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Employment and Productivity Growth in Egypt in a Period of Structural Change 2001-2008

Key messages

- The private sector was the main source of employment absorption, while the public sector witnessed declines in employment in almost all activities. MSEs represent around 96% of all enterprises in Egypt, and employ around 70% of the private non-agricultural workers. Within those enterprises the informal MSEs constitute the majority of enterprises (78%).
- The movement of labor from low productivity to high productivity economic activities, the "between" effects, were the main determinants of labor productivity changes in most activities. However, analysis also revealed that in economic activities such as Agriculture, Construction, Communication, and Community/ Social Services, the "within" effects through capital injections and/or technology advancement played a relevant role in explaining their labor productivity growth.
- In addition the analysis indicates that : i), the overall labor productivity grew slowly between 2001 and 2008 ; ii) the structural change was clearly associated with labor productivity growth ; iii) the key source of labor productivity growth was the "between effect", which led to movements from low productivity sectors to high productivity sectors. Labor was rationally seeking higher productivity sectors to move to whenever possible ; iv) the main features of the labor attracting sectors are the use of modern production technologies, which necessitate raising the skills of workers/employees, and thus leave their impact as higher labor productivity. However, the contribution of these sectors to total employment is quite limited.
- In order to support employment and productivity public policies should take into account the following points : i) One of the main areas where the government of Egypt should work on is the institutional set-up in which the private sector operates ; ii) Low productivity levels and their slow growth rates need to be stimulated through active fiscal incentives laws that encourage research and development activities and innovation in all enterprises by granting tax exemptions or tax cuts to cover the costs of R&D and Innovation or through offering grants to such activities ; iii) Results revealed that several economic activities especially those that have the highest share of employment to total employment such as agriculture, community and social services, construction, trade and tourism have relatively low labor productivity. These economic activities have to be targeted with special productivity enhancing policies, programs and initiatives ; iv) A starting point should be the specialized cluster communities, where the transmission of new production technologies and knowledge is faster due to the inter-firm connections as the subcontracting relationships as well as the horizontal and vertical firms integration are strongest.

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Abstract

Decomposition is applied as an analytical tool to distinguish the key issues in pace and patterns of sectoral labor productivity and structural change in Egypt during the period 2001-2008. The decomposition of sources of labor productivity growth during the period in question indicates that the movement of labor from low productivity to high productivity economic activities, the "between" effects, were major determinants of labor productivity changes in most activities. However, analysis also revealed that in economic activities such as Agriculture, Construction, Communication, and Community/ social services, the "within" effects such as capital injections, technology advancement played a relevant role in explaining their labor productivity growth.

The MSEs represent more than 96% of all enterprises in Egypt, and employ around 70% of the private non-agricultural workers. Within those enterprises the informality (80%) is the common feature, whether in the nature of the enterprise or in its relationship to its workers and to the government. With informality being widespread in the private sector, data analysis of MSEs Surveys in Egypt shows that the structural change occurred from Industry to Trade in the formal private sector and from Industry to Services in the informal private sector. One interpretation of this evidence toward a lower share of industry in total employment is possible deindustrialization phenomenon in the MSEs economy.

1. An Overview of the Economic Reforms in Egypt during the period of Study

With the implementation of the Economic Reform and Structural Adjustment Program (1991/1992-1996/1997) the Government of Egypt tried public sector reform through liberalization of trade and prices (exchange rate, interest rate, and goods and services), privatization of the public sector, and deregulation of laws. ERSAP was successful in restoring financial and monetary stability, though the labor market was affected negatively by it. Since the beginning of the new millennium, globalization moved at faster pace and governments strengthened this policy choice via a new wave of structural changes. In 2004 a new government led by Prime Minister Nazif started another phase of structural reforms, by introducing several new economic laws and programs and policies which had significant impact on the economic performance of the economy.

Strategic alliance between private business and political power led the trend of new capitalism in Egypt- a case observed in many countries of the world - to encourage major international companies, e.g. global retail chains, to enter the Egyptian markets. Companies in such vital activities as food, drug, cement and steel were acquired by foreigners, especially in the absence of legal controls for the privatization, mergers and acquisitions.

Net FDI in Egypt as percentage of GDP steadily increased from 0.5% in 2002 to 8.1% in 2008 and optimism prevailed about growth of every economic activity, especially mining, financial and real estate activities. GDP growth rates were rising until they reached 7.2% in 2007, and GDP per capita growth rate of 5.0% in 2008 up from 1.4% in 2001. Private and public sector contributions to real GDP growth show that the former always exceeded the latter. Egypt's competitiveness ranking such as World Bank's "Doing Business Index" and sovereign debt rating showed some bias by international agencies to support neoliberalism in Egypt.

Central Bank's monetary policy brought about shifts in money market fundamentals and participants' expectations. A major shift was the elimination of the parallel market for foreign exchange towards unified exchange rate regime at the end of January 2003, which led to increase in the supply of foreign exchange sufficient enough to meet the demands. Furthermore, positive developments led a stable dollar-pound exchange rate in the interbank market and net international reserves of Egypt reached about \$35 billion in July 2008, equivalent

to 7.9 months of imports. Developments in the banking sector included voluntary and forced mergers among a number of banks, which led to the reduction in the number of banks operating in Egypt from 57 banks in 2004 to 39 banks in 2008 and sale of 80% of the Bank of Alexandria to Italy's San Paolo Bank.

Interest rates were in the range of single digit except in 2005 when it reached 10%. Policies to fight inflation were less successful. Both the CPI and WPI inflation rates rose, swinging between single-digit average during the period prior to 2004 and double-digit average during the period post 2004. Observers frequently criticized official inflation figures as being less transparent and underestimate the actual inflation rates. Fiscal policy during the period of study succeeded in achieving a good number of positive reforms including prudent expansion of current and capital expenditure, introducing economic incentives to investment, advantages of reduced tax rates, abolished taxes on wealth and reduced overall budget sector deficit.

However, such reforms were less socially satisfying. For example, wages had large disparities in distribution and energy subsidies represented the largest share in the overall spending on subsidies but went mostly to "energy-intensive" companies such as iron and steel, aluminum, fertilizers, cement and ceramics, as compared to little share spent on food and other subsidies. Financing depended on exceptional revenues, e.g. L.E. 6.9 billion from sale of oil futures contracts, in the fiscal year 2006, L.E. 15.2 billion, from sale of the third mobile phone license to a foreign investor, a windfall tax revenue of L.E. 3.1 billion as a result of revaluation of Telecom Egypt assets, L.E. 1.5 billion from the sale of iron and steel and cement licenses, and L.E. 0.4 billion of export taxes imposed on rice and cement, and L.E. 0.6 billion tax arrears.

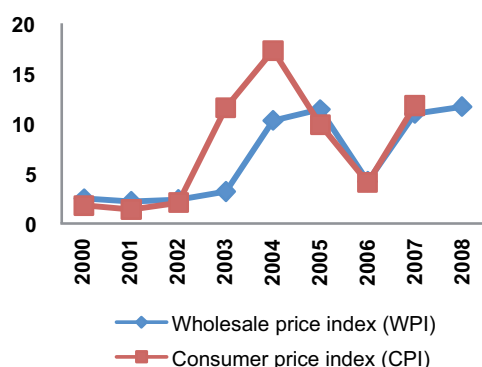
Such neoliberal economic policies widened inequalities both in income and wealth and increased the socio-economic and political burden. Fiscal incentives forced the state to borrow increasingly from domestic resources to fill in the budget revenue gap. Egypt rent income in foreign currency –namely, remittances from Egyptians workers abroad, Suez Canal, tourism and petroleum and gas export– mitigated the reliance on external debt, which rose slightly. However, level of public debt service rose to capture a quarter of the state budget and threaten social spending function of the government. Labor market policies were slack. The

inability of both large international companies that entered the Egyptian market as well as large Egyptian companies was insufficient to provide enough employment opportunities, and led to rising unemployment rates, particularly among young people. The structural characteristics of the Egyptian labor market shows that market dynamics were operating opposite to the intended targets, in which the formal private sector would absorb more of the labor force.

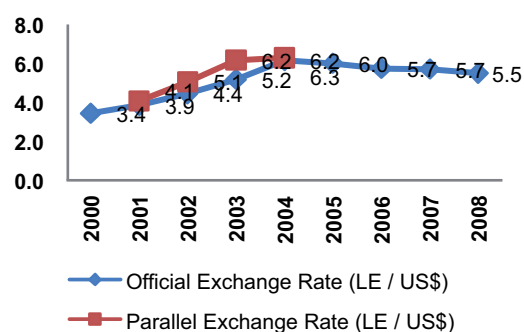
Most of the workers who joined the private sector worked informally, as two thirds of the total private non-agricultural sector workers worked informally or without contracts or social protection while only less than one third of the private non-agricultural sector workers were formally employed. Herein the risk lies as those employees are hired at relatively low wage levels, without contracts and are not registered with the National Authority of Social Insurance.

Figure 1.1: Selected Macroeconomic Variables

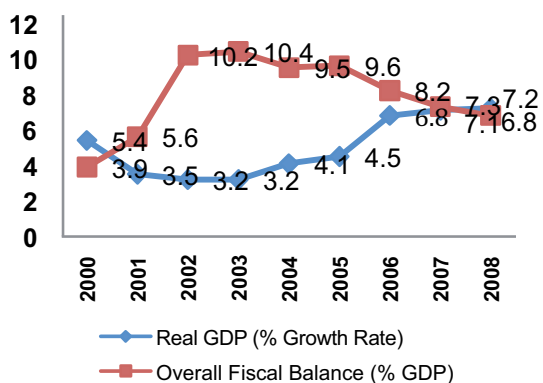
(a): Inflation Rates (yoy %)



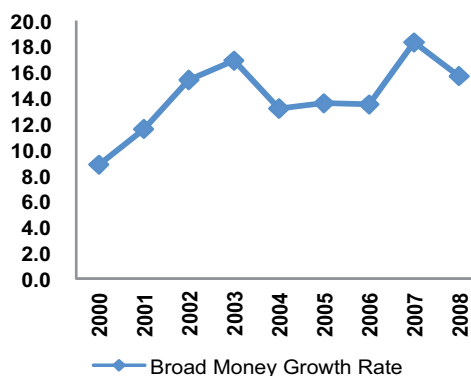
(b): Official Exchange Rate Vs, Parallel Exchange Rate (LE/US\$)



(c): Real GDP Growth Rate and Overall Fiscal Balance

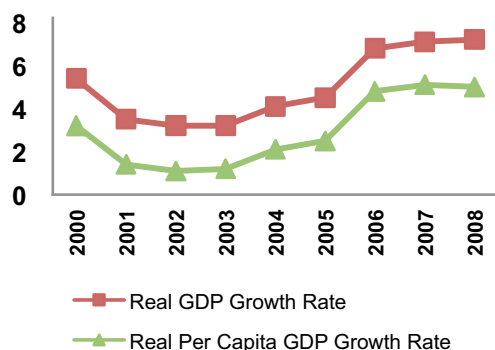


(d): Broad Money Growth Rate

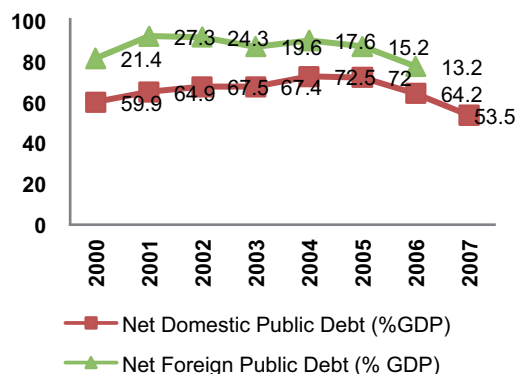


Source: CBE Monthly Bulletin

(e): GDP Growth and Per Capita GDP Growth Rates



(f): Domestic and Foreign Public Debt (% of GDP)



Source: Ministry of Economic Development online data files

Source Ministry of Finance, Egypt: Financial Monthly Bulletin

Objective of the research

This paper focuses on assessing the impact of structural changes during 2001-2008 on labor productivity growth and employment trends.

It extends the growth accounting framework to decompose the sources of labor productivity growth. **The main questions of the research are:**

1. How did overall labor productivity grow in the Egyptian economy?
2. How much did structural change contribute to the overall labor productivity?
3. What are the key sources of the sectoral productivity gap?

4. What are the key dynamics in the process of structural transformation¹?
5. Has labor been moving in the right/wrong direction?

This paper includes the following parts: Section 1 presents an introduction on the Structural Programs that were implemented in Egypt during the last 17 years and formulates the research questions that will be dealt with in the next sections. Section 2 deals with the literature review. Section 3 will present the decomposition methodology and data issues. Section 4 will include the main findings of the decomposition analysis. Section 5 analyzes the development of informality in the Egyptian economy based on evidence from MSEs Sample Survey and Section 6 concludes.

¹ Some survey-based measures of socio-economic indicators, labor market and enterprises capacity utilization and surplus capacity may also be used to shed light on such dynamics. Moreover to address institutional and governance issues that prevent the better allocation of domestic and foreign resources to stimulate productivity growth, surveys on perceived incidence of corruption in the private and public sectors of the economy may also be used.

2. Literature Review

Definitely a comprehensive review of literature on labor productivity and structural change is both challenging and exciting. Our literature review in this paper will be selective, however, it can be divided into three approaches.

The first approach, deals with theoretical motivation, and was led by Lewis (1952). Then the second approach, which is concerned with applied motivations, is the shift-share analysis led by the work of Fabricanti (1942) and Madison (1952). The third aspect, which is also concerned with applied motivations, attempts to explain the decomposed components from the shift-share analysis using policy variable so as to study the convergence hypothesis of labor productivity among the corresponding sectors in developed countries and attempts to conduct international comparisons². The core ideas of significance that can be deduced from the three approaches to labor productivity growth are the importance of the structure, the workings of the economy and the many ways in which the rest of the world affect decisions taken.

The first approach: The 1979 Nobel Prize Laureate William Arthur Lewis' work³ posited a formalization of a two-sector economy classical model that emphasizes the productivity gap between the sectors of an economy, where a modern "capital" intensive sector exists along side with a traditional labor-intensive "subsistence" sector with surplus non-productive labor. At an early stage of development, the modern sector develops by taking labor from the traditional with "unlimited" supplies of labor (the marginal product of labor in the traditional sector is zero); thereby the capital-intensive sector can gradually expand without the need to raise its wages. Accordingly, capital accumulation in the modern sector is the method for growing without doing any real damage to the traditional sector. Lewis dualistic model, however, assumes the productivity growth of the economy is only dependent upon the growth of the modern sector and fails to address institutional and governance problems in developing and less developed countries

that prevent the use of domestic and foreign investment to stimulate productivity growth.

The second approach: of literature studies the difference of labor productivity gaps among the various sectors in developing economies, where mixed realities of traditional and modern sectors of the economy co-exist.

The third approach: the applied sectoral decomposition⁴ was pioneered by Fabricant (1942) who was interested in measuring labor requirements per unit of output, i.e., the reciprocal of labor productivity, but later users of the method (.e.g. Madison (1952)) focused more on its reciprocal: labor productivity. There is ample literature on the impact of structural changes in sectors on aggregate productivity growth in advanced economies and also in the Asian, Latin American and other emerging economies Studies include Syrquin (1984); Paci and Pigliaru (1997); Fagerberg (1999); Timmer and Szirmai (2000); Caselli and Tenreyro (2004); Lenain and Rawdanowicz (2004); Alam et al (2008); and McMillan and Rodrik (2011).

In the following part only a selected literature review of this approach will be attempted. Madison (1952) analyzes the contribution which productivity increases have made to the remarkably rapid rate of growth of the Canadian economy over the 1931-49 period. Estimates of productivity are made in terms of real gross national product (GNP) rather than the GDP and per employed person as well as per man-hour. Real GNP rose 128.5% at a compound rate of 4.7% per annum in the period 1931-49. The greater part of this increase can be attributed to a rise in labor productivity, including a diversity of other factors such as the continuous rise in the labor force, the large decline in unemployment and favorable changes in economic structure on a scale only possible in such a rapidly expanding economy as Canada. Madison broke down the economy into 8 sectors: agriculture and Fishing, Mining, Manufacturing, Construction, Transport, Trade, Finance and Service.

² The OECD published a manual aimed at identifying and promoting best international practices for measuring productivity. See OECD (2001).

³ See Lewis, 1979. See also 1954, 1955 and 1958.

⁴ The decomposition is sometimes also referred to as shift-share analysis. It decomposes aggregate labor productivity growth into effects due to productivity growth within sectors and effects due to structural change.

The rate of growth and the relative importance of the factors contributing to it have differed widely in the two halves of the period considered. The within effects was difficult to estimate due to lack of price deflators. However, the increase in productivity due to intersectoral movements was 7-71% in the period 1931-49. The point of this result is well illustrated in the history of North American industrial development. For example in the transport sector, railroads particularly those in the west, were built very largely with the idea of creating economic expansion rather than of meeting existing demands. The same is true of hydro-electric power developments. In such cases productivity will rise with economic expansion. Additionally, when groups of industries or plants are created which are interrelated to such a degree that it is only possible for them to come into existence simultaneously, they function successfully at a certain level of economic development.

Timmer and Szirmai (2000) paper examines the role of structural change in explaining aggregate productivity growth in the manufacturing sector of four Asian countries: India, Indonesia, South Korea and Taiwan over the period 1963–1993. They apply the sectoral decomposition to measure the impact of shifts in both labor and capital inputs. They examine “the structural bonus” hypothesis, which states that during industrial development, factor inputs shift to more productive branches. The evidence, however, did not support the structural-bonus hypothesis on Asian industrial development. Reallocation of inputs within the manufacturing sector did not provide an extra bonus to aggregate productivity growth, in addition to growth in individual branches. Their finding is robust, even when the decomposition is modified to investigate the possibility of a particular bias (by accounting for increasing returns to scale). This finding is a striking one and runs counter to the expectations derived from the industrial development literature which suggests that in the course of industrialization, factor inputs move into more productive manufacturing industries. This is not to say that structural change is not important for economic growth. It is argued that the results of the decomposition analysis do show that the reallocations did not provide an additional bonus to aggregate productivity growth in the manufacturing sector of the Asian countries. Instead, aggregate productivity growth is driven by widespread productivity improvements across all manufacturing branches.

World Bank (2008) study of labor productivity based on three sectors (Agriculture, Industry, Services) in Thailand found that sharp falloff of productivity growth took place within industry and services. Labor

reallocation continued to be a strong contributor to the growth in aggregate labor productivity after the financial crisis. **Reallocation “between effects”** added 2 percent per year to growth in 1980-96 and 1.6 percent per year in 1999-2005. With a lower overall growth rate after 1999, **the reallocation effects accounted for 60 percent of the total labor productivity growth.** The study was puzzled by strongly negative trends in productivity, which fell sharply during the 1997-98's financial crisis and has remained stagnant ever since. This motivated a more detailed level of analysis for four key service-producing industries: airlines, commercial banking, telecommunications, and trucking, it was found that small variations in labor productivity could result from shifts in the mix of employment between high and low-wage job categories, but productivity would not rise on a sustained basis. The frequency with which negative rates of growth in labor productivity found in the service-producing industries was suggested to be explained by an underestimation of output and systematic over-estimation of the growth of employment in these industries, given that Thailand has no comprehensive economic census for the services industries and annual surveys are limited to a few select industries. Additionally, large scale employment existed in informality, representing 15-20 percent of employment in industry, but in excess of 50 percent in services⁵.

A more recent World Bank (2010) study conducted structural decomposition of labor productivity growth in the Belarus economy, 1996-2008. The data covered value added and employment in 27 sectors, including 16 large economic sectors and 11 industrial sub-sectors. Estimates of “the between productivity effect” from labor shift to sectors with higher growth in productivity and to sectors with higher productivity levels compared to “productivity growth within the sector” found that Belarus average growth in labor productivity declined in 2005-08 relative to the period of 2001-04, i.e. before and during the global financial crisis. Reallocation of labor between sectors did not contribute significantly to the productivity growth. In most economies in transition the overall growth in productivity has been driven by two factors. **The weak contribution of the “between effect” while overall growth was disproportionately dependent on “within productivity” improvements, especially in the recent years reflected the relatively static nature of the Belarusian industrial structure and policy supporting output and employment of the existing large state enterprises.** Additionally, high utilization of capacity made existing capital stock need rehabilitation and replacement.

⁵ Informal sector production is defined as those productive activities conducted by unincorporated enterprises in the household sector that work outside the formal administrative networks that cover the formal sector.

Alam et al (2008) conducted a pioneering work on labor productivity growth for 28 countries of Eastern Europe and the Former Soviet Union and Turkey. The countries are categorized into 5 groups: EU-10 countries (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, Slovenia, Bulgaria and Romania), Southeastern Europe (SEE) countries: (Albania, Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Serbia and Montenegro), Low-income CIS countries: (Armenia, Azerbaijan, Georgia, the Kyrgyz Republic, Moldova, Tajikistan, Turkmenistan, and Uzbekistan) and Mid-income CIS countries: (Belarus, Kazakhstan, the Russian Federation, and Ukraine) and finally Turkey. For those countries, the transition from a command economy to a market economy has involved restructuring and reallocating resources to foster greater efficiency in resource use. Over 1999–2005, the countries have enjoyed substantial productivity gains from the reallocation of labor and capital to more productive sectors and enterprises, from the entry of new firms and the exit of obsolete firms, and from the more efficient use of resources.

The analysis of labor productivity in this study demonstrates the relative importance of these drivers of productivity change and shows that policy and institutional reforms are important in achieving higher productivity growth. The study conducted macro-micro and sectoral level analysis. On the sectoral level, a key question “is overall productivity growth mainly driven by sectoral shifts or by within-sector productivity gains?” was considered. The analysis focuses on the relative contributions of three main sectors—agriculture, industry, and services—to overall labor productivity. Labor shifted to agriculture out of manufacturing in most low-income CIS countries, which increased the share of agriculture by around 20 percentage points. Agriculture was the employer of last resort because of the lack of opportunities in services and the absence of adequate social safety nets. As a result, the share of employment in agriculture in 2004 was still well above the corresponding share in the market economies. Labor shifted to service market in all countries where there existed a small market-oriented service sectors. During transition, the EU-10 countries and the Mid-income CIS countries adjusted by increasing the share of employment in services, thus moving closer to the patterns in market economies. In these countries, the share of services in total employment increased by about 5 percentage points during the transition, while the share of manufacturing fell by about 3 percentage points. In contrast, in the low-income CIS countries, market services gained little as a share in total employment, and the employment share

was still below that in market economies. The structural gap inherited from central planning narrowed, but this adjustment differed across countries over 1990-2004.

McMillan and Rodrik (2011) have documented the labor productivity gaps, and emphasized that labor flows from low-productivity activities to high-productivity activities are a key driver of growth and development. Their results for 38 countries from OECD, Africa, Asia and Latin America with data in 2000 PPP U.S. dollars disaggregated into 9 economic sectors since 1990 show that structural change has been growth-reducing in both Africa and Latin America, with the most striking changes taking place in Latin America⁶. Most of the differences between these countries’ labor productivity performance and that of Asia is accounted for by differences in the pattern of structural change. Namely, while labor has been moving from low- to high-productivity sectors in Asia, it was the opposite direction that occurred in Latin America and Africa. Low productivities were marked for certain sectors including Community, Social, Personal and Government Services (CSPGS), Agriculture, Hunting, Forestry and Fishing (AGR), Public Utilities (PU). A key promise of globalization was that access to global markets and increased competition would enhance allocation efficiency of economic sectors in the economy and thus overall productivity.

Globalization, however, has resulted in highly uneven outcomes shown by their empirical results as it did not alter the underlying reality constrained by policy choices: structural change does depend not only on what’s happening “within” industries, but also on the reallocation of resources across sectors.

Finally, while labor productivity growth is a popular economic concept among economists and researcher, decomposition of the sectoral labor productivity growth in Egypt is not really found in literature. Indeed, beyond growth accounting, there has been little applied research not only on structural decomposition at the sectoral level, but also on its sustainability and the driving forces of its improvement in Egypt.

However, Ikram (2005) reviewed extensively some stylized facts on productivity growth in Egypt. Looking at the political economy of economic growth in Egypt in the 35 years period, 1965-2000, Ikram noted that there are cross-sectoral reallocation of resources, mainly away from agriculture, and structural changes that affected output sectors of (1) services, with a share of 50 percent in GDP and economic

⁶ The study, however, does not consider the cross effect, or perhaps assumes it negligible.

growth, (2) **agriculture**, with a declining share, (3) **manufacturing**, with its share moving around but did not exceed 20 percent and a significant impact on the industrial sector accompanying the Infitah policy (Opening –up economic policy) in the 1970s due to greater access to investment and new technology, and (4) **petroleum**, with share in GDP fluctuating widely, depending on the movement of the world oil prices, but was important contributor to economic growth.

In 1980s the economic growth faltered by the fall in oil prices and subsequent economic growth was based on the external borrowing.

The major factor contributing to economic and productivity growth was the “within,” where capital accumulation drove output and productivity growth during 1965-1990. However, there are conflicting results concerning the growth in the 1990s. During 1965-2000 the Egyptian economy created 297,000 additional jobs annually and the growth rate of employment 2.4 percent a year, and elasticity of employment with respect to output during the 35 years was 0.48. Economic growth has not resulted in sufficient job creation. The unemployment problem increased during 1975-1985. Employment shifts to sectors with higher productivity levels in Egypt were generally small.

3. Methodology

In this research we conduct the decomposition analysis using the constant return to scale Cobb-Douglas production function⁷. Decomposing the the production function to derive the sources of labor productivity we arrive at the following equation:

$$\frac{Y_A^t - Y_A^{t-1}}{Y_A^{t-1}} = \frac{\sum_{i=1}^m \Delta y_{i,t} \theta_{i,t-1}}{Y_A^{t-1}} + \frac{\sum_{i=1}^m \Delta \theta_{i,t} Y_{i,t-1}}{Y_A^{t-1}} + \frac{\sum_{i=1}^m \Delta \theta_{i,t} \Delta y_{i,t}}{Y_A^{t-1}} \quad \text{(Equation 1)}$$

where

Y_A = the aggregate weighted productivity of worker in all economic activities. The weights are the share of each economic activity in labor to total labor.

Y_i = labor productivity in sector i

θ_i = share of economic activity i of labor to total labor

Accordingly, the aggregate labor productivity growth can be decomposed into:

Within effect	$\frac{\sum_{i=1}^m \Delta y_{i,t} \theta_{i,t-1}}{Y_A^{t-1}}$
Between static effect	$\frac{\sum_{i=1}^m \Delta \theta_{i,t} Y_{i,t-1}}{Y_A^{t-1}}$
Between dynamic or cross effect	$\frac{\sum_{i=1}^m \Delta \theta_{i,t} \Delta y_{i,t}}{Y_A^{t-1}}$

It follows that aggregate labor productivity growth could be achieved by two ways:

- a. Growth **within** economic sectors through capital accumulation, technology change (namely, more capital-intensive methods of production), and reduction of misallocation across firms; and
- b. Structural effects represented by labor movement between sectors from low to high productivity sectors, thus increasing overall labor productivity in the economy. Structural change effects consist of:

- a. A static shift effect, which measures productivity growth caused by a shift of labor towards branches with a higher labor productivity level at the beginning of the period; and

- b. A dynamic shift effect which measures labor shifts towards more dynamic economic activities, i.e. those with higher labor productivity rates.

Typically, structural change effect occurring through dynamic resource reallocation effects, the last term, is negligible, especially over short periods of time. Indeed, in McMillan and Rodrik (2011), this the last term is completely dropped; this is also what we follow in this paper.

Clearly productivity can grow even if there is no productivity growth within sectors. This is substantiated by the static between effect in the equation due to inter-sectoral employment changes. If employment movements occur from low (high) productivity sectors to high (low) productivity sectors, aggregate output per worker should increase (decrease). If the between effect is negative the reallocation of employment by sectors was detrimental to overall productivity growth.

More generally, sustained labor productivity is influenced by several factors. More countries than ever before are working to improve labor productivity. Their challenge is to develop institutions and processes that are more responsive, especially to country's external vulnerability and economic downturns.

It should be noted that though productivity growth is a popular economic concept among economists and researcher, there has been little formal research on its decomposition, sustainability of its factors the driving forces of its improvement in Egypt.

DATA

Our data comes from a single national source, the Ministry of Planning (MoP), which makes the value-added tables of GDP at factor cost available online. Both real and nominal value-added are available but at different base-year constant prices, where no intersecting year existing over 5-year periods corresponding to the 5-year National Plan.

⁷ See the derivation of the production function in Statistical Appendix.

⁸ Let a function be defined by $Z = x \cdot y$. Taking the change over time in Z we have $\Delta Z = (x + \Delta x) \cdot (y + \Delta y) - x \cdot y$.

Expanding this expression yields: $\Delta Z = x \cdot y + x \Delta y + y \Delta x + \Delta x \Delta y - x \cdot y = x \Delta y + y \Delta x + \Delta x \Delta y$. The last term is an interaction term.

The only exception was the last two periods, (FY2002-FY2007) and (FY2007-FY2009), where the value-added are available in 2001/2002 prices and 2006/2007 Prices are available for the year FY2007 and thus we could link together the two time-series on the same base-year (2001/2002) prices.

The entire data set is a panel data, with *m* sectors being the panel variable⁹. All constant prices are in Egyptian Pound (EGP). Dollar Purchasing Power Parity (\$PPP) conversion factors are not

available on sectoral levels.

The major variables included for analysis in this research are the following:

- Sectoral and aggregate employment
- Sectoral and aggregate real value added in 2001/2002 constant local currency prices.
- National GDP and Sectoral GDP Price deflators, 2001/2002=100

Figure 3.1: The Nine Economic Sectors

Economic Sectors	
1	Agriculture, Woodlands & hunting
2	Extractions
3	Manufacturing Industries
4	Public Utilities ((Electricity, Gas, and Water)
5	Construction & Buildings
6	Transportation, Storage & Communication including Suez Canal
7	Wholesale and Retail Trade, Hotels and Restaurants
8	Finance, Insurance, Real Estate and Business Services*
9	Community, Social, Personal and Government Services **

* includes financial intermediaries, supporting services, insurance, social Insurance, real estate activities.

** Includes Government, education, health, social, cultural, entertainment & personal services.

The research covers the time period FY 2002 - FY 2008. The period is characterized by several policy changes, namely:

- Before FY 2004 policy was oriented towards mainstreaming the macroeconomic aggregates and restructuring public sector enterprises;
- FY 2005- FY 2008 (Government support to output and employment of the private sector enterprises (e.g. tax incentives and budget subsidies), institutional changes and capping/reducing the size of the existing state-owned enterprises.

No complete data set were available for our analysis for years after FY 2008 for both GDP and employment. Interestingly, however, for the FY 2009- FY 2011, preliminary evidence shows decreased capacity utilization due to the Global Financial Crisis (GFC) and its aftermath as

well as the January 25th 2011 Uprising and its aftermath.

As was mentioned before, data were collected from public records concerning both GDP and employment in the nine economic sectors. Checks and comparisons were conducted to ensure the data validity and consistency according to the different sources of data (ministries and statistical offices). Several indicators were calculated which we will present in this part and they include:

- 1- Series of price deflators for the whole period in question (2001-2008).
- 2- The deflated values of GDP (overall and sectoral).
- 3- The distribution of labor between the different economic activities and the public/ private comparisons of labor distribution among the economic sectors.

⁹ Sectoral classification of value-added and employment has been constantly changing that makes studying a longer period impossible without high level of aggregation (e.g. only three sector classification agriculture, manufacturing and service). Thus, we could only handle the sectoral classification problems consistently over the last two periods, (FY2002-FY2007) and (FY2007-FY2008).

- 4- The labor productivity distributed according to the nine economic activities and the inclusion of public/ private sector comparisons in each economic activity).
- 5- The decomposition values that describe the sources of labor productivity whether they go back to reasons "within" the sectors such as technological change, capital accumulation, or acquisition of skills; or "between" sectors due to movements of labor from low

or higher productivity sectors or from declining to new rising sectors.

However, the macro data analysis will be supplemented -in section five- by analysis of the labor productivity in the micro and small enterprises using micro data sets. This analysis helps in explaining and shedding light on the impact of informality on labor productivity in general in Egypt.

4. The Main Findings

Before we delve into the interpretation of the results it has to be made clear that: a) the Egyptian economy could be considered a dual economy, where the technologically advanced, highly productive but limited number of large and medium sized enterprises coexist with a huge pool of low productivity and mostly primitive and informal micro and small enterprises and b), that the official data, though consistent from the different sources, could suffer from inaccuracy, especially where the total value added from the different sectors are concerned.

Taking these two remarks into consideration could be helpful in understanding some of the following results:

Firstly, where the labor productivity growth rates are concerned, data point out that they fluctuated over the period in question with an average of 2.4% between the first year 2001/2002 and the last year 2007/2008¹⁰. The fastest rising economic activities in terms of growth rates were in the following sectors: Transportation and Storage (including Suez Canal), Communication; Construction and Buildings; Public Utilities; and Wholesale/Retail, Trade Hotels and Restaurants, respectively. The economic activity that experienced decline in its labor productivity growth was the Mining and Extraction. The remaining economic activities revealed modest improvements in the productivity growth rates between the two comparative years.

Secondly, as to the distribution of labor between the different economic activities, data reveal marginal movements across activities, though some activities were more attractive to employment such as Mining/Extraction (with very limited share of total employment 0.0031% in FY 2002 to 0.006% in FY 2008 of total employment), Wholesale/Retail trade, Restaurants/Hotels, Manufacturing, and Transportation/Storage/Communication respectively.

The graphs in Fig.1¹¹ reflect the indices of employment change over the period in question in the nine economic activities (with 2001/2002 as base year=100): The trends of change show that the private sector employment witnessed a steady increase in all economic activities, with certain activities performing better than others. Whereas the private

sector employment in the areas of public utilities and extraction seems to be relatively growing at a faster rate than manufacturing, their employment basis is rather small and insignificant as percentage to total private sector employment.

The graphs also indicate that the employment changes in the public sector enterprises and the government were generally declining with few limited exceptions such as community services, public utilities and transportation and communication. This decline could be explained as being part of the structural adjustment policy adopted by the government, which aimed at reducing public employment.

Thirdly, the decomposition results reveal several important features of change. In this respect we will take into account a) the total decomposition values in the nine economic activities once by comparing the results according to the economic sector (private and public); and b) the decomposition values of the nine economic activities by distinguishing the "between" and the "within" sources of change.

A) The decomposition results classified according to the economic activity and the sector (public and private).

The graphs in Fig.2¹² depict the main trends of labor productivity growth rates in the different economic activities and distinguished according to the private/ public sector enterprises over the period 2001/2002 and 2007/2008. Those main trends reveal the following main developments:

1-All graphs (S.A.Fig.2) depict the developments in total labor productivity in the public and private sectors of the nine economic activities during the period in question. As we mentioned at the start of this paper the first comparison years 2001/2002-2003/2004 were years of recession, as reflected by the macroeconomic data on GDP growth rates, which averaged 3.5%, and unemployment rates, which averaged 10.4%. The lines reflecting overall labor productivity changes that are almost either flat or declining and have either negative or very low values during these recessionary years. Economic activities related to agriculture and finance/insurance/real estate/business services exhibit significant negative changes.

¹⁰ See S.A. Table A.0.

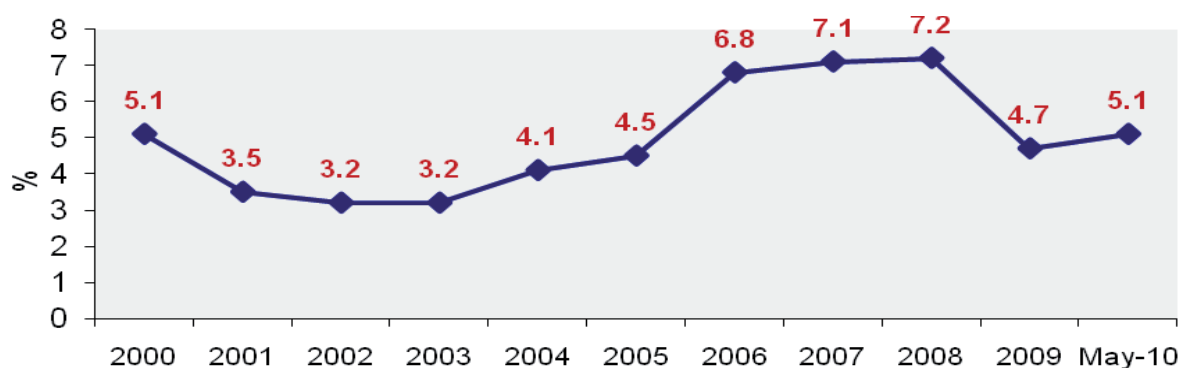
¹¹ See statistical Appendix, Fig.1.

¹² See S. A. Fig.2

2- The apparent slow growth trend is reversed by the end of 2005, as productivities start to show significant improvements in all economic activities. This change could be explained by the structural changes in economic policies, laws, and the favorable liberalized business environment which started in the beginning of the Millennium (especially since 2002) and affected the operations of the private

and public sector companies, large and small, and encouraged the Foreign Direct Investment to locate their businesses gradually in Egypt. During the years starting 2005 until 2010 the GDP growth rates (Fig 3) rose from 4% in 2004 to 7.2% in 2008 and then declined with the financial crisis to 4.7% in 2009 and started recovery again in 2010.

Figure 4.1: Egyptian GDP Growth Rates 2000 and Mid 2010



Source: Calculated by the authors based on the data in the tables A.1 till A.5 in the Statistical Appendix.

3- During the years of structural adjustment, the private sector was in the lead as regards the total labor productivity.

4- In the structural adjustment years, the private sector was the leading sector where the TLP was concerned.

5- The calculated overall total labor productivity values also indicate that the productivity's growth was primarily led by the private sector companies and activities. This result is visible in all economic activities with no exception.

B) The decomposition results classified according to the economic activity and the sources of productivity growth:

As to the decomposition of productivity growth rates into "between" and "within" factors, the graphs in Fig.3¹³ present the main results:

1- The movement of employment from low to high productivity activities or from declining to new rising activities or the "within" effects seem to play a dominant role in determining the overall changes in productivity in almost all economic activities.

2- The data of the year 2007/2008 reveal a strong departure from the

previous years and a clear positive improvement of productivity in all economic activities, which is mostly explained by the movements of labor "between" economic activities. This year is also the first year where the GDP growth rate exceeded 7% and the economy was picking up at a strong pace after a period of slow growth and modest reforms.

3- However, if the last year (2007/2008) is excluded from analysis, we can notice that factors related to productivity changes "within" several economic activities played a distinct role in inducing labor productivity changes. Activities such as agriculture, construction, transportation and communication, public utilities, and community and social services show that factors such as the usage of advanced technology, increasing the capital intensity, raising skills and efficiency of the workers mattered significantly in increasing productivity growth rates in those activities. These results correspond with the investment policies and investors tendencies that ventured in activities such as construction, communication, agri-business, hospitals and banks and insurance companies.

4- The last decade witnessed the establishment of wide scale plantations that are run using advanced agricultural machineries and production techniques. Some of these enterprises are associated with new agri-businesses especially in the activities such as dairy products, food

¹³ See S. A. Fig.3

processing, herbs planting and packaging, and exporting various new products.

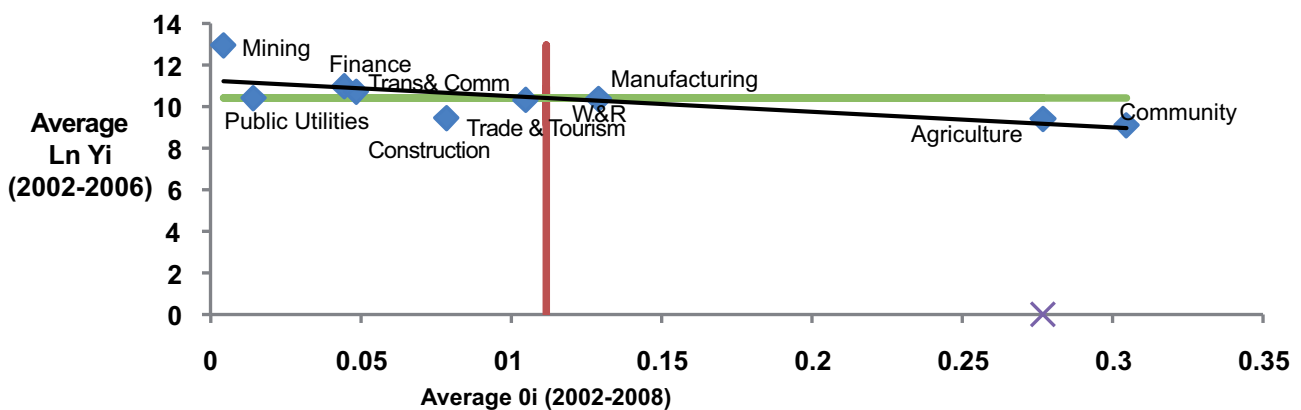
5- The same could be said about the new developers in the area of residential and entertainment construction. After a period of recession since the end of the nineties, new private sector companies erupted and flourished starting 2004. These companies were primarily specialized in building residential compounds for rich and middle income households and beach resorts and hotels. They depended on new technologies in construction and went into partnerships with international reputable and non-reputable developers.

6-The communication sector, with its various fields of specializations, high wages and promising potentials captured growing interest among the new investors, the new graduates, and the young highly educated generation.

C. Conditional and Unconditional Labor Productivity

In an attempt to monitor the changes that took place in both the labor productivity and the share of each economic activity in total employment over three points in time, 2002, 2004, and 2008. It was difficult to trace drastic changes in the relative importance of the economic activities through the three points in time. Thus, we took the unconditional averages of both the labor productivity (labor productivity was measured on the vertical axis on a log scale) and the share in total employment (as represented on the horizontal axis) of each economic activity over the whole period to identify the position of each economic activity in this space.(as depicted in the following figure 2).

Figure 4.2: The Average Change in Labor Productivity and Share of Economic Activities in Total Employment 2002-2008



Source: Calculated by the authors based on the data in the tables A.1 till A.5 in the Statistical Appendix.

The most relevant remark is that the economic activities that show the highest labor productivity (above the average, the green horizontal line) are the ones that add the least to employment (below the average contribution to total employment, left of the vertical red line) such as Mining, Finance, Transportation and Communication, whereas the economic activities with the higher share in employment experienced relatively less labor productivity levels such agriculture and community and social services.

In addition, it is also worth noting that there are no economic activities that could be described as "super performers" as measured by both average labor productivity and employment share. The fact that the averages do not show significant variations in the labor productivities could be explained by the duality of the economy, where the few emerging, advanced, highly productive and modern enterprises are surrounded by huge and growing numbers of micro and small enterprises

that are characterized by their modest performance and low labor productivity. This fact dampens the impact of structural change on the overall employment productivity.

Also, by adding the conditional mean value of log productivity given the average share of employment of each economic activity in total employment for the nine economic activities over the entire sample period 2002-2008, the fitted regression line shows some economic activities outperform, i.e. above the expected value of log labor productivity, while others are underperforming, i.e. be below the expected value of log labor productivity. The fitted line is downward sloping. Economically, it is not unanticipated in applied labor productivity literature to see such tradeoff. Counter intuitively, the agriculture activity is outperforming, while manufacturing is a marginal case in the high labor productivity-high share of employment.

The previous results seem to point out that there is vitality and flexibility in the labor market, which are confirmed by the impact of the reallocation of labor on productivity. However, the overall labor productivity growth rate has been extremely modest during the study period. This phenomenon minimal productivity raises several questions the most

important of which, is: Why is LP so modest in Egypt?

In order to answer this question one has to peek into the results of the micro data sets of MSEs. The following section will try to show the impact of informality on LP.

5. Development of Informality: Evidence from MSEs Sample Surveys

In an attempt to assess the changes that took place in employment and productivity in the private sector, while distinguishing between formal and informal activities we relied on three nationally representative Micro and Small Enterprises surveys that were undertaken in 2003/2004 and in 2011. Since there are no extensive and detailed national surveys that deal with the different enterprises sizes, we will confine our analysis to the above-mentioned surveys when we conduct the formal/informal comparisons in the following part and we will deal with two main variables, the employment and value added in MSEs, as they relate to formality.

The sampling unit in the Survey on micro and small enterprises (MSE's) in the non-agriculture activities is the "enterprise." The sampling unit has been classified by three overall economic activities: trade, industry and services and in each activity the enterprise is classified into formal and informal. The MSEs are units that employ less than 50 workers. The formality status of an enterprise has been determined based on the compliance by the formality procedures (license, registration, tax card and regular bookkeeping). If the MSE does not comply by all or a least one procedure it is considered informal. Accordingly, 21.9% of the MSEs are formal enterprises while the remaining percentage represents informality (78.1%).

As to the formality of a worker, it is linked to the availability of work contract/social insurance.

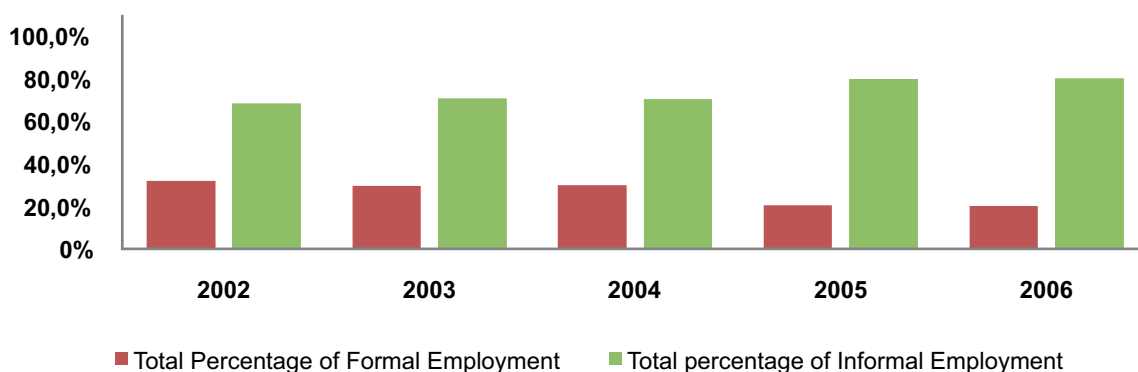
By the end of 2011 there were around 3.04 Million establishments and those MSEs employed around 7.9 million workers or 33.7% of total employment in Egypt in 2011 (23.46 Mill workers in December 2011)¹⁴, with an average MSE size equal to 2.63 workers. The MSEs are distributed into three main economic activities namely trade (60%), services (30%) and manufacturing (10%).

Only 15% of the workers in the MSEs have work contracts/social (excluding the self-employed or employers who have social insurance schemes for their own benefits).

1- The Overall Employment in MSEs and Its Behavior Over Time:

The majority of employment in the MSEs sector is characterized as being informal. Over the nine years from 2002 to 2011 the share of informal employment increased from 68% to 79% of all employment in the sector. This result indicates that despite the various efforts by the government to support MSEs, informality among its workers is rather high and growing.

Figure 5.1: Overall Formal and Informal Employment in the MSEs



Source: El Mahdi, A. Data bases of MSEs Surveys of 2003, 2004, 2011.

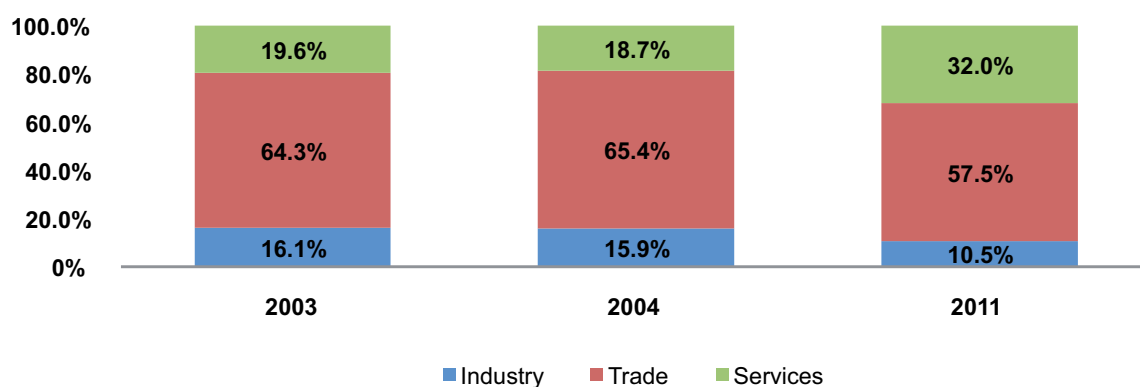
¹⁴ CAPMAS, Press Conference Bulletin 18/02/2012.

2- Distribution of Employment by Economic Activities:

When we look closer to the distribution of formal and informal employment according to the different economic activities over the available comparison years one could notice slight differences in the pattern of movement over time.

The distribution of the informal employment according to the different economic activities in the three main surveys reveals that the eight years period witnessed a significant change towards an increase in the employment in the services activities at the expense of the two other activities.

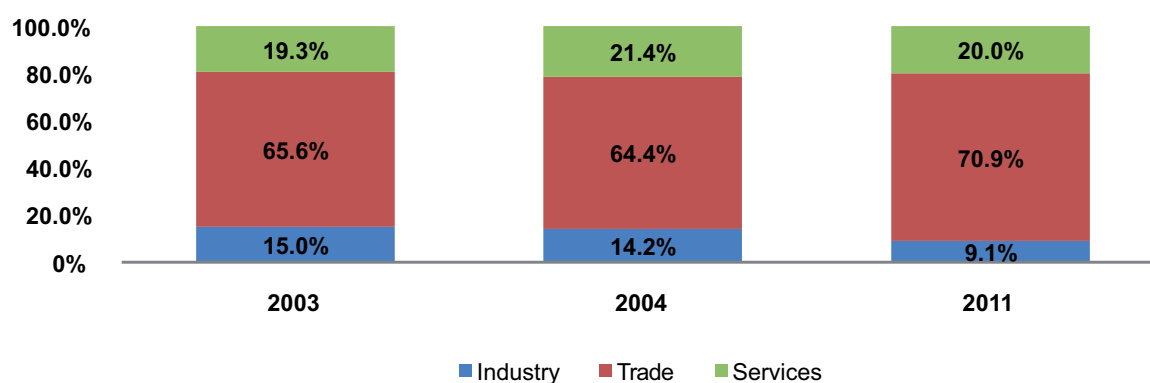
Figure 5.2: Informal Employment Distribution according to Economic Activity



Source: Calculated by the authors based on the data in the tables A.1 till A.5 in the Statistical Appendix.

On the other hand, the formal employment increased in the trade activity at the expense of the formal employment in manufacturing activities.

Figure 5.3: Formal Employment Distribution according to Economic Activity



Source: Calculated by the authors based on the data in the tables A.1 till A.5 in the Statistical Appendix.

The structural change occurred from Industry to Trade in the formal sector and from Industry to Services in the informal sector. One interpretation of this evidence toward a lower share of industry in total employment is possible deindustrialization phenomenon in the MSEs economy.

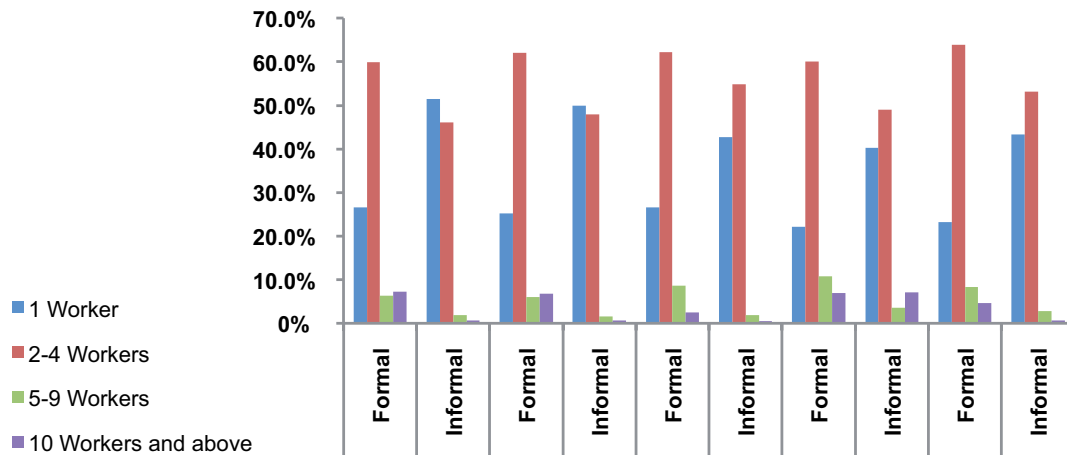
3- Overall distribution of employment between formal and informal MSEs :

As we classify the workers' distribution according to the enterprises size (1 worker, 2-4 workers, 5-9 workers and 10-49 workers) one could conclude:

On the overall economic activities level, the enterprise size is inversely correlated to informality; the smaller the size the higher the percentage of informal employment is. Accordingly, both the "1 worker" and "2-4 worker" sized enterprises account for the largest percent of the

informal employment during the period "2002-2003", "2004 and 2010-2011" respectively. Meanwhile, the "2-4" workers-sized enterprises accounted for the largest percent of formal employment all over the period.

Figure 5.4: The Overall Distribution of MSEs according to Formality and the Size categories



Source: Calculated by the authors based on the following data sets:

a) The years 2003 and 2004 are based on the MSEs data set, which has been constructed by El Mahdi, and published by the Economic Research Forum, Cairo, 2005.

b) The year 2010 and 2011 are based on the MSEs data set, which has been constructed by the author El Mahdi for the African Development Bank: El Mahdi, A., et al., "The Role of MSEs in the Egyptian Economy: Growth, Future Prospects and Success Determinants: An Empirical Study (2011)", African Development Bank, Social Fund for Development, Cairo, February 2012 (to be published by the ADB).

4- Informal Employment by Type of Economic Activity and Size of MSEs:

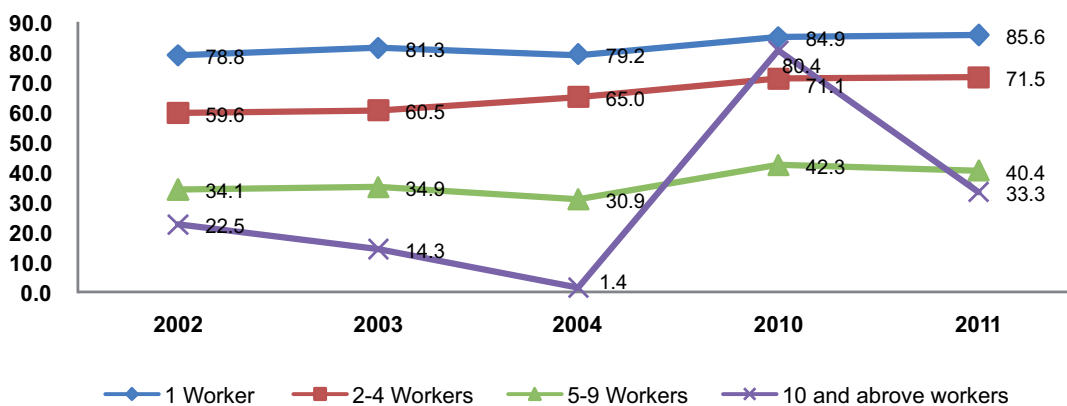
34.1% and 22% of the total employment in the "2-4 worker", "5-9 worker" and "10 or above" enterprises respectively.

Informal Employment by Size in Trade:

This pattern shows regularity over all the years except in the "10 and above" category in 2010 when it increases to 80.4% and is accompanied by a corresponding decrease in the percentage of the formal employment. This accordingly supports the previously deduced correlation between informality and the size of the enterprise in terms of number of workers.

According to the MSEs surveys results, the "informal employment" in trade accounted for 78.8% of the total employment in that activity for the "1 worker" size enterprises, but the percentage decreased to 59.6%,

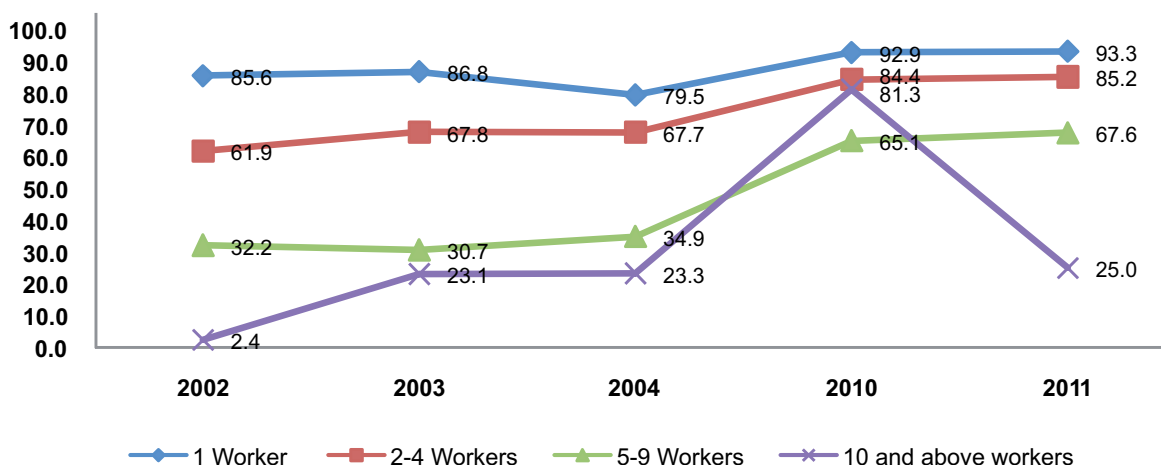
Figure 5.5: Informal Employment (%) by Size of Enterprise in Trade



Source: Ibid.

Informal Employment by Size of Enterprise in Service Activities: The informal employment in the services shows the same pattern over time as in trade.

Figure 5.6: Informal Employment (%) by Size of MSEs in Services

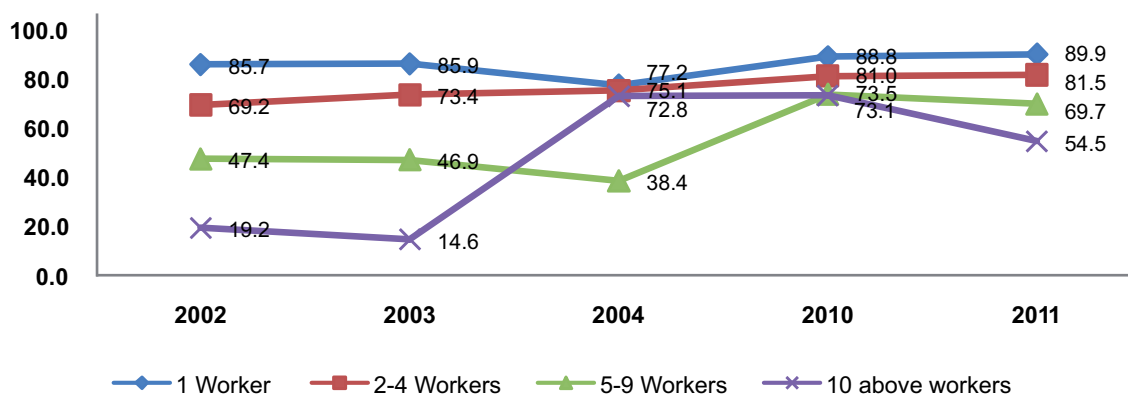


Source: Ibid.

Informal Employment by Size of Enterprise In Industry: of number of workers during the period (2002-2004) . However, the percentage of informal employment in the “2-4 workers” and “10 and above workers” categories becomes relatively higher since 2004.

Finally, the informal employment in Industry shows the same pattern of inverse correlation to the size of the enterprise in terms

Figure 5.7: Informal Employment (%) by Size of Enterprise in Industry



Source: Ibid.

Value added In MSEs

The MSEs surveys included several questions that helped in deriving and calculating the enterprise’s value added during the last month before the implementation of the surveys. Given that the number of workers, and the type of MSE whether formal or informal, it was also possible to

calculate the average monthly value added per worker in the three different economic activities, formal and informal, in the five years where these questions were posed in the surveys.

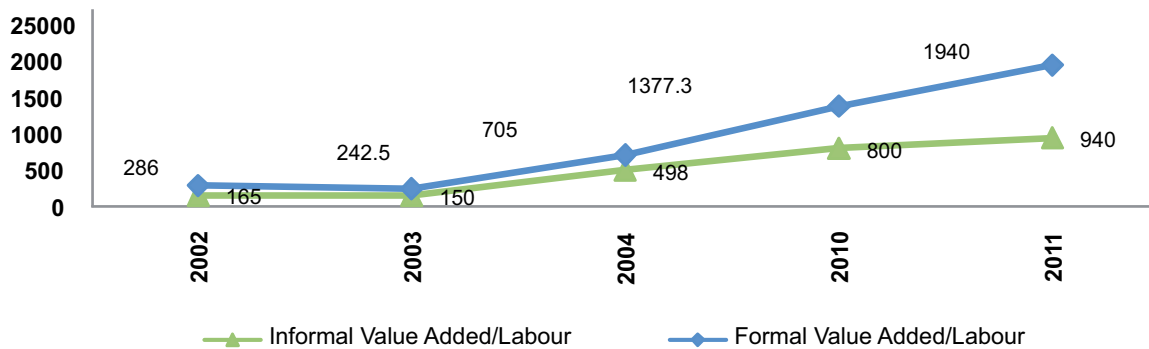
The value added per worker is expressed in real Egyptian Pounds (LE) using the prices of the year 2000=100.

Average Value Added in the three main economic activities

Trade: The value added per worker for both formal and informal MSEs

in trade activities shows an upward trend over the years, with that of the formal sector always exceeds its corresponding informal one and the gap between them gets wider over time.

Figure 5.8: Value added Per Worker in Formal & Informal MSEs operating in Trade Activities



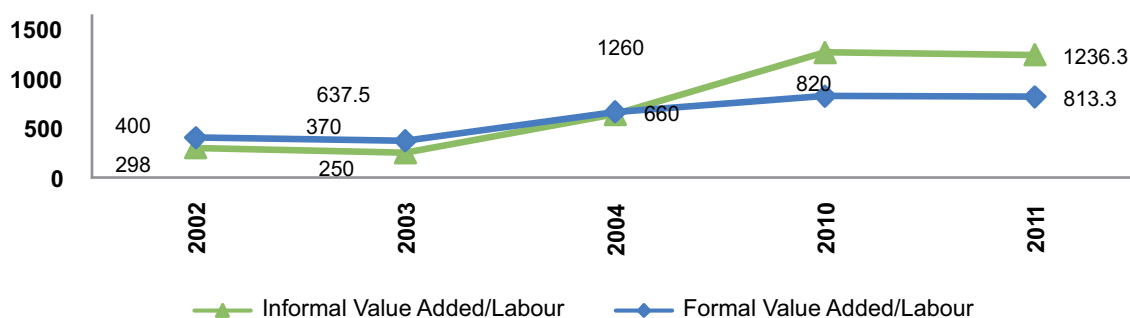
Source: *Ibid.*

Value added Per Worker in Industry: In manufacturing, the value added per worker of the formal sector remained higher than that of the informal one during (2002-2004) years but that was reversed in 2010 even though both levels decreased in 2011. It is rather difficult to explain the reversal in the trend except that the last survey was conducted in November 2011, so 10 months after the 25th of January revolution. At that time the manufacturing sector was experiencing hard recessionary times, with a substantial drop in its production, sales and demand. Production decreases exceeded 40% in most of the manufacturing activities in Egypt. The sector fired some of its workers but by a lesser

percentage as the entrepreneurs found it difficult to get rid of their experienced workers. Thus the value added per worker declined in the formal enterprises, which were usually bound by contracts with their workers. As to the informal enterprises, which were usually not bound by any contracts towards their workers, it was easier to fire more workers.

The severe recessionary climate that pervaded the market at the time of the survey shed its shadows also on the entrepreneurs' estimates of the 2010 numbers.

Figure 5.9: Value added Per Worker in Formal & Informal MSEs operating in Manufacturing activities



Source: *Ibid.*

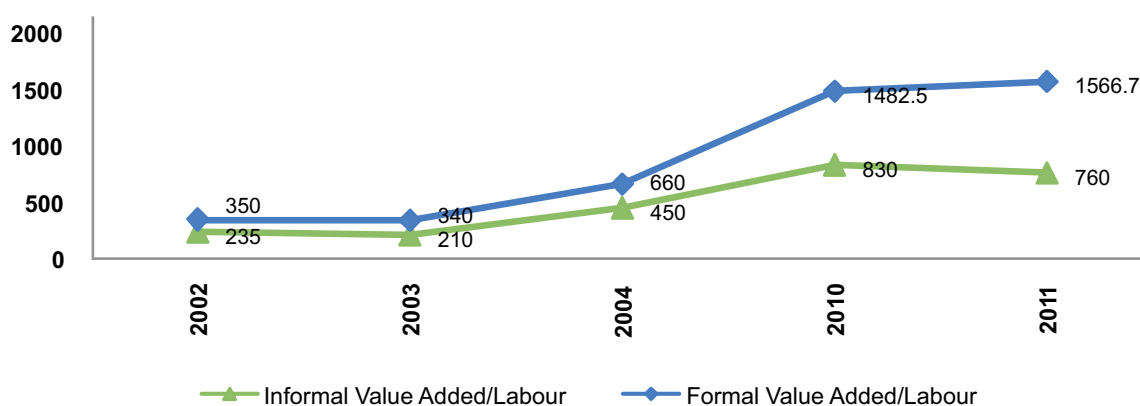
In services, the per worker value added of both the formal and informal sector maintained an upward trend over the years and the formal services sector has always higher value added per worker than its corresponding informal all over the years.

From the previous analysis one could conclude that in general the labor productivity is higher in the formal MSEs as compared to the informal ones. This phenomenon is clear in almost all the economic activities

over the five years with differences between them.

The worker's productivity in trade and services is more than twice as much higher in the formal MSEs compared to its productivity in the informal MSEs. This result is not as clear in the manufacturing activities especially in the results of years 2010 and 2011. One possible reason is that this sector, as mentioned before, was the strongest hit after the January revolution.

Figure 5.10: Value added Per Worker in Services in Formal & Informal MSEs



Source: *Ibid.*

6. Conclusion and Policy Recommendations

Several main results could be concluded from the previous analysis, namely that, the structural reforms that were undertaken after the beginning of the new millennium affected the distribution of employment between the different economic activities and led to a slow redistribution towards the following sectors: Manufacturing; Transportation /Storage /communication; wholesale/retail trade/ hotels/ restaurants; Mining and Extraction.

The structural change was also associated with an increase in productivity in the same economic activities (with the exception of Manufacturing and Mining and Extraction).

The private sector was the main source of employment absorption, while the public sector witnessed declines in employment in almost all activities. The same could be said about the improvement in labor productivity, where the private sector companies were more successful in achieving increases in labor productivity in almost all economic activities as opposed to the public sector agencies.

The decomposition of sources of labor productivity growth during the period in question indicates that the movement of labor from low productivity to high productivity economic activities, the "between" effects, were the main determinants of labor productivity changes in most activities. However, analysis also revealed that in economic activities such as Agriculture, Construction, Communication, and Community/Social Services, the "within" effects through capital injections and/or technology advancement played a relevant role in explaining their labor productivity growth.

The private sector is not a homogeneous sector. The medium and large enterprises do not make more than 4% of all the private sector non-agricultural enterprises. On the other hand the MSEs represent around 96% of all enterprises in Egypt, and employ around 70% of the private non-agricultural workers. Within those enterprises the informal MSEs constitute the majority of enterprises (78%). The micro and small enterprises captured around 42% of the total employment in 2006¹⁵,

which dampened the overall labor productivity levels, as the MSEs represent the fastest growing labor absorptive sector in the Egyptian economy;

The productivity of workers is positively related to formality and to the size of the MSEs. Thus any change or improvement in productivity levels has to target the informal enterprises with technical support and specialized training in the rising economic activities.

Therefore, to answer the questions at the beginning of the paper, we add the following points:

Firstly, the overall labor productivity grew slowly between 2001 and 2008.

Secondly, the structural change was clearly associated with labor productivity growth.

Thirdly, the key source of labor productivity growth was the "between effect", which led to movements from low productivity sectors to high productivity sectors. Labor was rationally seeking higher productivity sectors to move to whenever possible.

Fourthly, the main features of the labor attracting sectors are the use of modern production technologies, which necessitate raising the skills of workers/employees, and thus leave their impact as higher labor productivity. However, the contribution of these sectors to total employment is quite limited. So despite the dynamism in the labor market, the movements towards the high productivity sectors is modest, due to the narrow base of employment in these sectors, and their inability to absorb large numbers of workers.

The final question is: how do these conclusions help in the policy making process?

Going through the results it becomes clear that Egypt has to deal with several factors that influence the labor productivity and keep them relatively low and slow growing.

¹⁵ El Mahdi, A., (2009) The Changing Economic Environment and the Development of Micro and Small Enterprises in Egypt 2006; in R. Assaad, ed., *The Egyptian Labor Market Revisited*, the American University in Cairo Press, Cairo, pp 87-93.

1- One of the main areas where the government of Egypt should work on is the institutional set-up in which the private sector operates. Data indicate that the institutional framework in which the enterprises work is not conducive, encouraging or helps in raising productivity. Crony capitalism, nepotism, corruption, non-transparency have been listed as main sources of an inefficient system.

The economic freedom index listed “Egypt’s economic freedom score is 54.8, making its economy the 125th freest in the 2013 Index (amongst 167 countries). Its overall score is 3.1 points lower than last year, reflecting declines in seven of the 10 economic freedoms, especially investment freedom and labor freedom. Egypt is ranked 13th out of 15 countries in the Middle East/North Africa region, and its overall score is below the world and regional averages.

Deeper institutional reforms are critically needed to spur lasting economic growth and development. Those reforms include strengthening of the judicial system, better protection of property rights, and more effective action against growing corruption.

The rule of law has been unstable across the country, and the judicial system’s independence is poorly institutionalized. Judicial procedures tend to be protracted, costly, and subject to political pressure. Property rights are not protected effectively, and prices for private political-risk insurance have skyrocketed. Corruption continues to erode trust in the economic system.

Previous regulatory reforms, including establishment of a “one-stop shop” for investment, made starting a business less time-consuming and costly, but without needed reforms in other areas, they have proven to be largely cosmetic, failing to create real momentum for dynamic entrepreneurial growth. In the absence of a well-functioning labor market, informal labor activity persists in many sectors. Monetary stability is weak¹⁶.

1- Therefore working on the easing of procedures in terms of number and time to complete them, decreasing the cost of licensing and registration, simplifying tax payment procedures and structures especially for micro and small enterprises (lump sum taxes, linking taxes to electricity usage or the size of establishment in terms of square meters...) could be all helpful in reducing the extent of informality in the Egyptian labor market, and in achieving a more inclusive and enabling institutional framework for all entrepreneurs.

2- Low productivity levels and their slow growth rates need to be stimulated through active fiscal incentives laws that encourage research and development activities and innovation in all enterprises by granting tax exemptions or tax cuts to cover the costs of R&D and Innovation or through offering grants to such activities.

3- Results revealed that several economic activities especially those that have the highest share of employment to total employment such as agriculture, community and social services, construction, trade and tourism have relatively low labor productivity. These economic activities have to be targeted with special productivity enhancing policies, programs and initiatives. Agricultural productivity could be enhanced through the introduction of better water drainage systems; improvement of seeds quality; more rigorous agricultural guidance to the farmers; expansion of the size of the farmland and redistribution of farmers towards the new land; usage of new and modern technologies for planting, watering, and harvesting, etc.

Similar strategies could be envisaged to raise workers’ productivity in trade (macro and retail) activities by better organization, providing suitable well-planned land supplied with the necessary infrastructure and transportation networks (railways, roads, river transportation) in urban and rural areas.

4- Results indicated that Egypt had at least 3 million MSEs by the end of 2011. Since the majority of the MSEs were informal enterprises with relatively lower labor productivity appropriate programs should help the MSEs raise their performance. A starting point should be the specialized cluster communities, where the transmission of new production technologies and knowledge is faster due to the inter-firm connections, the subcontracting relationships as well as the horizontal and vertical firms integration are strongest.

Intervention in the cluster communities could be enhanced through establishing specialized training centers to meet the needs of the growing and diversified needs of the new industries for skillful production workers and administrative staff.

In addition, Business Services Centers are highly needed to help familiarize the entrepreneurs with new products, production techniques, machines and equipment, new potential business links, trade opportunities, export channels, etc.

¹⁶ <http://www.heritage.org/index/country/egypt>.

Also lacking in those cluster communities are banks and financial services providers that cater for the financial needs of micro and small entrepreneurs as well as larger ones.

Targeting cluster communities could be a starting point to create new success stories, that would be eventually emulated in other communities.

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Table A.0: Labor Percentage Change (i.e. Growth Rates) in Productivity and Employment Shares by Economic Activities between 2001/2002 and 2007/2008

Economic Activity	% Change in					
	Labor Productivity			Employment		
	Public	Private	Total	Public	Private	Total
Agriculture, Woodlands & hunting	-13.5	1.4	1.4	1.4	-1.1	-0.4
Extractions / Mining	6.6	-5.3	-5.3	-2.4	15.5	13.1
Manufacturing Industries	17.2	-1.2	0.5	-6.4	3.3	1.9
Public Utilities (Electricity, Gas, and Water)	2.1	20.9	3.7	2.3	33.3	0.5
Construction & Buildings	-7.0	13.8	4.8	-2.6	0.4	0.7
Transportation, Storage & Communication (including Suez Canal)	3.9	2.5	5.9	0.1	2.0	1.4
Wholesale and Retail Trade, Hotels and Restaurants	9.3	2.4	2.6	-3.3	1.6	2.2
Finance, Insurance, Real Estate and Business Services*	6.5	-0.5	1.2	-1.5	1.3	0.7
Community, Social, Personal and Government Services **	1.7	-1.0	1.2	0.7	2.5	-0.1
Grand Total	4.0	1.9	2.4			

Source: The Ministry of Planning, the National Accounts Reports for the years 2001/2001 to 2007/2008, Cairo.

Table A.1: Employment Distributed by Economic Sectors (Public - Private) 2001/2002 - 2007/2008

L.E. Millions	2001/2002		2002/2003		2003/2004		2004/2005		2005/2006		2006/2007		2007/2008	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Agriculture, Woodlands & hunting	79	4939.6	77	5007	76	5081	74	5169	72	5261	70	5357	67	5478
Extractions	11.3	44.2	11.4	49.9	11.6	56.5	11.3	65.2	10.6	79.8	10.7	94.8	10.4	110.6
Manufacturing Industries	444.7	1730.8	409	1845.9	383.4	1953.2	347.2	2087.8	313.8	2223.7	284	2368.5	294.5	2550.3
Public Utilities (Electricity, Gas, and Water)	247.5	0.1	255.4	0.2	265	0.2	272.8	0.3	276.8	0.3	277.1	0.3	281.7	0.4
Construction & Buildings	138	1237	135	1270	130	1307	128	1347	125	1400	120	1460	115.00	1525.00
Transportation, storage & Communication including Suez Canal	285.2	542.8	289.1	564.8	294.9	586	295.8	614.2	296.1	646.9	294.7	693.3	293.30	743.40
Wholesale and Retail Trade, Hotels and Restaurants	65.4	1677.6	64	1754	62	1832	61	1916	59.5	2012.5	52.5	2117.5	51.20	2238.20
Finance, Insurance, Real Estate and Business Services	224.7	557.4	224.2	574.2	223.2	592.8	222	615.4	219.5	640.5	212	674	204.00	728.00
Community, Social, Personal and Government Services	447.4	974.7	4534.6	1013.3	4601.9	1051.3	4660	1116	4709.1	1192.9	4750.2	1278.8	4780.30	1373.70
Grand Total	5969.5	11704.2	5999.7	12079.3	6048	12460	6072.1	12930.9	6082.4	13457.6	6075.8	14044.2	6062.40	14747.60

Source: The Ministry of Planning, the National Accounts Reports for the years 2001/2001 to 2007/2008, Cairo.

Table A.2: GDP in Public & Private Sectors - Constant Prices (2001/2002)

L.E. Millions	2001/2002		2002/2003		2003/2004		2004/2005		2005/2006		2006/2007		2007/2008		2008/2009									
	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total						
Agriculture, Woodlands & hunting	227.9	58,141.1	58,369.0	245.7	60,962.3	61,208.0	48.5	62,018.5	62,067.0	49.0	64,039.0	64,088.0	10.3	66,159.7	66,170.0	10.8	68,594.5	68,605.3	245.7	60,962.3	61,208.0	48.5	62,018.5	62,067.0
Extractions	25,300.5	4,069.0	29,359.5	25,831.9	4,374.3	30,206.2	26,252.0	4,664.0	30,916.0	26,435.0	4,663.0	31,098.0	31,800.7	5,770.3	37,571.0	32,906.6	6,130.4	39,037.0	25,831.9	4,374.3	30,206.2	26,252.0	4,664.0	30,916.0
Manufacturing Industries	9,470.7	60,613.5	70,084.2	9,150.4	61,630.4	70,780.8	9,501.3	63,489.0	72,990.3	9,905.0	66,315.5	76,220.5	10,382.9	70,258.0	80,640.9	10,986.1	75,513.0	86,499.1	9,150.4	61,630.4	70,780.8	9,501.3	63,489.0	72,990.3
Public Utilities (Electricity, Gas, and Water)	7,335.2	119.0	7,454.2	7,468.4	435.0	7,903.4	7,414.4	1,013.0	8,427.4	7,900.6	1,054.0	8,954.6	8,577.7	1,112.0	9,689.7	9,140.7	1,174.7	10,315.4	7,468.4	435.0	7,903.4	7,414.4	1,013.0	8,427.4
Construction & Buildings	6,870.0	9,690.0	16,560.0	6,535.0	9,168.6	15,703.6	2,011.0	14,427.8	16,438.8	2,107.0	15,158.0	17,265.0	2,368.3	17,318.9	19,687.2	2,651.5	20,155.1	22,806.6	6,535.0	9,168.6	15,703.6	2,011.0	14,427.8	16,438.8
Transportation, storage & Communication including Suez Canal	12,199.0	19,752.7	31,951.7	14,218.4	20,778.5	34,996.9	15,540.3	22,276.7	37,817.0	17,611.8	23,863.0	41,474.8	19,152.7	25,932.6	45,085.3	21,672.8	28,576.6	50,249.4	14,218.4	20,778.5	34,996.9	15,540.3	22,276.7	37,817.0
Wholesale and Retail Trade, Hotels and Restaurants	1,895.0	47,520.8	49,415.8	1,851.3	48,765.5	50,616.8	2,018.6	53,897.5	55,916.1	2,120.7	57,554.3	59,675.0	2,215.8	61,050.3	63,266.1	2,398.1	66,820.4	69,213.5	1,851.3	48,765.5	50,616.8	2,018.6	53,897.5	55,916.1
Finance, Insurance, Real Estate and Business Services	23,313.8	820,877.3	844,191.1	24,522.8	832,511.4	857,034.2	24,511.4	21,975.2	46,486.6	25,500.2	22,728.9	48,229.5	26,844.0	23,708.4	45,562.4	28,655.0	20,270.7	53,676.5	24,511.4	21,975.2	46,486.6	25,500.2	22,728.9	48,229.5
Community, Social, Personal and Government Services	36,027.4	11,149.7	47,177.1	136,902.4	11,630.5	48,532.9	37,882.2	12,059.9	49,942.1	139,023.7	12,498.9	51,522.6	64,386.7	13,100.6	53,487.3	41,789.3	14,001.9	55,791.2	136,902.4	11,630.5	48,532.9	37,882.2	12,059.9	49,942.1
Grand Total	122,640.5	231,923.1	354,563.6	126,210.8	238,966.3	365,171.1	125,179.7	255,821.6	381,001.3	130,663.4	261,874.6	398,538.0	141,739.1	284,410.8	426,149.9	150,206.7	305,987.3	456,194.0	126,210.8	238,966.3	365,171.1	125,179.7	255,821.6	381,001.3

Source: The Ministry of Planning, the National Accounts Reports for the years 2001/2001 to 2007/2008, Cairo.

Table A.3: The Contribution of Sectors to Aggregate Productivity on the total economy level based on the price of 2001/2002 - 2002/2007

	2002/2003			2003/2004			2004/2005			2005/2006			2006/2007			2007/2008		
	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total
Agriculture, Woodlands & hunting	0.010	-0.026	0.004	0.004	0.004	-0.024	0.004	-0.026	-0.021	0.004	-0.028	-0.024	0.005	-0.030	-0.025	0.003	0.055	0.059
Extractions	0.000	0.003	0.000	0.000	0.000	0.003	0.000	0.004	0.004	0.000	0.008	0.008	-0.001	0.008	0.007	-0.001	0.010	0.009
Manufacturing Industries	-0.003	0.017	0.000	0.000	0.000	0.015	0.000	0.020	0.020	0.002	0.018	0.020	0.003	0.020	0.024	0.003	0.076	0.079
Public Utilities (Electricity, Gas, and Water)	0.000	0.001	0.000	0.000	0.000	0.002	0.000	0.001	0.001	-0.002	-0.001	-0.001	0.001	-0.002	-0.001	0.001	0.005	0.006
Construction & Buildings	-0.006	-0.001	0.002	0.002	0.002	0.001	0.000	0.002	0.008	0.004	0.012	0.012	0.009	0.005	0.013	0.009	0.029	0.037
Transportation, storage & Communication including Suez Canal	0.003	0.004	0.003	0.003	0.003	0.006	0.003	0.006	0.002	0.004	0.006	0.006	0.003	0.009	0.012	0.003	0.026	0.030
Wholesale and Retail Trade, Hotels and Restaurants	-0.002	0.020	0.002	0.002	0.002	0.024	0.018	0.020	0.001	0.021	0.022	0.022	0.005	0.019	0.023	0.005	0.062	0.067
Finance, Insurance, Real Estate and Business Services	0.000	-0.001	0.000	0.000	0.000	-0.001	0.000	0.000	0.001	-0.001	0.000	0.000	0.001	0.000	0.002	0.001	0.025	0.026
Community, Personal and Government Services	0.003	-0.003	0.003	0.003	0.003	-0.010	-0.014	-0.011	0.005	-0.017	-0.013	-0.013	0.006	-0.022	-0.016	0.004	0.057	0.061

Source: The Ministry of Planning, the National Accounts Reports for the years 2001/2001 to 2007/2008, Cairo.

**Table A.4: The Contribution of Sectors to Aggregate Productivity on the public economy
2002/2008 level based the price of 2001/2002**

L.E. Millions	2002/2003			2003/2004			2004/2005			2005/2006			2006/2007			2007/2008		
	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total
Agriculture, Woodlands & hunting	0.001	-0.003	-0.002	-0.021	-0.002	-0.022	0.000	-0.002	-0.002	-0.019	-0.002	-0.020	0.001	-0.025	-0.001	0.001	-0.003	-0.002
Extractions	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	-0.002	-0.001	-0.000	0.007	0.000	0.000	-0.001	-0.001
Manufacturing Industries	-0.004	-0.063	-0.060	0.007	-0.048	-0.041	0.009	-0.064	-0.055	0.008	-0.058	-0.050	0.008	-0.051	-0.043	0.009	-0.061	-0.052
Public Utilities (Electricity, Gas, and Water)	-0.001	0.011	0.011	-0.002	0.013	0.011	0.002	0.011	0.013	0.003	-0.006	0.009	0.002	0.009	0.011	0.002	0.017	0.019
Construction & Buildings	-0.001	-0.007	-0.007	-0.026	-0.010	-0.035	0.001	-0.004	-0.003	0.003	-0.005	-0.002	0.003	-0.008	0.005	0.003	-0.008	-0.006
Transportation, storage & Communication including Suez Canal	0.007	0.004	0.011	0.003	0.006	0.010	0.006	0.000	0.005	0.004	0.000	0.004	0.006	-0.002	0.004	0.007	-0.003	0.004
Wholesale and Retail Trade, Hotels and Restaurants	-0.000	-0.003	-0.003	0.001	-0.004	-0.003	0.001	-0.002	-0.001	0.001	-0.003	-0.002	0.002	-0.012	-0.010	0.000	-0.002	-0.002
Finance, Insurance, Real Estate and Business Services	0.001	0.003	-0.002	0.001	-0.005	-0.004	0.002	-0.004	-0.002	0.002	-0.006	-0.003	0.004	-0.014	-0.011	0.004	-0.016	-0.012
Community, Personal and Government Services	0.008	-0.057	0.065	0.009	0.046	-0.055	0.013	-0.059	0.072	0.018	0.061	0.080	0.020	0.069	0.089	0.018	0.045	0.063

Source: The Ministry of Planning, the National Accounts Reports for the years 2001/2001 to 2007/2008, Cairo.

**Table A.5: The Contribution of Sectors to Aggregate Productivity on the private economy
2002/2008 level based the price of 2001/2002**

L.E. Millions	2002/2003			2003/2004			2004/2005			2005/2006			2006/2007			2007/2008		
	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total	Within	Between	Total
Agriculture, Woodlands & hunting	0.014	-0.071	-0.057	0.001	-0.063	-0.062	0.006	-0.076	-0.070	0.006	-0.083	-0.077	0.007	-0.090	-0.083	0.004	0.082	0.086
Extractions	0.000	0.004	0.004	0.000	0.005	0.004	-0.001	-0.006	0.005	0.000	0.010	0.010	-0.001	0.009	0.008	-0.001	0.012	0.012
Manufacturing Industries	-0.007	-0.051	-0.044	-0.004	0.041	0.037	-0.004	0.049	0.045	-0.001	0.039	0.038	0.001	0.035	0.037	0.001	0.134	0.135
Public Utilities (Electricity, Gas, and Water)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Construction & Buildings	-0.009	-0.005	-0.014	0.045	-0.002	0.042	0.002	-0.007	-0.005	0.010	-0.001	0.009	0.011	-0.001	0.011	0.011	0.045	0.056
Transportation, storage & Communication including Suez Canal	0.001	0.004	0.005	0.002	0.003	0.004	0.001	0.005	0.006	0.001	0.006	0.008	0.001	0.014	0.015	0.002	0.038	0.040
Wholesale and Retail Trade, Hotels and Restaurants	-0.003	-0.019	0.016	0.008	0.019	0.027	0.003	0.012	0.015	0.001	0.014	-0.016	0.006	0.013	0.019	0.007	0.089	0.097
Finance, Insurance, Real Estate and Business Services	-0.001	-0.001	-0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	-0.001	0.040	0.039
Community, Personal and Government Services	0.000	0.006	0.006	0.000	0.005	0.005	-0.002	0.018	0.016	-0.002	0.022	0.020	0.000	0.022	0.022	-0.002	0.063	0.060

Source: The Ministry of Planning, the National Accounts Reports for the years 2001/2001 to 2007/2008, Cairo.

Table A.6: Egyptian Economy: Selected Economic and Financial Indicators 1999/2000 - 2009/2010<

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GDP at Market Prices (LE Billions)	340.1	358.7	378.9	417.5	485.3	538.5	617.7	744.8	895.5	1,042.20	1,206.70
GNP (LE Billions)	356.1	373.6	393.2	432.1	502.8	563.3	649.4	787.4	949.2	1,081.70	1,235.00
Real GDP (% Growth Rate)	5.4	3.5	3.2	3.2	4.1	4.5	6.8	7.1	7.2	4.7	5.2
Public				1	-0.3	1.4	2.8	1.99	2.26	1.35	
Private				2	4.6	3.2	4.1	5.06	4.92	3.31	
Real Per Capita GDP (% Growth Rate)	3.2	1.4	1.1	1.2	2.1	2.5	4.8	5.1	5	2.4	2.9
Share of Private Sector in GDP (%)	70.4	68.8	65.7	63.2	62.2	61.7	60.3	62.4	61.6	62.8	62.7
Overall Fiscal Balance (% GDP)	-3.9	-5.6	-10.2	-10.4	-9.5	-9.6	-8.2	-7.3	-6.8	-6.9	-8.1
Net FDI in Egypt (%GDP)	1.7	0.5	0.5	0.9	0.5	4.4	5.7	8.5	8.1	4.3	3.1
Budget Sector Expenditure			30.5	30.5	30.1	30	33.6	30.4	31.3	33.8	
Budget Sector Revenues			40.1	38.8	41.8	43	50.6	52.8	51	52.1	
Budget Sector Deficit ¹			-10.2	-10.5	-9.5	-9.6	-8.2	-7.5	-6.9	-6.4	
Public Debt (% GDP)			86.3	94.7	91.6	92.1	89.6	80.6	67.1	62.2	
Public Domestic Debt (% GDP)								65.4	55	50.4	
Net Domestic Budget Sector Debt		59.9	64.9	67.5	67.4	72.5	72	64.2	53.5	54.1	45.9
Net Foreign Budget Sector Debt			21.4	27.3	24.3	19.6	17.6	15.2	13.2	12.2	
Inflation Rates											
CPI (% Growth Rate yoy) ²	2.5	2.2	2.4	3.2	10.3	11.4	4.2	11	11.7	16.2	11.7
Exchange Rates											
Official Exchange Rate (LE / US\$)	3.4	3.9	4.4	5.2	6.2	6	5.7	5.7	5.5	5.5	5.5
Parallel Exchange Rate (LE / US\$)	NA	4.1	5.1	6.2	6.3						
Interest Rates											
Interest Rate on T-Bills (91 days)	9.1	9.1	7.2	8.3	8.4	10.1	8.8	8.7	7	11.3	9.9
Broad Money (% Growth Rate yoy)	8.8	11.6	15.4	16.9	13.2	13.6	13.5	18.3	15.7	8.46	10.4
NIR in Months of Imports (US\$ Millions)	10.2	10.4	11.6	12	9.7	9.6	9	8.9	7.9	7.5	8.6
Poverty	42.6					40.5			41.7		
Poor (including Extreme Poor)	16.7					19.6			21.6		
Near Poor	25.9					20.6			20.1		
National Savings (LE Billions)	60	63	66	74.3	93.1	109.4	137.4	163.8	204.1	172.2	198.6

Source: Ministry of Economic Development, Ministry of Finance, CAPMAS and Central Bank of Egypt.

¹ Break in series. Starting 2001/2002 the budget is presented according to the IMF 2001 GFS Standards, modified to cash principles. The new classification was adopted by the Egyptian Ministry of Finance by Law 97/2005.

² Starting January 2005, Annual and Quarterly CPI (urban areas) data is based on weights derived from 2004/2005 income and expenditure survey, and using January 2007 as a base month. Prior to this date, the basket and weights were derived from 1999/2000 income and expenditure survey taking 1999/2000 as a base year.

³ Starting September 2005, WPI data is based on the average weights derived from indices of Industrial and agricultural sectors for the 2 years period extending from 1999/2000 to 2000/2001. Prior to this date, the basket and weights were derived from indices of Industrial and agricultural sectors for the period extending from 1986/1987 to 1987/1988.

⁴ The new series of Producer Price Index (PPI) was issued by CAPMAS starting September 2007, using 2004/2005 prices of goods and services as a base period, and deriving sub-group weights from average values of agricultural, industrial and services production for the years 2002/2003 and

The Derivation of the Decomposed Production Function

creation of productive employment is the main challenge of economic policy and it is the best method of achieving resilience and eradicating poverty. Typically, the concept of productivity is generally defined –at the aggregate, sector, industry or plant levels- as an average output-input ratio:

$$(1) \quad \text{Productivity} = O/I$$

where O denotes output and I input. Different metrics can be used for measuring and evaluating productivity from which one needs to rationalize and choose a way by which the different types of outputs and inputs are functionally combined or weighted in an appropriate manner.

Typically, researchers choose production functions whose parameters are estimated by statistical methods. Alternatively, a non-parametric approach may be applied, in which output-input ratio is computed by means of mathematical programming (e.g. Data envelopment analysis (DEA) method). Most macroeconomic empirical work assumes constant returns to scale Cobb-Douglas function, where production is a share-weighted geometric average of the inputs:

$$(2) \quad Q = AL^\alpha K^{1-\alpha}$$

where Q is a measure of gross output or value added, A is total factor productivity (TFP), which is also called “multi-factor productivity (MFP)” or the “Solow residual”, stands for the proportion of labor compensation (wages, salaries and supplementary benefits) to gross output, L is labor and K is the physical capital stock.

Taking the logarithms and differentiating results in the well-known growth-accounting equations,

$$(3) \quad \frac{dQ}{Q} = \frac{dA}{A} + \alpha \frac{dL}{L} + (1 - \alpha) \frac{dK}{K}$$

which decomposes the macroeconomic output growth into three sources: (i) growth in the employed part of the labor force, (ii) growth in the physical capital stock and (iii) TFP growth.

When considering the economic sectors, we note that aggregate output is the sum of the value-added of the composing activity sectors $Q = \sum_{i=1}^m Q_i$. Hence,

$$(4) \quad Y_A = \frac{Q}{L} = \frac{\sum_{i=1}^m Q_i}{L} = \sum_{i=1}^m \frac{Q_i L_i}{L_i L}$$

Let $y_i = \frac{Q_i}{L_i}$ be the value added of sector and $\theta_i = \frac{L_i}{L}$ be the share of sector i in total employment, $i = 1, 2, \dots, m$. Thus,

$$(5) \quad Y_A = \sum_{i=1}^m y_i \theta_i$$

The subscript (A) in the above equation denotes the aggregate output per worker, which is the weighted sum of output per worker in all sectors, where the weight is the employment share of each sector in aggregate employment.

Now, considering the sectoral labor productivity decomposition, let $Y_A^t \}_{_{t=0}^T} = \{y_{i,t} \theta_{i,t}\}_{_{t=0}^T}$ be a time sequence and using equation (5), the difference in aggregate labor productivity levels between times $t-1$ and t can be written as:

$$(6) \quad \begin{aligned} \Delta Y_A^t &= Y_A^t - Y_A^{t-1} \\ &= \sum_{i=1}^m \Delta y_{i,t} \theta_{i,t-1} + \sum_{i=1}^m \Delta \theta_{i,t} y_{i,t-1} + \sum_{i=1}^m \Delta \theta_{i,t} \Delta y_{i,t} \end{aligned}$$

