0.422	***	0.827	***
	(4.989)		(8.42)		(4.839)		(9.232)	
log gdp per worker (-1)	-0.503	***	-0.55	***	-0.534	***	-0.615	***
	(-3.678)		(-5.256)		(-3.355)		(-6.055)	
step dummy WTO 1995			-0.052	***			-0.065	***
			(-4.536)				(-6.109)	
impulse dummy Gulf war 1990-91					-0.021		-0.036	
					(-0.783)		(-1.49)	
long-run elasticity of capital	0.219		-0.369		0.359		-0.232	
long-run elasticity of schooling	0.905		1.451		0.789		1.346	
Adjusted R-squared	0.525		0.577		0.507		0.608	
F-statistic	49.204		62.524		133.1539		133.069	
Durbin-Watson	2.938		3.071		2.937		3.214	

Table 1.10 Production function for Egypt, sub-periods 1 and 2 with measures of trade and military expenditures.

EXPLANATORY VARIABLES	Dependent variable: percent change of gdp per worker							
	Sub – period 1:1960 - 1985				Sub – period 2:1986 - 2007			
	Model A		Model B		Model C		Model D	
constant	3.098	**	2.428	**	-2.480		2.625	
	(2.397)		(2.309)		(-0.718)		(1.392)	
percent change of capital per worker	0.974	***	0.916	***	1.121	***	0.980	***
	(7.514)		(6.399)		(3.627)		(3.246)	
percent change of capital per worker (-1)	0.192		0.145		-0.022		0.345	
	(1.012)		(0.753)		(-0.0787)		(1.523)	
percent change of human capital	0.970	**	0.445		-0.010		-2.143	
	(2.608)		(1.162)		(-0.005)		(-0.9731)	
percent change of human capital (-1)	0.900		1.232	**	1.273		1.895	
	(1.626)		(2.157)		(0.738)		(0.736)	
log capital per worker (-1)	0.445	***	0.494	**	0.644	*	0.257	
	(3.462)		(2.908)		(1.888)		(1.15)	
log schooling (-1)	0.019		-0.040		0.425	***	0.59	**
	(0.2127)		(-0.4)		(4.808)		(2.85)	
log gdp per worker (-1)	-0.788	***	-0.779	***	-0.543	***	-0.63	**
	(-3.800)		(-4.103)		(-3.847)		(-2.549)	
log trade / GDP (-1)	-0.053	*			0.045			
	(-1.865)				(1.583)			
log milex / GDP (-1)			0.027				0.043	
			(1.738)				(0.981)	
long-run elasticity of capital	0.565		0.635		1.185		0.408	
long-run elasticity of schooling	0.024		-0.051		0.782		0.942	
Adjusted R-squared	0.804		0.794		0.532		0.505	
F-statistic	489.644		374.6273		25.581		103.193	
Durbin-Watson	2.191		1.893		3.072		2.703	

Table 1.8 shows different versions of the error correction model, with a selection of dummies that should account for significant events in the recent history of Egypt.

The step dummy Infitah 1975 accounts for the effects of the new policy of international openness introduced by President Sadat since 1974. Contrary to his predecessor, Sadat allowed foreign capitals to enter the country, lowered or abolished duties, created free zones in order to attract foreign investors. However, all commentators agree that the economic effects of this policy were modest or even negative. The larger amount of money circulating in the country did not boost productivity and did not drive to faster economic growth. On the contrary, social inequalities improved so much that a new generation of enriched and corrupt "fat cats"[9] emerged. In fact, the dummy is significant and has a negative sign.

[9] See K. Beattie, "Egypt during the Sadat years", page 151, also cited in M. Campanini, "Storia dell'Egitto contemporaneo", page 216.

The impulse dummy Oil 1973-74 is related to the oil crises that affected the world economies in the early 1970s and, as expected, had a negative impact on Egypt as well.

The step dummy Break 1977 models a structural change in the relationship of the variables, observables in the graphs in the Appendix. A Chow test does not reject the null hypothesis of a structural break in 1977 (p-value = 0,000).

The 1977 dummy is a proxy for the unmeasured social instability that affected the country since the 1970s and that occasionally expressed violent protests, as happened just in 1977 when the population demonstrated against the increase in the prices of basic goods.

Going to the econometric results, in Model 1 and Model 3 the short run coefficient for physical capital varies between 0.882 and 0.94, meaning that a one percent change in stock of capital leads to a change in GDP growth of around 0.9, while the long run coefficient lies at about 0.6. The results are not far from the coefficients obtained by Loening (2004) for Guatemala and Morales (1998) for El Salvador (0.87 and 0.86 respectively in the short run and 0.444 and 0.49 for the long run elasticity of capital).

The short term effect of the average years of education is instead quite too high (between 0.803 and 0.899), considering that education is not expected to have short-term effects on growth. Comparing again the results with Loening (2004) and Morales (1998) we find that in the case of Guatemala the log-difference of education was dropped because not significant, while for El Salvador the coefficient was significant although very low (0.138).

The reason for a positive coefficient may lay in the expectations for future better economic circumstances. Increasing average years of education may be due to higher enrolment rates in the primary grades, that happened in the early 1950s, and higher enrolment rates in the upper grades happened in the second half of the 1960s (see Table 1 in Part 1 on the Egyptian education system). Higher enrolment ratios in the secondary level of education, boosted by the law on the public sector jobs, could be read as a proxy for improved expectations.

In Models 2 and 4, the short run coefficients for physical and human capital are outliers, therefore we consider that the dummies do not help to improve the model specification.

In fact, since the impulse dummy for the oil crises introduced in Model 3 is statistically not significant, we can conclude that the “plain” model without dummies represents the best specification for sub-period 1.

The results do not change significantly in Models A and B (Table 1.10), where the dummies are replaced by measures of trade and military expenditures, often used as proxies of technological progress. Again, these Models still show very high coefficients for human capital: 0.97 in Model A and 0.445 in Model B.

The coefficient for the long term elasticity of education has a different sign in Model 1, Model 3, Model A and Model b, but the coefficient is everywhere close to zero, meaning that, in the long run, schooling did not have the positive and noteworthy effect suggested by the growth model. A reasonable explanation could be that the public sector absorbed all better educated people.

Moving to Table 1.9, the dummies capture the permanent effect of the joining to WTO that happened in 1995 and the transitional effects of the Gulf War in the early 1990s.

Surprisingly, the dummy WTO has a negative sign, but the coefficient is very close to zero, thus the effect is negligible and the same argument holds for the dummy Gulf War which however has the expected negative sign.

In Model 5 and Model 6 the percent change of the capital per worker, at around 0.9, is close to the coefficients of the first sub-period. In Model 7 and Model 8, the introduction of the dummy Gulf War makes the coefficients far too high (1.176 and 1.310), therefore we consider that the dummy does not help to improve the model specification. The results do not change in Model C and Model D in Table 10, where the dummies are replaced by measures of trade and military expenditures.

The long run elasticity of capital is very unstable in signs, in particular it seems that the dummy WTO turns the signs into negative in Models 6 and 8.

As regards human capital, the short-run coefficients are highly unstable as well, either in the sign and in the magnitude and we consider the coefficients of Models 5 and 7 as outliers. The long run coefficients are all positive, ranging from 0.789 to 1.451.

In conclusion, Model 7 seems to be the best specified model for the second sub-period, with a positive long run coefficients for physical capital (0.359) and for human capital (0.789). human capital in particular might have benefited of the reforms of the law on the public sector jobs and of the schooling system.

However, the short run coefficients are quite puzzling (1.176 for physical capital and -2.436 for human capital). If the argument of expectations holds, the negative short-run effect of human capital may incorporate the outcome of the reforms in the public sector jobs. Instead, the structural reforms applied since 1991 with the assistance of the IMF may have affected the short-run equilibrium[10]. In fact, the introduction of a step dummy accounting for such reforms does not improve the coefficients, perhaps because the widespread effects cannot be easily captured.

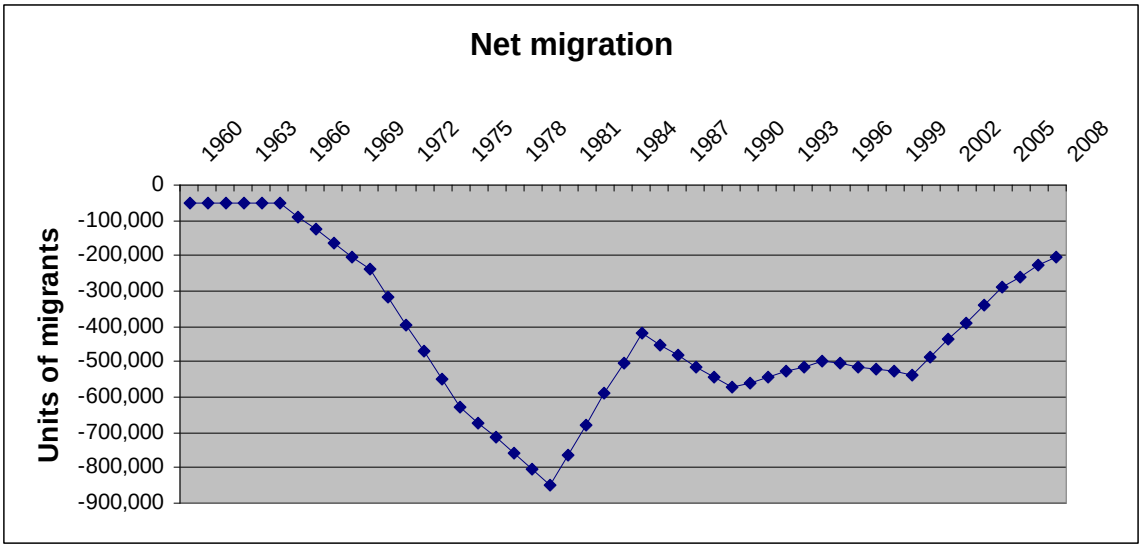
The results in Table 1.10 (Models C and D) do not help to find the best specified model, because at least one of the coefficients is an outlier and the variability of the coefficients prevents from comparing directly the models in Table 1.10 with the ones in Table 1.9.

[10] The joint Egypt-IMF/WB stabilisation programme (ERSAP, Economic Reform and Structural Adjustment Programme) can be summarised in three main points: reduction of the fiscal deficit, currency and financial system reforms, poverty alleviation policies.

Attempts to introduce data on migrations to improve the model were fruitless. As is evident in Figure 1.3, an increasing number of Egyptian migrated abroad since the mid-1960s. Most of them were high educated people leaving towards other Arab countries, thus depriving the country of the beneficial effects of the investments in education. However, this variable does not change the results significantly, neither used in substitution nor in combination with other dummy variables.

Explanations for this could be that the number of migrants was already accounted for in the data on human capital, since data on population come from census or surveys that should only number the residents in the country (Barro and Lee, 2000). Moreover, the data on GDP and capital stock have been normalised by the units of workforce, thus excluding migrants.

Figure 1.3 Net migration in Egypt.



Source: World Bank – World Development Indicators 2009.

1.6 Conclusion

The paper analyses the macroeconomic effects of the improvement in the average years of education in Egypt.

In order to obtain unbiased results, the error-correction model has been applied to two sub-periods, where all the variables proved to be stationary in their first differences.

The signs and the coefficients of the long run elasticity of schooling in sub-period 1 seem to tell that the first reforms of the schooling system did not affect much the economic growth. Such a reform involved the students in their early years of education, aiming at improving the literacy rate of the population, and this may have not been enough to have a significant impact on the GDP growth.

Although the law that granted a job to the secondary school and university graduates boosted attendance to higher levels of education, the allocation of the jobs was almost entirely in the public

sector. Again, this sector is usually poor of technological development, that should be the engine to growth, according to the economic model.

In the 1980s the public employment policy changed and in the 1990s the Government succeeded in shifting the enrolments towards vocational secondary schools, in order to meet the employment needs of the private sector. In 1981 the Government introduced compulsory education at the preparatory level

All these circumstances whose effects are included in the second sub-period, may have determined the change in the sign of the long run coefficient of education, showing the positive effect of the change in the quality of human capital.

This suggests that in the long-term the investments in education had a positive effect on economic growth. The 1960s schooling programme, with the strong increase in the number of students enrolled in the earlier years of education, paved the way for a further enhancement obtained with the 1981 Law on preparatory education and all this helped to increase the measure of the average years of schooling in the following decades.

The Government's guarantee of a job in the public sector proved to be unsustainable in the long run, however, it represented a real chance to improve the living standards also for poor people. Sure enough, enrolment in the secondary schools and university was merely related to the results obtained in the final exams, while attendance was free of taxes and for the poorest students the books were free as well.

It must be recognized that the Egyptian rulers achieved the goal of improving the living standards of the population and one of the means was certainly the right of access to basic education. Free access to superior education and the incentive of a job in the public sector could have helped many Egyptians to come out from poverty.

An econometric analysis on private incomes could be the way to quantify the effects of the policy.

Appendix to Part 1

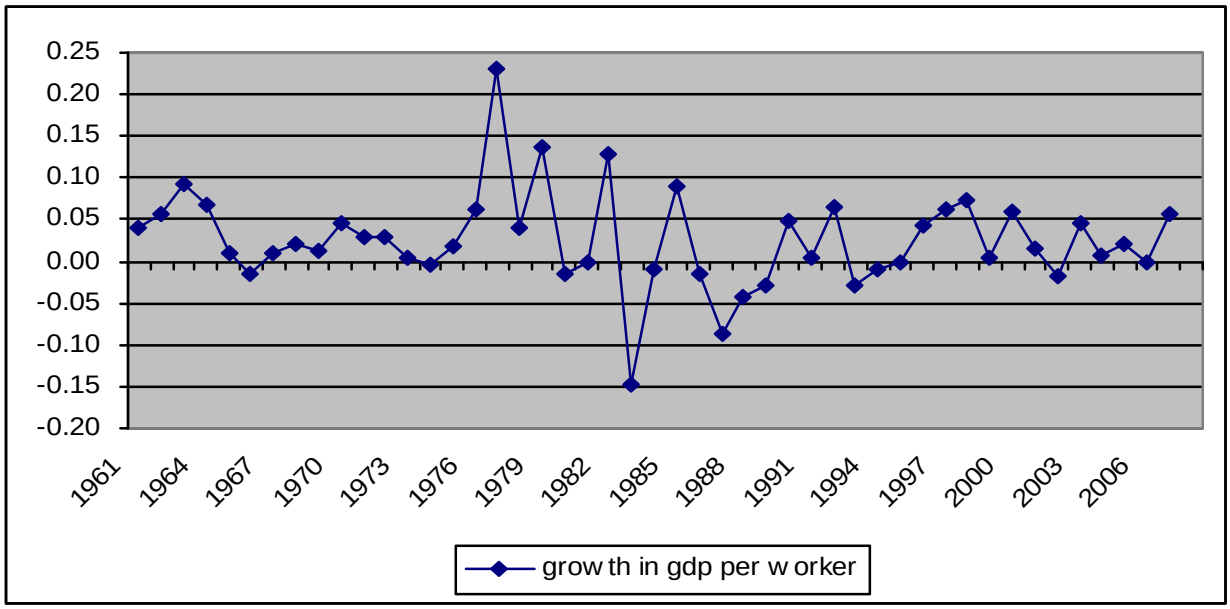
The Egyptian main source of data is CAPMAS (Centre for Public Mobilisation and Statistics) and some series are also available in the internet, however it has not been possible to build a long time series of homogeneous data. Therefore, all data used in the paper come from the International Institutions' databases.

Gdp

The IMF International Financial Statistics 2009 provided the data on GDP in Egyptian pound (LE). Values in current prices have been transformed in constant 2005 prices using the CPI index, also available in the IMF-IFS statistics and divided by the number of the workforce.

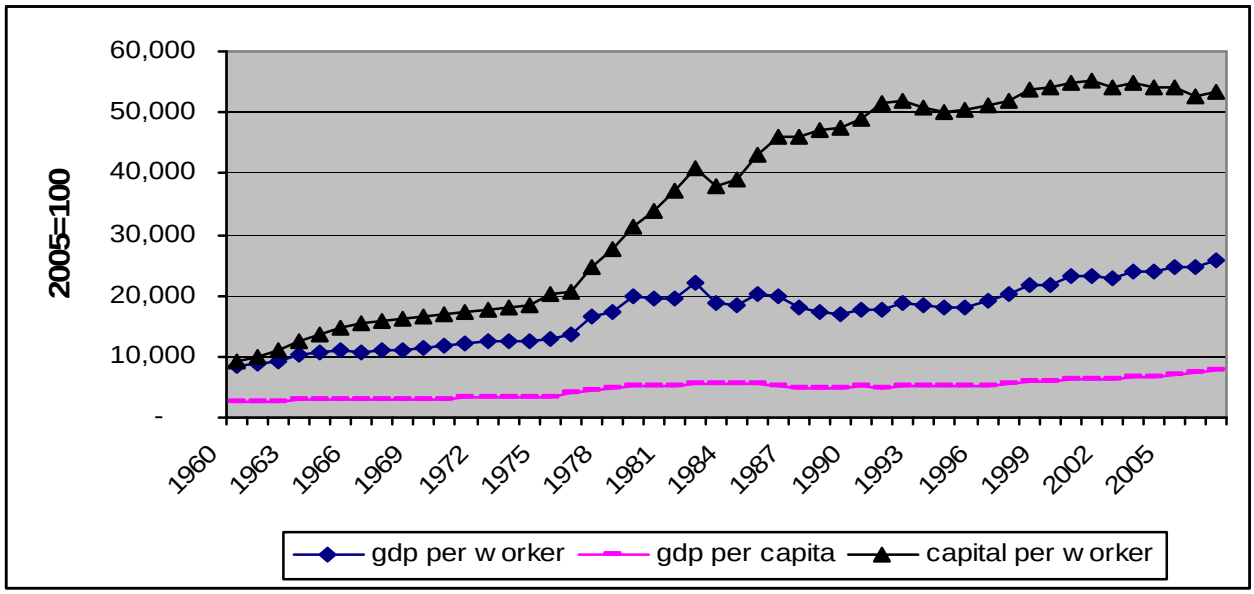
The GDP in US dollar (US$) come from the WB World Development Indicators dataset, that provided data in current prices, then transformed in constant 2005 prices using the CPI index.

Figure 1.A The percent growth in GDP per worker.



Source: author's calculations

Figure 1.B Evolution of GDP and capital.



Source: author's calculations

Capital

The time series on fixed investments was compiled using the IMF-IFS 2009 Gross Fixed Capital Formation for the data in current LE (then transformed in constant 2005 prices using the CPI index)

and using the WDI database for the data in current US$ (then transformed in constant 2005 prices using the CPI index).

Although it has some limits and problems, the Perpetual Inventory Method is the most common way to estimate capital stock. In this formulation the stock of capital at time t is the accumulation of the flows of past investments, accounting for depreciation.

When building a time series on the stock of capital, one has to deal with two main issues: the initial capital stock and the depreciation rate.

In this paper, the initial capital stock (K) has been derived using the capital/output ratio (c) from Nehru and Dhareshwar (1993) database:

$$K_t = c_t \cdot Y_t$$

An alternative equation to estimate the initial capital is

$$K_t = I_{t+1} / g$$

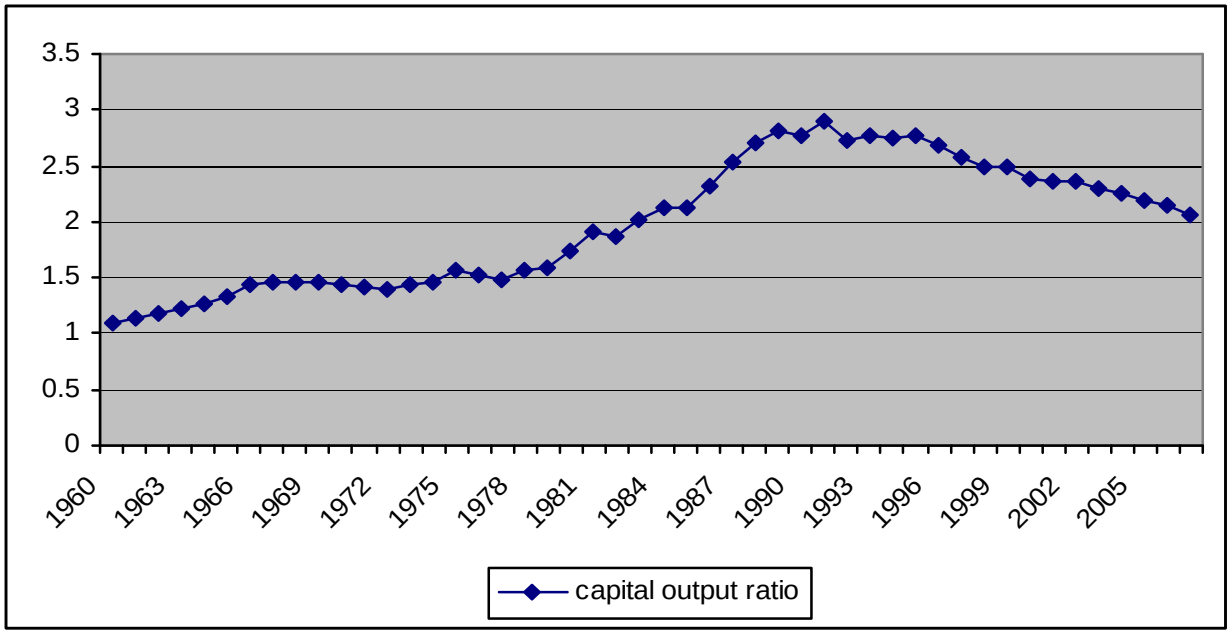
where I_{t+1} is the flow of investments at time t+1 (gross fixed capital formation) and g is the rate of growth of GDP at time t. The assumption is that the growth rates of GDP and capital are equal in a given period, thus the capital – output ratio is constant over that period.

Since the two methods did not drive to significant differences, the initial capital from Nehru and Dhareshwar has been used in all the time series.

The second issue to deal with is the depreciation rate of capital, whose choice affects the estimates much more than the initial capital. In this paper, the depreciation rate is assumed to be 5 percent, in line with other studies on emerging countries like Turkey (Ackabelen, 2009) that belongs to the same geo-political area as Egypt, and Guatemala (Loening, 2004) that experienced internal conflicts and social instability, not differently from Egypt (wars with Israel in 1967 and 1973, Middle East conflict in 1990-91, protests since the end of 1970s).

The path of the capital-output ratio since the end of the 1970s can be explained with a boom of investments in infrastructures. After decades of neglect, when Egypt's resources were mostly employed to expand the military power, the end of the war with Israel allowed the Government to invest in infrastructures and rebuild the country.

Figure 1.C The capital – output ratio in Egypt.



Source: author's calculations

Labour force

Data on the labour force are obtained from the ILO Labour Statistics Database (LABORSTA), whose sources are the population census and labour force surveys. Missing values usually involve not more than a couple of years, but in the period 1960 – 1973 only two censuses and a survey were available, thus leading to missing values for five or six consecutive years.

Due to a lack of alternative data, the missing values have been filled with a linear interpolation approach, although six years of missing data is quite a long period. Since 1993 a comparison with data from the Central Bank of Egypt and CAPMAS shows that the LABORSTA data are in line with original Egyptian figures.

Alternatively, the labour force (L_t) has been computed using the Penn World Tables 6.3 (2009):

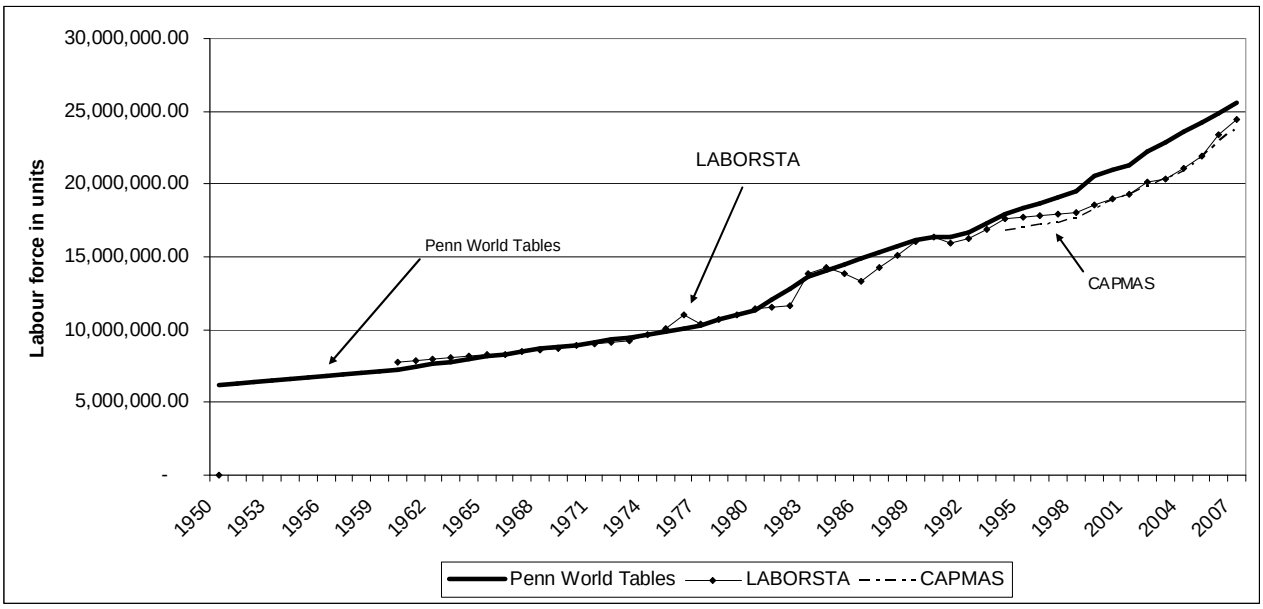
$$L_t = \left(y^{cap}{}_t \times Pop_t\right) / y^{wok}{}_t$$

where $y^{cap}{}_t$ and $y^{wok}{}_t$ represent GDP per capita and per worker at time t respectively, and Pop is the population.

Figure 6 shows the path of the labour force with alternative sources of data. The series from ILO and computed Penn World Tables overlap almost perfectly until the 1990s. Thereafter, ILO follows the trend of CAPMAS.

In the model we have used the workforce provided by the ILO, however, since either the capital stock and the GDP are standardised by labour units, the final effect of the choice is negligible.

Figure 1.D The labour force time series: a comparison of sources.



Source: author's calculations with data by Penn World Tables, ILO and CAPMAS.

Human Capital

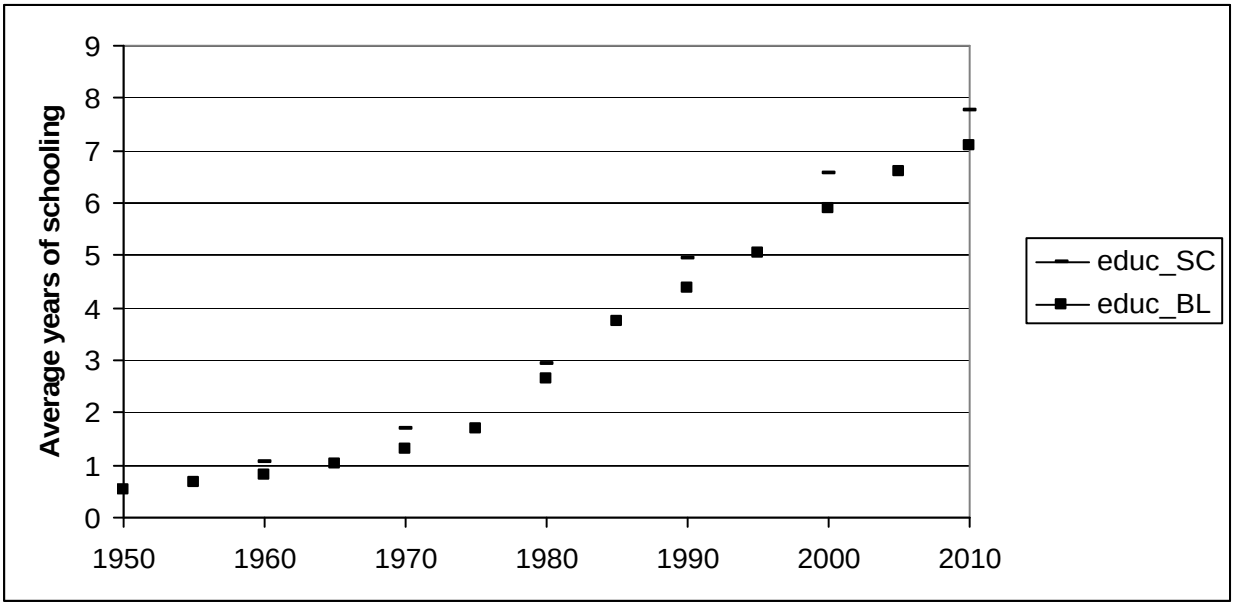
In this paper we have used the attainment levels of the workforce as a proxy for human capital. It is widely recognised that there not exist a complete measure of human capital, since it includes a large set of qualities. However, the attainment levels are preferred to alternative measures since they embody the output of schooling. The enrolment rates, often used instead, represent the investment in schooling or, in other words, the potential human capital.

The two datasets on human capital most commonly used in recent studies are Barro and Lee (2010) and Cohen and Soto (2001). The only limit of these sources is that data are available in 5 or 10 years intervals, and therefore a linear interpolation approach is needed in order to obtain a time series.

Barro and Lee have recently updated the original database extending the period observed, that now covers the years between 1950 and 2010. Figure 1.E shows the differences of the two time series, related to the population aged 15 and over.

In the regression models the regressor for education comes from the Barro-Lee database since they are available at shorter time intervals.

Figure 1.E Average years of schooling of the Egyptian labour force aged 15 +.



Source: Barro and Lee (2001, database updated in 2010) and Cohen and Soto (2001).

Part 2 The effects of opening to international trade: the case of Egypt

Summary
The debate on whether it is exports that support growth or a minimum level of growth is needed to boost exports is still open. The results of empirical works are contradictory and widely depend on the choice of the econometric approach. In this work we study the causal relationship between exports and GDP for the Egyptian economy. We apply the standard Johansen and Juselius cointegration test and a VECM for cointegrated variable. The Luetkepohl methodology allowing for structural breaks is also implemented. We detect causality from GDP to exports, thus finding support for the Growth-led Export hypothesis.

2.1 The economic theory on PTAs

Since Adam Smith's The Wealth of Nations, many scholars claimed that trade liberalisation could lead to fastest economic growth. Among these, the empirical researches by Dollar (1992), Sachs and Warner (1995) and Edwards (1998), seemed to support the hypothesis, although they were later criticised by Rodriguez and Rodrik (2001) for the use of misleading indicators of openness.

Also the international organisations like The World Bank and the International Monetary Fund support this view, particularly with regards to the developing countries. Rodrik (2006) summarises a list of ten essential reforms recommended by the international organisations to reach an acceptable level of economic development: fiscal discipline, reorientation of public expenditures, tax reforms, financial liberalisation, unified and competitive exchange rates, trade liberalisation, openness to FDI, privatisation, deregulation, secure property rights. And these are exactly the steps followed by the IMF in supporting the reorganisation of the Egyptian economy.

In the latest two decades, however, preferential trade agreements (PTA) were signed in such a huge number that Bhagwati (1995) labelled this trend as "the spaghetti bowl" phenomenon.

While some economists and many policymaker think that bilateral agreements are an alternative way to reach the goal of a world free of tariffs and barriers to trade, Bhagwati and other skeptics underline the confusion of innumerable applicable tariff rates depending on the origin of the goods. And the "rule of origin" is itself arbitrarily determined by the members of the agreement and may vary by products or by agreement: for example, Bhagwati notes that the EU applies different rules of origin with different non-EU countries.

Moreover, preferential trade agreements seem to have negative short-term effects, as Viner stated for the first time in 1950: trade creation among the partners and trade diversion with non-partners. In particular, if outside producers are more efficient, this will result in a general loss of efficiency[11].

Taking this into account, economists have tried to find solutions to avoid trade diversion in a PTA. Successful PTAs should be signed only among countries with the following characteristics, the so-called "natural trading partners": geographic proximity or alternatively low transport costs; a high initial volume of trade; similar development stage; a large number of countries involved, in order to increase the opportunities for specialization. The concept of natural trading partner was first developed by Wonnacott and Lutz (1989), and then emphasised by Krugman (1991) and Summers (1991).

In fact, Bhagwati and Panagariya showed in their works that at least the first two criteria rest on error, although "[their] appeal is intuitive to many". Panagariya (1997) proved that, unless transport costs completely eliminate trade between two countries, they have to be treated as any other cost. Thus, it is the marginal cost of import that is relevant to explain welfare gains or losses, and not the average cost, as stated, for example in Krugman (1991).

In the same paper, Panagariya referred to a previous work (Bhagwati and Panagariya, 1996) to show that welfare gains on a PTA individual member come from the tariff revenue effects rather than from trade creation or trade diversion, unless the agreement is followed by a redistribution of income from the low-tariff to the high-tariff country. He gave as an example just the PTA between the high-tariff North African countries and the EU, where the former "are likely to suffer static welfare losses".

As regards the stage of development, Bhagwati and others (1998) illustrated how PTAs proliferate among the developing countries, in most of the cases due to political and bureaucratic pressures rather than to economic incentives.

In the long-run view the question to be addressed is whether there are incentives to add members to a PTA, thus reaching multilateral free trade. Baldwin (1993) proposes a model that works in the case of endogenously-determined time path and where the time path of the PTA is separate from the path of the multilateral trade negotiations (MTN). Baldwin shows that there is a positive incentive to join for the non-member countries at the margin of the preferential trade area. Firms in those countries experience lower profits because of the trade barriers they face and therefore they lobby for entry. Countries at the next margin will then occur in the same situation, until a worldwide free trade area is created.

[11] Lawrence, R.: "Preferential trading arrangements: the traditional and the new".

On the other hand, if the PTA and the multilateral trade negotiations time paths interact, the bilateral agreement can reduce or remove the incentives toward a multilateral liberalisation (see Krishna, 1998 and Levy, 1994). Albertin (2008) further shows that once a preferential trade agreement is in place, firms lobby to protect their preferential market access, thus leaving the policymaker without the right incentives to move toward further liberalisation.

In the specific case of the Euro-Med Agreement, Nsouli (1996) finds an additional negative effect for the Southern Mediterranean countries: the so-called "hub-spoke" effect, due to the lasting high intraregional trade barriers among these countries. Instead of investing in one of the South Mediterranean countries because of the new liberalisation policy, foreign investors could prefer to establish themselves in the EU (the "hub") thus profiting by the access to all the Southern countries at the same time (the "spokes").

The issue is related to the South-South trade, a concern for many economists. It is known that on average goods traded among developing countries face much higher tariffs than in North-North trade or even North-South trade. Stiglitz and Charlton (2005) report a table where average manufacturing tariffs faced by developing countries exporting to other developing countries is 12.8%, but it is only 3.4% for exports towards developed countries. Therefore, developing countries could obtain considerable gains from liberalisation of South-South trade. Moreover, preferential agreements between developing countries should probably focus more strictly on trade issues and would be free of political conditionality often imposed by developed countries.

Again, Stiglitz and Charlton propose a framework called "Market Access Proposal" that should allow developing countries to gain the benefits of liberalisation and to minimise the adjustment costs. Indeed, trade agreements have high costs of implementation and it is often difficult for these countries to reconcile their commitments with other development issues. This is one of the reasons why developing countries are often excluded by the world trading system.

According to the Market Access Proposal, all WTO members should guarantee free market access to all countries poorer and smaller than themselves, scaled with regards to GPD and GDP per capita.

Finally, a study by Hoekman and Djankov of the World Bank (1996) compares the MENA countries with the countries of Eastern Europe, that also signed trade agreements with the EU. Both groups of countries started reforms in the late 1980s, the level of state intervention in the economy was high, they are geographically close to the EU.

Opening to Europe brought significant benefits to the Eastern European countries (EEC), especially looking at the so-called outward processing trade: the EU countries exported components and imported back the processed good, providing also the know-how in terms of designs or monitor

quality. A similar process may be implemented also for the MENA countries, since they share with the EEC a low cost of labour and an adequate level of technology and the agreements allow transfers to poorer countries in the form of technical assistance.

Moreover, the agreement signed with the EU, helped many Eastern European countries to implement other economic reforms, also in the view of a future membership of the EU, which in fact happened in 2004 and 2007.

Membership is out of question, at the moment, for MENA countries. However, the strong monitoring and enforcement mechanism in the Euro-Med agreements can give credibility to the reform process and more specifically to the commitment to liberalise trade.

According to Bhagwati and others (1998), the European Council of Ministers has taken into account the concerns expressed by some economists regarding the proliferation of PTAs and has resolved to limit new preferential agreements "when a strong case can be made, satisfying several criteria".

In the next sections we will analyse the case of Egypt, that experienced either openness to international trade and import-substitution policies. These phases are described in Section 2.2 to Section 2.6, emphasizing the recent economic relationship with the EU.

From Section 2.7 we provide an econometric approach to assess the effects of trade on the Egyptian economy, with regards to total trade and to trade with the EU. Section 2.11 concludes.

2.2 The open economy in Egypt between 19th and 20th century

The policy of opening to international trade that began in Egypt in the 1990s is not a new experience for this country[12].

Already in the second half of the nineteenth century, under Mohammed Ali's successors, Egypt experienced the integration with the world economy through the export of a primary commodity such as cotton.

In that period, the cotton imported into England from the southern states of America represented about 80% of the raw material required to supply the English cotton industry.

In 1861, as the American Civil War broke out, the southern states of America suddenly stopped the exports of cotton towards Europe, thus triggering a deep crises known as the Lancashire Cotton Famine (1861-1865). Great Britain tried to diversify her supplying sources supporting the cultivation of cotton in areas like British India and Egypt.

Since raw cotton prices rose from 6½ pence in 1861 to 27½ pence in 1864, Egypt had a strong incentive to specialise in the production and export of cotton, although at the expense of food

[12] For deeper details about the economic history of Egypt see C. Issawi: Egypt in Revolution; and R. Mabro: The Egyptian economy, 1952-72.

production. Important investments in the fields of agriculture, namely in irrigation, transports, banking and finance (the city of Alexandria hosted the futures market) supported the development of the new industry.

The production of cotton rose from 501,000 cantars[13] in 1860 to 2,140,000 in 1965 and reached 7,664,000 in 1913[14].

Unfortunately, nothing had been done in order to diversify the economy, nor the Government attempted to improve the quality of human capital through new investments in education. These could have helped the country in the following decades when the one-crop export-oriented economy would have shown its limits.

The growth in per capita income either for the upper and middle class and for the mass population was strictly related to the positive trend of the export-led economy, but the conditions for a sustainable growth were not met.

After the first decade of the twentieth century, the economic situation deteriorated: the soil was damaged by excessive exploitation due to multiple cropping and perennial irrigation, while a late introduction of fertilizers, improved seeds and drainage did not bring benefits until the 1930s. In fact, the great part of the investments done in agriculture in this period were used to repair the damages more than to improve productivity and therefore yearly output growth barely reached 1%.

Moreover, the international economy was in dire straits after the two World Wars and the Great Depression, and the price of cotton suffered large fluctuations[15]. The terms of trade became unfavourable. Wages started to decline. The service of the high public debt became unsustainable.

Under all these circumstances, either internal and external, Egypt was not able to persist in her attempt to reach sustainable economic development through openness to international trade. Soon after the World War II, Egypt still was an agrarian country with marked inequalities in the distribution of income. Industry, finance and services were in the hands of foreigners.

2.3 The decades after the World War II.

Although cotton still represented 70-80% of the value of exports in the 1950s, the data for the following decade show an interesting trend toward diversification. In 1969/70, rice, textiles and other manufacturing corresponded to the 11,5%, 14,3% and 15,5% of exports, at the expense of raw cotton that dropped to 49%[16].

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[13] The cantar is a traditional Arabic unit of weight that corresponds to about 45 kg. (F. Cardarelli. Encyclopaedia of scientific units, weights and measures. Springer, 2003).

[14] Data in this chapter are from C. Issawi. Egypt in Revolution. Oxford University Press, 1963. Page 27.

[15] Between 1947 and 1950 cotton prices ranged between $ 30 and $ 100 per cantar. (Issawi, Egypt in Revolution. Page 221).

[16] Mabro, The Egyptian economy, 1952-72. Page 180.

On the other side, imports have always been more diversified, although their composition changed throughout the years, according to the different needs of the country. In the 1930s textiles accounted for about 25% of total imports, and foodstuff for about 20%, half of this consisting of cereals. In the following decades, the process of industrialization had to be supported with increasing imports of petroleum (from 4% of total imports in 1950 to 11% in 1960), machineries and spare parts (from 8% to 17%). And the growing population asked for rising quantities of foodstuff, mainly cereals, thus making Egypt one of the world's main importers of wheat.

The Revolutionary regime that came to power in 1952 tried to eliminate from the economy all distortions and imbalances. In a few years, the Government applied an import-substitution industrialisation and put all economic activities under public control or under strict regulation: Egypt had to be self-sufficient in the production of all what was needed. The country closed to foreign business, regardless of whether it may have benefited the economy, except for the activity of oil exploration.

A financial crisis that hit Egypt in around 1964 and the 1967 War negatively affected the Egyptian economy, that went through a period of stagnation. The lack of investment capital and spare parts had a bad impact on the development of industry. Moreover, the country heavily relied on foreign imports of foodstuff.

In the years after the July Revolution, the public sector expanded rapidly. In 1963, the financial sector (insurance companies and banks) was fully owned by the state, that also controlled almost all international trade and 80% of the means of production[17]

In 1974 president Sadat launched the policy known as *infitah* (the open door), that consisted in relaxing the tight control on some economic sectors such as tourism, finance and constructions. A tax holiday was established to incentive foreign investments in Egypt.

In spite of official invitations to invest in Egypt, little was done to effectively make the country attractive. The Government continued to manage the economy with heavy interventions in the productive process, subsidies to companies, full control of trade and of foreign exchange.

In summary, the public sector expanded its size in the late 1970s. Public employment rose at a yearly rate of 3,7% and the public sector's share of GDP grew from 45,1% in the mid-Seventies to 53,6% by 1979[18].

2.4 The late 1980s: The ERSAP and the economic reforms.

In the mid-1980s, the Egyptian Government recognized that the reforms were urgent, in order to support the country's sustainable economic development.

[17] Iliya Harik. Economic policy reform in Egypt. Page 19, citing Nasser.
[18] Iliya Harik. Economic policy reform in Egypt. Page 20.

Structural reforms were introduced since the fiscal year 1990/91, with the assistance of the World Bank and the International Monetary Fund, which stated in a later report: "by the standards of recent experience with economic stabilization, Egypt in the 1990s is a remarkable success story".[19]

The main problems affecting the Egyptian economy were an excessive intervention of the State, as already remarked in the previous section; a heavy burden of debt service due to a high level of public debt (the central government deficit amounted to over 20% of GPD); an inflation rate at around 20%.

The first steps of the joint Egypt-IMF/WB stabilisation programme (the so-called ERSAP, Economic Reform and Structural Adjustment Programme) can be summarised in three main points:

1. **reduction of the fiscal deficit**, either on the revenue side (introduction of a general sales tax and adjustment of the exchange rate, which boosted the revenues from the Suez Canal and the oil company profits, both under Government control) and on the expenditure side (cuts in the capital investment budget and removal of untargeted subsidies);
2. **currency and financial system reform**: unification of the different foreign exchange markets and introduction of auctions for the sale of Treasury Bills; the exchange rate was pegged to the U.S. dollar and the Central Bank of Egypt (CBE) committed to an active policy on the monetary markets. The active policy of the CBE helped to increase the liquidity in the monetary market and to put inflation under control;
3. **poverty alleviation policies:** a Social Fund for Development was created, in order to reduce the short-term impact of the cuts to subsidies and protect the most vulnerable groups. The Fund supported micro enterprises, provided basic community services, hired workers in labour-intensive public works and improved the monitoring of living standards.

These reforms not only allowed the economic stabilization of the country, but also would be the foundations for the subsequent opening to international trade and financial flows.

In 1998, at the time of IMF's report, Egypt had already taken a number of trade reforms, thus reducing the burden on trade: reduction of tariffs, lowering the highest rate from 120% to 70%; elimination of quantitative restrictions on imports; elimination of non-tariff barriers on exports. Egypt also lifted the restrictions on private imports and exports of cotton.

In spite of this, according to the IMF, at the end of the 1990s Egypt's trade system still remained quite restrictive. A maximum tariff rate of 70% was judged too high, import surcharges between 2% and 5% were still applied to all imports and some import bans had been replaced by restrictive quality controls.

[19] Egypt beyond stabilization, toward a dynamic market economy. IMF, 1998. Page 1.

In 1981 the country had joined the PAFTA (Pan Arab Free Trade Area)[20], whose aim was the elimination of all customs duties and other fees on merchandise by 2005, and all non-tariff barriers. Preferential treatment was granted to the least developed member states, who could enjoy free market access in all member states, meanwhile they had to reduce their customs tariffs gradually in five instalments since 2005.

Egypt also signed other agreements for the establishment of free trade zones with her neighbours: AGADIR, with other Arab Mediterranean countries (Jordan, Tunisia, Morocco), signed in 2004 for the establishment of a free trade area in 2005; the 2005 FTA with Turkey, still in process; COMESA, a preferential trade agreement for the establishment of a Common Market for East and South Africa.

Finally, in 2001 Egypt signed a PTA with the European Union, for the establishment of a free trade area originally by 2010.

2.5 The Euro-Mediterranean Agreement.

The European Union's policy of cooperation with and assistance to her counterparts in the southern bank of the Mediterranean Sea springs in the Cooperation Agreements negotiated during 1975-77. The Mediterranean countries were granted duty-free access to the EU market for industrial goods. Agricultural products were excluded. Financial aid was provided by five-year Financial Protocols, which established the amount of resources to be delivered to each partner country. In the years 1978-91, the EU and the European Investment Bank delivered ECU 3.3 billion to the Southern Mediterranean Countries[21].

From the EU point of view, the Mediterranean countries under analysis are not an important market. Figure 2.1 shows the share of trade between the EU15[22] and some selected southern Mediterranean countries, computed as the sum of imports from and exports to these countries divided by the amount of the trade with the world. After two peaks in 1960 and 1980, since 1990 the share is not able to reach 1% with exports from the EU slightly prevailing on imports (see Figure 2.2 and 2.3).

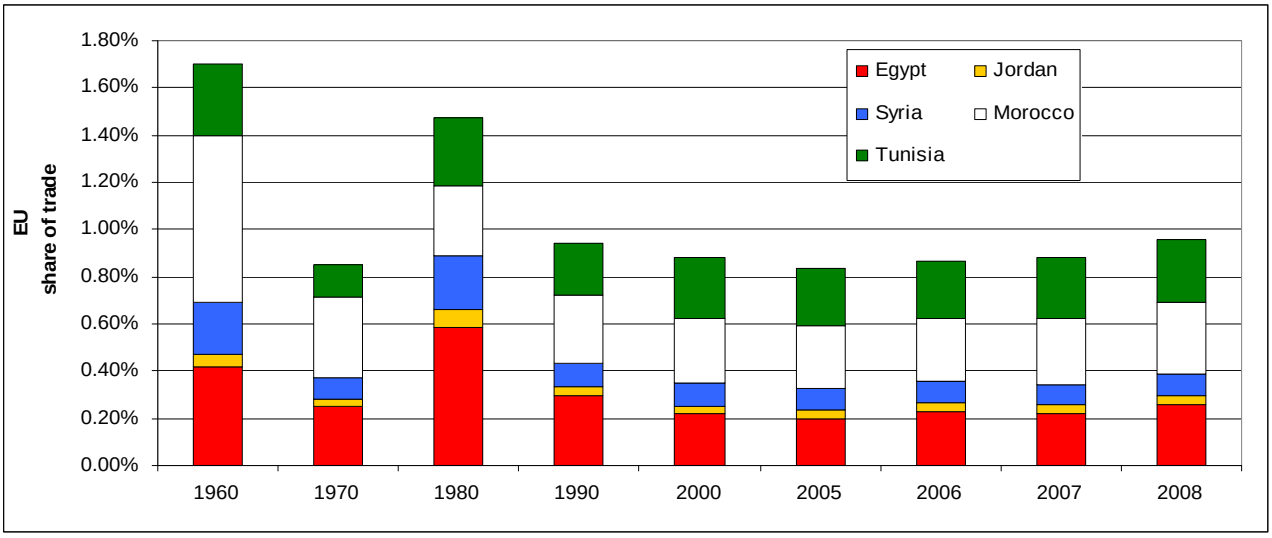
In the last two decades, all countries have kept their shares constant. Morocco, Tunisia and Egypt are the main trade partner among the countries in the area.

[20] PAFTA Member States are: Egypt – United Arab Emirates (UAE) – Bahrain – Jordon – Tunisia –Saudi Arabia– Sudan – Syria – Iraq – Oman – Palestine – Qatar – Kuwait – Lebanon – Libya – Morocco – Yemen.

[21] Nsouli, Saleh and others: "The EU's new Mediterranean Strategy". Page 14.

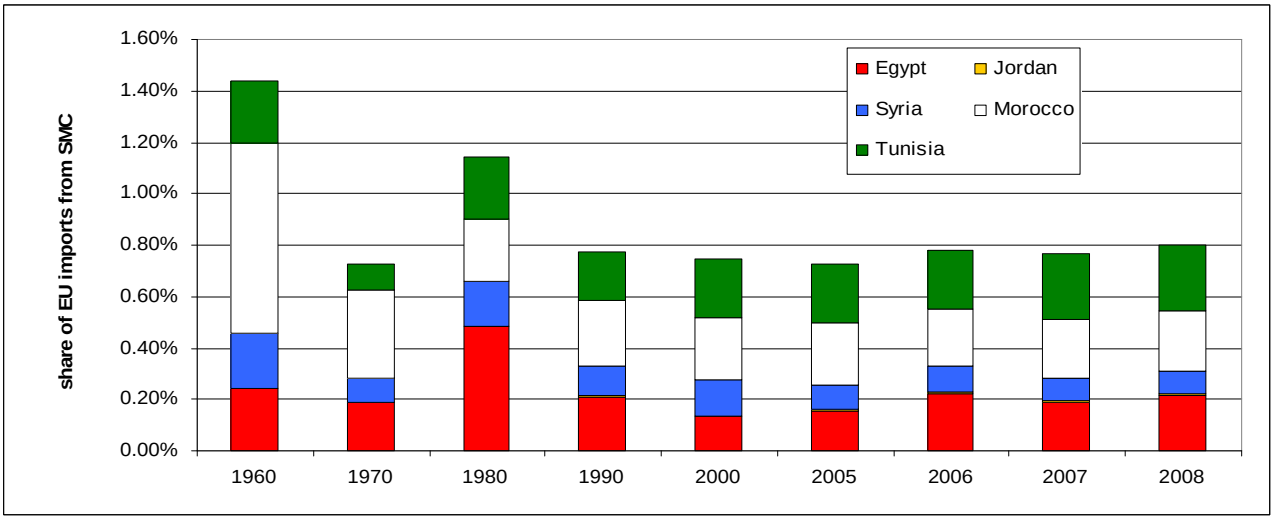
[22] OECD data are not available for the EU27. However, the results do not change substantially since Egypt's main European trading partners belong to the EU15.

Figure 2.1 Shares of trade between the EU15 and selected Med-countries.



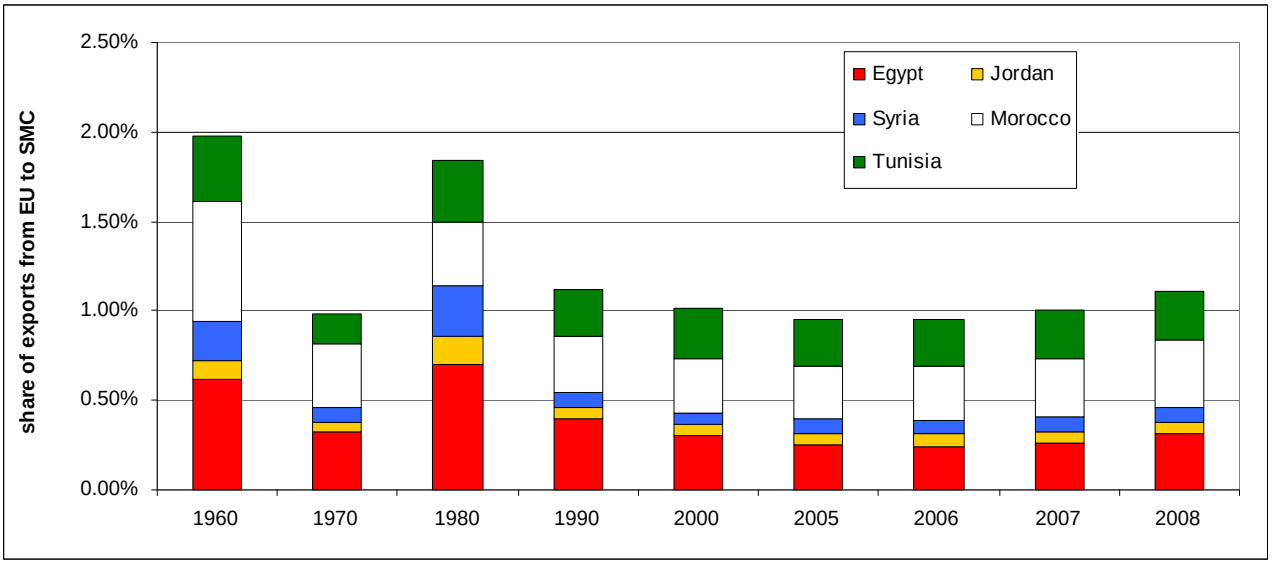
Source: OECD.

Figure 2.2 Shares of EU15 import from selected Med-countries.



Source: OECD.

Figure 2.3 Shares of EU15 export toward selected Med-countries.



Source: OECD.

In more recent times, the EU launched the so-called Barcelona Process[23], whose aim is to "establish a common area of peace, stability, and shared prosperity in the Mediterranean region" and therefore goes well beyond trade.

From the economic point of view, one important goal was to create a free trade area in the Mediterranean region by 2010. In this new framework, the EU signed bilateral agreements with each of the southern Mediterranean countries, except Libya that did not join the Partnership, Turkey that signed a customs union, and Syria that is still negotiating her agreement.

The first agreement was signed with Tunisia in July 1995 and entered into force in March 1998. It has been the landmark for all the following deals, including the one with Egypt, which was signed in June 2001 and entered into force in June 2004.

Article 1 states the main objectives of the agreement:

- development of close political relations between the EU and Egypt;
- progressive liberalization of trade in goods, services and capital;
- promoting balanced economic and social relations between the EU and Egypt;
- fostering the economic and social development of Egypt;
- consolidating peaceful co-existence and economic and political stability;
- encouraging cooperation in all areas of mutual interest.

It is only with Article 6 that the document starts dealing with trade issues, thus confirming that more commitments other than free trade are required to the parties in order to fulfil the agreement.

Finally, the EU agreements also deal with financial transfers towards Egypt, not only supporting project financing but also providing resources to modernise the economy and to help reducing the negative effects of trade liberalisation.

2.6 Trade between Egypt and the EU in the 2000s.

As of 2008, Egypt's main European trading partners were Italy, Germany, Spain, and France. However, the value of trade with Egypt was negligible if compared with other countries like China or the United States. The yearbook on external and intra-European Union trade shows that in 2008 China, the US and Russia represented 40% of total EU-27 imports and 33% of exports[24].

Egypt ranked 24th and 36th respectively among the importers from and exporters to the EU-27, improving the 2003 ranking where it was placed 29th and 37th.

In fact, in 2008 the amount of goods imported by Italy from the US was tenfold the imports from Egypt and the proportion for exports was four to one. Similar data hold for the other Egypt's

[23] More precisely, we are referring to the Euro-Mediterranean Partnership, that was launched at a Euro-Mediterranean Foreign Ministers meeting in Barcelona in November 1995.

[24] External and intra-EU trade - statistical yearbook. Data 1958-2008.

European trade partners, as shown in Table 2.1. All countries except Spain are net exporters to Egypt.

Table 2.1 Amounts traded by Egypt's main European partners as of December 2008.

	PARTNER COUNTRY					
	Import € / 1,000,000			Export € / 1,000,000		
	Egypt	China	United States	Egypt	China	United States
Italy	2,247.14	23,600.12	11,798.03	2,905.57	6,444.26	23,038.14
Germany	1,063.64	51,461.39	34,360.97	2,718.35	34,036.95	71,081.80
Spain	1,556.79	17,108.07	9,569.50	664.21	2,131.88	7,486.31
France	898.25	19,165.13	20,616.85	1,199.50	8,978.72	23,755.13
UK	752.80	32,705.60	37,441.33	1,148.67	6,106.71	43,239.32

Source: Eurostat.

If one considers quantities, however, things change considerably (Table 2.2). All countries except UK are net importers from Egypt and the comparison with China and the US is less unfavourable. For example, the quantity of goods imported by Italy from the US in 2008 was only twofold the imports from Egypt, while the proportion for exports was still four to one.

Table 2.2 Quantities traded by Egypt's main European partners as of December 2008.

	PARTNER COUNTRY					
	Import 100_Kg			Export 100_Kg		
	Egypt	China	United States	Egypt	China	United States
Italy	45,953,543	95,866,045	111,681,764	16,051,531	22,312,389	72,159,168
Germany	14,778,945	102,792,200	76,891,159	6,975,585	55,377,614	99,027,060
Spain	41,813,816	91,105,519	110,764,315	4,927,410	18,569,703	49,239,506
France	18,692,815	45,597,794	80,563,385	9,612,752	16,191,841	54,693,538
UK	5,606,525	78,185,470	95,606,341	9,985,780	37,349,410	204,304,716

Source: Eurostat.

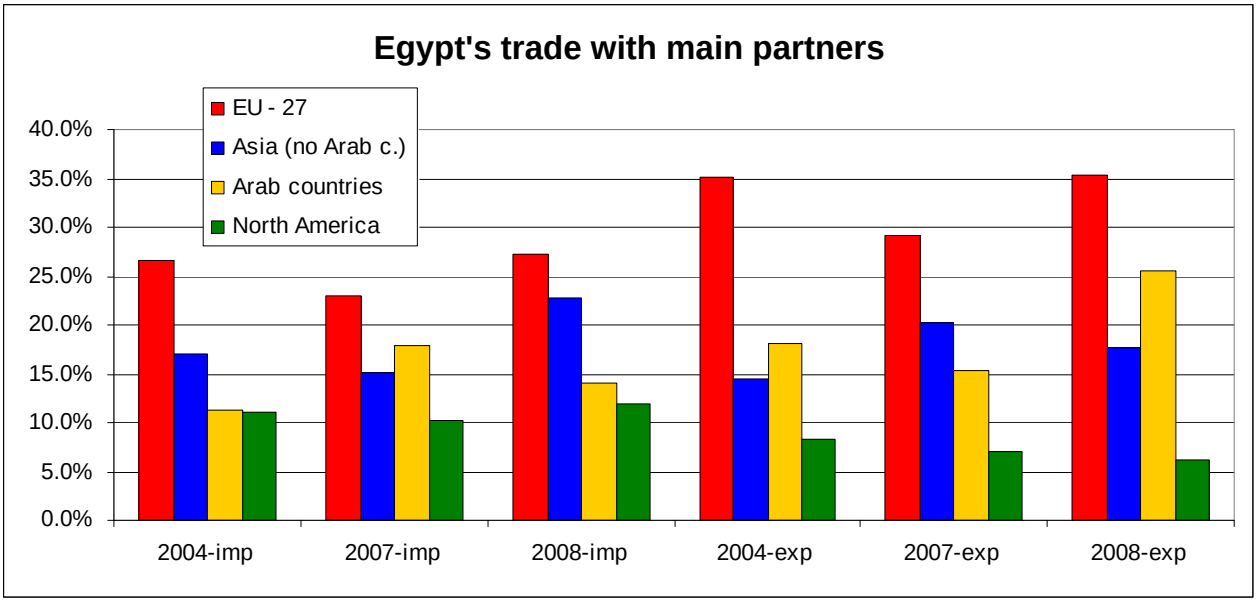
From Egypt's point of view, instead, in 2008 the EU was the main trading partner, representing the 35% of exports and the 55% of imports, followed by Asia and the Arab countries. As shown in Table 2.3 and Figure 2.4, trade with all partners is growing at a fast rate in the 2000s, however the relative importance of North America is decreasing in the exports.

Table 2.3 Amounts traded by Egypt with her main partners for selected years.

PARTNER COUNTRY	Import $ / 1,000,000			Export $ / 1,000,000		
	2004	2007	2008	2004	2007	2008
EU - 27	3,425	6,209	14,396	2,700	4,703	9,262
Asia (no Arab c.)	2,196	4,113	12,050	1,112	3,252	4,643
Arab countries	1,460	4,843	7,437	1,395	2,479	6,684
North America	1,426	2,745	6,318	639	1,135	1,597
World	12,838	27,063	52,916	7,676	16,161	26,204

Source: Egyptian Ministry of Trade and Industry.

Figure 2.4 Shares of Egypt's import and export with selected countries.



Source: Egyptian Ministry of Trade and Industry.

In the next part of this section, we will analyse in more details the components of the trade flows between Egypt and the EU using the data available in Eurostat.

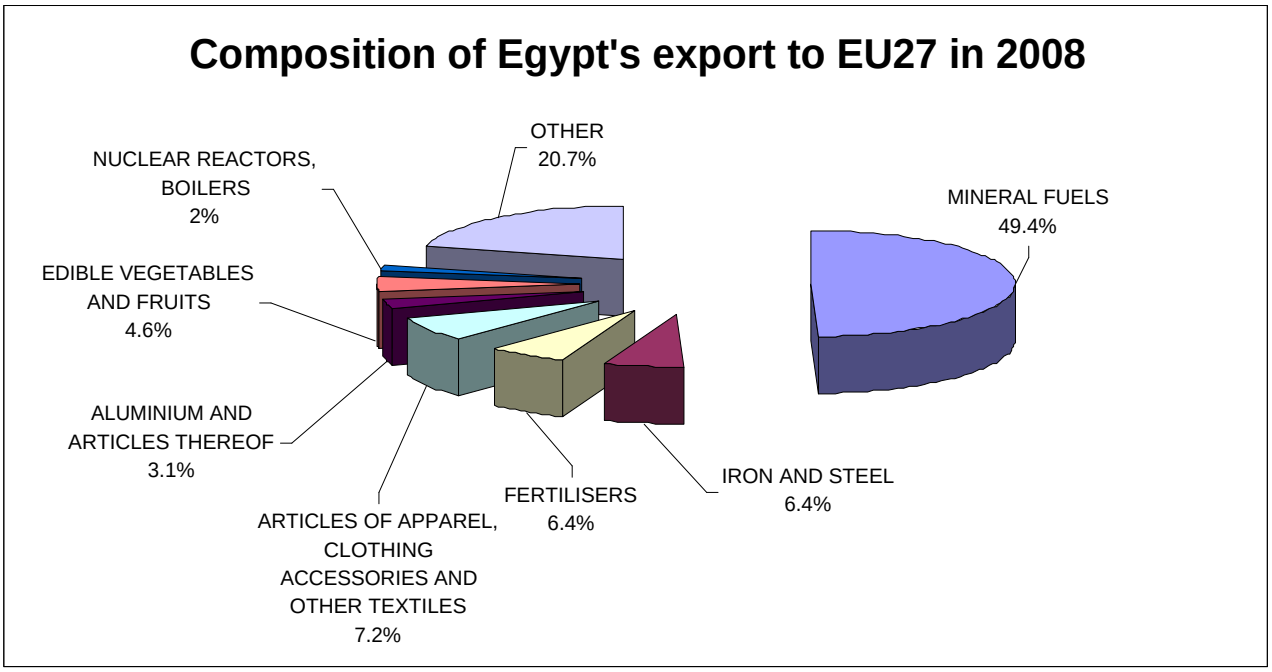
As of 2008, the most imported good was "Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes", that alone accounted for 45% in value and 66% in quantity. Spain and Italy contribute to the total imports of such good with a share of 33% each in value and 41% and 29% respectively in quantity. Within this category, Spain and France were importers of "Natural gas, liquefied", while Italy and Germany imported "Petroleum oils".

After mineral fuels, "Fertilizers" were mainly imported by France and were the second most imported good. However, they were only less than 7% in value and 10% in quantity. A wide range of items in the categories "Iron and steel", "Electrical machinery", "Aluminium and articles

thereof" were also imported but their contribution to the total imports was negligible, at around 3% to 5%.

Yet summing up the categories related to clothing and textiles, they are as much important as Fertilizers. In fact, they reached 7.2% in 2008, as is shown in Figure 2.5.

Figure 2.5 Composition of Egypt's export to EU27.



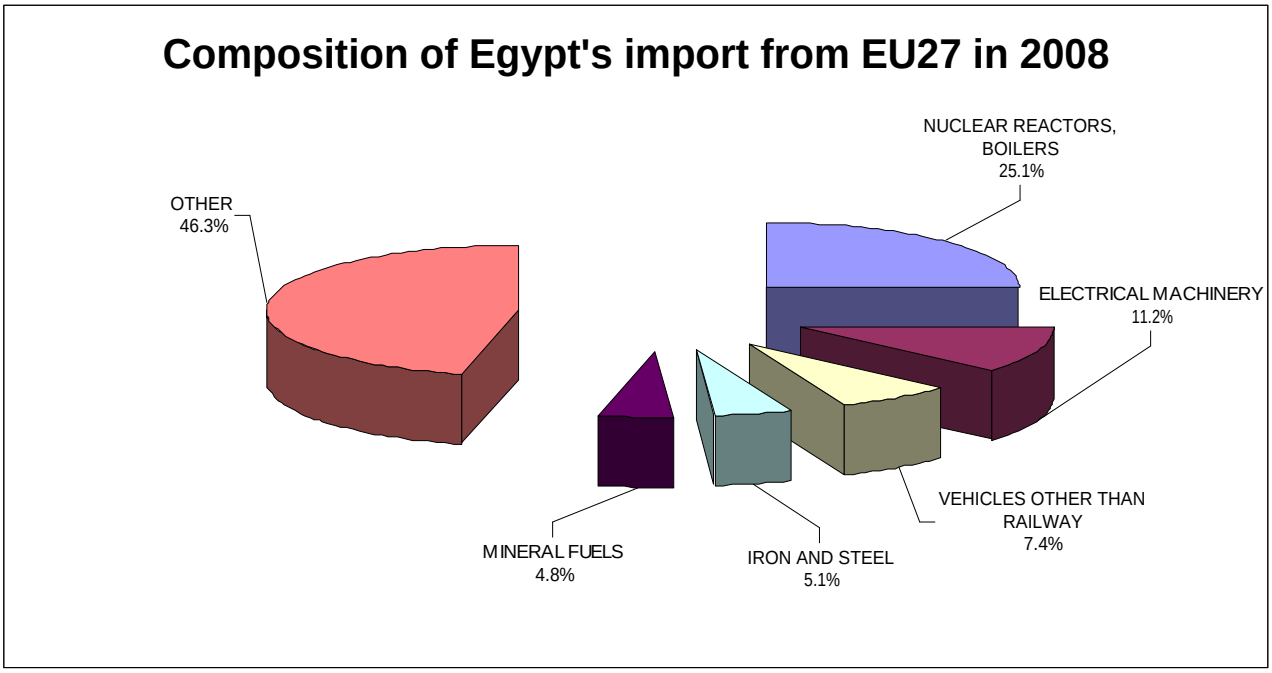
Source: Eurostat.

Export toward Egypt was much more variegated: 29% in value came from "Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof", of which 43% due to Italy's trade. This category has a very wide range of items from "Parts of gas turbines" and "Appliances for pipes, boiler shells and the like" corresponding to the 16%, to machineries for different industrial appliances and household applications.

At around 10% in value were "Electrical machinery and equipment and parts thereof" and "Vehicles other than railway or tramway". For this last good, Germany counted for 74% with the items "Motor cars", "Special purpose vehicles" and "Road tractors".

Though, the leading exported goods in terms of quantities were: "Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes" (Italy represented 87% of the total quantities exported by the five countries, with the items "Medium oils" and "Petroleum oils"); "Iron and steel" (72% came from UK's trade of "Waste and scrap of iron and steel"); "Cereals" (91% came from France's trade of "Wheat and meslin"). These items corresponded respectively to 16%, 15.9% and 11.75% of the total. Figure 2.6 shows the details.

Figure 2.6 Composition of Egypt's import from EU27.



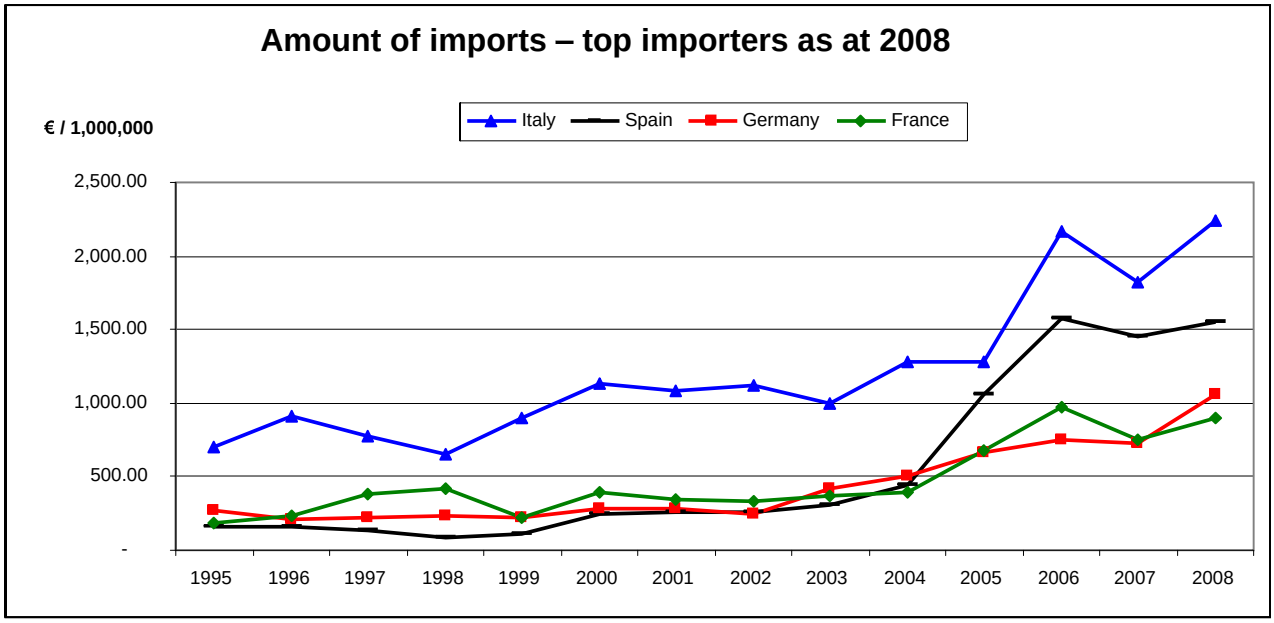
Source: Eurostat.

Looking at the previous years, Figure 2.7 shows for all countries a sharp increase in imports from Egypt since 2005. Particularly remarkable is the trend for Spain, that, starting from the lower levels of Germany and France, almost reached Italy. This performance is entirely due to her imports of mineral fuels and oils, that jumped from € 96 mln in 2004 to € 719 mln in 2005 (20% and 65% of imports respectively), and particularly to natural gas, imported for the first time just in 2005.

Also notable is the behaviour of Greece (not shown in Figure 2.5): in 1996 her imports were at the level of UK, well above Germany and Spain. Thereafter, it started a decreasing trend, moving away from the top five, because of the falling imports of mineral fuels, not covered by the fast increasing imports of iron and steel.

In general, mineral fuels and oils has always been the most imported good and their importance improved in the first half of the 2000s, exactly where the graph shows the increasing trend.

Figure 2.7 Trend of the import for Egypt's main European partners.



Source: Eurostat.

As regard exports, only Italy and Germany improved their volumes since 2007, more than two years after the Agreement came into force (Figure 2.8).

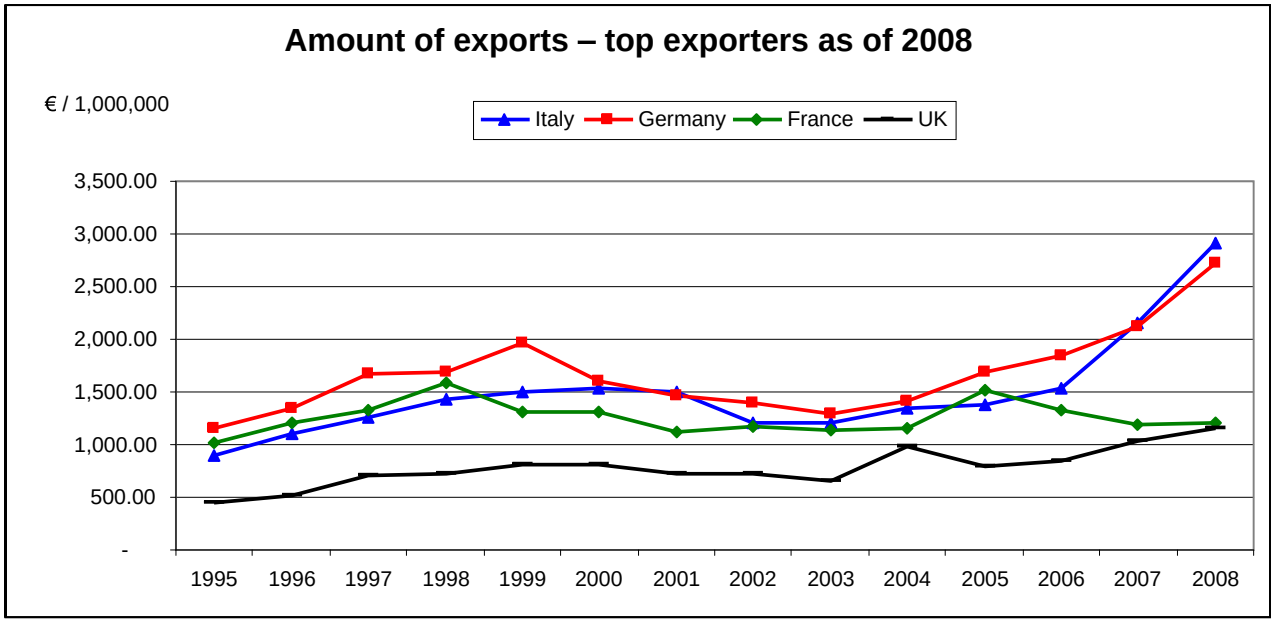
In the years running from 1995 to 2008, Germany increased its exports by 2.4 times from € 1,137 mln to € 2,725 mln, the leading items being the wide category of "nuclear reactors and boilers" (30% of the total value, constant over the years); "vehicles" (at around 20% in value, with growth rates between 20% and 30% since 2004 and 77% in 2008); "electrical machinery" and "optical and photographical appliances".

In the same time period, Italy performed an increase of total exports of 3.2 times from € 909 mln to € 2.909 mln, mainly due to "nuclear reactors and boilers" (at around 35% of total exports); "electrical machinery" and "articles of iron and steel" (between 8% and 10% respectively). Mineral fuels" jumped from € 7.6 mln in 1995 to € 381,6 mln in 2008, thus becoming since 2006 the second most exported good with a share of 13% on the total value.

For UK's exports, leaving aside the leading item "nuclear reactors and boilers", "iron and steel" showed a very significant growth since 1995, from € 14.2 mln and a share of 35 of total exports to € 177.8 mln and a share of 15%.

Finally, what was determinant in the decreasing trend of France's exports since 2006 was the category "aircraft, spacecraft, and parts thereof". Indeed, the exports of such good fell sharply after a peak in 2005 and was null in 2008.

Figure 2.8 Trend of the export for Egypt's main European partners.



Source: Eurostat.

The top trade partners already had a consolidated relationship with Egypt. What may be of further interest is the behaviour of the eastern European countries (EEC). Some of these countries were very close to Egypt in the 1960s, and not only from the economic viewpoint, if one considers the number of Egyptian doctoral students sent to these countries.

Contrary to the case of the countries just analysed, the top five EEC trading partners were all net exporters to Egypt in 2008. However, the amounts traded were absolutely negligible if compared with the other Egypt's European trading partners. As is evident in Table 2.4, ECC trade was particularly addressed towards Germany and Italy, ranging from 55% of Romania's imports to 16% of Slovenia's exports.

Table 2.4 Amounts traded by Egypt's EEC main trading partners as of December 2008.

	PARTNER COUNTRY					
	Import € / 1,000,000			**Export € / 1,000,000**		
	Egypt	Germany	Italy	Egypt	Germany	Italy
Romania	64.4	9,406.5	6,618.4	185.7	5,532.9	5,217.5
Hungary	8.2	18,828.3	3,162.2	176.1	19,577.9	3,997.0
Czech Republic	12.9	29,220.0	3,971.3	160.6	30,483.8	4,620.8
Poland	29.6	40,550.9	8,932.4	154.0	29,020.6	6,925.8
Slovenia	9.5	4,318.2	4,159.6	92.4	4,332.0	2,704.1

Source: Eurostat.

In the following two graphs (Figure 2.9 and Figure 2.10) we analyse the trends of trade between Egypt and its main partners among the Eastern European countries, in order to assess whether some

significant changes occurred after the 2004 Trade Agreement. Recall that Czech Republic, Hungary, Poland and Slovenia joined the EU in January 2004, and Romania did in January 2007.

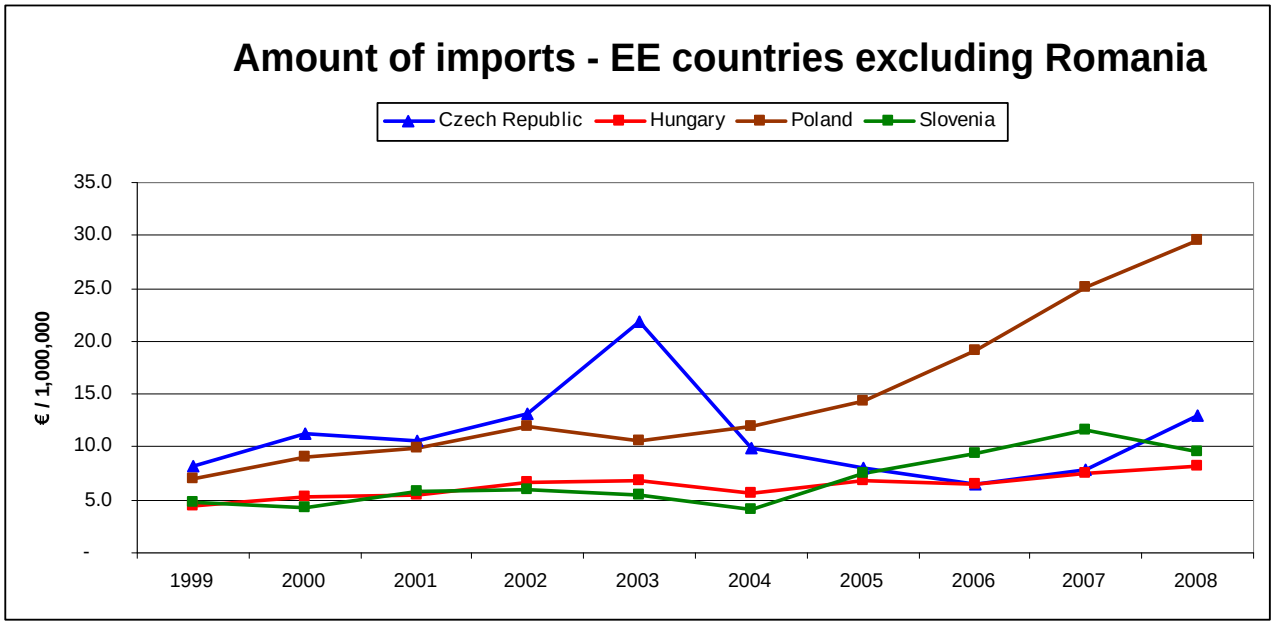
While for the Western European countries the effect of the Agreement should influence only exports towards Egypt - since the EU market was already open to the Egyptian goods - the EEC countries' trade could be affected on both sides: the entry in the EU opened their markets to the Egyptian exports and the entry into force of the Trade Agreement allowed exports towards Egypt.

Although Romania emerged as the main importer in 2008, with "Cereals", "Pharmaceutical products" and "Mineral fuels and oils", yet the data shows a weaving trend, due to an highly irregular import of Mineral fuels and oils. In many years (2000, 2002, 2003, 2004 and 2008) data are missing as if there were no imports of such good, but in 2006 a sudden jump brought imports of such item at 60% of total imports.

Excluding Romania, the trend for the remaining countries is much more regular, showing an interesting increase since 2004, especially evident for Poland. For this country, "Plastics and articles thereof" represented 49% of imports already in1999, but since 2004 new items were added to the list of goods imported from Egypt, leaving Plastics with a share of just 12.5% in 2008: "Edible preparations" (15%, achieving 22% if we also consider "Edible vegetables"), "Pharmaceutical products" (6%), "Carpets" (7%).

Hungary and Czech Republic's most imported item was cotton while Slovenia increased the imports of edible fruit and vegetables and plastic at the expense of cotton. The peak of the Czech Republic imports shown in Figure 2.7 for the year 2003 was entirely related to the purchase of aeroplanes, that did not happen in the previous or following years.

Figure 2.9 Trend of the Eastern European Countries' import from Egypt.



Source: Eurostat.

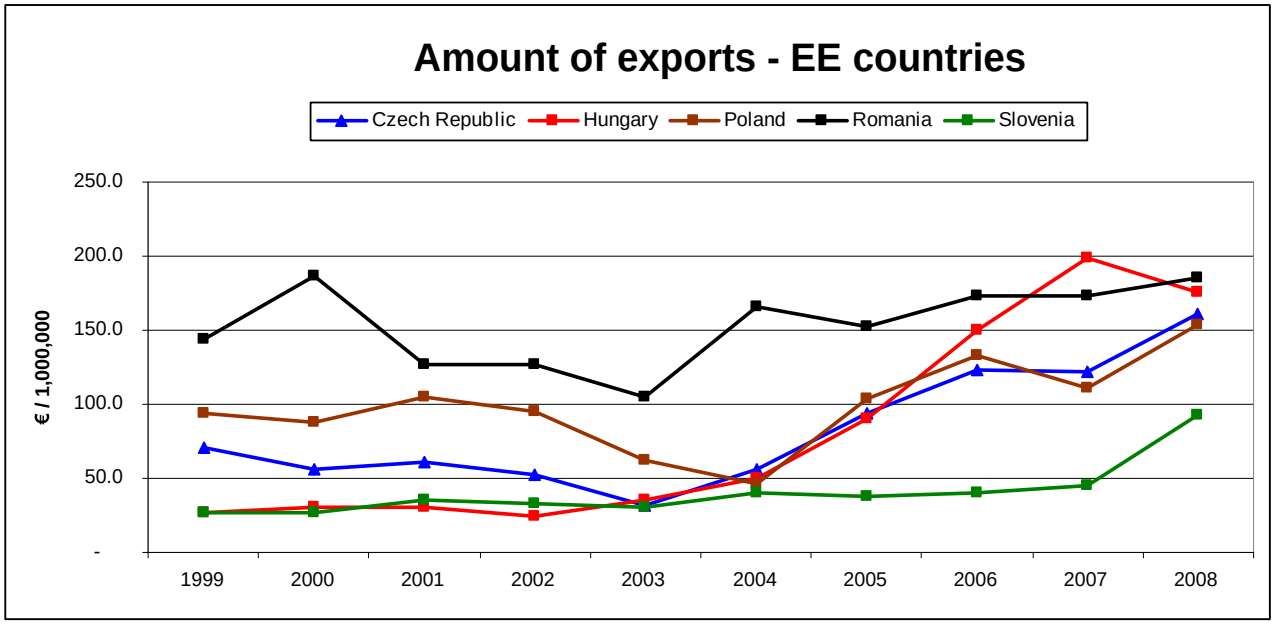
In terms of amounts traded, Romania is Egypt's main Eastern European partner. Similarly to imports, Romanian exports relied on a single article, "Wood", that represented 30% of exports in 1999, reaching 41% in 2008. "Vehicles" and "Iron and steel" followed with a share of about 11% and 7% respectively.

The impressive trend of Hungarian exports since 2004 was connected to a sharp increase in the article "Electric machinery, sound reproducers, television image reproducers" that multiplied by almost eight times in three years and counted for 72% of total exports in 2008. It is interesting to see that at H6 level, the growth was initially due to "Transmission apparatus for radio and television", but in 2005 this item was totally replaced by the new entry "Telephones for cellular networks" Also increasing, although not comparable in the magnitude of the growth, was "Nuclear reactors and boilers", representing only 14% of exports as second most exported item.

Poland's exports were supported by "Mineral fuels and oils" (minimum share of exports 11% in 2007, maximum share 38% in 2002). Unfortunately, data at H6 level are available only since 2004, showing "Bituminous coal" as leading item until 2006, then replaced by "Medium oils".

Data for the Czech Republic show a growing trend since 2004 for the two leading goods "Vehicles" and "Nuclear reactors and boilers". The former multiplied by six times since 1999 and represented the 32% of exports in 2008, while the latter showed a twofold increase in the same time period and were equivalent of 26% of exports in 2008.

Figure 2.10 Trend of the Eastern European Countries' export to Egypt.



Source: Eurostat.

After exploring the qualitative composition of Egypt's imports and exports, we propose in the next Section an econometric investigation on the causal relationship between trade and GDP and a survey of the results of previous empirical works.

2.7 An econometric analysis of the Egyptian trade: Previous empirical evidence[25]

The empirical part of this paper we will try to assess whether the Export-led Growth (ELG) hypothesis is valid for Egypt.

From the theoretical point of view, exports expansion can stimulate growth directly as a component of aggregate output, or indirectly through a more efficient allocation of resources, the adoption of technological improvements to face foreign competition, or economies of scale. The country's comparative advantage theory assumes that when the domestic markets are too small, the appropriate scale can be achieved with an expansion towards foreign markets.

Moreover, the foreign exchange deriving from exports allows the import capital goods and intermediate goods that raise the growth of capital formation and thus boost the economic growth.

The studies on pooled data usually support the ELG hypothesis. They are conducted using different notions of exports and growth. Particularly, since the results may be spurious due to exports being part of GDP, alternative measures of exports are used, for instance real manufactured exports earnings (Tyler, 1981) or share of changes in exports in GDP (Feder, 1983).

Some other works also run a regression on a complete production function, thus considering economic fundamentals such as capital, labour and foreign investments (Papanek, 1973; Balassa, 1978 and 1985).

Empirical works focused on the causal relationship started in the late 1980s with the application of the standard Granger causality test to time series (Jung and Marshall, 1987; Chow, 1987; Dodaro, 1993), but unfortunately the results were contradictory, even when related to the same country.

This may be due to the use of different variables or time intervals. However, critics point out that the limit in those early works was the arbitrary choice of the lag length and the failure in testing the cointegration properties of the variables (Bahmani-Oskooee at al., 1991 and Bahmani-Oskooee – Alse, 1993). Sure enough, the Granger causality test is valid only if the time series are not cointegrated.

The Bahmani-Oskooee – Alse study is also the first work that uses an error-correction model to assess causality. Such model allows for the long-run effect that is otherwise neglected when first differences are used to correct for non-stationarity.

[25] A complete survey of the empirical literature on the ELG and the GLE theory can be found in Giles and Williams, 2000.

Some researches grouped developed and developing countries or focused on geographic proximity, analysing South Eastern Asia (Islam, 1998), or North Africa and Middle East (Abu-Qarn, 2001 for MENA countries; Alsuwaidi, 1997 for Egypt; Elbeidy, 2010 for Libya), or Latin America (Arnade and Vasavada, 1995). The ASEAN countries particularly are considered with great interest since they performed impressive economic growth combined with trade openness, thus they are often perceived as a good example of export-led growth. Nevertheless, some scholars suggest that this is such a particular experience that cannot be interpreted as a general support for the ELG hypothesis (Buffie, 1992).

In recent studies, pretesting for unit roots and cointegration has become standard practice, in combination with more advanced econometric techniques, developed to deal specifically with time series. In spite of the adoption of standard practices, the results are not in favour of a specific theoretical hypothesis. Moreover, the increasing interest in single country case studies seems to support the concept that the results of an economic policy are strictly connected with the specific conditions of each country.

Among the studies conducted on Egypt, Alsuwaidi (1997) modeled a VEC on cointegrated variables and found support for the Growth-led Export (GLE) hypothesis, while Abustait (2005) could not refuse the opposite ELG hypothesis. Abustait applied the standard Granger causality approach on cointegrated variables, and chose to divide the original time series (1977-2003) in two parts and conducted the analysis on the sub-period 1991-2003. The year of the structural reforms, 1991, was in fact considered as a break point in the series. Riezman et al (2005) found support for the ELG hypothesis only in bivariate analysis, while no causality was detected once including imports.

Abu-Qarn (2001) modelled a VECM for cointegrated variables and a SGC for non cointegrated variables and compared the results of some countries in the MENA region. He also worked with the variable exports of manufactured goods and controlled for imports, thus assessing positive causality from exports to GDP or bidirectional causality for countries with a high share of manufactured goods on total exports, like Israel, Morocco, Tunisia and Turkey. No causality was detected for Algeria, Jordan and Egypt. When using total exports though, no causality at all is found for any of the countries involved.

For Lybia, Elbeydi et al (2010) estimate a trivariate VECM on cointegrated GDP, exports and exchange rate and found evidence of bidirectional causality between GDP and exports. Since the economy of the country heavily rely on oil exports (accounting for 95% of exports and 30% to 40% of GDP), the case of Lybia cannot be directly compared with other countries of the same geographical area, and in fact it was not included in the AbuQarn's sample.

Moving to studies on other countries, the evidence is again mixed, although the econometric techniques follow the standard practice: bidirectional causality between exports and GDP for Greece (Dritsaki, 2004), evidence of ELG for Mexico in a multivariate approach (Van den Berg and Lewer, 2007), for Bangladesh between exports and industrial production (Al Mamun and Nath, 2005), for Japan, USA, Germany, UK in Marin (1992). Maneschiøld (2008) detected bidirectional causality for Argentina and ELG for Brazil. The time series for Mexico presented a break, thus it was divided into two sub-periods, with different results: ELG in the pre-break period and bidirectional causality in the post-break period.

In this paper we will apply the customary econometric techniques to assess causality and moreover we will account for possible breaks applying the Luetkepohl (2004) approach, that allows to work with the complete time series instead of dividing it into sub-periods.

The next section introduces to the methodology, data and results follow in the further section.

2.8 Methodology

A well-established procedure recommends to start testing for the stationarity of all the variables before studying the possible cointegration and causal relations (Toda and Phillips, 1993).

To check for unit roots on the levels of the variables we have conducted the Augmented Dickey Fuller test (ADF). Moreover, since the ADF test is sensitive to the number of lags and sometimes fails in assessing the stationarity of the variables, we have used the KPSS test as well, which tests the null hypothesis of stationarity.

If the variables are stationary in their first differences, or I(1), we can perform the cointegration analysis, to assess the long run relationship between the variables.

According to Engle and Granger (1987), two variables are said to be cointegrated of order one CI(1,1) if both are integrated of order one I(1) and there exists a stationary linear combination of the two that can be expressed by the following equations:

(1) $$y_t = a_0 + b_0 x_t + e_{0t}$$

(2) $$x_t = a_1 + b_1 y_t + e_{1t}$$

Although the EG test is widely applied in empirical works, it has been criticised, mainly because its two-step estimator allows possible errors from the OLS regression to affect the results of the second step. Furthermore, the procedure delivers only one cointegration equation. This is a shortcoming in cases with more than two variables, where the long-run relationship among them may be explained by more than one equation.

The Johansen's (1998) maximum likelihood estimator is a valid substitute for the EG procedure. It is based on an error correction model that embodies an error term, as expressed in equation (4):

(3) $$\Delta Y_t = \Phi D_t + \Pi Y_{t-1} + \Gamma_1 \Delta Y_{t-1} + ... + \Gamma_{p-1} \Delta Y_{t-p+1} + \varepsilon_t$$

where D_t contains deterministic terms (constant, trend, dummies), Π is the long-run impact matrix and the Γ_k are the short-run impact matrices. The system expressed in the equation above can include more than two variables. Indeed, a trivariate model with a third control variable improves the power of the analysis. Such practice is widely applied in recent works with the aim of overcoming the limits of previous causality analysis based on bivariate systems (see among others: Abu Qarn, 1995, for trade, Loizides, 2004, and Keshtkaran et al., 2012, for government expenditures).

The Johansen's maximum likelihood (λ-max) and trace tests determine the number of cointegrating vectors r under the null hypothesis that r = r*, the cointegrating rank, against the alternative of r = r* +1 for the λ-max test and of r ≥ r* + 1 for the trace test.

The step forward is the assessment of a causal relationship between the variables. The results of the cointegration analysis influence the choice of the correct model to use.

If the variables are cointegrated, a VECM (Vector Error Correction Model) should be used, in order to account for the long-run relationship.

If instead no cointegration is detected and the variables are I(1), we could implement a VAR in first differences and apply the Standard Granger Causality. Sure enough, the absence of the error correction term in the VAR model is not a shortcoming since we are dealing with variables that do not have any long term relationship (Toda and Phillips, 1993).

Unfortunately, the customary F-test and Wald test that determine the joint significance of specific variables included in a VAR are not valid for non-stationary processes, since the test statistics do not have a standard distribution.

The procedure developed by Toda and Yamamoto (1995) allows to implement a modified Wald statistics (MWALD) with an asymptotical standard Chi-square distribution. They suggest to estimate a VAR ($k+d_{max}$), where k is the optimal lag lengths of the system and d_{max} is the order of integration determined with the unit-root test. The optimal lag length, k, is determined according to Information Criteria (AIC or BIC). Thus, the Toda and Yamamoto (1995) methodology improves the power of the Standard Granger Causality approach and can be applied irrespective of the integration or cointegration properties of the variables. As proved in Rambaldi and Doran (1996), the MWALD test can be obtained estimating the model as a set of Seemingly Unrelated Regressions (SUR). This is the metholodogy followed in this paper for the Granger causality analysis.

In order to further improve the analysis, we have also performed the tests in a framework allowing structural breaks. First of all, Perron (1989) showed that if we account for structural breaks the

results of a plain unit-root test favourable to the unit-root hypothesis may be reversed in favour of the stationarity of the series.

In this paper we apply Zivot and Andrews' (l992) model C testing the unit-root hypothesis in the presence of structural breaks at an unknown point in time:

(4) $$\Delta y_t = c + \alpha y_{t-1} + \beta_t + \theta DU_t + \gamma DT_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t$$

Where DU_t is a dummy variable that takes value one for any point in time since the break date TB and zero otherwise (DU_t = 1 for t > TB, 0 otherwise) and DT_t is the corresponding trend shift variable, DT_t = t - TB for t > TB, 0 otherwise.

If the variables have the same order of integration, we will then move to the cointegration test, again considering the possible impact of structural breaks, and to a VEC model for the cointegrated variables. The procedure developed by Luetkepohl et al (2004) is based on the equation

(5) $$y_t = \mu_0 + \mu_1 t + \delta d_{t\tau} + x_t$$

Where the vector process y_t is generated by a constant μ_0, a time trend t with its vector of coefficients μ_1 and a dummy variable $d_{t\tau}$ with its vector of coefficients δ. The dummy variable is defined as $d_{t\tau}$=1 for $t \geq \tau$ and zero otherwise, with τ representing the shift point at unknown time.

For the estimation of the model we adopted the procedure implemented by Pfaff (2008).

In case of non cointegrated variables, we will estimate a VAR and adopt the Standard Granger Causality approach, testing for the presence of structural breaks with the help of the QLR test.

2.9 Data and results

We start the analysis of the data with the assessment of a causal relationship between GDP and Egyptian world exports.

All data are from the World Bank WDI from 1965 to 2007 and are expressed in current Egyptian pound that incorporate the effects of changes in prices, as in Pomponio (1996). The end date of 2007 allows us to avoid the effects of the world economic crises that started at the end of 2008.

The null hypothesis of unit-root is rejected in the first difference for all the variables, suggesting that the variables are stationary in their first difference, or I(1). In order to find a possible evidence of trends, the unit-root tests are performed either in the case "constant only" and "constant and trend", see Tables 2.5 and 2.5a, but no significant difference emerges from the two cases, except for l_GDP that cannot be clearly assessed as I(1) in the tests with trend. In Table 2.5a the column "time" shows that this variable is significant only in the tests in levels.

Table 2.5 ADF and KPSS tests for unit roots. Case with constant only.

Variables	Levels			First Differences		
	ADF t-stat	KPSS t-stat	lags	ADF t-stat	KPSS t-stat	lags
log_gdp	-0.98	1.19	3	-3.16	0.15	5
log merch_imp	0.22	4.32	0	-5.33	0.11	0
log merch_exp	0.91	0.84	5	-5.73	0.21	0
log manuf_imp	0.21	4.28	0	-4.87	0.13	0
log manuf_exp	0.81	4.29	0	-5.07	0.19	0
log goser_imp	-0.13	2.23	1	-4.68	0.11	0
log goser_exp	0.16	2.24	1	-3.67	0.09	5

Source: author's calculations. Lag lengths are determined with the General to Specific method.
The McKinnon critical values for 40 observations are -3.60 and -2.93 at the 1 and 5 percent significant level with constant only. The KPSS critical values are 0.739 and 0.463 and 0.347 at the 1 and 5 and 10 percent significant level with constant only.

Table 2.5a ADF and KPSS tests for unit roots. Case with constant and trend.

	Levels				First Differences			
Variables	ADF t-stat	KPSS t-stat	lags	time	ADF t-stat	KPSS t-stat	lags	time
log_gdp	-2.99	0.16	3	***	-3.18	0.14	5	
log merch_imp	-2.19	0.21	2	**	-5.30	0.11	0	
log merch_exp	-2.24	0.20	0	**	-3.70	0.06	4	
log manuf_imp	-2.17	0.36	1	**	-4.84	0.14	0	
log manuf_exp	-1.87	0.36	0	**	-5.15	0.06	0	
log goser_imp	-2.27	0.32	1	**	-4.63	0.12	0	
log goser_exp	-3.23	0.10	3	***	-3.62	0.07	5	

Source: author's calculations. Lag lengths are determined with the General to Specific method.
The McKinnon critical values for 40 observations are -4.20 and -3.53 at the 1 and 5 percent significant level with constant and trend. The KPSS critical values are 0.216 and 0.146 and 0.119 at the 1 and 5 and 10 percent significant level with constant and trend.

With all the variables being non-stationary in their levels and having the same order of integration, we can apply the cointegration techniques to assess a possible long-run relationship between GDP and exports**,** following Toda and Phillips (1993).

The graphical examination of the series involved in the analysis (see Appendix) suggests a linear trend in the cointegration relation, thus in the Johansen test procedure we have applied the so-called Case 3: Unrestricted constant. Exports are expressed in three different ways: total exports as the sum of exports of goods and services (Goser_exp), merchandises (Merch_exp), and manufactured goods (Manuf_exp).

Since we have a few observations, the appropriate number of lags has been determined with the estimation of a VAR in levels using the Schwarz Information Criteria (BIC) which in this case is more appropriate than Akaike's, and that is two for the variable Goser_exp and one for Merch_exp and Manuf_exp.

The evidence reported in Table 2.6 assesses cointegration only when imports are included as endogenous variable. We obtained similar results with Case 4, Unrestricted constant and restricted trend. For sake of completeness we also report the results of Case 2, Restricted constant, (see Tables 2.A and 2.B respectively, in the Appendix). Although in this latter case we detected cointegration also in the bivariate models, we decided to ignore the result, since the application of restrictions on the intercept does not seem appropriate given the drift shown by the variables.

Table 2.6 Johansen cointegration tests. Case 3: Unrestricted constant.

Cointegration vectors	Hypothesized number of coint. equations	lambda-max	critical value	trace	critical value	rank
l_gdp, l_goser_exp	None	10.1110	15.6700	10.1110	19.9600	0
	At most 1	0.0003	9.2400	0.0003	9.2400	
l_gdp, l_merch_exp	None	2.55	15.6700	2.99	19.9600	0
	At most 1	0.44	9.2400	0.44	9.2400	
l_gdp, l_manuf_exp	None	3.2807	15.6700	3.2974	19.9600	0
	At most 1	0.0167	9.2400	0.0167	9.2400	
l_gdp, l_goser_exp, l_goser_imp	None	35.46	22.00	39.52	34.91	1
	At most 1	4.02	15.67	4.06	19.96	
	At most 2	0.04	9.24	0.04	9.24	
l_gdp, l_merch_exp, l_merch_imp	None	30.45	22.00	37.07	34.91	1
	At most 1	5.21	15.67	6.62	19.96	
	At most 2	1.41	9.24	1.41	9.24	
l_gdp, l_manuf_exp, l_manuf_imp	None	42.5140	15.6700	48.4690	19.9600	1
	At most 1	5.3635	9.2400	5.9550	9.2400	
	At most 2	0.5915	9.24	0.5915	9.24	

The results obtained with the Johansen cointegration test allow us to estimate a Vector Error Correction Model (VECM) to detect a causal relation between the cointegrated variables, while in the absence of cointegration, a VAR model in first differences has to be estimated and the standard Engle-Granger causality analysis is performed.

In line with the previous analysis of the data, the VECM has been modelled with Unrestricted constant. However, since such option was chosen only under a graphical basis and given that we

detected cointegration in the bivariate models of Case 2 (Restricted constant), we have run the model also in the alternative cases of “restricted constant” and “unrestricted constant and restricted trend”.

A further difficulty in modelling is the choice of the appropriate number of lags. We have performed the ECM with an initial time lag of two, that is the minimum lag to allow for the short-term effects, up to a maximum time lag of four. Table 2.7 shows the results of the VECM procedure for the case 3: Unrestricted constant. The results of the other cases can be found in the Appendix, Tables 2.C and 2.D. Following Dritsaki at al (2004), the models that better fit the data have been selected according to the best combination of the Durbin-Watson test for the residuals autocorrelation, the Doornik-Hansen test for the normality of the residuals, and the Schwarz Information Criterion (BIC). The appropriate lag length is two in each model.

According to Granger, a significant error correction term is an indicator of a causality relationship from the explanatory variable to the dependent variable.

However, in the case of multivariate models, like those exposed in Table 2.7, it is impossible to tell which of the two explanatory variables determines the causality relationship.

Since the error correction term is never statistically significant in the models with exports as the dependent variable, we can conclude that growth does not promote exports, whatever their definition.

Instead, the models detect causality from exports and imports to GDP, thus supporting the ELG hypothesis. The error correction term is always significant and has a negative sign, which suggests a long-run adjustment process towards the equilibrium. However, when exports are expressed as manufactured goods, the Doornik-Hansen test does support the hypothesis of the normality of the residuals only at the 10% percent critical value (p-value = 0.056). Therefore, we should be careful in drawing conclusions.

The error correction term is also significant in the equations with imports as the dependent variable, so we can detect a bidirectional relation of causality among the three variables.

With the differenced variables not significant, we do not find any evidence of short-run causality.

Table 2.7 Trivariate VEC model for causality test. Case III "Unrestricted constant".

Export as the sum of Goods and Services						
Independent Variables	ΔlogGDP	Significance: 1%: ***	ΔlogGOSER_EXP	Significance: 1%: ***	ΔlogGOSER_IMP	Significance: 1%: ***
constant	0.143	***	-0.039		-0.166	*
ΔlogGDP_1	0.139		0.953	*	1.638	***
ΔlogGOSER_EXP_1	0.005		0.082		-0.275	
ΔlogGOSER_IMP_1	0.020		0.263		0.547	**
EC	-0.095	***	0.060		0.226	**
BIC	-4.646		-4.646		-4.646	
Durbin -Watson	1.970		1.834		1.880	
Doornik Hansen (p-value)	48.598 (0.000)		48.598 (0.000)		48.598 (0.000)	
Export as Merchandises						
Independent Variables	ΔlogGDP	Significance: 1%: ***	ΔlogMERCH_EXP	Significance: 1%: ***	ΔlogMERCH_IMP	Significance: 1%: ***
constant	0.416	***	0.002		-1.402	***
ΔlogGDP_1	0.230		0.343		1.910	***
ΔlogMERCH_EXP_1	0.042		0.058		0.101	
ΔlogMERCH_IMP_1	0.014		-0.017		0.312	**
EC	-0.099	***	0.030		0.384	***
BIC	-2.999		-2.999		-2.999	
Durbin -Watson	1.968		1.996		1.843	
Doornik Hansen (p-value)	17.957 (0.006)		17.957 (0.006)		17.957 (0.006)	
Export as Manufactures						
Independent Variables	ΔlogGDP	Significance: 1%: ***	ΔlogMANUF_EXP	Significance: 1%: ***	ΔlogMANUF_IMP	Significance: 1%: ***
constant	0.782	**	-1.058		-3.302	***
ΔlogGDP_1	-0.010		0.224		2.448	***
ΔlogGDP_2	-0.041		0.778		0.474	
ΔlogMANUF_EXP_1	0.070	*	0.130		0.041	
ΔlogMANUF_EXP_2	-0.030		-0.179		-0.310	***
ΔlogMANUF_IMP_1	0.006		-0.010		0.553	***
ΔlogMANUF_IMP_2	0.053		-0.043		0.105	
EC	-0.194	**	0.331		0.903	***
BIC	-2.500		-2.500		-2.500	
Durbin -Watson	1.931		1.725		1.459	
Doornik Hansen (p-value)	12.241 (0.056)		12.241 (0.056)		12.241 (0.056)	

Significance levels: 1% (***), 5% (**), 10% (*). EC is the error correction term.

For the variables that are not integrated according to Johansen, we can apply the Standard Granger Causality (SGC) analysis and estimate three bivariate VAR(1) models, with lag lengths determined with the Schwarz Information Criteria.

Yet, given the critics moved to such an approach, we have also adopted the Toda and Yamamoto methodology and have run a VAR ($k+d_{max}$) model in levels. All the variables are I(1), thus d_{max} is one, while the optimal lag length, k, is chosen according to the Schwarz criterion (BIC) and results

to be one for the model with GDP and GOSER_EXP and two for the remaining variables MERCH_EXP and MANUF_EXP.

Therefore, we have run a bivariate VAR(3) in logs with the variables GDP and GOSER_EXP and two bivarate VARs(2) in logs for GDP and MERCH_EXP and MANUF_EXP.

The models are implemented following the Seemingly Unrelated Regression (SUR) as in Rambaldi and Doran (1996).

Since we are dealing with data expressed in current values, we have modelled a second series of VARs with a time trend, which is significant in almost all regressions although it does not change the outcome considerably. The results of the Granger causality test are set out in Tables 2.8 and 2.9 and 2.9b.

Table 2.8 Standard Engle-Granger causality analysis. VAR model in first differences.

	Dependent variable: dl_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from export to gdp	Dependent variable: dl_GOSER_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to export
VARIABLES						
Constant	0.069	***		0.020		
ld_gdp_1	0.451	**		0.713		
ld_goser_exp_1	0.062			0.275	**	
R-squared	0.305			0.305		
Durbin-Watson	2.223			2.223		
F-test (1,39)	0.938	(0.339)	NO CAUSALITY	2.531	(0.120)	NO CAUSALITY
	Dependent variable: dl_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from export to gdp	Dependent variable: dl_MERCH_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to export
VARIABLES						
Constant	0.068	***		0.107		
ld_gdp_1	0.539	***		0.242		
ld_merch_exp_1	-0.011			0.074		
R-squared	0.288			0.015		
Durbin-Watson	2.302			1.983		
F-test (1,39)	0.031	(0.861)	NO CAUSALITY	0.297	(0.589)	NO CAUSALITY
	Dependent variable: dl_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: dl_MANUF_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
Constant	0.067	***		0.177	***	
ld_gdp_1	0.494	***		-0.206		
ld_manuf_exp_1	0.042			0.100		
R-squared	0.307			0.008		
Durbin-Watson	2.286			1.731		
F-test (1,39)	0.742	(0.394)	NO CAUSALITY	0.147	(0.703)	NO CAUSALITY

Table 2.9 Granger causality test (Toda and Yamamoto approach as implemented by Rambaldi and Doran) – without trend.

CASE NO TREND	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_GOSER_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	0.243			-0.633		
l_gdp_1	1.274	***		1.220	***	
l_gdp_2	-0.077			-1.475	**	
l_gdp_3	-0.242			0.490		
l_goser_exp_1	0.082			1.160	***	
l_goser_exp_2	-0.106			-0.282		
l_goser_exp_3	0.064			-0.101		
Sum of lagged coefficients	0.047			0.236		
MWald test	1.931	(0.587)	NO CAUSALITY	10.433	(0.015)	YES
	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MERCH_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	0.085			-0.353		
l_gdp_1	1.531	***		0.291		
l_gdp_2	-0.548	***		-0.166		
l_merch_exp_1	-0.005			1.011	***	
l_merch_exp_2	0.023			-0.129		
Sum of lagged coefficients	0.018			0.125		
MWald test	0.461	(0.794)	NO CAUSALITY	2.008	(0.366)	NO CAUSALITY
	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MANUF_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	0.053			-0.973		
l_gdp_1	1.494	***		-0.231		
l_gdp_2	-0.487	***		0.418		
l_manuf_exp_1	0.039			1.007	***	
l_manuf_exp_2	-0.047			-0.173		
Sum of lagged coefficients	-0.008			0.187		
MWald test	1.337	(0.513)	NO CAUSALITY	3.554	(0.169)	NO CAUSALITY

Table 2.9b Granger causality test (Toda and Yamamoto approach as implemented by Rambaldi and Doran) – with trend.

CASE WITH TREND	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_GOSER_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	2.167	**		5.376	**	
trend	0.015	**		0.047	***	
l_gdp_1	1.241	***		1.117	***	
l_gdp_2	0.018			-1.176	*	
l_gdp_3	-0.382	**		0.052		
l_goser_exp_1	0.030			0.997	***	
l_goser_exp_2	-0.084			-0.214		
l_goser_exp_3	0.077			-0.061		
Sum of lagged coefficients	0.023			-0.006		
MWald test	1.617	(0.656)	NO CAUSALITY	9.640	(0.022)	YES
	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MERCH_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	2.067	**		8.478	**	
trend	0.015	**		0.067	***	
l_gdp_1	1.487	***		0.094		
l_gdp_2	-0.569	***		-0.262		
l_merch_exp_1	-0.034			0.879	***	
l_merch_exp_2	0.019			-0.146		
Sum of lagged coefficients	-0.015			-0.167		
MWald test	0.615	(0.735)	NO CAUSALITY	1.9292	(0.165)	NO CAUSALITY
	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MANUF_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	1.870	**		4.649		
trend	0.014	**		0.043		
l_gdp_1	1.425	***		-0.445		
l_gdp_2	-0.495	***		0.390		
l_manuf_exp_1	0.032			0.990	***	
l_manuf_exp_2	-0.052			-0.190		
Sum of lagged coefficients	-0.020			-0.054		
MWald test	2.1683	(0.338)	NO CAUSALITY	3.12472	(0.077)	NO CAUSALITY

With the SGC approach (Table 2.8) we do not detect any causality between the variables. The result is confirmed with Toda and Yamamoto (Tables 2.9a and 2.9b), except for the case GDP Granger-cause GOSER_EXP where we identify causality with the 5% significance. This is somehow evident also in Table 8 if we notice that the direction of causality from GDP to GOSER_EXP has the lowest p-value (0.120), although this result is not significant from the statistical point of view.

Things do not change when the causality analysis includes a trend, as expressed in Table 2.9b. Previous works using bivariate SGC found support for the ELG hypothesis (Sharma and Dhakal, 1994, and Riezman et al, 1996), while others detected causality only from GDP to exports (Alsuwaidi and Al Shamsi, 1997). These studies do not apply the Toda and Yamamoto approach, therefore their results are comparable with the first part of our SGC analysis as expressed in Table 8, where we detected no causality. The different results may be due to a different length of the time series, that in the cited works extend from 1960 to the early 1990s, while we reached 2010.

The changes in the trade strategy of the 1970s and the important economic reforms introduced since the 1990s suggest however to improve the analysis controlling for possible structural breaks.

Table 2.10 below shows the results of the Zivot and Andrews (1992) unit root test.

All the variables are I(1), therefore we can proceed with the study of the cointegration properties of the variables.

Table 2.10 Zivot and Andrews test for unit roots. Case with trend.

Variables	Levels		First Differences		
	t-statistics	lags	t-statistics	lags	Break year
log_gdp	-3.28	3	-8.92	5	1973
log merch_imp	-3.56	0	-6.62	0	1973
log merch_exp	-4.39	5	-5.94	0	1997
log manuf_imp	-3.59	0	-6.38	0	1969
log manuf_exp	-2.30	0	-5.34	0	2006
log goser_imp	-2.26	1	-5.01	0	1973
log goser_exp	-2.20	1	-10.37	5	1973

Source: author's calculations. Lag lengths are determined with the General to Specific method.
The critical values are -4.93 and -4.42 at the 1 and 5 percent significance levels.

In the framework allowing for structural breaks, we apply the Luetkepohl et al (2004) test for cointegration, as implemented by Pfaff (2008). The number of lags has been determined by the application of the Schwarz information criteria (BIC) and results to be two.

There is no evidence of cointegration between the variables, except for GDP and manufactured goods only when controlling for manufactured imports (see Table 2.11), with a break in 1987.

Such result is much more restrictive than in the case with parameter stability, since there the inclusion of imports determined cointegration between GDP and exports, whatever their definition.

Table 2.11 Cointegration tests allowing for structural breaks: Luetkepohl approach.

Cointegration vectors	Hypothesized number of coint. equations	trace	5% critical value	rank	Break year
l_gdp, l_goser_exp	None	15.24	15.83	0	1998
	At most 1	4.91	6.79		
l_gdp, l_merch_exp	None	14.45	15.83	0	1999
	At most 1	5.03	6.79		
l_gdp, l_manuf_exp	None	9.77	15.83	0	1976
	At most 1	4.03	6.79		
l_gdp, l_goser_exp, l_goser_imp	None	24.91	28.45	0	1974
	At most 1	12.93	15.83		
	At most 2	4.69	6.79		
l_gdp, l_merch_exp, l_merch_imp	None	28.21	28.45	0	1974
	At most 1	13.80	15.83		
	At most 2	4.72	6.79		
l_gdp, l_manuf_exp, l_manuf_imp	None	30.01	28.45	1	1987
	At most 1	14.61	15.83		
	At most 2	2.93	6.79		

The number of lags is two and is determined with the Schwarz (BIC) criterion.

Moving to the causality relationship, we will apply a VECM to the cointegrated variables, GDP and manufactures, while for non cointegrated variables we will rely on a VAR model adopting a SUR estimator.

In the VECM estimation, the chosen lag length is two, according to the Schwarz criterion, while a trend is found not significant at the 5% critical level.

The results in Table 2.12 confirm that no causality relationship exists from GDP to manufactured exports, since the error correction term is not significant. We detect instead causality from manufactured goods to GDP, with the negative sign of the EC coefficient (-0.419) suggesting a process of long-run adjustment towards equilibrium.

The differenced coefficients are never significant, thus we cannot confirm a short-run relationship between the variables.

Such results are in line with the previous analysis conducted in a framework of parameter stability.

Table 2.12 VEC Model according to Luetkepohl et al (1992).

Independent Variables	Dep var: ΔlogGDP	Significance: 1%: ***	Dep var: ΔlogMANUF_EXP	Significance: 1%: ***	Dep var: ΔlogMANUF_IMP	Significance: 1%: ***
ΔlogGDP_1	0.155		-0.544		1.190	**
ΔlogMANUF_EXP_1	-0.022		-0.199		0.111	
ΔlogMANUF_IMP_1	-0.042		-0.190		0.462	
EC	-0.419	***	-0.321		0.625	
BIC	-2.751					
Durbin -Watson	1.901		1.905		1.906	
Doornik Hansen (p-value)	46.955 (0.000)		46.955 (0.000)		46.955 (0.000)	

Significance levels: 1% (***), 5% (**), 10% (*). EC is the error correction term.

The seemingly unrelated regression approach is applied to the non-cointegrated variables: GDP, exports of goods and services, exports of merchandises, and exports of manufactures. In practice, all the bivariate relationships without imports.

The order of integration of the variables in the unit-root test was one, and the appropriate lag length chosen with a bivariate VAR in differences is one, according to the Schwarz criterion. Therefore, the number of lags in the SUR model is set to two.

In the equation with GOSER as explanatory variable, a trend is found significant at the 5% critical value (p-value 0.027) and the Quandt and Andrews test for breaks at unknown date gives evidence of a break in 1987 at the 1% significance level. The inverse relationship with GDP as independent variable shows instead a significant trend (p-value 0.001) but no evidence of breakpoints.

In the equations with MERCH and GDP a trend and two breaks are found significant at the 1% critical value. The break years are 1987 in the relation from MERCH to GDP and 1991 from GDP to MERCH.

In the equation from MANUF to GDP a trend and one break in 1988 are found significant, but in the inverse relationship we do not detect any trend or break.

Thus we estimate SUR models in levels with a trend and a dummy variable for each break, whose results are reported in Table 2.13.

Table 2.13 Granger causality test (Box and Jenkins approach allowing for structural breaks) – with trend.

	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_GOSER_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
Const	3.610	***		5.693	***	
trend	0.020	***		0.050	***	
Dummy 1987	0.120	**		n.a.		
l_gdp_1	1.209	***		1.120	***	
l_gdp_2	-0.470	***		-1.153	***	
l_goser_exp_1	0.067			1.012	***	
l_goser_exp_2	0.034			-0.279	*	
Sum of lagged coefficients	0.115			-0.032		
MWald test	5.365	(0.068)	NO CAUSALITY	11.301	(0.004)	YES
	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MERCH_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
Const	2.679	**		9.063	**	
Trend	0.018	**		0.070	***	
Dummy 1987	0.048			n.a.		
Dummy 1991	n.a.			0.048		
l_gdp_1	1.465	***		0.152		
l_gdp_2	-0.583	***		-0.341		
l_merch_exp_1	-0.033			0.875	***	
Sum of lagged coefficients	-0.006			-0.169		
MWald test	0.536	(0.765)	NO CAUSALITY	1.702	(0.427)	NO CAUSALITY
	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MANUF_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
Const	-0.111			-0.973		
Trend	0.002			n.a.		
Dummy 1988	-0.094			n.a.		
l_gdp_1	1.470	***		-0.231		
L_gdp_2	-0.480	***		0.4182		
L_manuf_exp_1	0.082			1.007	***	
L_manuf_exp_2	-0.061			-0.173		
Sum of lagged coefficients	0.002			0.187		
MWald test	2.811	0.245	NO CAUSALITY	3.554	0.169	NO CAUSALITY

The introduction of the breakpoints in the equations with MERCH does not allow to identify a causality relation between the variables, thus confirming the results obtained in the Toda and Yamamoto approach. We are able to detect causality only in the relationship from GDP to GOSER, thus supporting the GLE hypothesis.

This latter result could be due to the fact that the two main sources of income for services, tourism and the Suez Canal, are held by foreign companies and the Government respectively. Thus, they do not display any direct effect on the economic growth.

The productive sector expressed in manufactures has a positive impact on growth, as stated in the VECM analysis with the significance of the error correction term (Table 2.12), although in this case a major effect seems to be due to imports. It seems, in fact, that the leading variables are GDP and imports instead of exports. Such result would support the hypothesis on the role of imports in boosting GDP through exports and could be applicable to Egypt whose main imports are machineries and spare parts used for intermediate processing before exporting the final products.

Such result is not in line with previous works on Egypt in the trivariate case. For example, Riezman et al. (1996) and AbuQarn (2001) found no cointegration and no causal relationship at all between GDP and exports, even when exports are expressed as manufactured goods. The source of the different result might be that AbuQarn used constant data while we have carried out the present analysis with current data.

Further studies should also consider the importance of the oil sector, which is marked by the massive presence of foreign firms and is strictly under the control of the Government.

For sake of completeness, we have also implemented the Luetkepohl methodology with constant data. The results are exposed in the Appendix. We did not detect cointegration among the variables and the causality analysis is in line with the results obtained in the model with current data.

2.10 Trade with the European Union: data and results

In this section we will perform a causality analysis looking into Egypt's trade with the European Union. In this case, the export has been clustered into major categories in order to determine whether there is a specific sector that has an impact on GDP

Data are expressed in current LE and range from 1998 to 2010. The choice of including the years 2008-2010, hit by the economic crises, is due to the need of dealing with a longer time series.

GDP is from the WB-WDI while data on import and export are from the Eurostat database, and are expressed in current Euro. Therefore, we have used the cross exchange rate with the US$ to convert all data in Egyptian pound.

The variables Exp_eu and Imp_eu are Egypt's total export to and import from the European Union. The former is further detailed as Agritex_x (the sum of agricultural and textile exports), Chemals_x (chemicals and metals exports), Fuels_x and the residual category Oth_x (other exports).

Table 2.14 reports the results of the unit-root analysis conducted with the standard ADF and KPSS tests and with the Zivot & Andrews test, allowing for structural breaks. According to the KPSS test, all the variables are stationary in their first differences, or I(1).

For sake of completeness, we also present the results of the ADF unit-root test, that shows no clear evidence of the stationarity of the variables in their first difference. Indeed, the variables GDP, AGRITEX and METALS still have unit-roots after first differencing. However, critics suggest that the ADF test gives contradictory results according to the number of lags, and moreover the limited extension of the time series does not allow us to increase the lags above eight. In conclusion, we prefer to rely on the KPSS test. The introduction of a trend in the KPSS test gives as a result that almost all the variables are stationary already in levels at the 10% critical values, while first differencing turns the variables into non stationarity.

Finally, the test allowing for structural breaks shows that imports are not stationary even after first differencing, while GDP and exports are I(1). Therefore, the cointegration analysis allowing for structural breaks will be conducted only with GDP and exports.

Table 2.14 Unit-root tests.

ADF and KPSS: parameter stability, with constant only					
Variables	Levels			First Differences	
	ADF t-stat	KPSS t-stat	lags	ADF t-stat	KPSS t-stat
log_gdp	-0.107	0.862	0	-1.884	0.243
log exp_eu	-2.415	1.061	0	-3.320	0.224
log imp_eu	-0.559	0.579	2	-4.860	0.222
log agritex_x	-0.862	0.512	4	-2.089	0.255
log chemals_x	-1.290	1.162	0	-5.210	0.104
log fuels_x	-1.102	0.945	2	-4.170	0.177
log oth_x	-0.810	1.034	5	-3.173	0.298

ADF and KPSS: parameter stability, with constant and trend					
Variables	Levels			First Differences	
	ADF t-stat	KPSS t-stat	lags	ADF t-stat	KPSS t-stat
log_gdp	-2.815	0.128	3	-2.574	0.195
log exp_eu	-3.303	0.104	2	-3.290	0.144
log imp_eu	-5.562	0.099	1	-4.436	0.127
log agritex_x	-2.766	0.104	3	-2.041	0.107
log chemals_x	-3.248	0.112	4	-5.153	0.085
log fuels_x	-3.105	0.132	4	-4.078	0.147
log oth_x	-3.468	0.124	4	-3.101	0.103

Zivot and Andrew: structural breaks, with trend					
Variables	**Levels**		**First Differences**		
	t-statistic	**lags**	**t-statistic**	**lags**	**Break year**
log_gdp	-3.796	0	-5.389	0	2000
log exp_eu	-3.105	0	-4.940	0	1992
log imp_eu	-3.740	2	-3.597	2	1988

Source: author's calculations. Lag lengths are determined with the General to Specific method.
The McKinnon critical values for 20 observations are - 3.81 (-3.02; -2.65) at the 1 (5; 10) percent significant level, with constant only and - 4.499 (-3.658; -2.269) at the 1 (5; 10) percent significant level, with constant and trend.
The KPSS critical values are 0.356 and 0.481 and 0.701 at the 10 and 5 and 1 percent significant level with constant only and 0.124 and 0.149 and 0.208 at the 10 and 5 and 1percent significant level with constant and trend.
The Zivot and Andrews critical values are - 5.57 (-5.08; -4.82) at the 1 (5; 10) percent significant level

As happened in the study of the total trade, the graphical examination of the EU series (see Appendix) suggests a linear trend in the cointegration relation as well, thus in the Johansen test procedure we have applied the so-called Case 3: Unrestricted constant, whose results are exposed in Table 2.15. One cointegration relationship emerges between GDP and total exports, while the system including imports shows two cointegrating vectors.

Although the results of the unit-root test are quite uncertain, we have attempted a cointegration analysis for the variables composing the detailed exports.

However, the shortness of the time series and the relative high number of variables lead to indecisive results. In fact, the critical values from McKinnon et al (1998) or from Osterwald-Lenum (1992) are no longer applicable and we refer to the p-value specifically computed for small samples. In this case the number of cointegrating vector would be two.

Given the misleading results that possibly would come out from a standard VECM approach and the non applicability of the SGC, we will not go further with the analysis of the detailed trade with the EU, that could be instead the subject of further studies with a longer time series.

Table 2.15 Johansen cointegration tests. Case 3: Unrestricted constant.

Critical values from McKinnon, Haug, Michelis (1998), 5% critical level.							
COINTEGRATION VECTORS	Hypothesis	lambda-max	critical value	trace	critical value	lags	rank
l_gdp, l_exp_eu	None	9.4057	15.0200	13.8880	18.1100	1	0
	At most 1	4.4819	8.1900	4.4819	8.1900		
l_gdp, l_exp_eu, l_imp_eu	None	22.09	21.4900	42.64	31.8800	3	2
	At most 1	19.82	15.0200	20.54	18.1100		
	At most 2	0.72	8.1900	0.72	8.1900		
l_gdp, l_agritex_x, l_chemals_x, l_fuels_x, l_oth_x	None	58.804	38.320	112.310	88.790	2	1
	At most 1	28.626	32.120	53.511	63.870		
	At most 2	13.186	25.830	24.885	42.920		
	At most 3	11.139	19.380	11.699	25.860		
	At most 4	0.55969	12.520	0.55969	12.520		
DETAILED EXPORT CORRECTED FOR SAMPLE SIZE (Reinsel and Ahn, 1992)							
				trace	p-value	lags	rank
l_gdp, l_agritex_x, l_chemals_x, l_fuels_x, l_oth_x,	None			112.310	0.1017	2	2
	At most 1			53.511	0.3464		
	At most 2			24.885	0.4580		
	At most 3			11.699	0.2791		
	At most 4			0.55969	0.5122		
Critical values from Osterwald_Lenum (1992), 95%	Hypothesis	lambda-max	critical value	trace	critical value	lags	rank
COINTEGRATION VECTORS							
l_gdp, l_exp_eu	None	9.4057	15.6700	13.8880	19.9600	1	0
	At most 1	4.4819	9.2400	4.4819	9.2400		
l_gdp, l_exp_eu, l_imp_eu	None	22.09	22.00	42.64	34.91	3	2
	At most 1	19.82	15.67	20.54	19.96		
	At most 2	0.72	9.24	0.72	9.24		
l_gdp, l_agritex_x, l_chemals_x, l_fuels_x, l_oth_x	None	58.804	36.41	112.310	77.74	2	1
	At most 1	28.626	30.33	53.511	54.64		
	At most 2	13.186	23.78	24.885	34.55		
	At most 3	11.139	16.87	11.699	18.17		
	At most 4	0.55969	3.74	0.55969	3.74		
DETAILED EXPORT CORRECTED FOR SAMPLE SIZE (Reinsel and Ahn, 1992)							
				trace	p-value	lags	rank
l_gdp, l_agritex_x, l_chemals_x, l_fuels_x, l_oth_x,	None			112.310	0.1017	2	2
	At most 1			53.511	0.3464		
	At most 2			24.885	0.4580		
	At most 3			11.699	0.2791		
	At most 4			0.55969	0.5122		

The number of lags is determined with the Schwarz information criterion.

Following the results obtained with the Johansen cointegration analysis, we model a VAR in levels with 2 lags for the variables GDP and exports_EU in a SUR framework (Table 2.16). In this framework we detect Granger causality from exports to GDP.

However, to test the robustness of the results we have run a VAR with trend, thus assessing instead the inverse causality from exports to GDP.

We believe that this could be due to a quite short time series, and for this reason the results may not be consistent.

Table 2.16 Granger causality test (Toda and Yamamoto approach as implemented by Rambaldi and Doran).

CASE WITHOUT TREND	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_ EXP_EU	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	0.261			-0.471		
l_gdp_1	1.235	***		0.639		
l_gdp_2	-0.278			-0.322		
l_exp_1	0.094	**		1.050	***	
l_exp_2	-0.052			-0.386	*	
Sum of lagged coefficients	0.042			0.317		
MWald test	7.182	(0.028)	YES	2.312	(0.315)	NO CAUSALITY
CASE WITH TREND	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_ EXP_EU	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	5.700			83.050	***	
trend	0.024			0.375	***	
l_gdp_1	1.035	***		-2.422	***	
l_gdp_2	-0.307	*		-0.762		
l_exp_1	0.046			0.324	*	
l_exp_2	0.073			0.519	***	
Sum of lagged coefficients	0.054			-3.184		
MWald test	4.807	0.090	NO CAUSALITY	38.555	0.000	YES

Significance levels: 1% (***), 5% (**), 10% (*).

We also proceed with the cointegration and causality analysis in a framework of structural breaks, and conduct the analysis following Luetkepohl et al (2004).

As in the case with parameter stability, we are not able to detect any cointegration relationship, and the introduction of a trend does not change the results of the analysis (Table 2.17).

Table 2.17 Cointegration tests allowing for structural breaks.

COINTEGRATION VECTORS	Hypothesized number of coint. equations	trace	5% critical value	rank	break year
l_gdp, l_exp_eu	None	12.2800	15.83	0	1991
	At most 1	3.3000	6.79		
l_gdp, l_exp_eu l_imp_eu	None	21.07	28.45	0	2000
	At most 1	11.32	15.83		
	At most 2	3.05	6.79		

Thus, we perform a bivariate VAR model with Seemingly Unrelated estimators for GDP and exports. According to the Toda and Yamamoto approach, the number of lags will be 2. We cannot perform the same analysis for the second equation with imports because the optimal number of lags would be 4, but the number of observations is insufficient to carry the regression. Given the limits of the Standard Granger Causality approach already discussed, we decide not to proceed with the study, since the results would not be robust.

Going back to the bivariate VAR with GDP and exports, the QLR test shows two breaks significant at the 1% significance level: one in 1993 with GDP as dependent variable and one in 2003 in the inverse relation. Moreover, a trend is found significant in the second equation, so we will include all these variables in the model. The results are exposed in Table 18 and confirm what we found in the model with parameter stability.

We assess a bidirectional causality between GDP and exports with the EU. The support for the ELG hypothesis could be explained by the relative importance of the trade with the European Union, compared with other trade partners. Exports towards the EU has always been free of duties for most of the goods excluding agricultural products, and this may have displayed positive effects on the Egyptian economic growth.

The possible positive effect of a reduction of tariffs in the agricultural sector by the EU, could be the subject of further studies.

On the other hand, Egypt's economic and technological development of the latest decades can explain the evidence in favour of the GLE hypothesis. This result, obtained with the data on trade with the EU, further support the conclusions of the analysis of total Egyptian exports.

Table 2.18 Granger causality test (Box and Jenkins approach allowing for structural breaks) – with trend.

	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_ EXP_EU	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
VARIABLES						
const	0.024			64.689	***	
trend	n.a.			0.270	***	
D1993	-0.125	***		n.a.		
D2003	n.a.			0.318	*	
l_gdp_1	0.915	***		-1.909	**	
l_gdp_2	0.026			-0.436		
l_exp_1	0.049			0.275	*	
l_exp_2	0.027			0.460	**	
Sum of lagged coefficients	0.074			-2.404		
MWald test	11.658	(0.003)	YES	12.502	(0.002)	YES

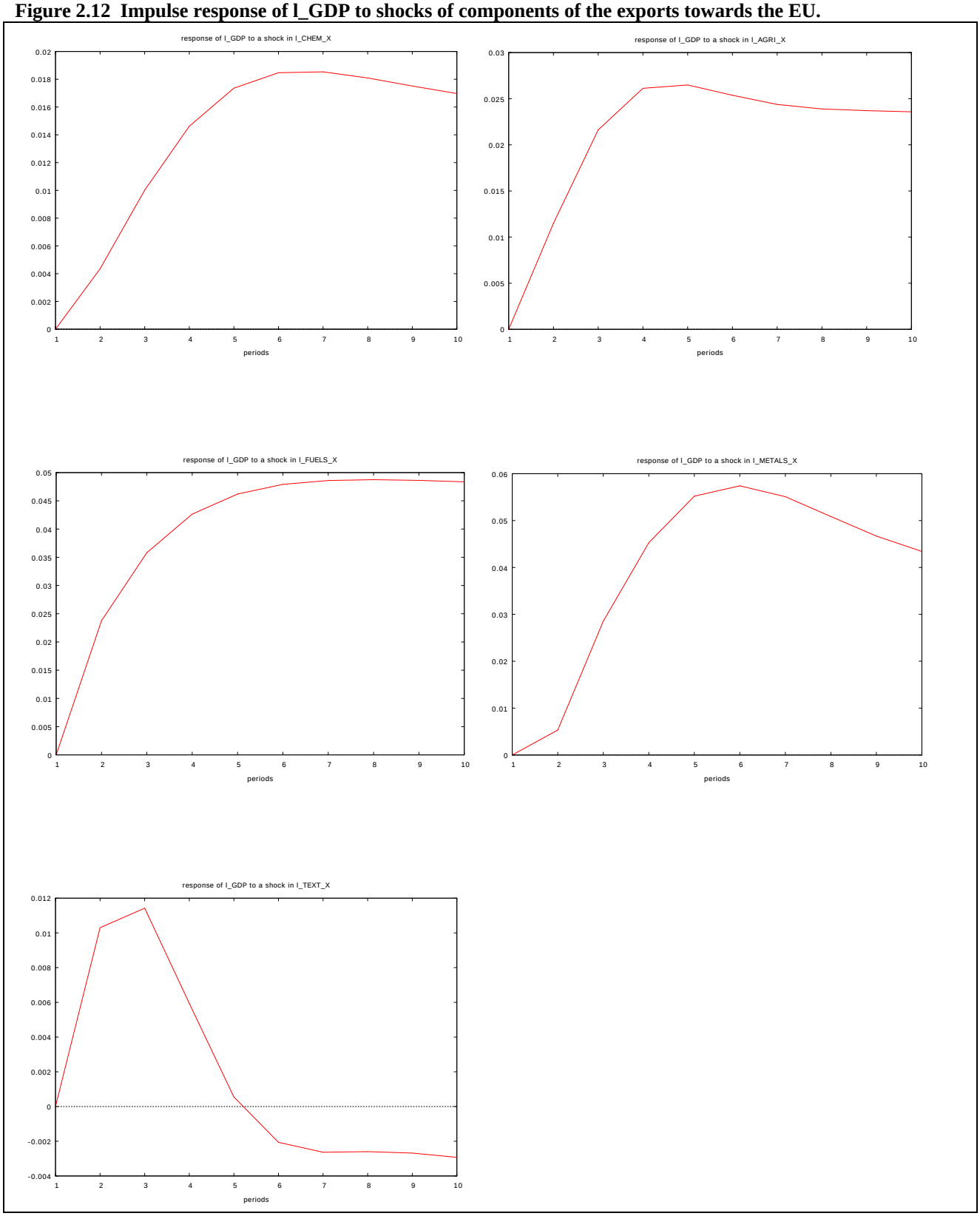
To conclude the study, we will try now to detect some information on the bivariate relationship between GDP and the components of the exports with the EU, making use of the impulse response analysis.

Figure 12 shows that in general a shock in one of the components of the exports with the EU always has a positive impact on the value of GDP, reaching the peak within five to six periods after the shock. The impact on the percentage variation of GDP displays its effects within the first three periods.

Fuels and metals are the variables that seem to have a major effect on GDP.

The case of textiles is instead quite peculiar, since after the customer initial positive effect, the shock leads to a sudden decrease of the level of GDP since period 3 and ends with GDP settling slightly below the initial level.

Figure 2.12 Impulse response of l_GDP to shocks of components of the exports towards the EU.



2.11 Conclusion

We have studied the direction of the relationship between GDP and exports applying the latest econometric methodologies.

The results on total trade support the Growth-led Export hypothesis and reveal an important role played by imports. Indeed, the trivariate analysis support the inverse causality relationship from exports and imports to GDP. This suggests that in the world economy Egypt plays the role of a country that transforms the imported intermediate goods into final products for exports.

This view is also supported when dealing only with trade with the European Union, Egypt's main trading partner. However, in this part of the study, we have detected bidirectional causality between GDP and total exports, thus finding a positive effect from exports to GDP.

The duty-free policy adopted since decades by the EU could explain the causality direction from exports to GDP and suggests that further liberalizations, on the EU side, in the field of agricultural products could be beneficial to the Egyptian economy.

The next step for Egypt could be the consolidation of her role of final goods producer with regards to the EU, challenging the predominance of the Eastern European Countries.

Appendix to Part 2

Figure 2.A ADF and KPSS tests for unit roots: total trade and trade with EU.

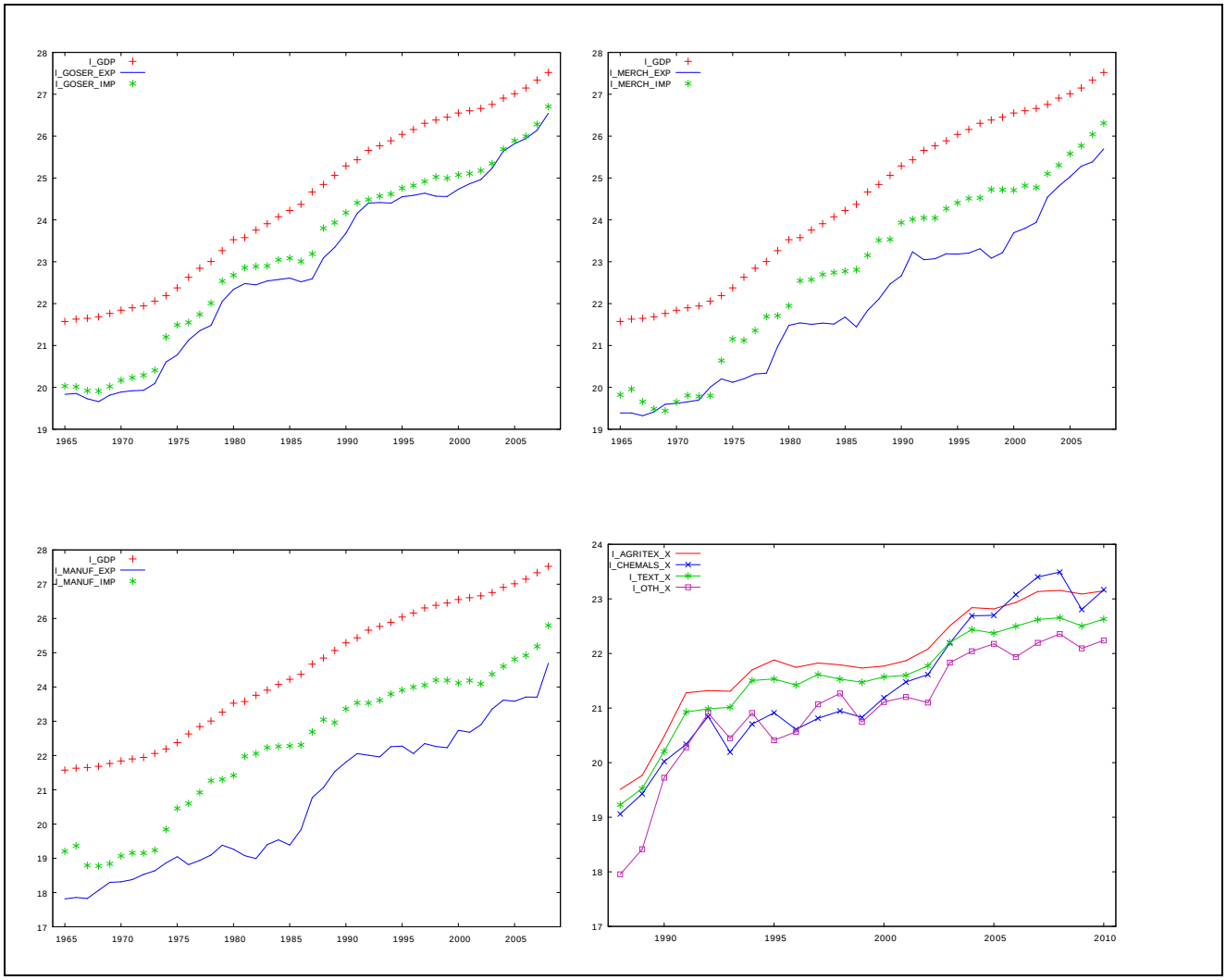


Table 2.A Johansen cointegration tests. Case 2: Restricted constant.

Cointegration vectors	Hypothesized number of coint. equations	lambda-max	critical value	trace	critical value	rank
l_gdp, l_goser_exp	None	16.71	15.6700	21.67	19.9600	1
	At most 1	4.96	9.2400	4.96	9.2400	
l_gdp, l_merch_exp	None	70.94	15.6700	73.47	19.9600	1
	At most 1	2.53	9.2400	2.53	9.2400	
l_gdp, l_manuf_exp	None	70.9610	15.6700	73.7150	19.9600	1
	At most 1	2.7536	9.2400	2.7536	9.2400	
l_gdp, l_goser_exp, l_goser_imp	None	102.19	22.00	111.69	34.91	1
	At most 1	6.47	15.67	9.51	19.96	
	At most 2	3.04	9.24	3.04	9.24	
l_gdp, l_merch_exp, l_merch_imp	None	93.24	22.00	108.22	34.91	1
	At most 1	10.61	15.67	14.97	19.96	
	At most 2	4.37	9.24	4.37	9.24	
l_gdp, l_manuf_exp, l_manuf_imp	None	105.370	15.670	118.920	19.960	1
	At most 1	10.084	9.240	13.557	9.240	
	At most 2	3.474	9.240	3.474	9.240	

Critical values from McKinnon, Haug, Michelis (1998), 5% critical level. The number of lags is determined with the BIC criteria.

Table 2.B Johansen cointegration tests. Case 4: Unrestricted constant and restricted trend.

Cointegration vectors	Hypothesized number of coint. equations	lambda-max	critical value	trace	critical value	rank
l_gdp, l_goser_exp	None	16.550	19.38	20.278	25.86	0
	At most 1	3.729	12.52	3.729	12.52	
l_gdp, l_merch_exp	None	9.230	19.38	10.335	25.86	0
	At most 1	1.106	12.52	1.106	12.52	
l_gdp, l_manuf_exp	None	6.828	19.38	7.772	25.86	0
	At most 1	0.944	12.52	0.944	12.52	
l_gdp, l_goser_exp, l_goser_imp	None	36.212	25.83	48.484	42.92	1
	At most 1	9.650	19.38	12.272	25.86	
	At most 2	2.622	12.52	2.622	12.52	
l_gdp, l_merch_exp, l_merch_imp	None	31.823	25.83	47.376	42.92	1
	At most 1	10.358	19.38	15.553	25.86	
	At most 2	5.196	12.52	5.196	12.52	
l_gdp, l_manuf_exp, l_manuf_imp	None	46.676	25.83	60.261	42.92	1
	At most 1	8.259	19.38	13.585	25.86	
	At most 2	5.326	12.52	5.326	12.52	

Critical values from McKinnon, Haug, Michelis (1998), 5% critical level. The number of lags is determined with the BIC criteria.

Table 2.C Trivariate VEC model for causality test. Case IV "Unrestricted constant and restricted trend".

Export as the sum of Goods and Services						
Independent Variables	Dep var: ΔlogGDP	Significance: 1%: ***	Dep var: ΔlogGOSER_EXP	Significance: 1%: ***	Dep var: ΔlogGOSER_IMP	Significance: 1%: ***
constant	-0.492	**	0.991		2.152	***
ΔlogGDP_1	0.198		1.227	**	1.901	***
ΔlogGOSER_EXP_1	-0.017		0.047		-0.287	
ΔlogGOSER_IMP_1	0.066		0.323		0.553	**
EC	-0.051	**	0.090		0.195	***
BIC	-4.692		-4.692		-4.692	
Durbin -Watson	2.025		1.931		2.048	
Doornik Hansen (p-value)	50.014 (0.000)		50.014 (0.000)		50.014 (0.000)	
Export as Merchandises						
Independent Variables	Dep var: ΔlogGDP	Significance: 1%: ***	Dep var: ΔlogMERCH_EXP	Significance: 1%: ***	Dep var: ΔlogMERCH_IMP	Significance: 1%: ***
constant	-0.227		0.543		1.619	***
ΔlogGDP_1	0.296	*	0.555		1.997	***
ΔlogMERCH_EXP_1	0.026		0.016		0.095	
ΔlogMERCH_IMP_1	0.038		0.022		0.289	**
EC	-0.051	**	0.077		0.290	***
BIC	-2.841		-2.841		-2.841	
Durbin -Watson	1.978		1.987		1.952	
Doornik Hansen (p-value)	16.763 (0.010)		16.763 (0.010)		16.763 (0.010)	
Export as Manufactures						
Independent Variables	Dep var: ΔlogGDP	Significance: 1%: ***	Dep var: ΔlogMANUF_EXP	Significance: 1%: ***	Dep var: ΔlogMANUF_IMP	Significance: 1%: ***
constant	0.955	***	-0.978		-3.512	***
ΔlogGDP_1	0.074		0.357		2.599	***
ΔlogMANUF_EXP_1	0.056		0.083		-0.009	
ΔlogMANUF_IMP_1	-0.020		0.006		0.505	***
EC	-0.222	***	0.289		0.868	***
BIC	-2.751		-2.751		-2.751	
Durbin -Watson	1.897		1.763		1.744	
Doornik Hansen (p-value)	8.197 (0.223)		8.197 (0.223)		8.197 (0.223)	

Table 2.D Trivariate VEC model for causality test. Case II "Restricted constant".

Export as the sum of Goods and Services						
Independent Variables	ΔlogGDP	Significance: 1%: ***	ΔlogGOSER_EXP	Significance: 1%: ***	ΔlogGOSER_IMP	Significance: 1%: ***
constant						
ΔlogGDP_1	0.206		1.063	**	1.880	***
ΔlogGOSER_EXP_1	-0.006		0.070		-0.295	
ΔlogGOSER_IMP_1	0.015		0.264		0.520	*
EC	-0.120	***	0.047		0.166	*
BIC	-4.774		-4.774		-4.774	
Durbin -Watson	1.981		1.830		1.890	
Doornik Hansen (p-value)	54.025 (0.000)		54.025 (0.000)		54.025 (0.000)	
Export as Merchandises						
Independent Variables	ΔlogGDP	Significance: 1%: ***	ΔlogMERCH_EXP	Significance: 1%: ***	ΔlogMERCH_IMP	Significance: 1%: ***
constant						
ΔlogGDP_1	0.294	*	0.572		2.091	***
ΔlogMERCH_EXP_1	0.060		0.121		0.152	
ΔlogMERCH_IMP_1	0.004		-0.053		0.285	*
EC	-0.125	***	-0.065		0.310	***
BIC	-2.870		-2.870		-2.870	
Durbin -Watson	2.083		2.005		1.900	
Doornik Hansen (p-value)	20.153 (0.002)		20.153 (0.002)		20.153 (0.002)	
Export as Manufactures						
Independent Variables	ΔlogGDP	Significance: 1%: ***	ΔlogMANUF_EXP	Significance: 1%: ***	ΔlogMANUF_IMP	Significance: 1%: ***
constant						
ΔlogGDP_1	0.145		0.786		2.819	***
ΔlogMANUF_EXP_1	0.063	*	0.128		0.007	
ΔlogMANUF_IMP_1	-0.036		-0.154		0.435	**
EC	-0.256	***	-0.057		0.712	***
BIC	-2.888		-2.888		-2.888	
Durbin -Watson	1.900		1.826		1.783	
Doornik Hansen (p-value)	4.690 (0.584)		4.690 (0.584)		4.690 (0.584)	

Table 2.E Cointegration tests allowing for structural breaks: Luetkepohl approach. Constant data.

Cointegration vectors	Hypothesized number of coint. equations	trace	5% critical value	rank	Break year
l_gdp, l_goser_exp	None	9.90	15.83	0	1981
	At most 1	2.57	6.79		
l_gdp, l_merch_exp	None	7.99	15.83	0	1981
	At most 1	2.30	6.79		
l_gdp, l_manuf_exp	None	9.43	15.83	0	1981
	At most 1	2.34	6.79		
l_gdp, l_goser_exp, l_goser_imp	None	21.26	28.45	0	1974
	At most 1	11.06	15.83		
	At most 2	3.57	6.79		
l_gdp, l_merch_exp, l_merch_imp	None	24.16	28.45	0	1974
	At most 1	8.98	15.83		
	At most 2	2.45	6.79		
l_gdp, l_manuf_exp, l_manuf_imp	None	19.67	28.45	0	1974
	At most 1	9.30	15.83		
	At most 2	2.80	6.79		

Table 2.F Granger causality test (Box and Jenkins approach allowing for structural breaks) . Constant data.

VARIABLES	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_GOSER_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
Const	-0.534			-10.867	***	
trend	0.003			-0.008	***	
Dummy 1987	-0.135	***		-0.196	*	
l_gdp_1	0.679	***		0.938	*	
l_gdp_2	0.317	*		-0.251		
l_goser_exp_1	-0.010			1.008	***	
l_goser_exp_2	0.038			-0.282	*	
Sum of lagged coefficients	0.028			0.321		
MWald test	1.222	(0.542)	NO CAUS.	4.917	(0.085)	YES
MWald test without trend	0.385	(0.824)	NO CAUS.	10.668	(0.004)	YES
VARIABLES	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MERCH_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
Const	-2.051			-15.369		
Trend	0.001			-0.006		
Dummy 1981	-0.142	***		-0.547	***	
l_gdp_1	0.755	***		-0.5605		
l_gdp_2	0.327	**		1.403		
l_merch_exp_1	-0.050	*		0.872	***	
l_merch_exp_2	0.051	*		-0.127		
Sum of lagged coefficients	0.0005			0.843		
MWald test	3.631	(0.162)	NO CAUS.	0.430	(0.5119)	NO CAUS.
MWald test without trend	3.420	(0.180)	NO CAUS.	1.241	(0.537)	NO CAUS.
VARIABLES	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from exports to gdp	Dependent variable: l_MANUF_EXP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to exports
Const	-1.918			26.565	**	
Trend	0.0008			0.0624	***	
Dummy 1981	-0.132	***		-0.290 .	*	
l_gdp_1	0.688	***		-1.798	**	
L_gdp_2	0.388	**		1.067		
L_manuf_exp_1	0.008			0.914	***	
L_manuf_exp_2	-0.0074			-0.294	**	
Sum of lagged coefficients	0.0008			-0.730		
MWald test	0.108	(0.947)	NO CAUS.	0.0862	(0.769)	NO CAUS.
MWald test without trend	0.286761	(0.866)	NO CAUS.	1.29789	(0.522)	NO CAUS.

Part 3 FDI and growth in Egypt: an ARDL approach

Summary

The paper deals with the relationship between FDI and GDP in Egypt. The application of the Pesaran's ARDL approach for cointegration shows that the effect of a shock in FDI has a negligible effect on GDP, either in the short-run and in the long-run. We have found instead a significant effect displayed by the human capital expressed in average years of education of the workforce.

The Toda-Yamamoto causality methodology supports the FDI-led growth hypothesis.

The study suggests that the poor performance of FDI could be due to an excessive concentration in the oil sector. Moreover, in spite of the dramatic increase in FDI of the recent years, the country could improve her attractiveness if more efforts are made to fight corruption.

Introduction

The economic theory has always perceived foreign direct investments (FDI) as beneficial for growth.

Through FDI the hosting country not only receives liquidity as in the case of capital investments, rather acquires skills, management abilities and new technologies. These reflect in an enhanced productivity which in turn positively affects the GDP. Under the expectations of higher returns from the investment, FDI should be directed more towards developing countries, however the evidence shows that such hypothesis is not always true.

In fact, according to the UNCTAD World Investment Report (2011), the share of FDI to developing and transition economies represented only the 52% of global flows, although this is a sharp increase if compared with the 25% reported for the year 2007.

The literature and empirical studies have long questioned what are the factors that make a country attractive for FDI, but unfortunately a clear answer has not been given yet.

While a number of issues have been suggested by the theory, the results of the empirical analysis are still inconclusive. It is clear however, that the hosting country must have reached a minimum threshold of economic development in terms of educational levels, infrastructures, financial development and openness to international trade.

This study focuses on the experience of a single country that in the latest decades has introduced a number of reforms in the economic and financial sector, also with the aim of boosting growth through foreign investments.

Our purpose is to assess whether there is evidence of a causal relationship between FDI and growth.

3.1 Literature review

A first body of the literature examines firms' behaviour, thus discussing the role of the FDI at the micro level (the so-called spillover effect).

Dunning (1993), offers a systematic classification of FDI and singles out four reasons that lead firms to invests abroad:

i. *Resource seeking* (vertical FDI), or the attempt to acquire production inputs at lower prices than in their own country, either natural resources, unskilled labour, or managerial and technological capabilities. The abundance of low cost natural resources seems to provide a reasonable explanation for FDI in developing countries (Groh and Wich, 2012).

ii. *Market seeking* (horizontal FDI), that is the effort of better serving the market. The firm may engage FDI directly in the target market or in the neighbouring countries, however the aim is to reduce tariffs and transport costs associated with exports. Free zones[26] with favourable tax regimes and easy bureaucracy should be able to attract FDI, as is reported in the case of Taiwan (Ranis and Schive, 1985), the Carribeans (Woodward and Rolfe, 1993), and China (Fung et al., 2000).

Although the determinants of the firms' behaviour are often a combination of resource and market seeking, the distinction between them can help explaining apparently controversial empirical results. Sure enough, Brainard (1997) finds that higher tariffs are positive related to an increase of FDI in the USA, and Wheeler and Mody (1992) also detect the same effect for the US manufacturing sector. Most likely, such investments were of the horizontal type, aimed at hopping trade barriers. On the contrary, studies focused on developing countries and China find that openness is a strong determinant for FDI (Dees, 1998; Sing and Jun, 1995; Lecraw, 1991; Kravis and Lipsey, 1982). This suggests that these might be vertical FDI requiring considerable flows of goods in and out of the hosting country and therefore benefiting from easier trade conditions.

The remaining items in Dunning (1993) are:

iii. *Efficiency seeking.* Using Dunning's words, this occurs when firms "take advantage of differences in the availability and costs of traditional factor endowments in different countries"; or when they "take advantage of the economies of scale and scope and of differences in consumer tastes and supply capabilities". The hypothesis that foreign investments are more productive than the domestic capital and hence display a positive

[26] The Free Zones are located within the national territory, but work in fact as offshore areas. To ease import and export procedures, they are usually sited near sea ports and airports. Companies operating in such areas enjoy exemptions from customs duties, sales taxes and taxes on capital assets and intermediate goods.

effect on the country's GDP growth is supported for example by Borensztein et al (1995) for a sample of 69 developing countries.

iv. *Strategic asset seeking* (or Competence creating), when the firm's aim is acquiring a new technology or exploiting an asset. Skilled labour also is included in this category. Under this hypothesis, firms tend to localize in regions or countries with leading research centres, thus creating technological pools. Such a transfer of technology has been proved to be beneficial for the hosting country's economic growth, as assessed for example by an OECD study on OECD and developing countries (OECD, 1991).

As the complementary point of view, another body of research studies what the determinants of FDI are, or in other words, what makes a country attractive for foreign firm's investments.

Natural resources, skilled labour, the market size, the factor costs have been analyzed in the four points above. Although quite intuitive, these do not fully explain the direction of FDI, when we consider for example that the industrialized countries are often poor of natural resources but attract the bulk of the world's total investments. In addition, there is no clear evidence of the effects of a skilled workforce.

Groh and Wich (2012) identify four further determinants of FDI, related to country-specific characteristics:

i. *The economic activity*. Under this definition the authors include the macroeconomic stability and the size of the economy or the economic growth. Indeed, Rodrik (1999) argues as well that foreign firms tend to invest in more productive and faster growing economies, thus suggesting an inverse relationship from GDP to FDI. The degree of openness is another indicator of the willingness of a country to attract investments. Besides, joining Preferential Trade Agreements (PTA) rises the expectations to receive more FDI.

ii. *Legal and political system.* The transparency and predictability of the legal framework in the hosting country, a low level of corruption and political stability reduce the risks connected with the investment (UNCTAD, 2008; Ramcharran, 1999). This is one of the weakest points in several emerging and developing countries.

iii. *Business environment*. This category includes in general the costs of establishing and running a firm in a foreign country: labour costs, the tax policies on FDI, the complexity of bureaucracy, and corruption that affects many emerging countries (see among others Wei, 2000; Baniak et al, 2005).

iv. *Infrastructure*, in the sense of an efficient transportation and communication system. For developing countries this feature seems determinant in the firms' decisions of investments, as stated in Wheeler and Mody (1992).

Although the classification of the determinants for FDI is quite exhaustive, it is in fact rather difficult, in empirical studies, to take into account all the possible variables affecting the FDI and their interactions, or which element prevails in each specific case study.

Hence, a further step in Groh and Wich's work is the creation of an FDI index based on the four categories identified above. The application of the Index to their sample of 127 countries places Singapore, Hong Kong, Luxembourg and the United Arab Emirates in the top ranking, while Venezuela, East Timor, Burundi, Zimbabwe, and Chad are ranked the lowest.

Finally, Medveded (2012) claims that joining a PTA is often associated with an increase in FDI inflows. This is assessed by case studies on the accession of Spain and Portugal to the EU, Brazil and Argentina to MERCOSUR, Mexico and Canada to NAFTA. The implementation of the European Common Market itself lead to an increase in intra-EU FDI. However, it is not possible to generalize such findings and some studies also suggest that the positive effect may not depend on the PTA itself, but rather on the reforms implemented by the candidate countries before joining the agreement (Blomstrom and Kokko, 1997; Graham and Wada, 2000).

3.2 Previous empirical evidence

In this section we will focus on previous studies conducted on the relationship between FDI and GDP. The econometric approach applied to recent works is pre-testing for unit-root and cointegration properties of the variables and then estimating a VECM for cointegrated variables or a VAR in differences in case of no cointegration. Besides the Johansen and Juselius (1990) cointegration tests and the standard VAR model, some authors also apply the Luetkepohl (2004) cointegration technique and the Toda and Yamamoto (1995) augmented VAR in levels for the causality analysis. Finally, a few studies are conducted with the Pesaran et al (2001) ARDL-ECM approach (Kyuntae and Hokyung, 2008; Pinn, 2011; Ellahi, 2012).

While the economic theory suggests that FDI inflows should support GDP growth, the empirical evidence has not yet come to conclusive results on the relationship between FDI and economic growth.

In combination with the most advanced econometric techniques, many studies introduce further variables other than FDI and GDP, in an attempt to avoid mis-specification of the models. The variables are chosen among those that could somehow have an impact on the main relationship, such as trade, the labour force, domestic capital (Cuadros et al., 2001; Kyuntae and Hokyung,

2008), the attained level of education (De Gregorio, 1999; Alalaja, 2010), the stock capital and indicators of financial development (De Gregorio, 1999; Khan, 2007), foreign aid (Ellahi, 2012).

Indeed, such regressors express the specific characteristics and policies adopted by the different countries.

Many developing countries, for example, show a limited capacity of absorbing the advanced technologies imported by foreign investing firms (Blomstroem et al, 2000), or have weak and inefficient capital markets that do not direct the financial flows towards real economy investments (Khan, 2007). Moreover, FDI seem to better display their effects in open economies and in an environment of economic and political stability (OECD, 1998). Otherwise, the benefits would be merely directed towards a higher rate of return of the investing firm, as suggested in Balasubramanyan et al (1996).

Fedderke and Romm (2006) verify in their study of South Africa, that the market size and an export promotion policy attract FDI, while corporate taxation and wage costs have a negative impact. Interestingly, they also analyze how foreign investments combine with domestic capital, reporting a crowding-out effect of FDI on domestic investments in the short-run, but complementarity in the long term.

Cuadros et al (2001) not only find a positive causal relationship from FDI to GDP in Mexico, but also controlled for the possible effects of openness to trade and claim that FDI supported exports in Mexico and Argentina. Indeed, the Mexican Government opened the economy already since the 1980s. The results also confirm that for this country the foreign investments were export-oriented. Similar effects, with causality going from FDI to growth, have been obtained by Iqbal et al (2010) for Pakistan and by Kyuntae and Hokyung (2008) with the ARDL approach for Ireland. In both cases, export promotion and favourable taxation policies have been successful in attracting FDI.

In a further ARDL study on Pakistan, Khan (2007) introduced a variable indicating the country's level of financial development, thus finding that a positive long-run relationship between FDI and GDP is reached only when the ratio private sector credit/GDP lies above 13%. However, the relationship between the financial market indicator and GDP is negative, thus supporting the hypothesis that such financial flows are not used for real investment purposes, or alternatively that the financial system is weak and inefficient.

Indeed, De Gregorio and Guidotti (1995) find that the positive effects of financial development on growth are displayed not only with a high volume of investments, but rather through efficiency. The evidence comes from a panel study of 69 countries.

The necessity of a minimum level of financial development is also supported by panel data studies: Chien-Chiang and Chun-Ping (2009) who find a highly significant long-run relationship among

financial development, FDI and GDP in a dataset of 37 countries, and Azman-Saini et al (2010) support the point in their panel analysis of 91 countries. Among time series studies, AbuBader and AbuQarn (2005) confirm that the rise in private investments was supported by the financial liberalization that happened in Egypt since the 1990s.

Ellahi (2012) confirms that in Pakistan FDI positively affect GDP in the long-run, along with the capital stock. Besides, he finds a bidirectional causality between GDP and foreign aid, supporting the hypothesis that foreign development assistance cause FDI. ARDL was the methodological approach adopted.

Kalirajan et al (2009) select a few countries for a comparative study of the relationship among trade, FDI and GDP. They choose India and Pakistan as Asian countries that have recently open their economies, Malaysia and Thailand as Asian countries who have been successful in attracting FDI and that have a per capita income higher than the former two. Finally, Mexico and Chile again among the best FDI attractors but belonging to a different geographical area. They apply either Johansen and Juselius, and Luetkepohl cointegration analysis in bivariate regressions combining the three variables. The study shows that it is not possible to detect common paths of causality, since each country applied different policies to attract FDI or to facilitate trade. Thus, the evidence is again mixed.

In separate papers on Mexico and Chile, Ramirez (2002, 2009, 2010) shows that in both experiences the economic reforms and changes in the legislation for investments contributed to attract FDI in those countries.

Instead of measuring the impact on GDP, Pinn et al (2011) apply an ARDL approach to the relationship between FDI and employment growth in Malaysia. No cointegration is detected between the variables, while causality goes from FID to employment.

Herzer et al (2008) apply the cointegration techniques on a country-by-country basis, finding a long-run relationship between FDI and growth only in four countries out of the 28 selected. Furthermore, no clear association is detected between FDI and the variables usually singled out as their determinants: education, financial development, openness. Egypt has been included in the sample as one of the major recipient of FDI in its region. Modelling the regressions for such country, Herzer et al. include a step dummy since 1980 to account for possible positive effects on GDP and increase in foreign aids following the peace treaty signed with Israel. The results for the period 1970-2003 indicate a positive long run effect of 4.7% on GDP due to a 1% shock in the ratio FDI/GDP and a bivariate causality relationship. In the short-run, instead the causality is directed from FDI to GDP.

In a panel analysis, Borensztein et.al (1995) found that FDI's positive impact on growth starts to occur at a human capital threshold of 0.52 years of adult secondary school. This is particularly evident for investment flows from developed to developing countries. FDI are found more productive than domestic capital and this seems to be due to a positive interaction with human capital. A similar threshold of 0.45 years of secondary education is found in the panel study by De Gregorio (1999).

Again, the results of an ARDL model applied to the Jordan economy (Alalaja, 2010) support the hypothesis of a minimum level of education of the workforce, needed to deal with the technological changes introduced by foreign firms.

In the next section we will treat in more detail the case study of Egypt, illustrating the country's efforts to attract foreign direct investments.

3.3 FDI in Egypt

After two decades of import-substitution policies, since the early 1970s, Egypt has turned to a more open economy, in order to attract foreign investments and support exports.

Such trend has been strengthen in more recent years within the Structural Adjustment Programme (ERSAP) supported by the IMF and implemented since 1991. Liberalization of the exchange rate, progressive reduction of tariffs and barriers to trade and privatizations are some of the reforms implemented. According to the economic theory, this should have create an economic environment more favourable to FDI. The Central Bank of Egypt suggests that FDI have been particularly attracted by the privatizations of public-owned companies, that also concerned sectors that were considered strategic and previously closed to private investments, such as banking, petrochemicals and telecommunications.

Egypt also eased the bureaucratic procedures needed for the establishment of foreign enterprises, through the creation of a "One Stop Shop" for investors. The General Authority for Investment and Free Zones (GAFI) is in charge of regulating and facilitating investments. With this purpose, it provides support for all the necessary licences and residence and work permits, and in general offering a quick procedure to create and register new enterprises. It takes two days for the registration of a new company and no longer than two weeks for other official authorization and permits.

The Social Fund for Development (SFD) is instead in charge of the small enterprises with less than 50 workers. Similarly to GAFI, the SFD works as a link between the entrepreneurs and the administration and reduces bureaucracy, thus allowing the conclusion of all the procedures within 30 days.

Following the economic theory assessing that the favourable tax regime of the Free Zones should be beneficial for FDI, in Egypt operate ten public Free Zones (listed in Table 3.1) and a number of private ones, as well. According to a report by the African Development Bank, in the fiscal year 2007/08 more than 1,100 companies had established in the free zones, hiring a workforce of about 230,000 units.

The Qualified Industrial Zones (QIF) have instead been created following a protocol signed in 2004 between Egypt and Israel. It designated a few territories in the two countries as "enclaves where merchandise may enter for purposes of export, without payment of duty or taxes, no matter what the country of origin of the merchandise".

Table 3.1 Egyptian Public Free Zones.

LOCATION	FIELDS OF INVESTMENTS
Alexandria	Textile, food processing, chemicals and petrochemicals
Nasr City, Cairo	Food processing, pharmaceuticals, and medical equipment
Port Said	Textile, chemicals, food processing, goods storage and re-export
Suez	Petrochemicals, glass industry, ships industry and navigation services
Ismailia	Textile, computer HW and SW, chemicals, goods storage and re-export
Damietta	Petrochemicals, medical equipments, textile, furnitures.
6th October City	Radio and TV broadcasting and industries connected, hotels and tourists facilities.
Shebin el-Kom, Menofia Gov.	Textile and complementary industries
Queft, Qena Gov.	Food processing, pharmaceuticals
East Port Said	Containers and transit activities

Source: Egyptian Ministry of Industry and Foreign Trade website.

The country has also modified some legislation in order to improve the business environment and regulate the market for jobs.

The establishment and operation of companies in Egypt is regulated by the Companies Law 159/1981, improved by the Investment Law N. 8/1997 that introduced more incentives to private and foreign investments. Under the Investment Law, foreign investments are allowed within a list of 16 possible fields, among which some that were previously restricted like mining, tourism, oil production and refining, and cinema. Foreign investors are allowed to own up to 100% of a company, although the Companies Law requires that the majority of the directors must be Egyptians and the employees must be represented in the Board.

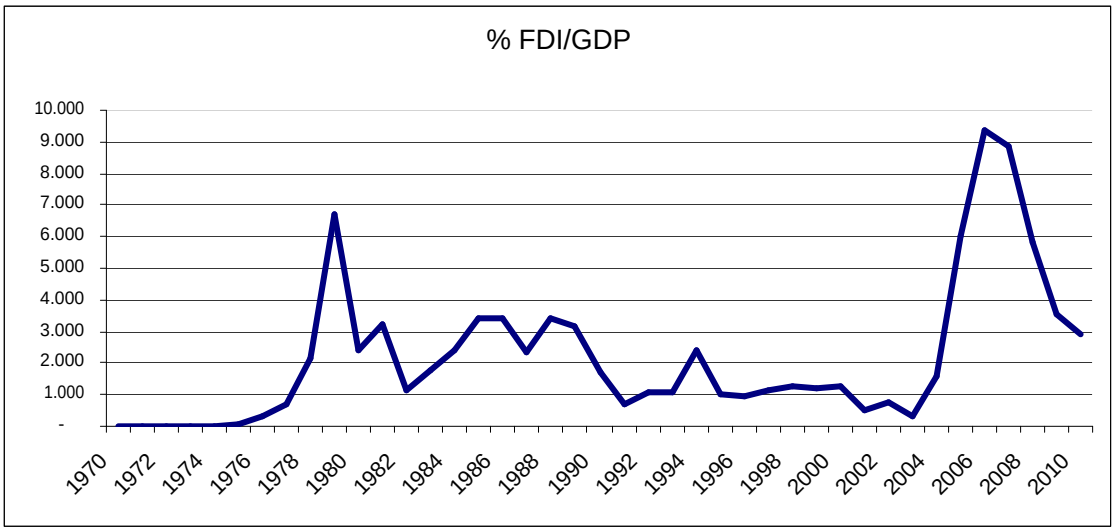
The new Labour Law N. 12/2003 introduced more flexibility in hiring and firing workers, also allowing the downsizing of the workforce for economic reasons. Moreover, the law has standardized the rights and relationships between employers and employees in all sectors except for the public employees. The right to strike and to join unions is also regulated by the Labour Law.

Finally, with the aim of encouraging the private financing of the necessary investments in infrastructures, the Government promoted the Public-Private Partnership Projects (PPP) initiative. The Ministry of Finance's Central Unit verifies that the projects are supported by sound analysis and that the selection of the partners takes place with fair and transparent competition. It works in co-operation with experts and consultant at international level.

The African Development Bank reports that the boom in FDI that happened since 2004/2005 was due to the reforms and a favourable economic environment. Not only capital flew into the country, but also know-how and governance.

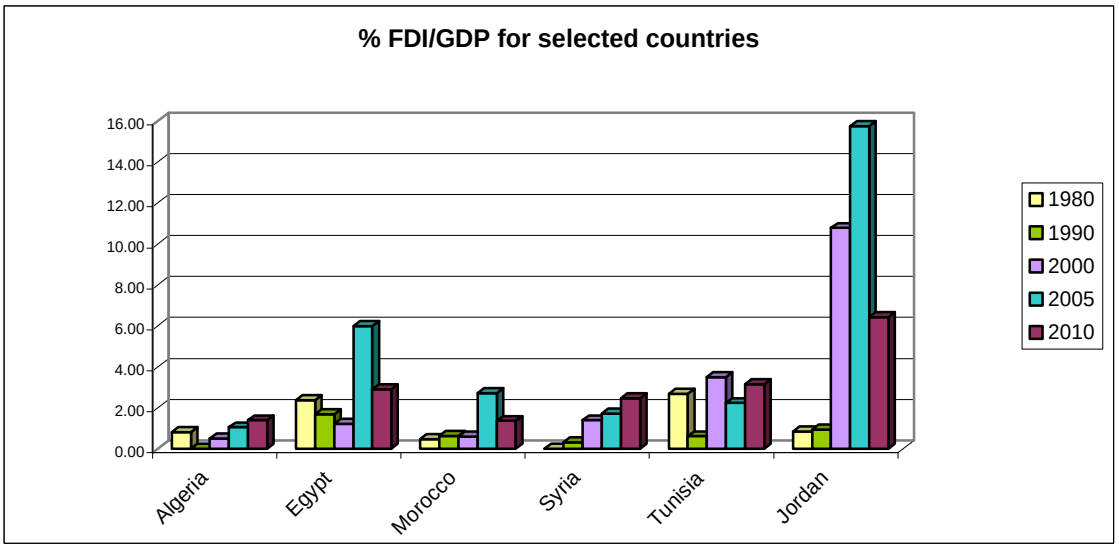
Figures 3.1 illustrates the path of the ratio FDI/GDP in Egypt, showing the sudden increase in a few years after 2004 and until 2008, when the economic crisis broke up. Indeed, this trend is common to other countries of the MENA region, as represented in Figure 3.2.

Figure 3.1 Foreign direct investments/ GDP in Egypt. Period 1970-2010.



Source: World Development Indicators, The World Bank.

Figure 3.2 Foreign direct investments/ GDP for selected MENA countries and selected years.

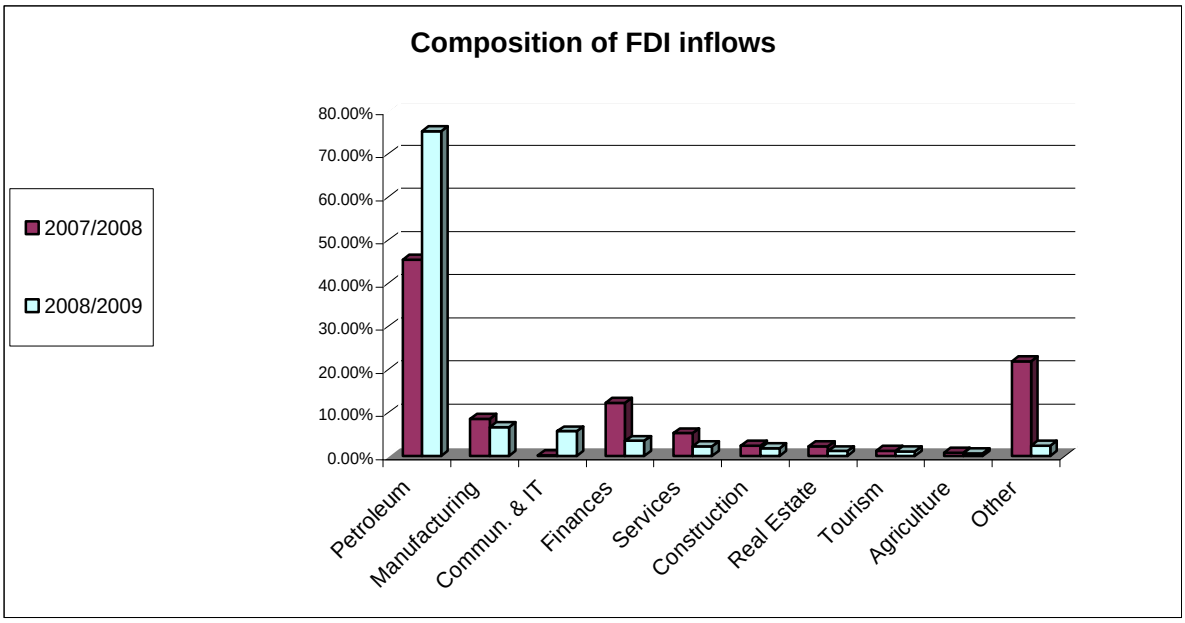


Source: World Development Indicators, The World Bank.

Figure 3.3 illustrates the composition of the FDI inflows in Egypt. Data from the Egyptian Central Bank show that foreign investments are concentrated in the oil sector, that in one year jumped from 45% to almost 80% of total FDI inflows. Foreign companies are very much involved in the exploration activities and the setting up of the infrastructures needed to exploit the fields. Egypt is the largest African non-OPEC oil producer, and the second largest African producer of natural gas, following Algeria. According to the Central Bank of Egypt, 48.3% of investments in the oil sector come from the EU countries, mainly the UK and Belgium, while the USA contribute for about 33%. The second recipient of FDI is the Manufacturing sector, followed by Communications and IT that registered a sharp increase. However, the relative importance of such sectors is clearly negligible. In spite of the impressive development of tourism facilities, especially along the Red Sea coast, the FDI account for a mere 1% of the total.

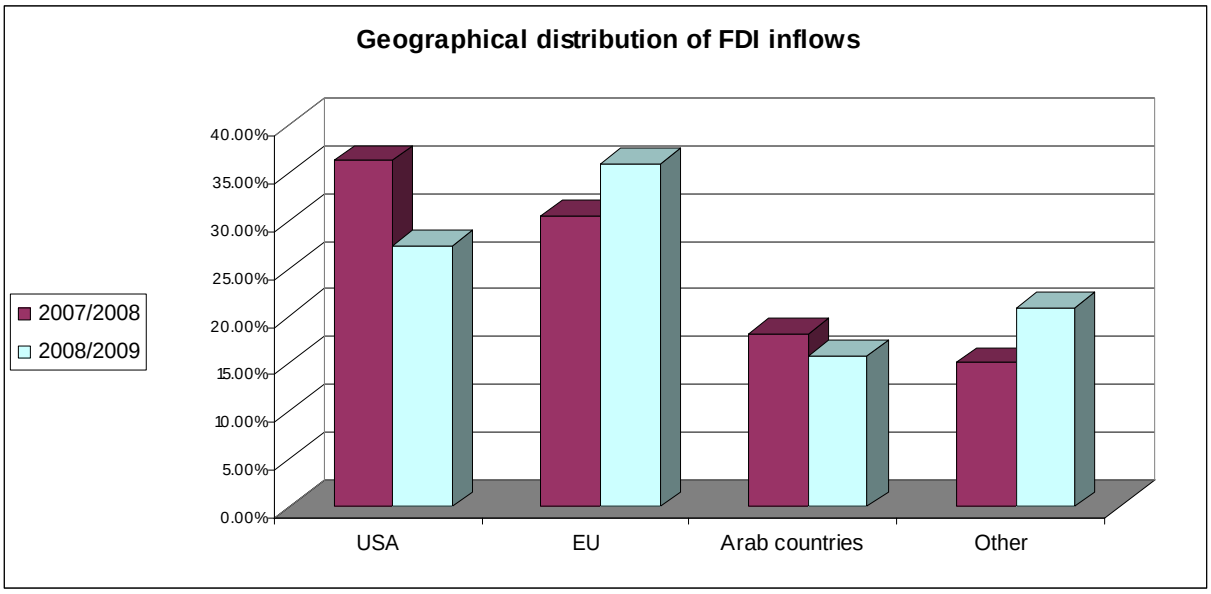
The main contributors to FDI inflows are the USA and the European Union, as evidenced in Figure 3.4. The UK accounted for about 50% of the European investments in the fiscal year 2008/09, while in the previous year the share was close to 60%.

Figure 3.3 Composition of FDI inflows for fiscal years 2007/2008 and 2008/2009.



Source: Central Bank of Egypt Economic Review.

Figure 3.4 Geographical distribution of FDI inflows for fiscal years 2007/2008 and 2008/2009.



Source: Central Bank of Egypt Economic Review.

In the next sections we will analyze whether the efforts in attracting new foreign investments have been beneficial for the country's economic growth measured in terms of GDP.

Since the improvement in the economic environment happened in the latest years, we do not expect a high impact of FDI, at least in the short term. However, we will also try to assess whether there is at least a causal relationship in the sense of Granger.

3.4 Methodology

In this paper we will study the relationship between GDP and FDI using the two-step cointegration method developed by Pesaran et al (2001), also known as ARDL bounds testing approach, and the Toda-Yamamoto (2005) methodology to assess causality. Moreover, we will include in the model other variables that could have an indirect impact on GDP or on FDI.

Thus, the model takes the following semi-log linear form:

$$lY_t = \Phi D_t + \Pi lX_t + \Gamma open_t + \varepsilon_t \quad (1)$$

where Y_t is GDP, D_t contains deterministic terms such as constant and trend, and X_t represents the list of variables included in the model: FDI inflows, education, gross fixed capital formation, exchange rate. Open is a measure of openness and ε_t is the error term.

The first step of the Pesaran's bounds testing procedure allows to assess the existence of a long-run relationship among the variables of Equation (1). In order to implement the test, the ARDL representation of Equation (1) can be formulated as:

$$\Delta \log GDP_t = a_0 + a_1 t + \sum_{i=1}^{p} a_2 \Delta \log GDP_{t-i} + \sum_{i=0}^{p} a_3 \Delta \log FDI_{t-i} + \sum_{i=0}^{p} a_4 \Delta \log EDUC_{t-i} +$$
$$+\sum_{i=0}^{p} a_5 \Delta \log GFCF_{t-i} + \sum_{i=0}^{p} a_6 \Delta \log EXRAT_{t-i} + \sum_{i=0}^{p} a_7 \Delta OPEN_{t-i} + b_1 \log GDP_{t-1} + \tag{2}$$
$$+b_2 \log FDI_{t-1} + b_3 \log EDUC_{t-1} + b_4 \log GFCF_{t-1} + b_5 \log EXRAT_{t-1} + b_6 OPEN_{t-1} + \varepsilon_t$$

The model expressed in Equation (2) can be estimated by OLS and an F- or Wald-test is conducted for the joint significance of the coefficients of the lagged levels of the variables, i.e.

H_0: $b_1 = b_2 = b_3 = b_4 = b_5 = b_6 = 0$ against the alternative hypothesis H_1: $b_1 \neq b_2 \neq b_3 \neq b_4 \neq b_5 \neq b_6 \neq 0$.

Since the F- test used in such procedure does not have a standard distribution, two sets of critical values are provided by Pesaran et al for a given significance level. One set assumes that the variables are I(0) while the other assumes that they are all I(1).

If the computed F-statistic lies within the bounds, the test becomes inconclusive. If the F-statistic falls below the lower bound, the null hypothesis cannot be rejected and the variables are not cointegrated. Lastly, if the F-statistic exceeds the upper bound, then the null hypothesis is rejected and we can conclude that the variables are cointegrated.

Similarly to Johansen and Juselius (1998), Pesaran et al. compute the sets of critical values for five cases, according to the deterministic terms included in the model.

Once the cointegration properties of the variables are detected, in step two the long run coefficients are estimated. The order of lags of the model is determined by the customary Information Criteria (Akaike, AIC or Schwarz Bayesian, BIC) before the model is estimated by OLS. Since we are dealing with annual data, Pesaran and Shin (2007) recommend not to exceed the maximum of two lags. In addition, we can obtain the estimation of the short-term coefficients by estimating an error correction model associated with the long-run estimates, like the one represented in Equation (3), where EC_t is the one period lagged error correction term and β represents the speed of adjustment toward the long-run equilibrium:

$$\Delta \log GDP_t = a_0 + a_1 t + \sum_{i=1}^{p} a_2 \Delta \log GDP_{t-i} + \sum_{i=0}^{p} a_3 \Delta \log FDI_{t-i} + \sum_{i=0}^{p} a_4 \Delta \log EDUC_{t-i} +$$
$$+\sum_{i=0}^{p} a_5 \Delta \log GFCF_{t-i} + \sum_{i=0}^{p} a_6 \Delta \log EXRAT_{t-i} + \sum_{i=0}^{p} a_7 \Delta OPEN_{t-i} + \beta EC_{t-1} + \varepsilon_t \tag{3}$$

At this stage it is also possible to test the stability of coefficients of the regression equations using the Brown et al. (1975) cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests, based on the recursive residuals. The stability of the coefficients is assessed when the statistics fall inside the bounds of the 5% significance.

The ARDL approach has many advantages in comparison to other cointegration procedures, such as Johansen and Juselius (1990). First, it is applicable irrespective of whether the variables are I(0) or I(1); it is appropriate for studies with small samples; then, it estimates the long-run and short-run components of the model simultaneously, removing problems associated with omitted variables and autocorrelation; finally, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger method are avoided.

The Toda and Yamamoto (1995) method for causality is a powerful alternative to the standard Engle-Granger approach and can be applied irrespective of the integration or cointegration properties of the variables. The procedure consists in the estimation of an augmented VAR ($k+d_{max}$) in levels, where k is the optimal lag lengths of the system as determined by the Information Criteria and d_{max} is the order of integration determined with the unit-root test. Instead of the customary F-statistic and Wald test, Toda and Yamamoto developed a modified Wald test (MWALD) with an asymptotical standard Chi-square distribution. Such statistic can be obtained estimating the model as a set of Seemingly Unrelated Regressions (SUR), as proved in Rambaldi and Doran (1996).

3.5 Data and results

We are interested in the relationship between GDP and FDI inflows for Egypt.

Data come from the World Bank's World Development Indicators and from the Barro-Lee database for education and cover the period from 1970 to 2010. The monetary variables are expressed in constant Egyptian Pound, base year 1992.

According to what stated in the literature, we have chosen a number of variables that could have played a role in attracting FDI in Egypt: the exchange rate as Egyptian Pounds per US$, the existing fixed capital, the levels of education expressed in average years of schooling for the working-age population (between 15 and 64), openness computed as the sum of imports and exports as a percentage of GDP, with the purpose of taking into account the country's openness to international trade, and the ratio Banks credit to private sector/GDP as the level of financial development. Such ratio expresses the volume of funds channelled to the private sector, and hence seems more efficient than M1, M2 or M3 in identifying the link between investments and growth (De Gregorio and Guidotti, 1995).

The effects of these variable have been discussed in the previous sections.

Although it is not necessary to assess the presence of unit-roots in the variables before applying the Pesaran's ARDL approach, we prefer to run the unit-root tests, to ascertain that the order of integration the variables is not bigger than one. Moreover, the order of integration from the unit-root test will be useful in the Toda and Yamamoto causality analysis.

The results of the tests for unit-root, conducted with the general-to-specific method, are presented in Table 3.2.

The ADF tests clearly assess that almost all the variables have unit-roots in levels and are stationary in their first differences at the 1% significance level. Education and FDI inflow and Gross Capital Formation are stationary already in levels, or I(0). Adding a trend does not change the results, except for Education, that seems to be stationary in first differences in the KPSS test.

However, we are able to apply the bound test methodology since it allows the use of the variables whether they are I(0) or I(1).

Table 3.2 Unit-root tests.

	Levels: constant only			First differences: constant only		
	ADF	KPSS	Lags	ADF	KPSS	Lags
log_gdp	-1.077	2.081	1	-3.545 ***	0.158 ***	0
log fdi	-5.171 ***	0.805	2	-3.893 ***	0.133 ***	3
log educ	-2.791 *	2.005	1	-1.257	0.821	0
log exrat	-0.866	2.016	1	-3.975 ***	0.084 ***	0
log gfcf	-2.866 *	1.460	0	-4.655 ***	0.205 ***	0
log open	-1.823	0.547 *	0	-4.226 ***	0.160 ***	0
	Levels: with trend			First differences: with trend		
	ADF	KPSS	Lags	ADF	KPSS	Lags
log_gdp	-2.060	0.400	1	-3.613 **	0.081 ***	0
log fdi	-4.805 ***	0.200	2	-4.320 ***	0.061***	3
log educ	-1.502	0.508	1	-2.649	0.085 ***	0
log exrat	-2.899	0.155 **	1	-3.918 **	0.084 ***	0
log gfcf	-3.539 **	0.269	2	-4.890 ***	0.131 ***	0
log open	-1.792	0.331	1	4.174 **	0.093 ***	0

Source: author's calculations. Lag lengths are determined with the General to Specific method with a maximum of 5 lags.
The McKinnon critical values for 40 observations are -3.60 and -2.93 and -2.61 at the 1 (***), 5 (**) and 10 (*) percent significant level with constant only while -4.21 and -3.53 and -3.19 at the 1 and 5 and 10 percent significant level with constant and trend.
The KPSS critical values are 0.739 and 0.463 and 0.352 at the 1; 5 and 10 percent significant level with constant only while 0.212 and 0.149 and 0.122 at the 1 and 5 and 10 percent significant level with constant and trend.

Table 3.3 shows the results of the cointegration analysis under the null hypothesis that the coefficients of the lagged variables are zero.

As anticipated before, we included in the models some variables that could have had an impact, thus, keeping the fundamental relationship between GDP and FDI, we modelled different combinations of the remaining variables.

A constant and a trend are also added to all equations.

The order of lags was obtained by means of the Bayesian Information Criteria (BIC), which tends to define more parsimonious specifications.

Table 3.3 Pesaran cointegration test. Dependent variable: lGDP.

Progr.	Regressors	F-test	95 % Lower Bound	95% Upper Bound	90 % Lower Bound	90% Upper Bound
1	lFDI	23.5393	7.104	7.910	5.862	6.568
2	lFDI, lGFCF	19.5411	5.409	6.407	4.515	5.391
3	lFDI, lEDUC	6.6289	5.409	6.407	4.515	5.391
4	lFDI, LEDUC, lGFCF	6.6513	4.431	5.666	3.720	4.813
5	lFDI, LEDUC, OPEN	6.6082	4.431	5.666	3.720	4.813
6	lFDI, LEDUC, LEXRAT	5.6241	4.431	5.666	3.720	4.813
7	lFDI, LEDUC, LGFCF, OPEN	15.1323	3.944	5.127	3.307	4.377

Critical value bounds for the F-statistic, case Intercept and Trend, Pesaran et al. (2001).

In almost all models the F statistic falls above the upper 95% critical value, except for the case with FDI, EDUC and EXRAT (Progressive number 6), which however rejects the null of no cointegration at the 90% critical value.

In conclusion, we detect cointegration among the variables and we are able to proceed with the second stage of the ARDL approach and estimate the long-run coefficients. Table 3.4 presents the results of models with different combinations of independent variables. The coefficients have been inferred by the estimates of the long run parameters b_2 , b_3 , b_4 , b_5 , b_6 normalized on b_1 in Eq. (2).

For the selection of the variables, the General to Specific method has been applied. This has lead to the exclusion of some models for which the variables had the highest p-value, such as the trivariate cases (GDP, FDI, OPEN), (GDP, FDI, EXRAT) and (GDP, FDI, BKCREDIT).

In the remaining models all coefficients are found statistically significant.

The long run impact of FDI on GDP is not very remarkable, the highest coefficient being 0.049 in the first model. The variable that mostly affect GDP in the long run is the average years of education, assessing an impact varying from 0.215 to 0.509 for a 1% shock of this regressor. Such result may be explained by the sharp increase in the average years of education of the workforce, that rose from 1.3 in 1970 to 7 in 2010[27]. Openness is the second most important regressor after education, a 1 percent change increasing GDP by around 0.1. The impact of the exchange rate is negligible.

[27] Robert J. Barro and Jong-Wha Lee, *A New Data Set of Educational Attainment in the World,1950-2010.* Paper revised in October 2010.

Table 3.4 Estimated long run coefficients. Dependent variable: lGDP.

Regressors	ARDL(1,1) FDI	ARDL(1,1,0) GFCF	ARDL(1,1,1) EDUC	ARDL(1,1,1,0) EDUC, GFCF	ARDL(1,1,1,0) EDUC, OPEN	ARDL(1,1,1,0) EDUC, EXRAT	ARDL(1,1,0,0,1) EDUC, GCFC, OPEN
	1	2	3	4	5	6	7
lFDI_1	0.049	0.031	0.029	0.012	0.011	0.013	0.006
	(5.568) ***	(3.385) ***	(4.447) ***	(3.177) ***	(2.215) **	(3.699) ***	(2.945) ***
lGFCF_1		0.098		0.084			0.047
		(2.505) ***		(4.208) ***			(2.967) ***
lEDUC_1			0.215	0.241	0.509	0.364	0.454
			(1.785) *	(3.019) ***	(3.858) ***	(3.835) ***	(5.132) ***
OPEN_1					0.180		0.116
					(3.495) ***		(4.074) ***
lEXRAT_1						-0.076	
						(-3.959) ***	

The symbols *, **, * denote significance at the 1%, 5%, 10% levels respectively. T-ratios in parenthesis.**

The inclusion of a dummy in 1982 does not change the results consistently (Table 3.4a). The year 1982 has been signalled by the Quandt likelihood ratio test for breaks at unknown time (p-value = 0.000) and could represent a break in the series following the peace treaty signed with Israel in 1979, as suggested in Herzer (2008).

The attempt to account for the level of financial development was fruitless, since the ratio Banks credit/GDP was always not significant and thus was excluded from the regression.

Table 3.4a Estimated long run coefficients. Dependent variable: Lgdp, with dummy.

Regressors	ARDL(1,1) FDI	ARDL(1,1,0) GFCF	ARDL(1,1,1) EDUC	ARDL(1,1,1,0) EDUC, GFCF	ARDL(1,1,1,0) EDUC, OPEN	ARDL(1,1,1,0) EDUC, EXRAT
	1	2	3	4	5	6
lFDI_1	0.032	0.025	0.031	0.016	0.031	0.019
	(6.321) ***	(5.351) ***	(6.524) ***	(6.138) ***	(6.524) ***	(5.979) ***
lGFCF_1		0.047		0.054		
		(2.672) **		(6.130) ***		
lEDUC_1			0.142	0.141	0.372	0.165
			(1.785) *	(3.464) ***	(3.858) ***	(2.869) ***
OPEN_1					0.132	
					(3.495) ***	
lEXRAT_1						-0.042
						(-4.520) ***

We complete the model estimation and present in Table 4 the short-run coefficients associated with the long-run relationship expressed in the Error Correction model of Equation (3).

The one-lagged error correction term is always highly significant and has the expected negative sign, indicating that all models converge to the long-run equilibrium. The magnitude of the

coefficient implies that at least 33% of disequilibrium of the previous period converges towards the long-run equilibrium in the current year.

Similarly to the long-run analysis, the short- run impact of FDI on GDP is negligible: the coefficients, all statistically significant, are in practice equal to zero. The variable mostly affecting GDP in the short run is Education, with a positive impact ranging from 0.592 to 0.930, significant at the 1 percent level.

Among the diagnostics, the R^2 suggests that the models fit the data reasonably well. The Durbin-Watson test is close to two especially in the multivariate models (from Model 4 to Model 7), assessing the absence of residuals autocorrelation. The models pass the tests controlling for normality of residuals (Jarque-Bera), and heteroskedasticity (White), but the Ramsey's RESET test for mis-specification is not clear-cut.

The inclusion of the dummy (Table 3.4a) again confirms the results and improve the models in terms of some diagnostics. The Ramsey test, for example, suggests a progress in the models specification, although the Durbin-Watson is quite poor, especially in the models from 4 to 6 .

Table 3.5 EC representation of the ARDL Model. Dependent variable: logdiff_GDP. Normalized coefficients.

Regressors	ARDL(1,1) FDI	ARDL(1,1,0) GFCF	ARDL(1,1,1) EDUC	ARDL(1,1,1,0) EDUC, GFCF	ARDL(1,1,1,0) EDUC, OPEN	ARDL(1,1,1,0) EDUC, EXRAT	ARDL(1,1,0,0,1) EDUC, GCFC, OPEN
	1	2	3	4	5	6	7
ΔlGDP_1							0.265
							(2.109) **
ΔlFDI	0.009	0.006	0.005				
	(3.411) ***	(2.174) **	(2.043) **				
ΔlEDUC			0.662	0.592	0.735	0.930	
			(3.690) ***	(2.744) ***	(3.890) ***	(5.398) ***	
ΔOPEN							-0.068
							(-2.427) **
ΔlEXRAT						-0.043	
						(-3.864) ***	
ΔlEXRAT_1						0.0328	
						(3.668) ***	
EC_1	-0.330	-0.364	-0.368	-0.468	-0.408	-0.495	-0.732
	(-4.591) ***	(-5.927) ***	(-4.182) ***	(-5.563) ***	(-5.402) ***	(-5.868) ***	(-6.362) ***
const	23.719	21.738	23.809	22.155	23.857	23.869	22.951
	(4.564) ***	(5.616) ***	(4.127) ***	(5.427) ***	(5.352) ***	(5.799) ***	(6.440) ***
trend	0.042	0.040	0.039	0.036	0.030	0.042	0.028
	(4.279) ***	(5.537) ***	(5.011) ***	(6.481) ***	(5.371) ***	(6.6759 ***	(5.865) ***
Diagnostics	Statistics (p-value)						
R^2	0.606	0.661	0.694	0.717	0.721	0.760	0.775
Durbin-Watson	1.555	1.683	1.801	1.991	1.992	1.816	2.130
RSS	0.011	0.009	0.008	0.008	0.007	0.006	0.006
F-stat	9.398 (0.000)	11.056 (0.000)	21.710 (0.000)	22.612 (0.000)	22.539 (0.000)	55.027 (0.000)	39.917 (0.000)
X^2_{Reset}	1.569 (0.210)	3.240 (0.072)	7.073 (0.008)	4.371 (0.037)	3.559 (0.059)	3.842 (0.050)	1.011 (0.314)
X^2_{JB}	0.243 (0.885)	0.304 (0.859)	2.227 (0.328)	3.439 (0.179)	2.277 (0.320)	2.330 (0.312)	1.123 (0.570)
X^2_{H}	8.563 (0.003)	8.235 (0.004)	4.525 (0.033)	6.852 (0.009)	4.277 (0.039)	6.680 (0.010)	5.140 (0.023)

The symbols *, **, * denote significance at the 1%, 5%, 10% levels respectively. T-ratios in parenthesis. Durbin – Watson is the test for residuals autocorrelation. Reset is the Ramsey RESET test for functional form mis-specification. JB is the Jarque-Bera for normality of residuals. H is the White for heteroskedasticity. All tests have a Chi-Squared distribution.**

Table 3.5a EC representation of the ARDL Model. Dependent variable: logdiff_GDP. Normalized coefficients. Case with dummy.

Regressors	ARDL(1,1) FDI	ARDL(1,1,0) GFCF	ARDL(1,1,1) EDUC	ARDL(1,1,1,0) EDUC, GFCF	ARDL(1,1,1,0) EDUC, OPEN	ARDL(1,1,1,0) EDUC, EXRAT
	1	2	3	4	5	6
ΔlGDP_1	0.310	0.263		0.254		
	(3.177) ***	(2.421) **		(2.547) **		
ΔlFDI	0.007	0.006	0.005		0.005	
	(4.452) ***	(2.916) ***	(2.562) ***		(2.562) ***	
ΔlFDI_1			-0.004	-0.006	-0.004	
			(-1.816) *	(-3.331) ***	(-1.816)*	
ΔlEDUC			0.825	0.770	0.825	0.874
			(4.682) ***	(4.301) ***	(4.682) ***	(5.848) ***
ΔOPEN						
ΔlEXRAT						-0.030
						(-3.514) **
ΔlEXRAT_1						0.041
						(5.028) ***
EC_1	-0.537	-0.560	-0.558	-0.870	-0.558	-0.766
	(-6.809) ***	(-8.541) ***	(-6.514) ***	(-8.707) ***	(-6.514) ***	(-6.574) ***
Dummy 1982	0.117	0.108	0.123	0.071	0.123	0.086
	(5.440) ***	(6.287) ***	(5.155) ***	(6.637) ***	(5.155) ***	(6.993) ***
const	23.907	22.931	23.838	22.796	23.838	23.903
	(6.809) ***	(8.039) ***	(6.494) ***	(8.537) ***	(6.494) ***	(6.550) ***
trend	0.041	0.041	0.044	0.038	0.044	0.043
	(6.492) ***	(7.775) ***	(6.732) ***	(9.299) ***	(6.732) ***	(7.811) ***
Diagnostics	Statistics (p-value)					
R^2	0.773	0.799	0.824	0.717	0.721	0.760
Durbin-Watson	1.434	1.755	1.844	0.875	0.824	0.882
RSS	0.006	0.005	0.005	2.113	1.844	2.188
F-stat	23.708 (0.000)	25.698 (0.000)	29.279 (0.000)	0.003 (0.000)	0.005 (0.000)	0.003 (0.000)
X^2_{Reset}	1.577 (0.691)	1.308 (0.253)	0.018 (0.891)	0.402 (0.526)	0.014 (0.903)	0.218 (0.640)
X^2_{JB}	0.876 (0.645)	1.213 (0.545)	0.357 (0.836)	2.942 (0.868)	2.183 (0.798)	2.495 (0.916)
X^2_{H}	0.790 (0.374)	8.804 (0.003)	1.861 (0.172)	2.942 (0.086)	2.183 (0.139)	2.495 (0.114)

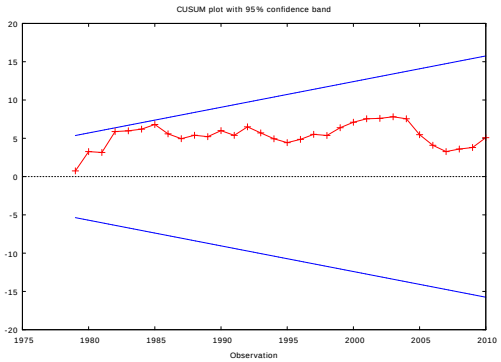
The Pesaran's ARDL analysis is usually completed with the study on the stability of the residuals. We have run the Brown et al (1975) stability test, known as CUSUM and CUSUMQ, whose results are expressed in Figures 3.5 and 3.6 for the case with trend and dummy.

In general, the plots of the CUSUM tests confirm that the statistics are within the 5% critical value represented by the straight lines, although the models with the variable Educ show some border-line results. The plots of the squares of recursive residuals (CUSUMQ) cross the upper straight line in the sample period covering the 1980s and the 1990s.

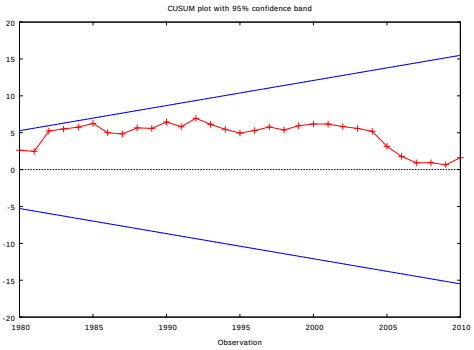
The plots of CUSUM and CUSUMQ for the models with trend only are reported in the Appendix.

Figure 3.5 CUSUM test: Plots of Cumulative Sum of Recursive Residuals for the stability of residuals. Models with trend and dummy.

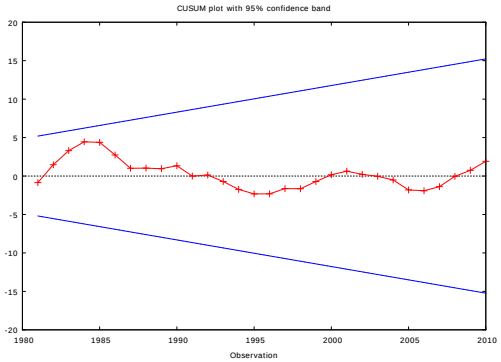
Model 1: FDI



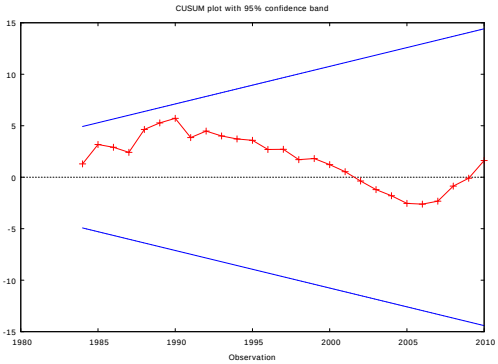
Model 2: GFCF



Model 3: Educ



Model 4: Educ, GFCF



Model 6: Educ, exrat

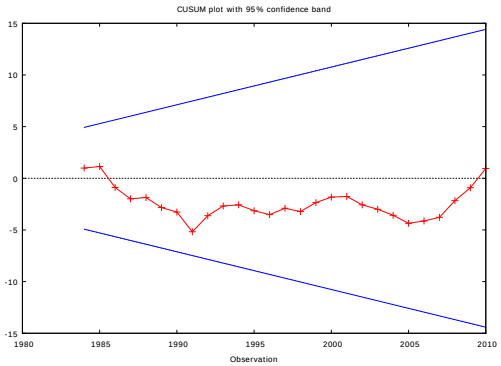
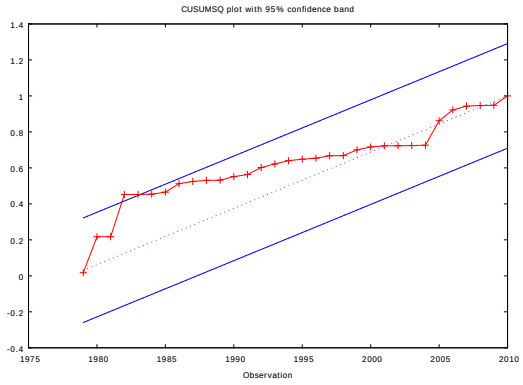
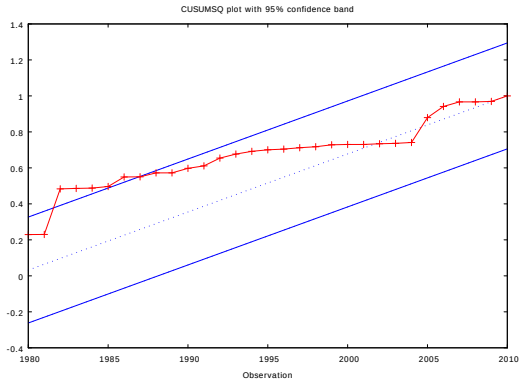


Figure 3.6 CUSUMQ test: Plots of Cumulative Sum of Squares of Recursive Residuals. Models with trend and dummy.

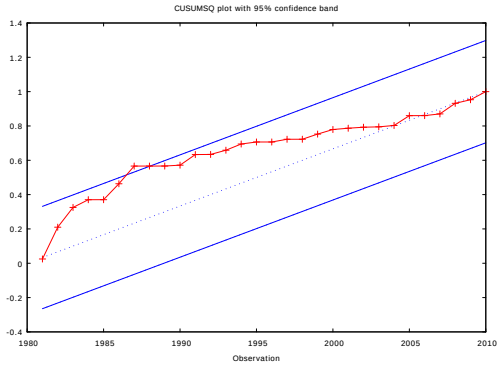
Model 1: Fdi



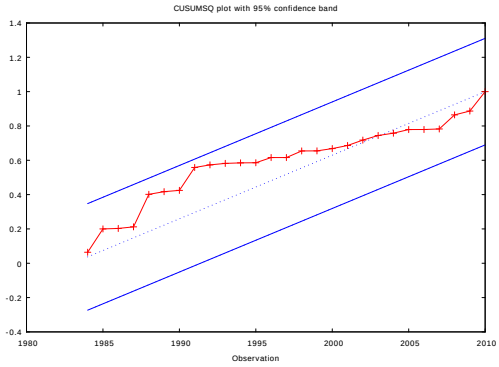
Model 2: GFCF



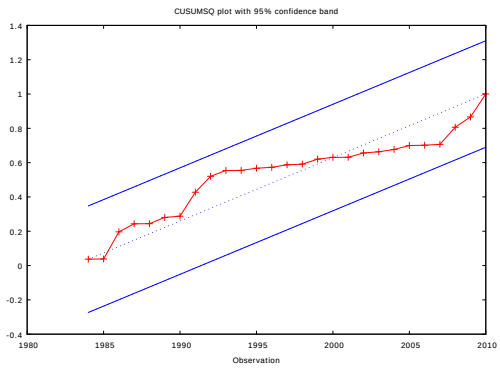
Model 3: Educ



Model 4: Educ, GFCF



Model 6: Educ, exrat:



We now complete the study with the analysis of the causal relationship between GDP and FDI, in particular we will assess the direction of the causality and find which of the following hypothesis holds for the case of Egypt: i) FDI-led growth, when FDI supports the economic growth of the host country; ii) growth-led FDI, if it is the economic growth that attracts foreign investments; iii) bidirectional relationship between FDI and growth.

We have applied the Toda-Yamamoto approach to a bivariate VAR ($k+d_{max}$) model in levels. According to the unit-root test, all the variables resulted I(1), while the optimal lag length choosen

with the Schwarz Bayesian Criterion is one. Therefore, the lag length for the VAR will be two. We have included a trend, although the results do not change in the estimations without trend. For sake of completeness, we have estimated a model with three lags, according to the Akaike Information Criterion that suggested two lags.

The models are implemented following the Seemingly Unrelated Regression (SUR) as in Rambaldi and Doran (1996), see Table 3.6.

In all the cases, the p-value of the MWald test indicates support of the FDI-leg growth hypothesis, with causality directed from FDI to GDP.

Table 3.6 Causality test: Toda-Yamamoto approach.

CASE WITH TREND, 2 lags	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from fdi to gdp	Dependent variable: l_FDI_INFL	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to fdi
VARIABLES						
const	6.872	***		62.468		
trend	0.012	***		0.144		
l_gdp_1	0.989	***		12.476		
l_gdp_2	-0.277	**		-14.927	*	
l_fdi_infl_1	0.010			0.458	**	
l_fdi_infl_2	0.001	***		0.367	*	
Sum of lagged coefficients	0.011			-2.451		
MWald test	13.880	(0.001)	YES	5.101	(0.078)	NO CAUSALITY
CASE NO TREND, 2 lags	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from fdi to gdp	Dependent variable: l_FDI_INFL	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to fdi
VARIABLES						
Const	0.185			-14.311		
lgdp_1	1.393	***		17.116	**	
lgdp_2	-0.400	***		-16.335	**	
lfdi_1	0.007	**		0.416	**	
lfdi_2	-0.007	**		0.284	*	
Sum of lagged coefficients	0.000			0.781		
MWald test	6.011	(0.050)	YES	5.084	(0.079)	NO CAUSALITY
CASE NO TREND, 3 lags	Dependent variable: l_GDP	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from fdi to gdp	Dependent variable: l_FDI_INFL	Significance: 1%: *** (p-value in parenthesis)	Direction of causality: from gdp to fdi
VARIABLES						
const	0.283			-6.913		
l_gdp_1	1.166	***		1.796		
l_gdp_2	-0.275			-1.205		
l_gdp_3	0.099			-0.028		
l_fdi_infl_1	0.011	***		0.666	***	
l_fdi_infl_2	-0.003			0.381	***	
l_fdi_infl_3	-0.008	***		-0.398	***	
Sum of lagged coefficients	0.0002			0.5626		
MWald test	16.734	(0.001)	YES	2.867	(0.412)	NO CAUSALITY

The results of the causality analysis (Table 3.6) seem to suggest that Egypt is already an attractive country for foreign investments. However, since the coefficients of the long-run and short-run

cointegration relationship are quite small, we do not expect a further increase in FDI to affect GDP significantly.

However, the country's attractiveness seems to be mainly due to a large availability of oil and gas resources. This is clearly expressed by the sectorial composition of FDI, where the oil sector represents almost 80% of total investments.

In spite of the improvements in legislation and the Government efforts, one of the weakest points in Egypt is still the level of corruption and lack of transparency and accountability, as stated in the Transparency International Country Profile 2009. While the judiciary system is recognized as one of the most independent and least corrupt public institution in Egypt, the country has to deal with "frequent conflict of interests of parlamentarians who are prominent figures in the business community". The public sector as well appears highly corrupt and poor performing in terms of accountability, integrity and transparency. The overall negative effect on the economy is clear, given the large importance of the public-owned companies Egypt, and the inflows of FDI could be harmed too by the perceived corruption.

After the implementation of the economic structural reforms, the country should now embark in the improvement of transparency and accountability at all levels of the civil society.

3.6 Conclusion

In this paper we have studied the causal relationship between FDI and GDP in Egypt. The policy of openness, implemented since the mid-1970s and confirmed in the 1990s under the ERSAP Programme for structural reforms, should have turned Egypt into an attractive countries for foreign investments.

Indeed, the FDI increased dramatically in the early 2000s, but they have been mainly concentrated in the oil sector. Thus, the inflow of new technology and managerial skills has been limited to a specific economic sector, that, besides, is still under strict governmental control.

The favourable tax regime of the Free Zones could be a further incentive to foreign investments, although with the possible risk that the benefits are again limited to the Free Zones areas.

However, the Government has still to deal with the issue of corruption. The perceived lack of transparency and accountability is harmful in any country.

Appendix to Part 3

The following Table A reports the F-tests for all the model estimated. In all cases, the computed F statistics falls above the upper critical value.

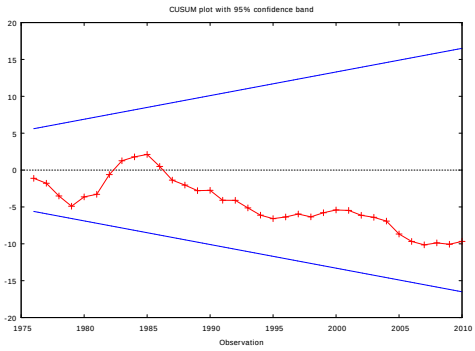
Table 3.A Pesaran cointegration test. Dependent variable: lGDP.

Progr.	Regressors	F-test	95 % Lower Bound	95% Upper Bound	90 % Lower Bound	90% Upper Bound
1	lFDI	23.5393	7.104	7.910	5.862	6.568
2	lFDI, lGFCF	19.5411	5.409	6.407	4.515	5.391
3	lFDI, lEDUC	6.6289	5.409	6.407	4.515	5.391
4	lFDI, OPEN	15.387	5.409	6.407	4.515	5.391
5	lFDI, lEXRAT	15.4062	5.409	6.407	4.515	5.391
6	lFDI, LEDUC, lGFCF	6.6513	4.431	5.666	3.720	4.813
7	lFDI, LEDUC, OPEN	6.6082	4.431	5.666	3.720	4.813
8	lFDI, LEDUC, LEXRAT	5.6241	4.431	5.666	3.720	4.813
9	lFDI, LGFCF, EXRAT	15.1675	4.431	5.666	3.720	4.813
10	lFDI, LGFCF, OPEN	14.6096	4.431	5.666	3.720	4.813
11	lFDI, LEDUC, LGFCF, OPEN	15.1323	3.944	5.127	3.307	4.377
12	lFDI, LEDUC, LEXRAT, LGFCF	5.1561	3.944	5.127	3.307	4.377
13	lFDI, LEDUC, OPEN, LEXRAT	5.9325	3.944	5.127	3.307	4.377
14	lFDI, LGFCF, OPEN, LEXRAT	12.0826	3.944	5.127	3.307	4.377

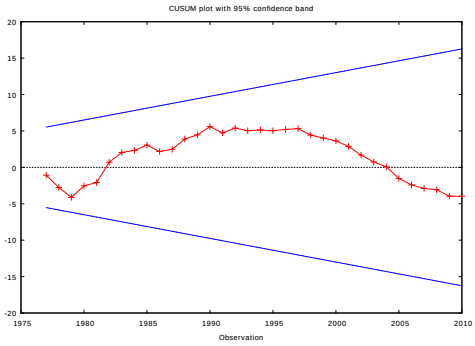
Figure A and Figure B show the plots of the CUSUM and CUSUMQ tests on the recursive residuals for the models with trend only. In some cases, the plots fall outside the critical value of 5% represented by the straight line, in particular in the models with the variable Educ and in the time period 1980s-1990s.

Figure 3.A CUSUM test: Plots of Cumulative Sum of Recursive Residuals. Models with trend only.

Model 1: FDI

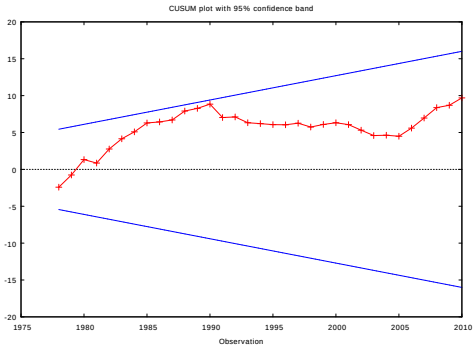


Model 2: GFCF

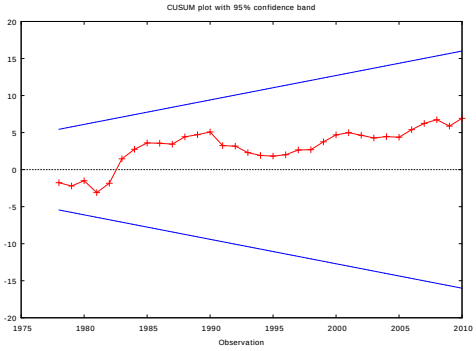


Model 3: Educ

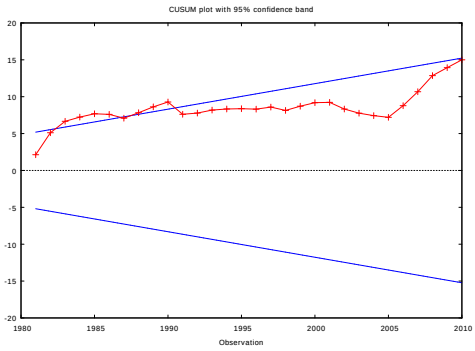
Model 4: Educ, GFCF



Model 5: Educ, open



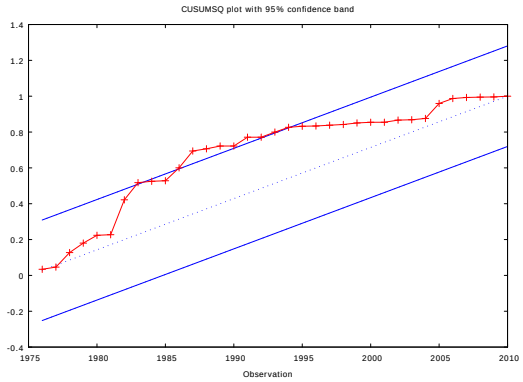
Model 6: Educ, exrat



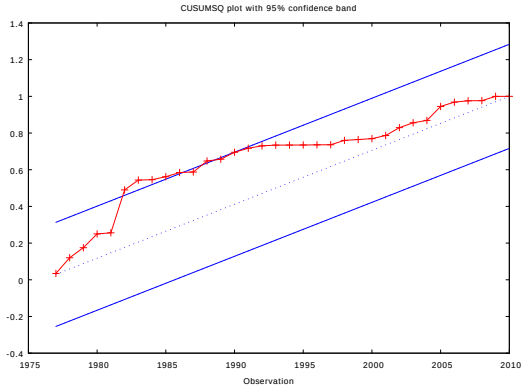
Model 7: Educ, GFCF, open

Figure 3.B CUSUMQ test: Plots of Cumulative Sum of Squares of Recursive Residuals. Models with trend only..

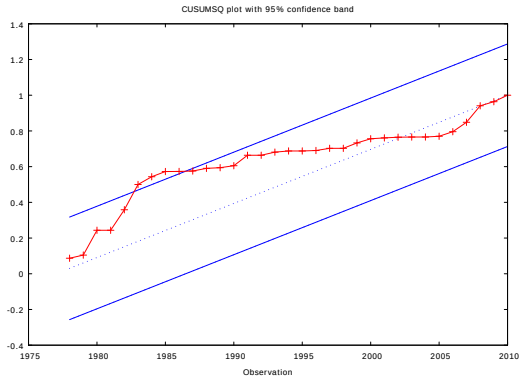
Model 1: Fdi



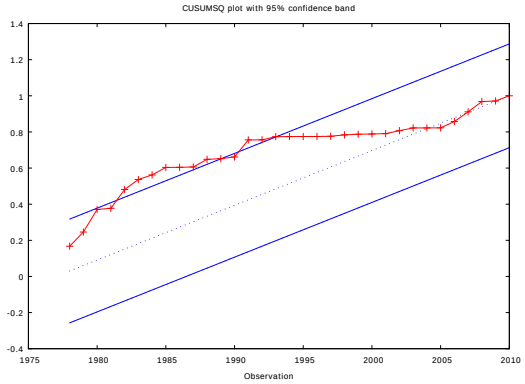
Model 2: GFCF



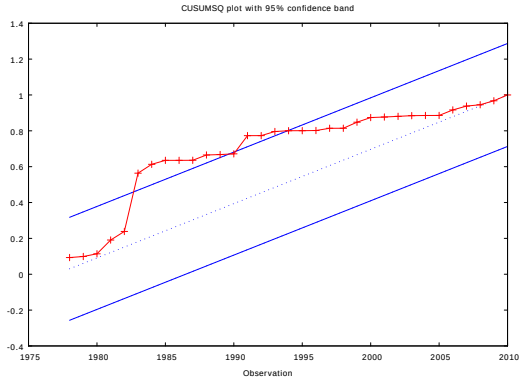
Model 3: Educ



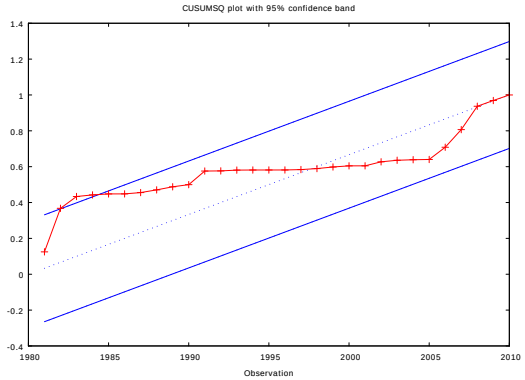
Model 4: Educ, GFCF



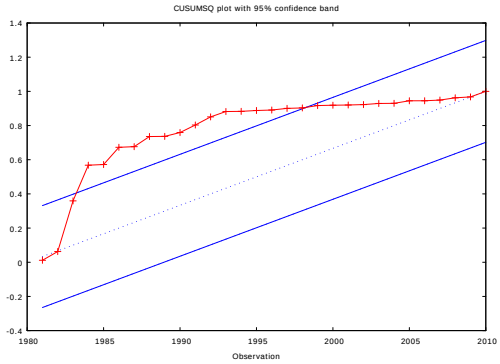
Model 5: Educ, open



Model 6: Educ, exrat



Model 7: Educ, GFCF, open



Conclusion

In this work we have attempted to assess whether some major economic reforms implemented in Egypt since the 1960s had a positive effect on the country's GDP.
The first reform in chronological order was adopted in the 1960s to reach the goal of "free basic education for all". It was then improved in the 1980s with the introduction of compulsory attendance at the preparatory level. In the 1990s the Government supported the shift of enrollments towards the vocational secondary school, in order to meet the firms' needs. These two latter reforms seem to have reached the goal of increasing the productivity expressed as GDP per worker. Sure enough, we have found that the improvement of the quality of human capital in terms of average years of education had a positive effect on GDP per worker. It must be recognized that such result would not have been achieved without the first reform of the 1960s that paved the way to the subsequent reforms.
Again in the 1990s, the IMF supported Egypt in a Structural Reforms Programme (ERSAP) that called for a progressive liberalization of trade and for more incentives to FDI.
Although we might be able to assess a positive effect of trade on GDP when the time series is extended to a longer time period, at present our results support the opposite Growth-led Export (GLE) hypothesis. The analysis focused on trade with the European Union shows instead a bidirectional relationship. Yet, imports are fundamental for the assessment of such causal relationships. This suggests that Egypt could gain if she will be able to enhance her role of transformer of intermediate goods.
With regard to FDI, we have not been able to detect any significant positive relationship from FDI to GDP. Egypt implemented important reforms in order to attract foreign investments, particularly she eased the legislation on labour and the bureaucratic procedures needed to establish a new enterprise. Thus, the country seems to be already prepared to attract FDI, and indeed they have increased significantly in the recent years. Unfortunately, they are mainly concentrated in the oil sector (about 80% of total FDI according to recent data from the Egyptian Central Bank), that is under strict governmental control, while the investors are multinational firms. In such a situation, the foreign investments do not seem to provide the expected widespread effects in terms of inflows of managerial skills or higher productivity of the local workforce.
Yet, the country still has to deal with high levels of corruption, little transparency and accountability of the public sector. Although excluded by the analysis, the recent political events since 2011 have introduced an additional element of perceived instability, that will probably further affect negatively the attractiveness of the country for foreign investments in the coming years.

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