**PRIVATIZATION, INVESTMENT AND
EFFICIENCY IN THE
TELECOMMUNICATIONS INDUSTRY:
THEORY AND EMPIRICAL EVIDENCE
FROM MENA COUNTRIES**

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Abstract

Inadequate levels of investment in the telecommunications industry in MENA countries resulted in a network unable to meet demand, with poor service quality, limited choice of services, low productivity and an inappropriate tariff structure. There is a strong need to speed up the privatization and liberalization of telecommunications in Arab countries to attract investments in the provision of universal service and the development of information and communication technologies. Nevertheless, it is not clear at all, either theoretically or empirically whether privatization and entry lead to an increase in investment in infrastructure and in social welfare. Using a theoretical model, this paper examines the incumbent's and the entrant's strategies in terms of investment in an open regulatory framework. The theoretical results are ambiguous. Using recent data from MENA countries, the paper goes on to examine the investment behavior and overall performance of the telecommunications firms that have experienced some form of entry and privatization. Preliminary results show that privatization and entry do increase investment in the sample countries examined.

1. Introduction

Telecommunications infrastructure is beset by many deficiencies in most developing markets and in particular in MENA countries. Inadequate levels of investment for prolonged periods of time resulted in a telecommunications system unable to meet demand, with poor service quality, inadequate or very limited choice of services, low productivity and an inappropriate tariff structure. This was acknowledged during the fourth Arab Internet Technology and Telecommunications Conference (AITEC) held in Beirut on15th February 2002. Arab leaders there stressed the need to speed up the privatization and liberalization of telecommunications in Arab countries to attract investments in the provision of universal service and for the development of information and communication technologies.

It is increasingly recognized that productive, technological, management and other inefficiencies are well entrenched in the telecommunications industry of many MENA countries making any reforms at best difficult to implement[1]. In the wake of the telecommunications industry reforms in the industrialized countries and under the pressure from international organizations, some MENA countries went ahead with privatization plans of their telecommunications industries. The path of the privatization process has been difficult and different depending on each country's political, sociological and economic conditions. Countries such as Morocco and Mauritania for example, have partially privatized their telecommunications industry while others (Egypt, Turkey, Syria.) opted for state operators with the intention to privatize them at an unspecified later date. Some other countries (Morocco, Mauritania) have attempted to restructure profoundly their industry before privatization (new legislation allowing the creation of independent regulatory bodies, write-offs of stranded costs, competition policy, etc.), while others preferred to adopt an ad hoc approach to privatization (opting for BOOT or other contractual arrangements)[2]. Both approaches aim at improving industry's performance in terms of better quality service, innovation (process and service), higher levels of *investment in network expansion* and better management and pricing practices.

Standard textbook analysis teaches us that investment in infrastructure will increase with privatization and entry. The traditional models ignore, however, the role of regulation and the political and economic contexts within which regulation takes place, especially in MENA countries. Regulation and market conditions are quite important factors in evaluating investment opportunities.

Recent theoretical models (Biglaiser and Ma, 1995, 1999), developed in the context of the new regulatory economics, demonstrate that the effects of privatization and entry on investment are at best ambiguous. The purpose of this paper is three-fold. First, to develop a theoretical regulatory model that links privatization and entry to the investment decisions of the incumbent. Second, to collect data from 1995 to 2001 for the telecommunications industry for nine MENA countries (Egypt, Syria, Lebanon, Jordan[3], Algeria, Tunisia, Mauritania, Morocco, and Turkey) and empirically examine the relation established in the theoretical model. Third, to provide policy recommendations and highlight the needs for further research. The results of this research are important for policymakers because they shed new light on the issues relating privatization, restructuring and infrastructure development especially for countries with pressing needs for growth and prosperity.

2.a Privatization, entry and investment – The Analytical Framework

Many MENA countries espoused the textbook idea that privatization and entry is the preferred policy to accomplish telecommunications network modernization and deployment of new technologies and to attain higher growth rates and living standards. Despite these alleged benefits there is very little empirical evidence and scant theoretical examination of this relationship. Establishing such a relationship has important implications for policymakers and regulators alike given that the regulatory outcome depends entirely on the way the regulatory agency designs the process of regulation. In an industry such as telecommunications with rapid technological changes, lumpy and significant sunk investments, the regulatory design must be done in a way that it provides the appropriate incentives to the firms to make the necessary *investments in infrastructure* and attain the productive and technical efficiencies.

The new theory of regulation treats the regulation of infrastructure as a principal-agent problem (Laffont and Tirole, 1993; Caillaud et al., 1988; Benasko and Sappington, 1987). In that context, the regulatory agency is subject to information asymmetries with respect to the regulated firm and it ignores basic information such as the truthful costs of the regulated incumbent. The regulator can observe the level of investment of the regulated firm but it cannot observe the actual costs of realizing the investment. This is the firm's private information, which permits it to realize an *information rent*. The latter is a decreasing function of the firm's marginal cost. The objective of regulators is to maximize the social welfare in an *incentive-compatible* way, that is, a way that respects the strategic private interests of the firms in the industry. Using a weighted average of consumer and producers' surpluses as a welfare index the regulator imposes an

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[1] For example, Syria, despite talks of amending its telecommunications law, does not yet intend to privatize the telecommunications sector and wants to limit private activity to service contracts.

[2] See Galal (2001) for an excellent presentation of these arrangements in the electricity sector in MENA countries.

[3] These four countries planned to establish a committee to conduct studies on a *common* telecommunications policy system.

optimal regulatory scheme, which defines the transfers and quantities in a way as to minimize the incumbent's information rents.

The theoretical model developed in this paper is within the lines of the new theory of regulation (Biglaiser and Ma, 1999) and it takes into account the decision of the incumbent to invest in infrastructure when privatization and entry occur or it is threatened to occur. When a firm invests in infrastructure it does so to maximize profits. Its decision to invest can be analyzed as a non-cooperative game. Its extensive form is as follows. In stage 1, the regulator decides on the industry's structure. In stage 2, the incumbent chooses its investment (I) level. Once realized, the firm knows its cost and it becomes private information. In stage 3, the regulator can observe the investment level but not the incumbent's actual costs. Because of the asymmetry of information, the regulator chooses an incentive-compatible regulatory scheme that allows the firm to choose its strategy (prices and quantities) within the regulatory constraints (maximization of social welfare). In stage 4, the entrant chooses its quantity, given the information on the incumbent's level of investment and output. Prices are adjusted to clear the market given the total quantity supplied by the entrant and the incumbent.

Following Biglaiser and Ma (1999), I demonstrate that the firm's investment decision is determined by the marginal return of investment while the expected information rent determines the returns on investment. Given the equilibrium regulatory policy that is expected to prevail at stage 3, the firm maximizes its profits by equating the marginal cost of investment to the expected marginal information rent due to the investment. When regulators decide to privatize and open the market to competition, the incumbent's production drops and with that its expected information rent. The loss of information rent when the market is privatized is decreasing in investment. To make the loss smaller, the incumbent may increase its investment when entry occurs. Social welfare will thus increase. But it is possible too that privatization induces the incumbent to reconsider its investment strategy and to choose a lower level of investment. Then the effect on social welfare will depend on the level of investment of the new entrant. If the entrant chooses to invest more than the level of reduction of the incumbent, the net effect will be positive with a dumping effect on prices.

2.b The Model

Investment incentives have become a central policy tool for many regulatory agencies and especially for MENA countries. Regulators may entice the incumbent and potential entrants to accelerate investments in infrastructure but given the asymmetry in information the incumbent may use this information asymmetry to its advantage. The outcome may not be that straightforward. Entrants' reactions may be such that total investment may increase or decrease. The effect of investment on social welfare is ambiguous.

Let's consider two industry structures, a monopoly (the incumbent firm 1) and an oligopoly (the entrant, firm 2, and the incumbent, firm 1) with a homogeneous product. The entrant has a constant marginal cost of production c_e while the incumbent's cost is the result of its investment decisions (I) and a random variable. An increase in investment reduces costs but the incumbent's actual cost is private information. Incumbent's marginal cost is distributed on the interval $[(C_L),(C_H)]$ with distribution function $F(c,I)$ and density function $f(c,I)$. The "hazard rate" $g(c,I)=F(c,I)/f(c,I)$ is assumed strictly increasing in c.

The two firms compete in a Cournot-type market by setting quantities rather than prices and they follow the Stackelberg leader-follower game. Assuming a linear demand function $P(Q) = \alpha - \beta Q$, where $Q = q(c)+q_e$ (q = quantity produced by the incumbent and q_e = quantity produced by the entrant). The regulatory framework is such that the regulator guarantees a nonnegative profit to the incumbent, i.e. the incumbent receives from the regulator a transfer $t(c)$ while it is required to produce $q(c)$. The incumbent's profits are:

$$\Pi^1 = (P(Q) - c) \, q(c) + t(c) \qquad (1)$$

and the entrant's profits

$$\Pi^2 = (P(Q) - c_e) q_e \qquad (2)$$

In a Stackelberg leader-follower game, the entrant chooses q_e as a best response against incumbent's quantity $[q_e(c)]$. This best response maximizes the entrant's profit:

$$\Pi^2 = \max [(\alpha - \beta q(c) + q_e)) - c_e] q_e \qquad (3)$$

$$q_e \geq 0$$

$$[\alpha - \beta q(c) - c_e]/2\beta \quad \text{if } q(c) < [(\alpha - c_e)]/\beta$$

$$q_e(c) = \begin{cases} 0 & \text{otherwise} \end{cases}$$

A regulatory scheme $[q(c), t(c)]$ is incentive compatible if the profits resulting from this scheme are higher than or equal to the ones resulting from another regulatory scheme $[q(c\tau), t(c\tau)]$, i.e.

$$\pi(c) = ((p(c) - c) \, q(c) + t(c)) \geq (p(c\tau) - c) + t(c\tau) = p_i(c, c\tau) \qquad (4)$$

Following Baron and Myerson (1982) and applying "envelope" arguments we get the incumbent's *information rent* expressed with the following mathematical expression:

$$\pi(c) = \pi(c_H) + \int_0^{c_H} q(x)dx \qquad (5)$$

Incumbent's information rent is inversely related to its marginal cost. Regulators choose transfers to minimize the incumbent's information rent. The transfers make $\pi(c_H) = 0$.

The asymmetry of information gives the incumbent the opportunity to behave opportunistically. It has the incentive to misrepresent the true information and earn thereby an information rent $[\xi_1 g(c)]$. In that circumstance, the regulatory agency treats the incumbent with true costs c as if its costs were $c + \xi_1 g(c)$, the incumbents *virtual cost*. The incumbent's monopoly optimal output is:

$$q^*(c) = [\alpha - c - \xi_1 g(c)]/\beta$$

Because the hazard rate, g, is increasing in c, incumbent's optimal quantity, $q^*(c)$, is strictly decreasing in c. If incumbent's cost, c, is less than a critical value $\hat{c}$ (the value of the incumbent's cost at which the entrant just begins to produce), then

$$q^*(c) > [\alpha - c_e]/\beta \quad \text{iff } c < \hat{c} \qquad (6)$$

From a regulatory perspective, allowing entry into the market will be of no avail since the incumbent produces such a large quantity that the prospective entrant's best response is not to produce at all. Regulators should then consider freeing the market and allow entry when incumbent's cost is not very small[4]. Indeed, the entrant enters the market if and only if the incumbent's cost is higher than $\hat{c}$. When the incumbent produces $q(c) < [\alpha - c_e]/\beta$, the entrant's profit, $\pi_e(c)$, becomes (it is derived from its best response function):

$$\pi_e(c) = [\alpha - \beta q(c) - c_e]^2/4\beta \qquad (7)$$

The regulatory agencies are concerned with incentive-compatible regulatory policies so that the entrant can enter and be viable without compromising the viability of the incumbent. In such circumstances, the regulators' welfare function (W^R) becomes:

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[4] An example is the liberalization of the local telephone market in Canada. No entry occurred in the local market (but in some lucrative business in downtown buildings) despite its liberalization because the incumbent firm, Bell Canada, had a market size for local calls 100 percent and costs much lower (they have been amortized) than the prospective entrants. This is less likely to occur in MENA countries because there is an unsatisfied demand on the one hand and the incumbent does not have a significant cost advantage over the entrants (both are on equal footing when they are required to invest in new territories to satisfy the unmet demand) on the other hand.

$$W^R=$$
$$\int_{CL}^{\hat{c}}\left\{\int_0^{q(c)}(a-bx)dx-(c+\xi_1 g(c))q(c)\right\}f(c)dc+$$
$$\int_{\hat{c}}^{cH}\left\{\int_0^{Q(c)}(a-bx)dx-(c+g(c))q(c)-c_e\left[\frac{a-bq(c)-c_e}{2b}\right]-\xi_2\left[\frac{(a-bq(c)-c_e)}{4b}\right]\right\}f(c)dc\right\} \qquad (8)$$

Pointwise optimization and simplification of the first-order conditions yield the optimal quantities produced by both the incumbent and the entrant. The entrant produces nothing if $c < \hat{c}$. If $c > \hat{c}$, the optimal output produced by the incumbent becomes:

$$q_i^*(c) = [\alpha - c - \xi_1 g(c)]/\beta + 1/\beta [(2\theta_2 - 3)/(2\xi_2+1)](c + \xi_1 g(c) - c_e) \qquad (9)$$

and the output produced by both firms becomes:

$$Q^*(c)=q_i^*(c)+q_e(c)=[\alpha-c-\xi_1 g(c)]$$
$$/\beta+1/\beta[(2\xi_2-1)/(2\xi_2+1)][(c+\xi_1 g(c)-c_e)] \qquad (10)$$

It becomes clear from the last equation that when $c > \hat{c}$, the output under oligopoly is larger than that resulting from a monopoly regime, if and only if ξ_2 is greater than $\frac{1}{2}$ ($\xi_2 > \frac{1}{2}$), that is, when the regulatory agency values at the intermediary level the entrant's profits. When the regulator values highly the entrant's profits, ($\xi_2 < \frac{1}{2}$), the total market quantity will be *lower* under oligopoly.

These results are depicted graphically (figure 1). The oligopoly output is lower than the monopoly one because of the effect of investment on information rent. When the entrant is favored by the regulators (the regulator values highly the entrant's profits), the entrant's positive output has a dumping effect on the incumbent's information rent. As entrant's production increases, incumbent's information rent diminishes and with that its production (proportionally more than the increase in entrant's output). There results a fall in the total quantity in the market. This regulatory policy makes sense whenever the entrant's costs are lower than incumbent's virtual costs. The regulators can use this information to reduce the incumbent's information rent. But since the latter is positively related to the incumbent's production level, regulators should then follow a balancing approach to regulation so that total production should not diminish and investment in infrastructure should not be discouraged.

The investment decisions of both the incumbent and the entrant are analyzed next formally. Investment in infrastructure is a key variable in the current regulatory regimes. Firms choose the level of investment to maximize profits. In an asymmetric regulatory environment, the incumbent expects to earn some information rents, which in turn determine the return on investment. Obviously, these returns differ in monopoly and oligopoly regimes.

Under monopoly, the information rent of the incumbent is $\int_{c}^{c_H} q(c)dc$

and its optimal output is $q^*(c) = [\alpha - c - \xi_1 g(c,I)]/\beta$ and the incumbents net profit, $E(\pi(I)-I)$, that is, expected information rent net of investment costs is

$$E(\pi(I)-I) = 1/\beta \int_{c_L}^{c_H}\int_{c}^{c_H} [\alpha - x - \xi_1 g(x,I)]dx\, f(c,I)dc \qquad (11)$$

Integrating by parts, produces the following result for the investment decisions of the incumbent,

$$E(\pi(I)-I) = 1/\beta \int_{c_L}^{c_H} F(c,I) [\alpha - c - \xi_1 g(x,I)]dc \qquad (12)$$

The incumbent's investment decision is determined on the marginal return it earns on its investment. This is obtained by the first-order derivative of the expected information rent function $E[\pi(I)]$, which is:

$$\partial E((\pi(I))/\partial I = 1/\beta \int_{c_L}^{c_H} [F_I(c,I)(\alpha - c - \xi_1 g(c,I)) - \xi_1 g_I(c,I)F(c,I)]dc \qquad (13)$$

The effect of investment on profits is decomposed into two parts. The first part (first part of the integrand) shows the incumbent's capability to increase its information rent by changing its investment level, while the second part shows the regulator's unwillingness to commit itself to the incumbent's expected rent. Incumbent's virtual cost, $c + \xi_1 g(c,I)$, is changed by its investment decisions by $\xi_1 g_I(c,I)$. If $\xi_1 g_I(c,I) > 0$ at c, then the regulatory agency will lower the incumbent's output for cost level c and reduce the incumbent's information rent for this cost. By contrast, the regulatory agency will allow the incumbent to increase its output at c, if $\xi_1 g_I(c,I) < 0$.

When the regulatory agencies allow entry into the market, the entrant makes its decisions after observing the incumbent's investment decisions and the regulatory game. Given the regulatory regime and the industry structure, the incumbent's expected net profit (net of investment costs) becomes:

$$E[\pi(I;c_e)] = 1/\beta \int_{c_L}^{c_H}\int_{c}^{c_H} [\alpha - x - \xi_1 g(c,I)]dxf(c,I)dc - (1/\beta)[(3-$$

$$\xi_2)/(2\,\xi_2+1)] \int_{\hat c}^{c_H}\int_{c}^{c_H} [(x+\xi_1 g(x,I) - c_e)f(c,I)]dc \qquad (14)$$

Integrating by parts we get:

$$E(\pi(I;c_e)) = 1/\beta \int_{c_L}^{c_H} [F(c,I)(\alpha - c - \xi_1 g(c,I))dc - (1/\beta)[(3-$$

$$2\xi_2)/(2\xi_2+1)] \int_{\hat c}^{c_H} [F(c,I)(c+\xi_1 g(c,I) - c_e)]dc \qquad (15)$$

The first term of the above equation represents the expected information rent in the monopoly regime, $[U(I)]$, while the second term represents the incumbent's loss of information rent, $[V(I)]$, when entry is allowed. The incumbent's marginal return when entry is allowed is:

$$\partial E[\pi(I;c_e)]/\partial I = U\tau(I) - V\tau(I) \qquad (16)$$

Where $U\tau(I)$ is the derivative of expected information rent given above and $V\tau(I)$ is the difference in incumbent's marginal returns on investment between the two regimes (monopoly and oligopoly).

$$V\tau(I) = 1/\beta[(3-2\xi_2)/(2\xi_2+1)] \int_{\hat c}^{c_H} [F(c,I)(c+\xi_1 g(c,I) - c_e) + F(c,I)\xi_1 g_I(c,I)dc \qquad (17)$$

This equation shows the interplay of regulation, information rents, virtual costs and entrant's investment and production decisions. The incumbent will receive a lower information rent because of entry and because its output is lower after entry. The incumbent's level of output is directly related to the change in virtual cost $g_I(c,I)$. If the latter is positive, more investment results in higher virtual costs and incumbent's output is reduced. On the contrary, if the virtual cost is negative, the incumbent may get a higher marginal return on its investment. When incumbent chooses its optimal investment (I^*) under monopoly (I^*_M) or oligopoly (I^*_O) regime, the following inequalities hold:

$$U(I_M^*) - I_M^* \geq (I^*_o) - (I^*_o) \quad \text{in a monopoly regime} \qquad (18)$$

$$U(I^*_o) - V(I^*_o) - I^*_o \geq U(I^*_M) - V(I^*_M) - I^*_M \text{ in oligopoly regime} \qquad (19)$$

Adding these inequalities and simplifying, we get

$$V(I^*_o) \leq V(I^*_M) \tag{20}$$

The behavior of the V(I) determines the size of the difference in the investment levels under the two regimes. If V(I) is monotonically increasing, then $I^*_M > I^*_o$ and the reverse is true when V(I) is monotonically decreasing. A sufficient condition for a positive $V\tau(I)$ and a $I^*_M > I^*_o$ is $g_I(c,I)>0$ for all c. The welfare effects are not unambiguous when the regulatory agencies decide about the structure of the industry. When V(I) is decreasing the welfare is higher in oligopoly but if it is increasing the welfare effect is ambiguous. It can be either higher or lower in oligopoly. It might be higher when entrant's cost is lower. The entrant's cost structure (lower costs) has an effect on incumbent's investment decision. If the change in the hazard rate at ĉ is positive, then the marginal return on investment is lower if the entrant's cost falls. Incumbent lowers its investment, reducing thereby social welfare. By contrast, if the change in the hazard rate at ĉ is negative, welfare unambiguously increases. Table 1 summarizes the theoretical findings of the model.

All in all, privatization may have an ambiguous effect on social welfare. In the short run a drop in prices is expected due to entry. In the long run, the effects are uncertain depending on the reactions of rival firms in the industry, their cost structure and the regulatory scheme in place. There are at least two circumstances where the effects of privatization and entry are unambiguous (Biglaiser and Ma, 1999). When entrants' costs are not particularly low, the incumbent's marginal returns on investment wouldn't be affected by entry or its investment level. Privatization and entry are thus beneficial. Furthermore, when technological changes significantly reduce the costs of the firms and when investments must be made in a lumpy way as it is in the telecommunications industry, new technologies are adopted by the incumbent despite the entry. In both special cases social welfare is increased (Riordan and Sappington, 1989; Caillaud, 1990; Baron and Myerson, 1982; Laffont and Tirole, 1993). Regulators should then concentrate on the incumbent's investment incentives and *commit* to the design of the industry structure (privatization, restructuring and entry) that brings most benefits of restructuring to society. Commitment is even more important in MENA countries where regulatory institutions are rather recent.

3. Review of the Empirical Literature

There are few empirical studies that examine the effects of ownership, entry and investment in infrastructure in the telecommunications industry in both industrialized and developing nations (Kwoka, 1993; Ramamurti, 1996; Galal et al., 1992; Vickers and Yarrow, 1988). Most of these studies are concerned with the effects of competition on some performance variables (productivity, innovation, penetration ratios, etc.) but they fail to systematically examine the relation between privatization, entry and investment in infrastructure. Moreover, given that privatization and competition have occurred simultaneously most of these studies cannot distinguish the separate effects of privatization or competition on investment. The purpose of this section is to revise the empirical literature and highlight some stylized facts with regard to the effects of privatization on firms' investment performance.

Bortolotti et al., (2001) examined the financial and operating performance of 26 partially or totally privatized telecommunications firms for the period 1984 to 1997. The variables used to evaluate performance were various indices such as changes in profitability, output, efficiency, employment, capital expenditure and leverage. Their empirical proxies for each variable and for each company[5] were computed for a seven-year period encompassing three years before through three years after privatization. Efficiency was tested by analyzing two ratios: (i) real sales per employee and (ii) average number of access lines in service per employee. Changes in capital investment spending were calculated by constructing three ratios; (i) normalized real capital expenditures, (ii) capital expenditures to sales, and (iii) capital expenditure to total assets.

Their findings are interesting and quite robust. Profitability[6], output and sales efficiency all increased after privatization for the sample of privatized telecom firms. Their results show that return on sales (ROS) and operating income to sales (OISALES) increases significantly, while return on assets and return on equity change insignificantly. The mean (median) increase in OISALES was 2.74. As far as investment in infrastructure is concerned, their Wilcoxon and proportion tests both showed that normalized real capital expenditures increased significantly – and often dramatically[7]. This was anticipated given that many countries were moving from mechanical switches to digital switches during their study period. Further, the ratio of capital spending to sales and capital spending to total assets both decreased insignificantly. Apparently, sales and total assets after privatization increased more than capital expenditures, a reason sufficient enough to explain the insignificant decrease of capital spending.

These findings corroborate the ones found by Megginson, Nash and Van Randenborgh (1994). They examined the pre- and post-privatization financial and operating performance of 61 companies from 18 countries and 32 industries that experienced full or partial privatization through public share offerings during the period 1961 to 1990. The authors present strong evidence that, following

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[5] Their study is based on a sample of 26 telecommunications firms from 21 countries (thirteen industrialized and thirteen non-industrialized).

[6] Profitability is measured by the operating income to sales, return on sales, return on assets and return on equity ratios.

[7] The Wilcoxon and the proportion test statistics were significant at the one percent level.

privatization, their sample firms become more profitable and efficient, and also increased real sales and capital expenditure. Furthermore, these companies significantly lower their debt levels and increase dividend payments. In addition, they find no evidence that employment levels decline after privatization. Instead they find an increase in employment levels for 64 percent of the sample companies.

Boubakri and Cosset (1998) examined the financial and operating performance of 79 firms in 21 developing countries that experienced full or partial privatization over the period 1980 to 1992. The authors report significant increases in profitability, operating efficiency, capital expenditure, real sales, total employment and dividends. Dewenter and Malatesta (1997), on the other hand, study 63 firms privatized during the years 1981 to 1993, and find that profitability, using return on sales as proxy, increases significantly after privatization, while profitability, using earnings before interest and taxes to sales, declines insignificantly. Further, they show that productivity increases significantly. Perhaps most importantly, they document that privately owned firms (including privatized companies) are significantly more efficient and profitable than are state-owned firms.

Finally, D'Souza and Megginson (1999) examined the pre- and post-privatization financial and operating performance of 85 companies from 28 countries for the period 1990 to 1996. They found that the absolute level of investment spending increases--but capital expenditures as a fraction of sales does not (since sales increase even more rapidly than capital expenditures). Further, there is a significant increase in the mean levels of profitability, real sales and operating efficiency, significant decreases in leverage ratios, and insignificant changes in employment and capital expenditure. Interestingly, they find that a much larger fraction of the firms in their sample are from regulated industries (primarily telecom and electric utilities) than was true for Megginson, Nash, and van Randenborgh (1994).

Dewenter and Malatesta (2000) also found that profitability, output and sales efficiency increased after privatization and return on sales increases. Galal, et al. (1992) also showed that capital expenditure increases significantly after privatization for the three telecommunications firms included in their sample of privatized firms. Taken as a whole, this body of evidence clearly indicates that privatization increases the financial and operating performance of divested firms, and does so in a way that does not necessarily result in widespread employment losses.

Another interesting cross-national study is the one realized by Ros (1999). He estimates empirically the effects of privatization and open entry on telephone penetration in 84 countries (only 14 of them had opened some segments of their telecommunications market to competition) from 1986 to 1995. The results are

quite interesting and startling. Competition results in reduced spending on infrastructure while penetration ratios increase at the same time. Thus, entry affects penetration ratios positively but infrastructure development negatively. In another study (OECD, 1995), the relationship between facilities competition and investment in infrastructure was examined by means of a survey of OECD member countries. It was found that countries that permitted infrastructure competition had greater penetration ratios, better service quality and lower prices. There is no evidence of the effects of competition on investment. In another cross-national study (Dekimpe, Parker and Sarvary, 1998) examined cellular penetration ratios and competition. The authors found that penetration increases with the number of competitors.

However, it is hard, to draw implications from these studies for MENA countries. First, most of the studies use U.S. or other industrialized countries' data, which compromise their applicability to the MENA countries with their unique market and institutional characteristics and political contexts. Second, these studies were realized for firms other than telecommunications whose market behavior is quite sensitive to technological and regulatory changes. Third, these studies were conducted having as an objective to examine other relationships than the ones we are interested in here. Their findings may be less appropriate to the objectives of our study. For these reasons, the examination of the impact of privatization and regulatory changes on the telecommunications incumbent performance is suggestive to the current policy debate. The next section examines whether telecommunications privatization or would-be privatization in the MENA countries yields comparable to the other industries performance improvements, and if so, to isolate the sources of performance gains.

4. Overview of Major Market Structures and Regulatory Changes in the MENA Countries

Algeria Until 2001, the Ministry of Posts and Telecommunications was responsible for all telecommunications services in Algeria. *Algérie Télecom* was established in August 2001 as a joint-stock company wholly owned by the State and it has an exclusive monopoly (until end of 2004) on all telecommunications services except for GSM services, which opened to competition in February 2002 through a license granted to Orascom in July 2001. There are now two mobile operators in Algeria; the incumbent *Algérie Télécom* and *Orascom*. The privatization plans are to sell up to 35 percent of Algérie Télecom capital to a strategic foreign investor in August 2003.

Investment in telecommunications infrastructure has declined dramatically after oil revenues attained their peak in the 1970s and 1980s. Algeria's fixed network remains under-developed (1.9 million fixed lines or 6 lines per 100 inhabitants) with long waiting lists (up to a year) and an estimated unmet demand of more than 600,000 people. The Ministry's modernization program has as a goal to

increase teledensity to 7 lines per 100 inhabitants in 2002, 12 lines in 2004 and 20 lines in 2010. This will be achieved through the network's digitalization (with a rate of digitalized lines reaching 95 percent at the end of 2001), the installation of over 600,000 switching equipments and development of the fiber optical network. The incumbent operator, Algérie Télécom, plans to invest in its MPT (mobile) network in order to attain a capacity of 500,000 lines in 2002. Orascom which operates in Algiers plans to invest more than 300 million USD and extend its services to 11 other cities, and reach 500 000 subscribers by the end of 2002.

Egypt. In 1998 a new law (no. 19) established an independent telecommunications regulatory agency (TRA) and transformed ARENTO, the Arab of Egypt National Telecommunications Organization into a joint stock company (*Telecom Egypt*), the public operator, which holds a monopoly on the provision of fixed telephony and data transmission services and networks. The law provides for privatization of the currently 100 percent state-owned incumbent (up to 49 percent of its capital) but because of unfavorable stock market conditions the privatization of 20 percent of its capital stock scheduled initially for autumn 2000 was postponed indefinitely.

Telecom Egypt has the biggest fixed network of the MENA region. In 2001 its network had 6.2 million lines (96 percent of main telephone lines are connected to a digital exchange) after experiencing an average annual increase of around 15 percent between 1995 and 2000. Despite a threefold increase of its fixed network between 1990 and 2001, teledensity remains low (9.5 percent). To solve the problem of long waiting lists (1.3 million of telephone lines applications), Telecom Egypt plans to invest USD 4700 million in development and expansion of its network over the period 2000-2005.

Egypt has a competitive market for mobile phones. In 1998, *MobiNil*[8] (now known as ECMS/MobilNil)[9] and *Vodafone Egypt* (formerly known as Misrfone)[10] were awarded a 15-year license with a four-year period of exclusivity that expires in December 2002. A third GSM operator, the incumbent *Telecom Egypt*, awarded a license in 2001 and it plans to enter the market at the end of the exclusivity period of the current GSM license holders. It is scheduled that a fourth mobile license will be granted in the near future. The introduction of competition in the mobile market led to a spectacular increase of the number of

subscribers[11]. In the payphones market, two private operators exist, Menatel[12] and Nile Telecom. They got a 10-year license in 1998.

Jordan. The Telecommunications Regulatory Commission (TRC), a national regulatory agency independent from the operator, was created in 2002 after amendment of Jordan's telecommunications law (no. 13) which was originally ratified in September 1995 and became effective on October 1, 1995. On January 1, 1997, T.C.C. the state telecom monopoly became a company and was renamed *Jordan Telecommunications Company (JTC)*, which has a monopoly on infrastructures and services until December 31, 2004, when a license for another telecom operator will be issued. In January 2000, the government partially privatized the JTC by selling off of a 40 percent stake to JITCO, a joint venture between France Telecom (88 percent) and the Amman-based Arab Bank (22 percent), for USD508 million, and 8 percent to Social Security Corporation. The government plans to further privatize the company by selling another part to the private sector by the end of 2002. Prior to its partial privatization, in May 1999, JTC was awarded licenses to provide a number of services in addition to fixed line telephony, including GSM, pay phones, Internet/data, paging and trunking.

Like in most other MENA countries, the market for mobile services is dominated by two GSM operators, *JTMS* (90 percent owned by the Egyptian operator Orascom) since 1995, and *MobileCom* (a 100 percent JTC subsidiary), since 2000. They have market exclusivity until the end of the year 2003.

Lebanon. In Lebanon, the telecommunications industry is still governed by the Telecommunications Act of 1959 (Decree Laws No. 126 and 127 dated 12 June 1959). For the time being, there is no independent regulatory authority in Lebanon. This function is accomplished by the Ministry of Telecommunications (MT, formerly known as Ministry of Posts and Telecommunications or MPT) and its two directorates (General Directorate for Operations and Maintenance[13] and General Directorate for Equipment and Construction[14]) that were set up in 1980.

After some hard and long discussions and repeated withdrawals of a new telecommunications law drafted by the MT in 1999, the Council of Ministers accepted the second draft in March 2001 with some modifications concerning issues related to regulatory objectives, open markets, competition and other

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[8] The first GSM network was launched in November 1996 by Telecom Egypt and then sold to MobiNil in April 1998.

[9] ECMS (Egyptian Company for Mobile Services is 50.1 percent owned by MobiNil and 49.9 percent owned by the public; while MobiNil is 71.25 percent owned by France Telecom, and 25.75 percent by Orascom.

[10] Vodafone Egypt is a consortium 60 percent owned by Vodafone, the remainder being owned by international investors (EFG-Hermes, 10 percent, Alkan Group, 10 percent, Mobile System International, 7 percent, Vivendi, 7 percent, etc).

[11] The number of subscribers was 3 million in June 2001 representing a penetration ratio of 4.5 percent (1 701 000 for MobiNil (i.e a 56,7 percent market share) and 1 300 000 for Vodafone Egypt (a 43.3 percent market share).

[12] A France Telecom-led consortium.

[13] In charge of operating and regulatory policy.

[14] In charge of the telecommunications network planning, the drawing up and implementation of installation, and development policy.

administrative and social factors. Finally, this bill was passed to the Parliament for final enactment as a law. Recently, the Parliament Committee accepted the government's proposal but made some modifications[15]. The new law will create an independent regulatory body responsible for various regulatory issues of the telecommunications industry[16]. It will create a 100 percent government owned enterprise, Liban Telecom, after merging the current state owned fixed line company, *OGERO* and some MT departments. Ogero is a 100 percent state owned company, which acts under the control of MT's General Directorate for Operations and Maintenance. Under the new law, Liban Telecom will be granted a 25 year license for the provision of eight kinds of telecommunications services including PSTN, Internet and data. Moreover, the new law aims to improve the competitiveness of the state-owned sector before a partial sell off in the near future. No sell off can be realized under the current law and a new bill will be required for a partial or total privatization of *Liban Telecom*. Full liberalization of the telecommunications industry is planned for the year 2004.

There are two mobile telecommunication firms that operate under the framework of Build-Operate-Transfer (BOT) contracts granted in 1994 to France Telecom Mobile Liban (*FTML*) and *LibanCell*. These contracts have a minimum duration of 10 years with 2 more optional years (12-year period contracts) and 7 years and a half of exclusiveness. According to the terms of the BOT contracts, the networks are freely transferred to MT at the end of the period contract (end 2004, with an option for two additional years)[17].

The Lebanese mobile market grew rapidly since the first two licenses were granted in 1994. Inadequate fixed telephony infrastructure (destroyed by civil war) pushed the demand for mobile services attaining a penetration rate of 21 percent in 2000 from 3.6 percent in 1995. In 2002 the penetration rate was 23.34 percent, equally split between the two operators. Both, fixed and mobile networks cover about 95 percent of the Lebanese population. Fixed telephone lines grew from 330 000 in 1994 to 741 000 at the end of 2001, and the related fixed teledensity increased from 10 percent to 20 percent. This was realized thanks to coordinated actions of the Council for the Rebuilding and Development (CDR) created after the civil war for rebuilding the public infrastructures. A total investment of approximately 1 billion USD was realized from 1992 to 1998. By the end of 1998, this resulted in an increase in capacity of approximately 1 line per three inhabitants (the PSTN capacity was extended to 1 730 000 lines).

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[15] These were mostly related to the reallocation of the 4 000 employees of the Ministry of Communications and its operating company (Ogero).

[16] These include licensing procedures, interconnection, tariffs, spectrum allocation, USO, etc.

[17] In May-June 2000, the Lebanese government entered into conflict (which ran over 2000 and 2001) with both mobile phone companies about alleged irregularities. In June 2001 the government unilaterally cancelled the contracts of the two operators.

Morocco. Structural and regulatory reforms in Morocco can be traced back to 1984 when the government separated the regulatory and industrial activities. The operation of telecommunication services was attributed to a distinct entity, the Office National des Postes et Télécommunications, and the Ministry was responsible for regulating the sector. Morocco's telecommunications industry was profoundly restructured in 1997 when the government created *Maroc Telecom* (formerly Itissalat Al-Maghrib) as a joint-stock company wholly owned by the government and an independent regulatory authority, the ANRT (agence nationale de régulation des telecommunications). Maroc Telecom was partially privatized in December 2000 by selling off 35 percent of its capital to Vivendi Universal (an additional 15 percent share is scheduled to be sold in 2002). Maroc's monopoly over fixed telephony will end soon after the government has completed its announcement for an international bid for tender for the allocation of a license for fixed lines (2002). The government ended Maroc's Telecom monopoly over mobile services in 1999 when it sold a second GSM license to *Medi Telecom,* which holds a 25 percent market share. A third GSM license may be allocated in 2003. In April 2001, Maroc Telecom acquired 54 percent of the capital of Mauritel, the Mauritanian operator.

Morocco's mobile penetration ratio increased substantially after Medi Telecom entered the market (the number of subscribers increased from 375 000 in December 1999 to 2.7 million in December 2000 and nearly 5 million at the end of 2001) making the mobile market the drive engine of development of Morocco's telecommunications industry. The number of mobile subscribers is now well above the number of fixed subscribers (3.7 million fixed subscribers).

Telecommunication services remain underdeveloped in rural areas. In March 2001, 1015 municipalities were not connected to the network (against 2 350 connected municipalities). Maroc Telecom has undertaken major investments to expand and modernize its network. Digitalization was completed in 1999 and by the same time Maroc Telecom launched a program for the development of a fiber-optic network. A conflict between the ANRT, the regulatory authority, and the ministry of communications over responsibilities and sanctioning resulted in the demotion of the head of ANRT creating thereby uncertainty about the future of reforms in the country. The new appointment (in March 2002) may dissipate these uncertainties.

Syria. Syria's telecommunications regulatory framework is quite different from the rest of MENA countries. Syria does not have a separate regulatory authority. The Ministry of Communications is responsible for regulatory and other telecommunications policy issues. Telecommunications services are provided by the Syria Telecommunications Establishment (*STE*), a financially and administratively independent operator. It is a state-owned enterprise created in 1994 by Decree-Law no.20. It provides exclusively all telecommunications

services and has the monopoly for all forms of wired and wireless communications. The STE is the only institution that can build and operate telecommunication infrastructures, although it can delegate the operation of certain facilities to private national or international companies under contract (as it is the case for mobile telephony services). The government has no plans to privatize STE.

To develop its mobile network, the STE used the BOT (Build-Operate-Transfer) formula. At the beginning of 2001, two private companies, *InvestCom*[18] and *SyriaTel*[19] were granted license by STE to operate the first GSM pilot project in Syria under two 15-year GSM mobile telephony contracts. The STE may invite a third operator to serve a further 850 000 subscribers after 7 years. By the end of the project, the total mobile network capacity will be about 1.7 million lines. Both operators are set to operate under revenue-sharing deals[20].

The mobile market in Syria is very weak with a small number of subscribers (103,000 in July 2001 (Syriatel has 45 percent market share while Investcom has 55 percent). It is expected that this market will grow rapidly reaching a 4.17 percent in 2002 from its current level of 0.62 percent and 13.03 percent by year 2005.

With a low teledensity rate for both the fixed and mobile services, Syria is, by all means, the most under-equipped country in the region. Progress has been made though. Fixed teledensity in Syria grew from less than 5 percent in 1994 to more than 11 percent in 2000. Its network is partially digital (only 87 percent in 1999) and there are long waiting lists for the installation of individual telephone lines. To further develop its PSTN network (install 1.650 million additional telephone lines, inter-city fiber optic, Digital Micro-wave links), Syria has launched in 1996 a telecommunications investment program of 326 million USD, which is planned to end by December 2002. By the end of this program, Syria will have 3.2 million lines and a penetration ratio of fixed telephony of about 18 percent.

Tunisia is still in its infancy as far as the telecommunications industry reforms are concerned. Although telecommunications restructuring started before the one realized in Morocco, Tunisia was very slow to go ahead with bold steps towards privatization and the introduction of competition in the mobile market. Its telecommunications network is not yet well developed and the fixed line

penetration ratio is low, 11 percent in 2002, while the mobile penetration ratio is as low as 10.34 percent (it was only 0.69 percent in 2000). For this reason, by the end of 2000, Tunisia accelerated its liberalization process especially for the mobile market. After the adoption of a new code of Telecommunications in January 2001 (Law n. 2001-1), the government opened the mobile market to competition by granting a GSM license to a private operator (Orascom of Egypt) and created two regulatory agencies - the NIT (National Instance of Telecommunications), in charge of the regulation of the telecom and the NAF (National Agency for Frequency), in charge of spectrum management. Nevertheless, the 2001 Telecommunications Act leaves significant lawful capacities to the Ministry of Communications Technologies (MCT) with regard to license awarding, dispute settlements and application of sanctions.

Tunisie Telecom also known as The Office National des Télécommunications is a 100 percent state owned company created in 1995 and it is the national monopoly on the fixed telephony services[21]. The government plans to sell off a 49 percent stake to a foreign investor. Tunisie Telecom has a monopoly on the mobile telephony through its subsidiary Tunicell, which was created in 1998. It has nearly 400 000 subscribers (September 2001) and an estimated 600 000 requests on standby. The current mobile penetration rate is 4 percent only. Tunicell's monopoly ended in March 2002 when the Egyptian operator *Orascom* was granted a GSM license by the Ministry of Communication Technologies for a USD 454 million fee (payable in two parts before the end of 2002)[22]. Orascom plans to launch its services before the end of the year 2002.

Turkey. The liberalization of Turkey's telecommunications industry has not been easy. It was not until January 2000 (Law No. 4502) that the government set up an independent regulatory body, the Telecommunications Authority (TK)[23], and set the deadline (31 December 2003) for the liberalization of all telecommunications services. *Türk Telekom* (TT) was created in 1995 as a joint-stock company wholly owned by the State and it was granted a monopoly status on all voice services and telecommunications infrastructure until January 2004. TT could grant licenses to private companies that operate new services on the basis of shared revenues agreements. TT's monopoly on fixed line telephony services and infrastructure is bound to end in December 2003, or before in case the government's participation in the company decreases below 50 percent. Although the privatization of TT started in 1994, it has never been completed

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[18] A subsidiary of the Lebanese InvestCom part of group Mikati.

[19] Syrian investors and the Egyptian Orascom Telecom.

[20] Under the BOT contracts, the operators must pay up-front a frequency fee of 20 million USD for the use of GSM 900 MHz and an additional 15 million USD for the use of GSM 1800 MHz without any further bidding procedure. Further, the contracts specify that both operators will have to pay a predetermined percentage of their revenues to STE - 30 percent for the first 3 years, 40 percent for the next 3 years and 50 percent for the remaining period.

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[21] Its network has been fully digitalized since June 2001.

[22] The first tender for a second GSM licence was called off in March 2001 because the offer by Telefonica and Portugal Telecom was considered too low by the government.

[23] The new telecommunications law (Law No. 4673) adopted in 2001 has significantly increased TK's scope of competencies with regard to licensing and other regulatory functions.

because of unfavorable conditions. The privatization of TT is not expected to take place before 2003.

In 2001, Türk Telekom had 19 million fixed subscribers giving a penetration ratio of 27.64 percent. Its network (88 percent digitalized, 2001) is expanding rapidly. The development of mobile telephony has had a tremendous impact on Turkey's telecommunications market in recent years. Since 1998 the number of mobile subscribers has increased from less than 4 million (penetration rate of 6 percent) to nearly 19 million in 2001 (penetration rate of 28 percent). Mobile and fixed lines penetration ratios are almost equivalent now. The introduction of prepaid services has greatly increased the mobile market. Prepaid services now account for around 66 percent of users. Turkey's mobile market is less concentrated than the rest of the MENA countries. There are now four mobile operators; two started operations in 1994 (*Turkcell* and *Telsim*) and the other two entered the market in 2000 (*Aycell*, a TT's subsidiary and *Aria*, a consortium formed by Is Bankasi and Telecom Italia). As of December 2001, the market shares of the four mobile operators are: Turkcell 63 percent, Telsim 34 percent, Aria 3 percent and Aycell less than 1 percent.

To put the above analysis into perspective, it is interesting to make a comparative study of each country's development with regards to its telecommunications industry. The IJJP curve (ENCIP, 2002) linearly correlates the teledensity ratio and a country's GDP. It shows how well a country performs in terms of telecommunications equipment compared to other countries with similar GDP per capita. Countries below the curve are over-equipped while the ones above the curve are under-equipped. Figures 2, 3 and 4 show the correlation between fixed and mobile lines density with GDP per capita in MENA and some European countries. As far as the fixed lines density is concerned, the countries such as Algeria, Lebanon, Morocco and Tunisia are under-equipped while Jordan, Syria, Egypt and Turkey are over-equipped. With regard to the mobile line density, countries such as Algeria, Tunisia and Syria are under-equipped while Jordan, Morocco and Turkey are over-equipped. Both, Egypt and Lebanon are rightly equipped.

5. Empirical Investigation – Methodology

In order to empirically verify the findings of the theoretical model presented above, I examine the investment behavior of the telecommunications incumbent in nine MENA countries from 1997 to 2001. Starting from the premise that privatized telecommunications incumbents are expected to operate more efficiently especially when market reforms and restructuring take place before or during privatization, I examine their relative efficiency and compare their performance in terms of investment in infrastructure. Two capital investment measures are used: capital expenditures divided by sales (C/S), and capital expenditures divided by total assets (C/A). This approach is justified on the

grounds that privatized incumbents have greater access to capital markets (private debt and equity markets) and given the growth opportunities and the development of new markets, incumbents would have an incentive to invest in infrastructure. Efficiency (performance) is measured using the following indices: *profitability*, (return on sales, or on assets or on equity), *operating efficiency* (sales or net income efficiency), *real sales* and *capital investment* are some commonly used measures of performance.

Given the limited number of observations, no meaningful statistical or econometric analysis is attempted here. The data are collected directly from the telecommunications companies' annual reports, from various Internet sources, through government agencies, from the ITU's database and CEREF's (Center for the Study of Regulatory Economics and Finance) database. The calculation of the above-mentioned efficiency measures is done for purposes of shedding more light on the debate and to aid policymakers to fine tuning policies that promote investment in network infrastructure and increase social welfare in MENA countries.

Not all firms analyzed here are totally privatized. Some are partially privatized while some others are still state-owned but are scheduled to be privatized some time in the future (Turkey, Egypt). They are included in the sample on the grounds that would-be privatized firms tend to behave as if they were privatized. All sample countries examined here belong to the Lower-Middle-Income, except two, Lebanon and Turkey, which belong to the Upper-Middle-Income category according to the World Bank classification.

Unlike other researchers, [Megginson, Nash, and van Randenborgh (1994) and D'Souza and Megginson (1999)], I don't report on employment differences and dividend policies of the telecommunications firms examined here. The statistical results of operating and financial performance for the sample countries are reported in Table 3.

Investment in infrastructure has increased significantly for most of the firms in the sample. Capital expenditures to sales have increased for 68 percent of the firms in the sample, while capital expenditures to total sales have increased for 63 percent of the firms. The reasons for such an increase, however, are unknown. Privatization or would-be privatization and entry may be one of the reasons for the increase in investment. Other reasons may include drastic technological changes or greater opportunities for debt and equity finance of major infrastructure projects. Each of these factors affects the incumbent's information rent negatively, enticing it to invest more in infrastructure corroborating the findings of the theoretical model presented above. These results are also consistent as well with the findings of Boubakri and Cosset (1998).

Efficiency, as measured by sales to total assets has declined by almost 2 percent for a great number of firms in the sample. Only 42 percent of the firms managed to get efficiency gains after restructuring. It seems that assets use is not much different before or after privatization. This result may be attributed to the fact that most of the previously state-owned firms have had difficult times for a turnaround and that they did not have enough time to improve on efficiency.

Production as measured by real sales has decreased by almost 3.5 percent. Only 39 percent of the firms in the sample have increased their production. This may be attributed to the entry of new firms and the high churning ratio that followed the entry of new telecommunication firms in the industry.

Profitability has increased at an average ranging from 1.60 to 1.80 percent but this increase is not significant. The increased competition and the incumbents' strategy to invest in new technologies with uncertain outcomes may have a negative effect on their profitability. These results are in line with the ones found in the study realized by Boubakri and Cosset (1998) for thirty-six privatized firms operating in Low-Income and Lower-Middle-Income Countries. By contrast, Megginson, Nash, and van Randenborgh (1994) found significant profitability improvement for their sample of developed economies.

6. Implications and Conclusions

Theory suggests that privatization and liberalization of market structure increases overall industry investment but incumbent's investment can go either up or down depending on the nature of pre-entry and post-entry regulation, and the returns on investment. *Infrastructure competition* and *infrastructure development* (investment) increase penetration ratios, improve quality and variety of services and have a dumping effect on prices. Construction of basic infrastructure and next generation networks is quite expensive, lumpy and risky. Without a better understanding of the relationship between privatization and entry and investment in infrastructure the expected beneficial long run effects of restructuring may not be realized in many MENA countries. The current "technology divide" between industrialized and MENA countries may persist despite the latter's efforts to restructure their telecommunications infrastructure.

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Figure 1: Oligopoly Versus Monopoly Production under Alternative Regulatory Regimes and Cost Structures
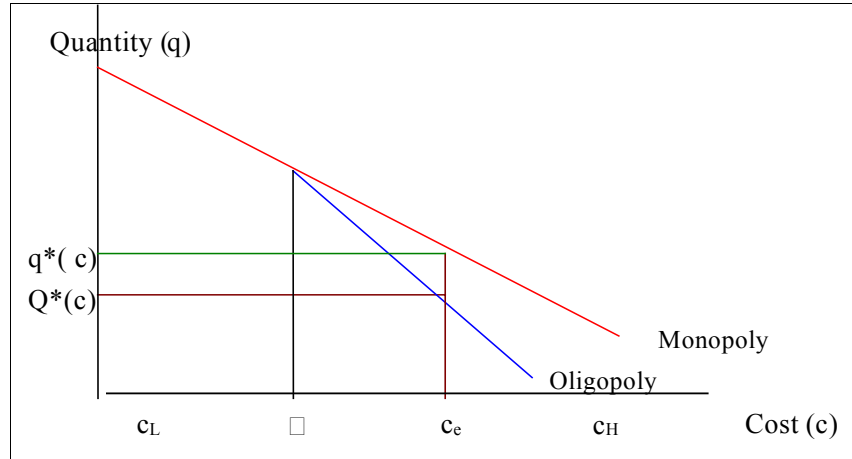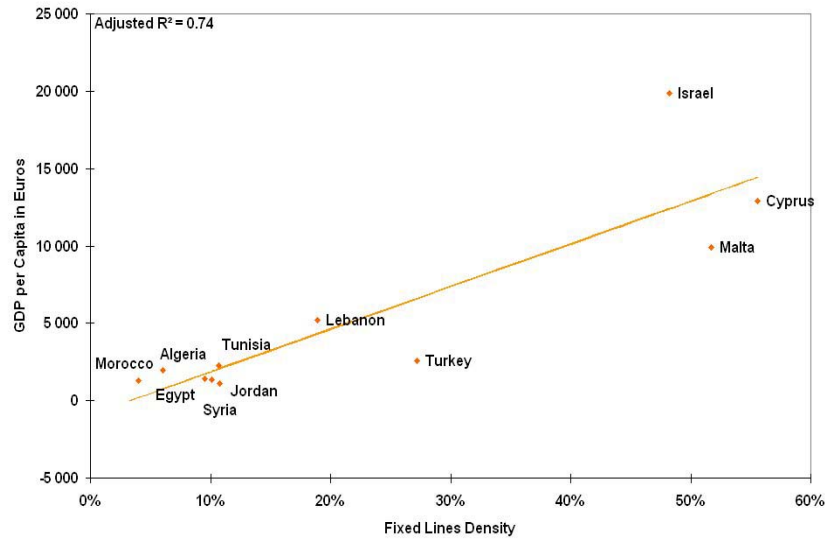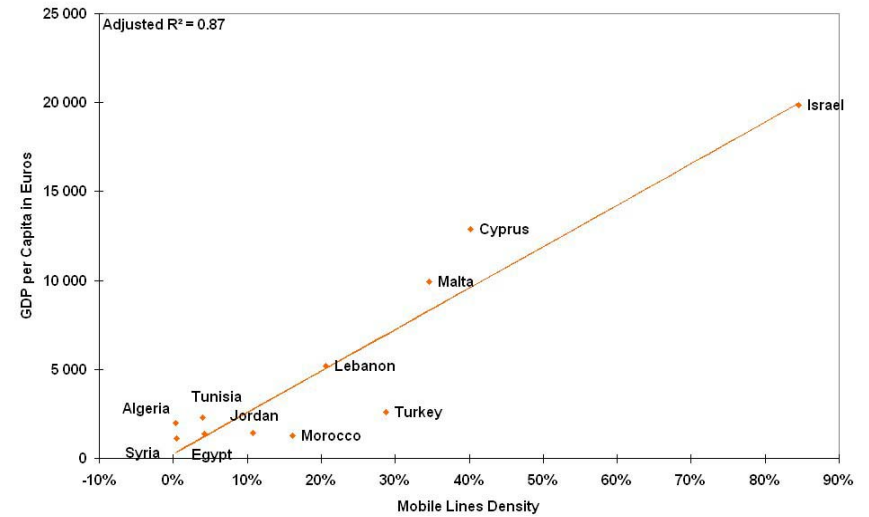

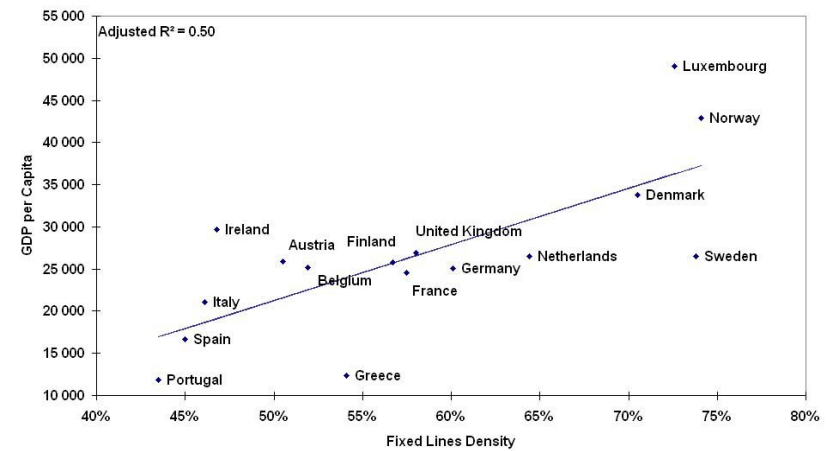**Figure 2: JIPP Curve for Fixed Lines Telephony, Selected MENA Countries (2001)**

Source: ENCIPE/IDATE, 2002

Figure 3: JIPP Curve for Mobile Lines Telephony, Selected MENA Countries (2001)

Source: ENCIPE/IDATE, 2002

Figure 4: JIPP Curve for Fixed Lines Telephony, Selected European Countries (2001)

Source: ENCIPE/IDATE, 2002

Table 1: Theoretical Effects of Privatization and Restructuring on Investment

Structural change	Information rent	Investment in infrastructure	Output	Prices	Quality	Welfare
Regulated Monopoly	↑	↓	↓	↑	↔	n/a
Regulated oligopoly entrant's cost structure unfavorable($c_e>c_i$)	↑	↓	↓	↑	n/a	↓
Regulated oligopoly entrant's cost structure favorable ($c_e<c_i$)	↓	↓	↑	↓	n/a	↑
Drastic technological changes	↓	↑	↑	↓	↑	↑

Table 2: Empirical Effects of Privatization and Restructuring on Investment

Performance Indices	Bortolotti et al. (2001)	Megginson et al. (1994)	Boubakri & Cosset (1998)	Ros (1999)*	D'Souza & Megginson (1999)
Sample size	26	61	79	84	85
Period	1984-97	1961-90	1980-92	1986-95	1990-96
Profitability	↑	↑	↑	n/a	↑
Efficiency	↑	↑	↑	n/a	↑
Leverage	n/a	↓	n/a	n/a	↓
Employment	↑	↑	↑	n/a	stable
Investment	↑	↑	↑	↓	↑
Output	↑	↑	↑	n/a	↑

Notes: * Ros' study is the only one to include totally or partially privatized telecommunications firms in his sample. His goal was to examine the effects of privatization and competition on various key telecommunications variables such as penetration ratios, growth in main lines, productivity and investment in infrastructure. His results are thus less comparable to the ones of the other studies.

Table 3: Key Structural and Institutional Characteristics of Selected Incumbents in Nine MENA Countries

Country	Incumbent Operator	Ownership or major regulatory change	Date of privatization or corporatization*	State of competition Fix / mobile
Algeria	Algeria Telecom	Scheduled to be privatized in 2003.	Corporatization August 2001	Monopoly/Competition in mobile between two private operators
Egypt	Telecom Egypt (TE)	Privatization postponed indefinitely	Corporatization 1998	Monopoly/Competition in mobile since 1998 (3 operators)
Jordan	Jordan Telecommunications Company (JTC)	Partially (40%) privatized	Privatization 2000	Monopoly/Competition in mobile since 1995 (2 operators)
Lebanon	OGERO to be renamed Liban Telecom	Not to be privatized before 2004	Corporatization of Liban Telecom 2002	Monopoly/ Competition (2 operators) in mobile since 1994
Mauritania	Mauritel	Privatized (54%)	Privatization 2001	Monopoly/Competition in mobile since 2001
Morocco	Maroc Telecom	Partially privatized	Privatization 2000 (35% in 2000 and 15% in 2002).	Soon duopoly/Competition in mobile since 1999 (2 operators, soon 3)
Syria	Syrian Telecom Establishment (STE)	No privatization plans	Corporatization 1994	Monopoly/ Competition in mobile since 2001 (2 operators, soon 3)
Tunisia	Tunisie Telecom	Goal for privatization (sell 49%)	Corporatization 1995	Monopoly/ Monopoly in mobile since 1998 (beginning 2003, competition with 2)
Turkey	Turk Telecom	Privatization not before 2003	Corporatization 1995	Monopoly/Competition in mobile since 1998 (4 competitors)

Notes: * In some cases, this is the date of announcing the intent of privatization of the incumbent.
Sources: A. Gentzoglanis, 2001, ITU, World Telecommunications Indicators, 2002, ENCIP / IDATE and author's research.

Table 4: Key Telecommunications Statistics in Nine MENA Countries and a Sample of European Countries

Country	Penetration rate*		GDP/capita (2001 in Euro)	JIPP** Fix/mobile	Total Investment in infrastructure (M US$) / per main line (2000)
	Fix (2000) /(2002)*%	Mobile (2000) / 2002 %			
Algeria	5.6 / 6.91	0.28 /4.17	1964.66	Under/under	114.5 / 120
Egypt	8.64 / 11.07	2.13 / 8.46	1353.32	Over/on	513.1 / 94
Jordan	9.29 / 10.99	5.80 / 16.71	1427.12	Over/over	216.9 / 350
Lebanon	19.96 / 19.38	21.23 / 23.34	5178.82	Under/on	n/a
Mauritania	n/a	n/a	520.12	n/a	4.1 / 248
Morocco	4.96 / 4.77	8.81 / 22.30	1265.49	Under/over	237.3 /161
Syria	10.35 / 17.34	0.18 / 4.17	1107.82	Over/under	222.1 /133
Tunisia	8.99 / 11.59	0.69 / 10.38	2277.16	Under/under	156.6 / 208
Turkey	28.0 / 27.64	23.58 /34.30	2599.32	Over/over	627.9 / 34

Notes: * Lines per 100 inhabitants. ** The IJJP curve linearly correlates the teledensity ratio and a country's GDP. It shows how well a country performs in terms of telecommunications equipment compared to other countries with similar GDP per capita. Countries below the curve are over-equipped while the ones above the curve are under-equipped.

Sources: A. Gentzoglanis, 2001, ITU, World Telecommunications Indicators, 2002 and author's research.

Table 5: Key Structural and Institutional Characteristics of Selected Incumbents in Nine MENA Countries

Country	Mobile Operators	Market shares	Mobile HHI 2001**
Algeria	Algeria Telecom	99.9%	10,000
	Orascom	0.01%	
Egypt	MobilNil	56.7%	5,002
	Vodafone Egypt	43.3%	
	Telecom Egypt (TE)	Not in operation yet	
Jordan	JTMS	n/a	6, 987
	MobilCom	n/a	
Lebanon	OFTML	n/a	5,001
	LibanCell		
Mauritania	Mauritel	n/a	
Morocco	Maroc Telecom	75%	6,664
	MediTel	25%	
Syria	InvestCom	55%	5,050
	SyriaTel	45%	
Tunisia	TunisCell	100%	10,000
	Orascom	Starts in 2003	
Turkey	TurkCell	63%	5,004
	Telsim	34%	
	Aria	3%	
	Aycell	<1%	

Notes: *The Herfindahl-Hirschmann index (HHI) informs us on the nature of competition in the mobile market. The higher the number the higher the concentration in the market and probably the lower the level of competition.

Sources: A. Gentzoglanis, 2001, ITU, World Telecommunications Indicators, 2002, ENCIP / IDATE, 2002 and author's research.

Table 6: Summary of Results for Nine Telecommunications Firms in some Selected MENA Countries

Variables	Mean before (median)	Mean after (median)	n	Mean variation (median)	Z-statistic for median variation	Proportion of firms behaved as expected in %	Z-statistic for significance of proportion change
Investment in infrastructure							
Capital expenditures/total sales	0.02915	0.3115	9	0.28235	1.7321***	63.00	0.875
Capital expenditures/total assets	0.01327	0.08423	8	0.07096	1.5635***	68.00	1.035
Efficiency							
Sales/total assets	0.7125	0.6943	9	-0.0182	0.572	42.00	0.597
Profitability							
Return on sales	0.1287	0.1458	9	0.0171	1.045	57.00	0.459
Return on assets	0.0413	0.05913	8	0.0178	0.534	41.00	0.745
Return on equity	0.3165	0.3327	6	0.0162	1.064	63.00	0.536
Output							
Real sales	0.9876	0.9145	7	-0.0731	0.432	39.00	1.042

Notes: *** significant at 10% level