

Research and Development As Potential Driver of Egypt's Pharmaceutical Industry

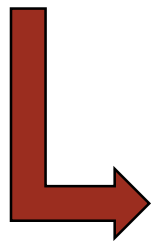
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Cairo, September 2012

Outline

- Importance of the pharmaceutical industry in Egypt
- Motivation of the study
- R&D: nature of research carried out, and implications
- **Methodology employed:**

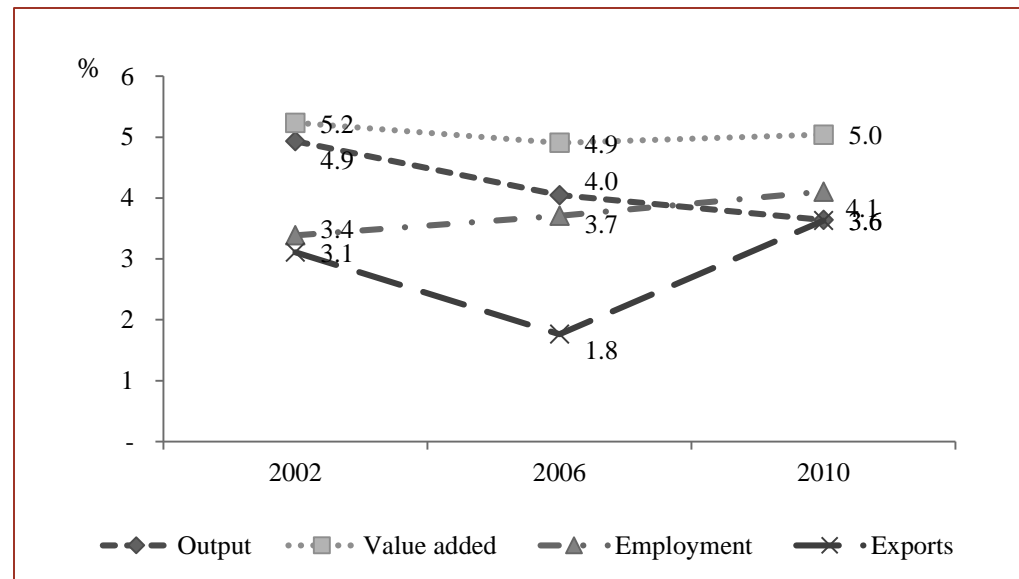


- Panel data **econometric estimation**
- Explain estimation results via:
 - **macro-level R&D outlook**
 - **micro-level R&D outlook**

- Macro and micro-level policy implications.

The Pharmaceutical Industry in Egypt

- The pharmaceutical industry has a relatively modest contribution to manufacturing output, value added, employment and exports.



Source: CAPMAS Annual Industrial Statistics

- On average, its share of manufacturing output is 4 - 5%; value added 5-6 %, employment 3.5 %, and exports around 3%.

The Pharmaceutical Industry in Egypt (Cont.)

- As an R&D-intensive industry it has further growth potential *especially* in today's knowledge-based economy.
- There has been recent debate over the pricing of newly-registered drugs. If R&D were to help drive output growth, this may help mitigate the problem of increased prices or of R&D expenditure constituting an added cost.
- The study is therefore motivated by examining the relation of R&D to output (**elasticity of output with respect to R&D**).

Motivation of the Study

- Exploring whether R&D can potentially drive the pharmaceutical industry. International experience indicates that growth in firm-level R&D expenditure is associated with growth in industry output. India's pharmaceutical industry is a relevant case in favour.
- How may this come about?

Through the creation of knowledge, R&D fuels invention/innovation. As the rate of innovation increases, it drives growth in output and in productivity

What is R&D?

- R&D is the *planned* and *creative* work aimed at *discovering new knowledge* and *developing* new or significantly improved goods, services and processes.
- It is of three types:

Basic Research

Acquire new
knowledge

Applied Research

Solve
practical
problem(s)
Target
specific
commercial
applications

Development

Yield
significantly
improved
goods,
services and
processes

Methodology

- 1) Estimate a Cobb-Douglas form of the ‘**knowledge production function**’ using firm-level data for 29 pharmaceutical firms over the period 2004-2009. This functional form incorporates an **R&D variable** in the *standard* production function :

$$Y_{it} = A L_{it}^{\beta_l} K_{it}^{\beta_k} R_{it}^{\beta_r} e^{u_{it}}$$

A = TFP
L = labour
K = capital
R = R&D expenditure
 $\beta_l, \beta_k, \beta_r$ = elasticity parameters

Firm-level data was queried from CAPMAS electronic database of “Annual Industrial Statistics.”

Methodology (Cont.)

- Studies employing similar estimations forward possible **explanations** for the results obtained.
- We verify if these hold for the case of Egypt through:
2) macro-, and **3) micro-level R&D outlooks.**

2) Macro-level R&D outlook

- **World Development Indicators;**
- **CAPMAS data for macro level expenditure;**
- **OECD-World Bank 2010 “Review of National Policies for Higher Education in Egypt”;**
- **Analysis of dimensions of the ‘innovation pillar’ of Global Competitiveness Index (2006/07-2011/12)**

Methodology (Cont.)

3) Micro-level R&D outlook

- **In-depth interviews with selected representative firms;**
- **Selection criteria for purpose of this study would typically have been “R&D expenditure” by firm;**
- **In the absence of such data, other selection criteria were used (ownership structure, labour and contribution to industry employment, range of export markets, market capitalization for those traded on stock market);**
- ***Key selection criterion: ownership.***

Public

Private

Joint ownership
(Egyptian and
foreign capital)

Joint ownership
(Egyptian
private-public
capital)

Wholly-owned
subsidiary of
MNC

Knowledge Production Function Estimation Results

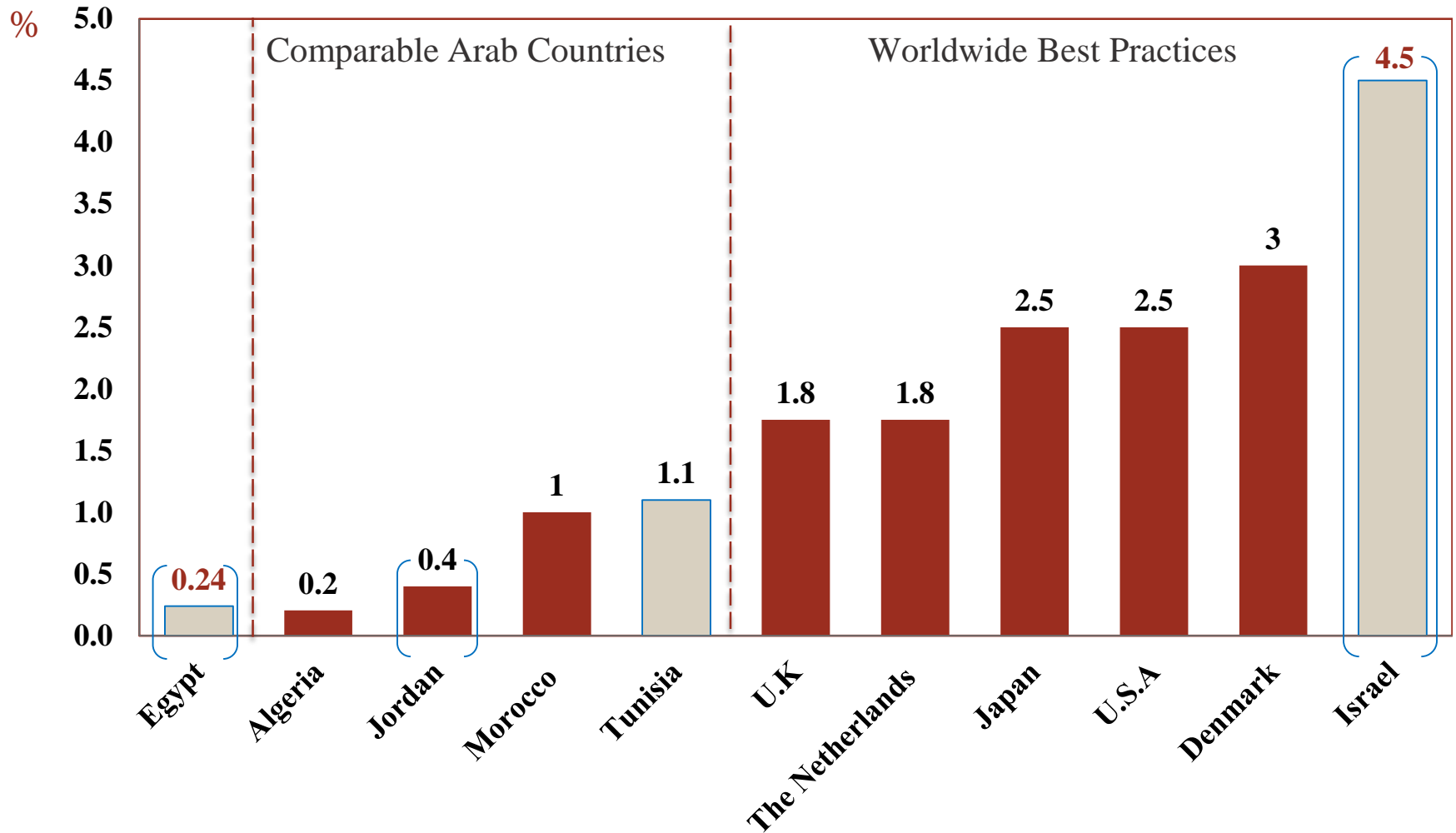
Dependent variable Independent variable	Output <i>Sign</i> of η of output with respect to independent variables		
	(1)	(2)	(3)
Intercept term	Significant +	Significant +	Significant +
Labour	Significant +	Not significant	Not significant
Capital	Significant +	Significant +	Significant +
R&D Expenditure (level)	Not Significant		
R&D Expenditure (1-year lag)		Significant +	
R&D Expenditure (2-year lag)			Significant +

It takes *one-to-two* years for output benefits to be realized from R&D investment

This may be attributed to:

- The research project taking more than a year to be completed;
- When complete (and if successful), it may be some time before management recognizes the merits of a new *process* or commercializes a new *product*.

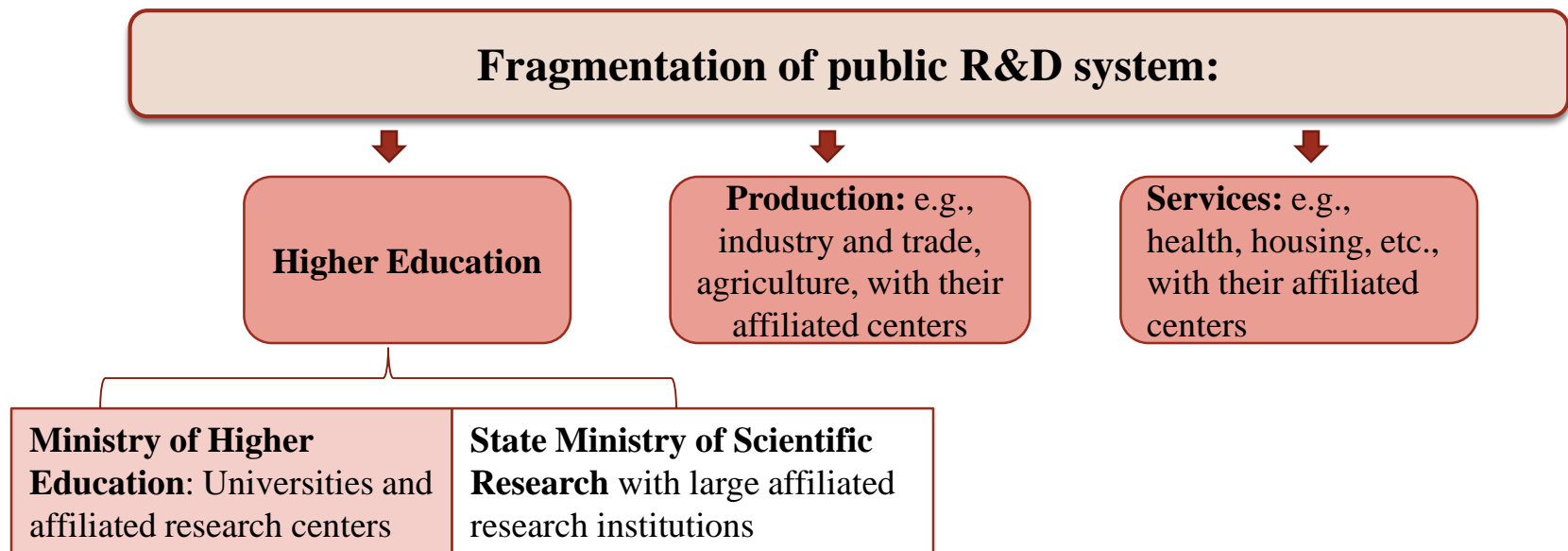
Macro-level explanations: Low economy-wide R&D intensity (R&D expenditure as % of GDP(average for 2000-2009))



Source: Calculated from World Bank "World Development Indicators"

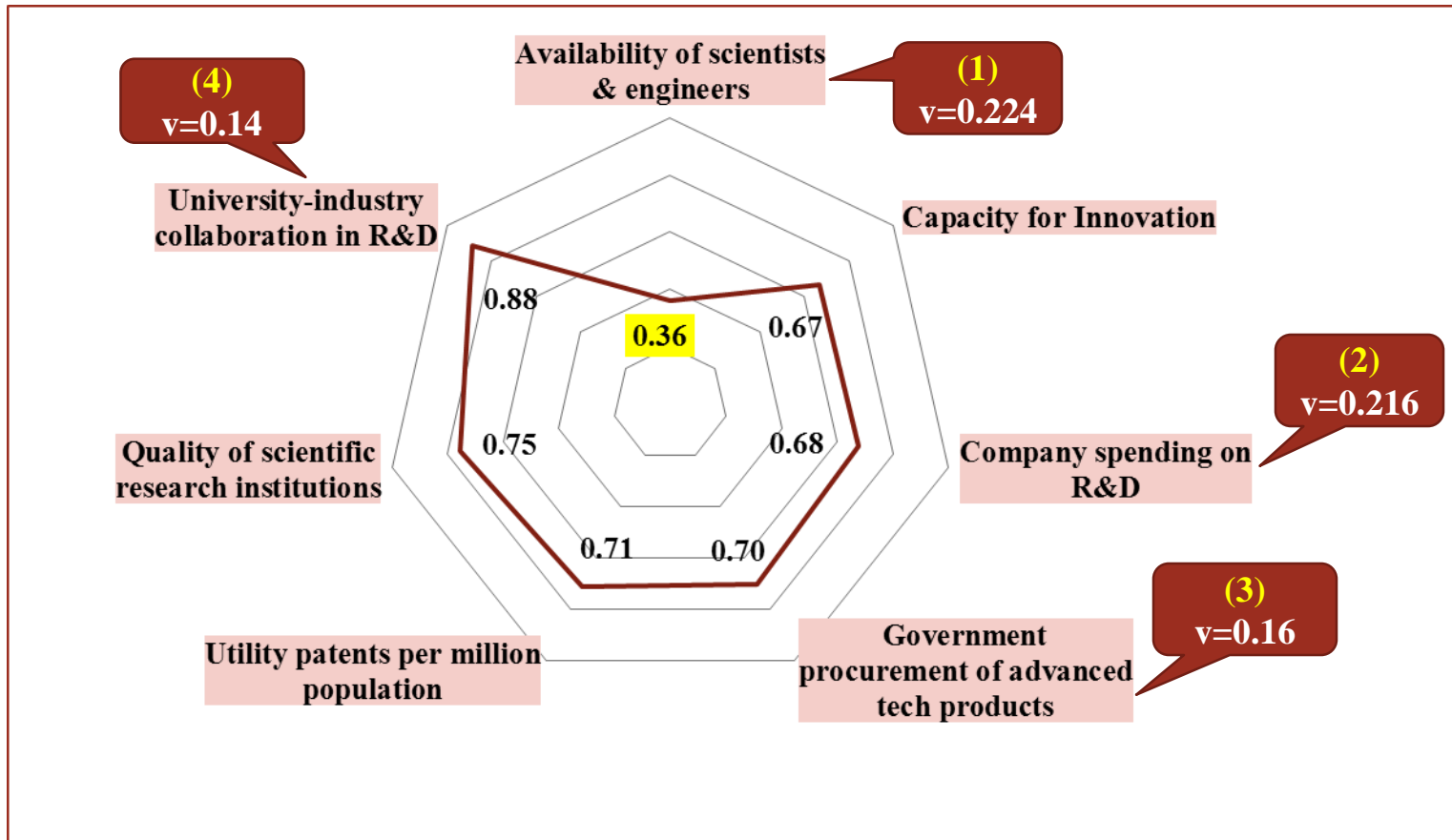
Macro-level explanations: Low capacity to translate R&D into output gains due to inadequate organizational structures

- Public research institutions are fragmented across different sectors within the public R&D system



- Public R&D expenditure priority lies with the Ministry of Higher Education.

Macro-level explanations: as evident from the dimensions of the ‘innovation pillar’ of the GCI



- Clockwise, Egypt fares **best** on the ‘*availability of scientists and engineers*’ (falling closest to the center) and **worst** on ‘*university-industry collaboration*’.
- However, from the ‘*capacity for innovation*’ to ‘*university-industry collaboration*’, Egypt falls in the lowest third bracket of countries.

Macro-level explanations: low or absent fiscal and financial incentives for R&D purposes

- Lack of **fiscal incentives** (e.g., tax allowances) for R&D purposes



Egypt's Income Law No. 91/2005 includes no tax allowances or credits, but only an allowance to deduct the value of donations made to research centers/for R&D endeavours (article 23).

Fiscal incentives are widely practiced in India

- Lack of **financial incentives** (e.g., availability of venture capital for R&D).

Financial incentives are widely practiced in U.S. and Canada

Micro-level explanations: low R&D intensity and inadequate organizational structure

- Low firm-level R&D intensity (expenditure as % of sales). For the most part falls in the 1-2% range.

Intensity for U.S. pharmaceutical firms is 8-10%; for Indian firms 4-7%

- Nature of research carried out intra-firm: mostly of the development type, with firms not introducing new products of processed (in the strict sense)

Best practices refer to basic and applied research tipping the scale

- Nature of research carried out inter-firm: virtually no inter-firm collaboration in R&D either horizontally or vertically, also very modest university-industry collaboration in R&D,

Best practices include inter-firm collaboration in R&D (e.g., technical cooperation agreements)

Micro-level explanations: low R&D employee intensity and inadequate organizational structure

- Low firm-level R&D personnel intensity (employees working in R&D as % of firm total employees). For the most part falls in the 1-2% range.

Intensity for U.S. pharmaceutical firms is 4-5% range, Polish 3.8%, Czech 5.3%

- No evidence of firm-level practices fostering the exchange of know-how (e.g., hosting post-doctoral research fellows, or sending R&D personnel for training abroad)

Indian pharmaceutical firms reputed to host post-doctoral research fellows, and to send personnel for training in the U.S. and U.K.

To Sum Up

- **Macro-level explanations** for weak R&D performance have been found to vary

From :

- Very modest public R&D expenditure;

To :

- Need for a well-defined medium-to-long national research strategy;
- Lack of sound coordination of the public R&D system in Egypt;
- Lack of coordination between public institutions and businesses;
- Lack of fiscal and financial incentives for R&D;
- A high degree of variability in the availability of scientists and engineers.

- **Explanations are almost completely mirrored at the micro-level.**

Macro-level Policy Implications

Modest public R&D expenditure

- It is imperative that Egypt raise its public R&D expenditure for knowledge creation at the level of public research entities *and* for the creation of fiscal space for R&D grants to small and large private sector firms alike

Need for a well-defined medium-to-long national research strategy

- Identifying a medium-to-long term national research strategy that spans the host of economic activities, *and* ranks this particular industry higher on its priority list

Lack of coordination between public research institutions

- Egypt's national strategy needs to spell out a division of responsibility among various public research institutions
- It also needs to have better governance practices with adequate monitoring and evaluation mechanisms in place

Macro-level Policy Implications (cont.)

Lack of coordination between public research institutions and businesses

- Egypt's national strategy needs to strengthen university-business links to ensure that public research is demand-driven.
- Once public R&D funds are available, they must be allocated on competitive basis.

Lack of fiscal and financial incentives to R&D

- Egypt's government needs to initiate some viable fiscal incentives such as tax allowances and credits, in addition to introducing financial tools such as venture capital specifically earmarked for R&D.

An inconsistency in the availability of scientists and engineers

Although not strictly short of scientists and engineers, Egypt has shown evidence of an inconsistency in their supply year-after-year. Encouraging secondary-level study of mathematics and science may help mitigate the problem of overwhelming concentration of university graduates in humanities and social sciences.

Micro-level Policy Implications

-Firms undertake piecemeal projects with no long-term strategy in sight

-Are mostly development-oriented as opposed to basic or applied research

-Have virtually no collaboration either with other firms in research or intellectual property, or with universities in research.

-Their overall capacity to innovate is assessed as being 'limited'

- Although we cannot give a specific policy prescription to firms, they may be well-advised to:
 - Incorporate an R&D expenditure item in their income statements. Moreover, CAPMAS annual industrial survey would be advised to incorporate a more detailed entry of R&D expenditure;
 - Enhance their practices for exchange of R&D personnel for further knowledge acquisition;
- We may leave firms with the note that it is their recognition of the true growth potential through R&D that they may decide to deepen their R&D practices.

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Thank you.

