La séquence des réformes concurrentielle a-t-elle un impact sur la performance de l'industrie ? Le cas du secteur des télécommunications dans les pays de la région MENA

Depuis la fin des années 80, les gouvernements se lancent dans des réformes de libéralisation des industries d'infrastructures parmi lesquelles le secteur des télécommunications. L'introduction de la concurrence s'accompagne d'un redécoupage de l'organisation industrielle, de la mise en place d'un nouveau cadre de régulation et dans certains cas de la privatisation des opérateurs historiques. Ces différentes dimensions de la réforme de libéralisation peuvent intervenir de manière simultanée ou séquentielle. Les pays sont en effet libres de choisir comment procéder et selon quel calendrier : faut-il installer un régulateur indépendant avant ou après la privatisation d'une part et l'introduction de la concurrence d'autre part? Cet article évalue de manière empirique l'effet des séquences de réformes dans le secteur des télécommunications sur la performance du secteur en utilisant un échantillon de 17 pays du Moyen-Orient et d'Afrique du Nord (MENA) pour la période 1995-2010. Nous supposons que le choix de la séquence des réformes est influencé par des variables institutionnelles, politiques et économiques. Nous utilisons un modèle IV-2SLS pour mesurer l'impact de la séquence des réformes sur les performances du secteur des télécommunications en termes d'accès aux services, de prix, de productivité et de qualité des services. Nous montrons que la présence d'un régulateur indépendant avant le lancement de la privation de l'opérateur historique permet d'améliorer l'accès au service mais se traduit par une augmentation des prix dans la téléphonie fixe. Par ailleurs, l'installation d'un régulateur indépendant en amont de la mise en œuvre de la libéralisation n'a pas le même impact dans la téléphonie fixe et la téléphonie mobile.

Mots clefs : régulation, privatisation, libéralisation, dynamique des réforme, région MENA, télécommunication

Do reforms sequences matter for telecom sector performance? Evidence from MENA countries

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Abstract
Since the late eighties, governments have designed telecommunication policies aiming at introducing competition. This implies new regulation framework and privatization of State Owned Enterprises (SOEs). This paper empirically assesses the effect of reforms sequences in the telecommunications sector on the sector performance, by using a sample of 17 Middle East North African (MENA) countries for the period 1995-2010. Countries are free to choose how to proceed notably whether to establish an Independent Regulatory Authority (IRA) before or after privatizing the SOEs, as well as they can create an IRA before introducing competition rather than after. We assume that the choices of reforms sequences are affected by institutional, political and economic variables. We use IV-2SLS estimation to analyze the outcome of reforms sequences in terms of telecom performance (access, prices, productivity and quality). We find that an IRA established before privatizing the incumbent operator improves the sector access but with an increase in fixed prices. However, the effect of an IRA before introducing competition differs between the fixed and the mobile sector. Regulation still works as an imperfect substitute for competition in the fixed market, which is no more the case for the mobile market.

JEL classification. L11. L14. L33. L43. L51. L96. O38. O50
Keywords. Regulation. Privatization. Competition. Telecom industry. MENA region. Reforms dynamics.

1. Introduction

Since the late eighties, telecommunication reforms took place both in developed and developing countries. Liberalization of the telecom sector contributes largely to the economic growth through the Information and Communication Technology (ICT) development and diffusion in the economy. Market openness in telecommunications services and the quality of regulatory regimes are main drivers of ICT sector development (OECD, 2000b). As in many other infrastructure industries, technological innovations, as well as institutional changes, have made possible the move away from a natural monopoly model to introduce competition where possible in the telecommunication sector[4] through so-called regulatory reforms (Laffont and Tirole, 1994; Noll, 1989; Laffont, 2005; Armstrong and Sappington, 2007).

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[4] The regulatory framework in MENA countries has received considerable attention also in the energy sector due to the relevant exchanges with Europe; see Cambini and Franzi (2014).

Once that said, the question is how to proceed to efficiently introducing competition, privatizing SOEs and re-regulating the industry. Indeed, new regulatory mechanisms[5] and institutions (notably Independent Regulatory Authority (IRA) and Competition Authority) are needed to create a reliable and stable institutional framework to deal with new kind of relationships based on transparency and impartiality between the state on one side, and private-owned firms and all stakeholders on the other side. Regulatory reforms consist in fact in "reregulating" the sector (Ménard and Ghertman, 2009) through different types of reforms.

A crucial question for policymakers is what the optimal sequence of reforms should be considering that privatization, liberalization and creation of an IRA might occur simultaneously or sequentially. This paper deals more precisely with the following question: the question is whether a country should create an IRA before the privatization of its incumbent operator and/ or the introduction of market competition or whether it is better to liberalize and privatize before creating an IRA as it has been done typically in Germany (Glachant et al., 2008). This paper deals with this specific aspect of reforms sequences. Up to now, no single way to proceed has emerged; countries have followed quite heterogeneous and changing policies regarding the sequence. Still, for most of MENA countries as for many other countries, liberalization is typically done in two steps. First step consists of the enactment of a telecom law and the establishment of an independent regulatory authority. In the second step, dependent on the success of the first one, the telecom authority starts to liberalize the telecom market (Hakim and Neaime, 2014). But as we will see, that is not always the case, specifically in the case of MENA countries, while the law reforming the telecom sector has been adopted, in practice, the powers delegated to the IRA and the number of effective entries do not fit with the standard approach adopted in EU.

Intuitively, the reforms' sequences should have an impact on the behaviors of both public and private actors and, consequently, the performance of the industry. Typically, an IRA is supposed to create the conditions for new entrants to have a reasonable expectation of obtaining a return for their investments (Richardson, 1960/1990) and the insurance not to be expropriate (Levy and Spiller, 1994). While socio-political and institutional factors help explaining the differences in the pace of economic reforms among MENA countries, the main explanation of the heterogeneity of MENA countries at the general regional level are the distinguishing structural features of the economies in the region (Karshenas, 2001). As argued by Ianchovichina et al. (2013), MENA countries may find themselves in a resource trap unless they succeed in strengthening institutions and improving investment climate, especially political and macroeconomic stability. Thus, assessing economic reforms in MENA region, and notably telecommunication sector reforms, that strongly impact other economic outcomes, is crucial to be able to make an assessment after MENA political transitions. *The absence of significant economic reforms, combined with persistent political and macroeconomic instability, is likely to keep investment and growth below potential in developing MENA, not only in the short run but in coming years, unless there is a break with past practices* (Ianchovichina et al., 2013). So, it is not surprising that the same sequence applied in MENA countries and in less centralized countries gives different results in terms of performance.

In this paper, we will investigate empirically the effect of various reforms sequences on the telecom sector performance for MENA countries in order to derive policy implications for reforms sequences in the region. This is particularly acute since, to our knowledge, only two studies explore the impact of reforms sequences in telecom sector (Wallsten, 2003; Fink et al, 2003). Telecom reforms sequence – a neglected issue in MENA region agenda – is very crucial for MENA reforms policies. Thus, we aim at assessing what the best recipe, if any, should be for reforms sequences in MENA region.

According to our main findings, the presence of IRA apparently represents a necessary condition for the creation of a favourable regulatory framework, but it is not sufficient to actually

[5] These regulatory mechanisms include licensing rules, interconnection agreements and dispute resolution mechanisms, third party access to networks and incentive contracts (Intven, 2000; Levy and Spiller, 1994; Laffont and Tirole, 2001).

achieve first best outcomes. The main reason lies in the political and institutional nature of countries under study.

The paper is organized as follows. Section 1 introduces issues at stake regarding the sequences of reforms in the telecommunication sector in the specific context of MENA countries. We insist on the fact that even if MENA countries differ among each other, they share some characteristics that justify considering them together in the empirical strategy to test the impact of the sequence of reforms on the telecommunication performance. In the second section, we review the literature on the dynamics of reforms and we derive the testable propositions. In the third section, we present our empirical strategy and results. Section 4 discusses the results and we end by concluding remarks in section 5.

2. Overview on MENA telecom sector

The reforms process in MENA countries remains far from complete in spite of international pressures from the IMF, the WTO or the WB to implement these reforms[6]. Market liberalization in telecom sector has been slower in MENA region than elsewhere in the developing world. Latin American countries, such as Argentina and Brazil, started reforming their sector in the 1980s. However, for MENA countries, they have been late in adopting telecom reforms; they started telecom reforms only in the 1990s by the establishment of the first independent regulatory authority in Jordan in 1995. As stated by Gelvanovska et al. (2014), there is a fundamental delay in MENA region in introducing competition in the telecommunication sector.

As shown in table 1, in terms of entry of new operators, as of 2010, every market in MENA region has at least two mobile operators. However, this is not the case in the fixed-line market which is a key aspect for the liberalization process. Although fixed-line markets are competitive in Bahrain, Jordan, Morocco, Oman, Saudi Arabia, Sudan and United Arab Emirates, some countries still have a monopolist in their fixed-line services as Algeria, Djibouti, Egypt, Kuwait, Lebanon, Libya, Qatar, Syria, Tunisia and Yemen. Moreover, the monopolist incumbent operator remains a state-owned operator in Algeria, Djibouti, Kuwait, Lebanon, Libya, Syria and Yemen which reinforces inertia and rigidity. However, it is not the case for the mobile sector, which is mostly competitive.

It is noteworthy that even after introducing different telecom reforms since 1995, not all MENA countries become better off in terms of different performance indicators. In several cases for developing countries, liberalization and privatization have been severely criticized for leading to vertically unregulated private monopolies with high prices and minimal quality improvement (Mohamad, 2014).

Surprisingly, there are relatively few studies addressing the impact of telecom reforms on performances in MENA countries (Rossotto et al., 2005) as compared to other developing countries like in Latin America (Wallsten et al., 2001; Fink et al., 2003; Estache et al., 2006). MENA countries share many features with other countries regarding the motives and the implications of the liberalization of telecommunication industry as it has been theoretically and empirically analyzed based on different experiences in developed and developing countries. The same reasons why regulation based on monopolies has failed as analyzed by Laffont and Tirole (2001) apply in MENA countries.

However, liberalization and privatization in MENA region should not be taken for granted (Cankorel and Aryani, 2009). For instance, Algeria has repeatedly postponed the privatization of the fixed incumbent operator it committed to in the Telecommunications Sector Policy Statement in 2000[7]. Many countries, like Lebanon, still have a monopolist state-owned incumbent operator.

[6] Typically, telecom liberalization is a requirement for accession to the WTO (Hakim and Neaime, 2014). Such conditions apply to the telecom sector, among services sectors.

[7] This Policy Statement called for the gradual liberalization of the sector including the privatization of the public telecommunications operator.

Although the restructuring and privatization of Liban Telecom is defined in the Telecommunications Law 2002, it doesn't take place up to now due to political conflicts. Indeed, telecommunications markets in MENA region remain less open to competition than elsewhere in the developing world; on average, the level of telecom restrictive policies affecting the developing world is 0.35[8] compared to 0.46 in MENA countries. Therefore, this denies the region the benefits of increased participation into global trade, with stronger export and growth performance (Rossotto et al., 2005). In addition, in the case of some MENA countries, the relatively low performance of the telecom sector should be analyzed while taking into account all institutional factors since there is no obvious reason why the reforms should not be successful, except in some segments of the industry, given the specificities of the telecom sector in MENA region.

In some MENA countries, the introduction of additional network-based operators may not be a feasible option since investors may be reluctant to enter markets with high entry costs in a highly uncertain environment[9]. Thus, the introduction of service-based competition – by relying on the existing infrastructure of network operators – would enable them to recover their initial investments relatively quickly and thus, services-based competition may be the primary enabler for better market development. The sector that is most reluctant to such a competition is the fixed voice market (El-Darwiche et al., 2008). In this case, having a regulator in place before the introduction of competition is crucial to ensure that operators would allow access to their networks through unbundling or resellers' access, in a non-discriminatory manner. The fixed market is still with importance for the region, most of the region accesses the internet through dial-up connections and rural areas are disconnected from the world (Cankorel and Aryani, 2009). Some countries still also access the internet through fixed broadband internet services.

As a result, the range of competition varies across MENA region. It is possible to propose a typology of MENA countries depending on their competitiveness and their openness to FDI. The first group is composed of most Gulf Cooperation Council (GCC) countries. Although not all GCC countries are opened for competition and for foreign investments, they still have the financial resources to invest domestically in the telecom sector. However, telecom performances in these countries are very different. For instance, Oman, even if it is a completely closed country to foreign equity share, it has a competitive fixed and mobile market, as well as a partially private incumbent operator. The other group of countries – mostly oil importing countries which contrary to GCC countries don't have enough domestic capital – is facing external financial constraints and fiscal pressures. With the exception of Morocco, North-African countries know moderate level of competition compared to GCC countries. Lebanon and Libya are crippled with high service tariffs or entry barriers with a state-owned monopoly in the fixed sector and a government owned-duopoly in the mobile sector.

As such, it is not easy to characterize MENA countries according to their competitiveness and openness to FDI. Too many differences are among them. The analysis of the telecom sector in MENA region suggests that the level of performance and the number of operators in each market are more likely to be explained by differentials in income levels rather than regulatory policies and

[8] It is the value of the Services Trade Restrictiveness Index (STRI) obtained from the World Bank's Services Trade Restrictions Database (STRD). It varies from 0 (open market) to 1 (closed market). It is the translation of different policy measures provided by the database into a quantitative, cross-country indicator. The database covers five major sectors for 103 countries; 24 OECD developed countries and 79 developing countries. The data available for the telecom sector covers only restrictions on commercial establishment in the fixed and mobile segments. Relevant policy measures include limits on the number of licenses issued, restrictions on the extent of foreign ownership, nationality requirement for the Board of Directors, restrictions on establishing international gateways (IG) and the use of Voice over Internet Protocol (VOIP) technology. This average is calculated from a sample of 79 countries from Asia, Africa, Latin America and MENA.

[9] That is due to the reluctance of investors to enter markets, either due to market limitations (high level of saturation, small size and decreasing returns) or technical limitations (scarce resources and spectrum availabilities) (El-Darwiche et al., 2008).

commitments to open the market (Ezzat and Aboushady, forthcoming 2018). There are countries in the region that are quite advanced and have ICT levels quite comparable with developed countries, as UAE, Bahrain, Kuwait and Qatar. All these countries are oil producers and are small compared to North African countries as Egypt.

As depicted in Table 2 extracted from the World Development Indicators Database (2018), MENA region witnessed an overall increase in landline penetration between 1995 and 2010 from 11.49 to 15.26 lines per 100 inhabitants (World Development Indicators Database, 2018). In 1995, higher income GCC countries know penetration rates of over 20% (World Development Indicators Database, 2018). However, the remaining MENA countries suffer from significantly lower landline penetration due to large geographical size and relatively lower income levels. In 2010, most middle-income MENA countries (Egypt, Morocco and Tunisia) witnessed an increase in landline penetration. However, most GCC countries witnessed a decrease in landline penetration. Concerning the mobile market in MENA region, it is oversaturated with 10 out of 17 countries having mobile penetration rate of over 100%. Moreover, MENA region knows a mobile penetration higher on average than low- and middle-income countries and OECD countries.

In this paper, we assess the efficiency conditions for regulatory reforms by focusing on the telecom reforms sequences. While experiences in other countries suggest that reforms sequence is a crucial issue, it has been a neglected issue in MENA agenda until now. We aim to illustrate the impact of reforms sequences on the efficiency of the telecommunication sector. Reaching a consensus on economic reforms for MENA region becomes a pre-requisite for high economic growth in MENA countries.

3. Related literature and testable propositions

Very few papers (to our knowledge only the studies by Wallsten (2003) and Fink et al. (2003) explore the impact of reforms sequences in telecom sector, but none of them focuses on MENA countries which might be due to the lack of reliable data and long time series to implement an adequate empirical analysis. The aim of our analysis is exactly to start filling this gap. Telecom reforms sequences explored in our paper are twofold: Regulation-Privatization and Regulation-Competition sequences.

3.1. Does the establishment of a separate regulator prior to the incumbent privatization help reducing privatization drawbacks?

Large monopolies firms were often privatized with no regulatory authorities in place that could help facilitate competition (Wallsten, 2003). Moreover, governments sometimes give exclusivity periods to privatized monopolies, so they can make higher profits before introducing competition. Thus, by regulating the sector, the government would retain its interests in the operator publicly owned to maintain its monopoly profits rather than promoting market efficiency. As a result, a separate regulator appears as a way to eliminate inefficiencies occurring in the public operator functioning and regulation through incentive regulation notably. Therefore, it is recommended to have a new regulatory framework prior to privatization, i.e. a reregulation (Ménard and Ghertman, 2009). Moreover, an independent regulator is important to ensure commitment and spur investment (Cambini and Jiang, 2009). The OECD stated that *one core element in any reform package is the introduction of fair rules of the game in a newly privatized market for public services including the establishment of independent, competent and credible ad hoc institutions* (Goldstein, 2002). However, while privatization can bring about great improvements, it must be combined with effective regulation (Wallsten, 2001). More specifically, it is recommended to have a regulatory framework prior to privatization (Wallsten, 2003). Spiller (1993) confirmed that the prior or simultaneous development of the required institutions is crucial when the incumbent operator is privatized. This would serve to avoid opportunistic behavior and give guarantees for investors against the risk of expropriation (Shapiro and Willig, 1990).

Wallsten (2003) tests the effect of the sequence of different reforms and finds that establishing a regulator prior to the privatization process is correlated with improvements in telephone penetration and incumbent investment. Consequently, investors pay more for telecom firms in countries that established a regulator prior to the privatization process. From the above analysis, we derive the following proposition:

Proposition 1. The establishment of a separate regulatory authority prior to the privatization of the state-owned incumbent operator helps increasing the telecom sector performance (in terms of higher service penetration, higher productivity and lower prices).

3.2. Does a regulator in place prior to the introduction of market competition affect the telecom sector performance?

The presence of a separate regulatory authority prior to the introduction of market competition is crucial in the fixed as in the mobile sector. If all markets worked perfectly, we would not need regulation to either substitute for or complement competition. Regulation is considered as an inferior substitute for competition since competitive markets have enormous informational advantages (Crew et al., 2005). Regulation is thus important to address market failures, to advance public interest and to assist in the transition to a competitive market. The key is to have the right balance between competition and regulation.

An IRA should put in place the rules required to introduce market competition and to efficiently regulate *the residual monopoly elements* in the sector (Estache et al., 2006). Such rules concern: licensing conditions, interconnection agreements, technical standards and management of scarce resources in non-discriminatory way. The presence of a separate regulator prior to the entry of new competitors in the fixed and the mobile sectors is thus of great importance, to get the expected benefits from competition. Pro-competitive measures taken in this phase should result largely in higher penetration and lower prices. Consequently, the establishment of a regulatory authority before the entry of new competitors is a priority, in order to oversee the incumbent behavior and to serve as guarantee for potential new entrants to have suitable interconnections terms and fair access to networks. We thus have the following proposition:

Proposition 2. The establishment of a separate regulatory authority, before the introduction of market competition, helps increasing telecom penetration and decreasing prices for the fixed and mobile voice markets. However, for the fixed sector, an increase in prices would take place firstly after the entry of new competitors, due to the elimination of cross subsidization.

3.3. Institutional, economic and political determinants of reforms

The institutional and political framework for MENA countries is of great importance since it affects the decision to adopt different reforms. In their study, Levy and Spiller (1994) find that the credibility and effectiveness of a regulatory framework and its ability to facilitate private investment vary with the country political and social institutions. It is crucial to take into account the interplay between the institutional, economic and political variables and the adoption of telecom market reforms, as well as their sequences.

Some previous findings have found that telecommunications reforms have little effect on telecom performance, while others have found that reforms improve telecom performance. At the end, the results highly depend on the effective nature of institutional governance in place (Mohamad, 2014). Following a universal remedy through reforms may be detrimental for telecommunications development in the absence of satisfactory institutional capacity (Mohamad, 2014). In this subsection, we argue that institutional, economic and political factors explain the reforms adoption by MENA countries. We follow Ezzat (2015) and we use the following determinants as the main political, institutional and economic determinants that affect telecom reforms.

The first determinant of reforms we would rely on is the level of democracy in each country. Empirically, Giuliano et al. (2012), Giavazzi and Tabellini (2005), Djankov and Amin (2009) and Quinn (2000) study the relationship between democracy and reforms. We argue that a more democratic country is likely to have a high level of reforms adoption. The second determinant is the legal origin per country. Legal origins prove their persistency in different countries and continue to have substantial economic consequences (La Porta et al., 2008). La Porta et al. (2008) find that civil law countries are qualified by government ownerships, while common law countries are more likely to use private contracts, due to better investor protection, lighter government ownership and regulation and more secure property rights. Thus, we expect that a civil law country is less likely to adopt reforms, specifically in terms of privatization and competition.

Furthermore, major reforms are introduced under the pressure of the IMF and the WB in order to reschedule debt service payments or to resort for new loans. As MENA countries lead the world in the natural resources rents (World Development Indicators Database, 2013), countries that are more independent in their resources are less forced to adopt reforms under such pressures. Therefore, countries are more reluctant to adopt different reforms when they have abundant natural resources. Finally, we control for the independence year from colonization per country. We argue that latter the independence year from colonization, more the delays in reform adoption and lower the time available for the country to develop its national requisite institutions.

4. Empirical strategy

4.1. Empirical model

Our aim is to develop an empirical analysis on 17 MENA countries[10] from 1995-2010 to explore the impact of the sequences of different reforms – namely the Regulation-Privatization sequence and the Regulation-Competition sequence – on the telecom sector performance in the voice market for fixed and mobile segments. We estimate the following model by using Instrumental Variable Two-Stage Least Squares (IV-2SLS) estimation[11] while accounting for the endogeneity of reforms and while including year dummies[12]. We adopt a log-linear specification to transform different variables into a normal distribution. The regression takes the form:

$$\boldsymbol{Y_{it} = \beta_0 + \beta_1 R_{it} + \beta_2 X_{it} + Z_t + \mu_{it}} \qquad \textbf{(1)}$$

Where i stands for country and t for year, Y_{it} is one of the four performance indicators we have chosen to consider. R_{it} is a vector of reforms and reforms sequences dummies, X_{it} is a vector of control variables (GDP per capita and population density), Z_t are year dummies and μ_{it} is the disturbance term. Each equation is estimated for each of the dependent variables we consider here.

To get the first stage results, we test the effect of institutional, economic and political variables, used as instruments, on different reforms variables. Specifically, we model the decision to

[10] Countries included are Algeria, Bahrain, Djibouti, Egypt, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates and Yemen. We eliminate Iraq and Palestine, due to the lack of consistent data for many variables over the whole period.

[11] Even if our endogenous variables are discrete variables, the consistency of IV-2SLS estimation does not require the endogenous variables to be continuous (Heckman and Robb, 1985). Using the logit model in the first stage is unnecessary since in 2SLS estimation, the consistency of the estimates in the second stage are not dependent on the correct functional form in the first stage. Moreover, performing the 2SLS step by step procedure leads to inconsistent standard errors, since it does not take into account in the second stage that the endogenous variables were predicted in a previous stage.

[12] We don't use fixed effect estimation, since they don't allow for the estimation of time invariant effects. Such variables would be dropped from the estimation process. In our sample, we have some time invariant variables, whose effects would be lost in the fixed effects estimation. Fixed effects and first-differencing methods can lead to imprecise estimates in cases where the key variables in X_t do not vary much over time (Wooldridge, 2010).

have an independent regulator, to privatize and to introduce competition, using an OLS model. The regressors are mainly democracy indicator, legal origin, natural resources rents as % of GDP and independence year, plus the exogenous variables we use in the second stage equation (such as population density, GDP per capita and year dummies).

4.2. Data[13]

The previous propositions, mentioned in section (3), will be tested using a panel dataset of 17 MENA countries from 1995 to 2010. We construct an original database from various sources, as detailed in this section. Moreover, we are focusing only on the voice market in the fixed and mobile segments.

The access rate is measured by the fixed and mobile penetration (the number of fixed and mobile telephone lines in a country per 100 inhabitants in natural log). The productivity is measured by the number of telephone subscribers in fixed and mobile telephone per employee. To measure price levels, we use different prices corresponding to different telephone services: first, the monthly subscription for residential telephone service in US$ and second, the price of a 3-minute fixed telephone local call (at peak and off-peak rates) in US$. We also use mobile price of 3-minute local call (at peak and at off-peak rates) in US$. As suggested by the ITU (2012), we construct fixed and mobile price baskets for mobile and fixed-lines[14] using ITU database. To measure fixed quality, we use waiting list for fixed-lines, faults per 100 fixed-lines per year and percent of fixed telephone faults cleared by next working day.

To measure the effect of different reforms, we use dummy variables that equal 1 starting from the year in which the reform took place. Then, to reflect the state of competition in the telecom market, we construct an index that equals 0 if a monopoly exists in both fixed and mobile segments, equals 1 if at least one segment operates with more than one operator and equals 2 if both segments become competitive.

To test the effect of the sequences in telecom reforms, we construct two variables for the two sequences we account for. The first dummy variable equals one when the country established an IRA before the incumbent privatization, starting from the first year in which the privatization took place[15]. Then, we construct another variable as a cumulative variable that takes the value of 1 starting from the first year of the sequence, and it increases by one for each subsequent year. Concerning the second sequence, we construct another variable that equals 1 when an IRA is in place before the introduction of market competition starting from the first year in which the competition dummy variable or the competition index equals 1[16]. Then, we construct another variable as a cumulative one that takes the value of 1 starting from the first year of the sequence, and it increases by one for each subsequent year. Concerning the third sequence of privatization and competition[17], no country in our sample introduced competition in the fixed segment before the privatization of its incumbent operator. Thus, the effect of such variable could not be statistically tested.

[13] See Table 3 for list of variables and Table 4 for summary statistics.

[14] Landline price basket includes monthly subscription fees in addition to the rate for 30 three-minute local calls to the same network (15 minutes at peak rate and 15 minutes at off-peak rate). The monthly mobile price basket includes the price of 30 outgoing calls (on-net, off-net and to a fixed-line, for peak, off-peak and weekend periods), plus 100 SMS messages (50 on-net and 50 off-net). As in ITU (2012), mobile basket is equivalent to 50.87 minutes, we calculate it as 10* (mobile price of 3-minute local call at peak + mobile price of 3-minute local call at off-peak) due to the lack of some prices indicators.

[15] Countries which didn't privatized till 2010 are considered as Zeros.

[16] Countries with a competition index that is equal to zero till 2010 are considered as Zeros.

[17] Fink et al. (2003) studies only the implications of alternative sequences between privatization and competition.

We control for demographic and macroeconomic variables, such as GDP per capita based on purchasing power parity (PPP) in constant US dollars as a determinant of demand and population density as a determinant of market size.

Finally, to correct for possible endogeneity of reforms variables, firstly, we use Polity IV Project's political regime indicator for democracy as a political variable. It ranges from -10, fully institutionalized autocracy, to +10, fully institutionalized democracy. The way by which this indicator is computed reflects the institutional and political characteristics per country. These data are available at the Center for Systemic Peace "Polity IV" Website. Then, we normalize the variable to be in the range from 0 to 1. Then, to take into account the legal origin for each country, either it is civil law or common law country, we collect data from the CIA World Factbook on the legal origin. We construct a dummy variable that equals 1 if the country has a civil legal origin, zero otherwise. Moreover, we use the total natural resources rents (% of GDP) to reflect the country natural resources potentially leading to rents. These data come from the World Development Indicators Database created by the World Bank. Finally, we collect data about the independence year from colonization[18] for each MENA country from the CIA World Factbook data.

4.3. Descriptive statistics

Table 4 below provides basic analysis of the data allowing for a number of observations. To assess the sector performance, we use four dimensions: access rates, productivity, prices and quality. Higher the access rates and the productivity, better the performance. On the contrary, lower the prices, higher the performance.

The average values of our performance variables show that an independent regulator prior to the incumbent privatization seems to lead to lower fixed access (11,33 fixed-lines per 100 inhabitants when there is an IRA prior to the privatization instead of 13,14 when there is no IRA before privatization, i.e. a decrease of 14%) and higher prices (12,02 US$ for the fixed basket when there is an IRA prior to the privatization instead of 7,04US$ when there is no creation of IRA before privatization, i.e. an increase of 70%). However, the creation of an IRA prior to the privatization process leads to higher productivity (935,8 total lines per employees instead of 246,82) and higher quality.

The establishment of an IRA prior to the introduction of competition in the market leads also to lower fixed access (13,1 fixed-lines per 100 inhabitants when there is an IRA prior to the competition instead of 12,13 when there is no creation of IRA before competition), but to higher mobile access (77,15 instead of 22,15) and higher productivity (838,36 Lines instead of 207,61 Total Lines per Employee). Also, this sequence leads to better quality across different indicators. However, the effect of this sequence on prices is not clear-cut. Definitely, descriptive statistics do not necessarily hold for the econometric specification. We therefore conduct an econometric analysis to validate or nuance these previous conclusions.

4.4. Results[19] and robustness checks: IV-2SLS estimation findings[20]

Table 6 shows the estimation for the regressions of different performance indicators on our three reforms variables, then it shows the sequences results. We focus on the effect of sequences between the presence of a separate regulator and the privatization of the fixed incumbent operator. Then, we focus on the establishment of a separate regulator before the introduction of competition in the telecom market (in the fixed sector, in the mobile sector or in both of them). In table 6, the results show that regulation, when tested without sequences, is statistically insignificant for some performance indicators, mainly fixed prices indicators. However, the establishment of a separate

[18] "The independence year from colonization" and "the number of years since the independence" can be used interchangeably.

[19] OLS estimations are available upon request. The first stage estimations are depicted in table 5.

[20] The results are robust but with lower coefficients when we use the sequences cumulative variables (Table 7).

regulator has a positive effect on fixed and mobile access and it helps increasing productivity. The effect of a separate regulator on quality indicators is ambiguous. While its establishment helps decreasing the number of faults per 100 fixed-lines per year, it increases the fixed waiting lists. The fixed incumbent privatization has a negative significant effect on fixed access. Moreover, it has no effect on the productivity indicator but it increases prices indicators in terms of fixed monthly subscription and price of 3-minute fixed call, as well as in terms of fixed price basket. However, privatization helps improving quality indicators, in terms of fixed waiting lists and percent of telephone faults cleared by next working day. Concerning the competition variable, it has a positive but insignificant effect on telecom access and it helps reducing different indicators of fixed and mobile prices. However, competition has no effect on telecom productivity with a positive effect on telecom quality in terms of fixed waiting list.

Regulation-privatization sequence leads to higher fixed access. However, from the other side, having a regulator prior to the incumbent privatization leads to an increase in fixed prices, thus a regulator does not help to limit the increase in prices after the incumbent privatization. Finally, this sequence doesn't affect the productivity. Moreover, it is with an ambiguous effect on the quality indicators as it leads to a decrease in the number of waiting lists and in the percent of faults cleared by next working day, and to an increase in the faults per 100 fixed-lines per year. This is not the case when we test for the effect of the privatization without taking the sequence into account.

The sequence between regulation and competition has a negative effect on fixed access, with no effect on mobile access. Furthermore, the prior presence of a regulator decreases the telecom productivity. Moreover, establishing a regulator before introducing competition in the market leads to higher fixed prices, with no effect on mobile prices. Concerning fixed quality indicators, this sequence has an ambiguous effect on telecom quality. Although this sequence improves fixed quality by reducing the number of waiting lists of fixed-lines, from the other side, it increases the number of faults per 100 fixed-lines per year and reduces the number of faults cleared by next working day.

5. Discussions

Focusing on the sequence between regulation and privatization, we find that privatization alone has a negative effect on fixed access, however this sequence helps improving fixed access since this provides investors with credibility and confidence before entering the market and new investors would ensure they will not be abused by the presence of the state as main shareholder. After the privatization process, the objectives of the firm change from the maximization of the social welfare to the maximization of the firm profits. Thus, the prior establishment of a regulator helps to eliminate the negative effect of privatization on fixed access, which means also that an IRA mitigates the harmful effects of exclusivity periods. This result is important since a regulator in place serves as a guarantee that the privatized incumbent would not restrict output and reduce fixed access. A privatized firm has no incentives to offer services if this would not be profitable for it. However, the prior establishment of a regulator does not help reducing the increase in fixed prices that occurs after the incumbent privatization, which implies that they would remain high due to privatizing the incumbent operator. This effect may be also due to the regulatory capture. Also, such effect has a negative impact on consumers; however high prices would give incentives for investors to enter the market and recover high costs. Finally, although privatization alone leads to a decrease in the number of fixed waiting lists, the effect of the sequence is not clear-cut on quality indicators. Regulation-Privatization sequence helps decreasing the number of fixed waiting lists, but it leads to higher number of faults in fixed-lines and lower percent of fixed faults cleared.

Then, we test for the role of an IRA in making competition more efficient in the fixed and mobile market in MENA region. For the fixed sector, the sequence between regulation and competition has a negative significant effect on fixed access. Therefore, the regulator – assuming that it introduces the rules that would facilitate the operation of new competitors in the market in terms of interconnection agreements and licensing conditions – hinders competition in the market.

Moreover, the prior establishment of a regulator reduces telecom productivity. This negative effect could only be explained by the regulatory capture by the incumbent operator. Finally, we notice that this sequence increases fixed prices, due to tariff rebalancing system. This may be a way to attract investors since this would be profitable for them to have higher prices and to avoid any strategic behavior by the incumbent operator to excessively reduce fixed prices as a way to deter entry in the fixed market. Concerning the effect of this sequence on quality indicators, we find that it helps decreasing the number of fixed waiting lists, but it leads to higher number of faults in fixed-lines and lower percent of fixed faults cleared. In other words, these results seem to suggest that regulation still works as an imperfect substitute for competition in the fixed market and a *de jure* independent regulator does not necessarily imply that the regulator is also *de facto* independent. For the mobile sector, strong competition alone helps to deliver lower prices and better access. Having a regulator in place has no effect on mobile access and affordability. This reflects that competition alone leads to the expected results in the mobile market. Thus, effective competition succeeded to replace regulation in the mobile market.

The Appendix below shows that, even after IRA establishment since 1995 in different MENA countries, not all of them become better off. Only the countries above the line in the access and productivity graphs in figures 1, 2 and 3 (and below the line in the prices graphs in figures 4, 5 and 6) have better performance indicators after IRA establishment. So, the establishment of an independent regulator is not a sufficient condition to reach a better telecom performance. Constraints to the regulator actions limit its independence by increasing the risk of capture, thus exposing its actions to external interests. For example, in the absence of sufficient resources (such as budget, jurisdiction or technical expertise), the regulator may depend on the information provided by market operators, that often are state-owned companies whose leaders are appointed by political authorities. A form of political capture may especially emerge when the issues at stake are related to tariffs. In this situation, consumers' opinions deeply affect incumbents, whose main interest is not to lose voters' support and maintain a sort of social order and stability. Thus, this reflects the importance of institutions to set market rules since the incumbent can represent a high barrier for new entrants by preventing interconnection, even by adopting vertical price squeezing or by capturing the regulator in place. It is obvious that without an IRA, no incumbent operator would allow competition since it would not be profitable for it[21], however its role needs to be more efficient.

All in all, the presence of IRA apparently represents a necessary condition for the creation of a favourable regulatory framework, but it is not in itself sufficient to actually achieve first best outcomes. The reason lies in that the effectiveness of a regulator depends also on the characteristics of the environment in which IRAs operate, notably on the set of political and social institutions of the country. Indeed, factors such as the executive-legislative-judiciary relations, the bureaucratic system, the level of political stability, the degree of conflict among stakeholders, the arbitrariness or the scale of corruption have a significant influence on the regulatory performance by determining the receptivity of the environment to regulators' activities. In turn, this has predictably a strong impact on private investments. To avoid mistakes in our estimations, we do consider such political and institutional differences across MENA countries in our empirical investigation.

6. Conclusion

This paper is a first attempt to test the effect of sequences in telecom reforms on sector performance in MENA countries, as a group of developing countries, to reduce the gap in the literature about this research question.

[21] MENA competition authorities are not completely established yet. MENA countries that have competition laws include Jordan, Lebanon, Oman, Saudi Arabia, Algeria, Egypt, Morocco, and Tunisia. Countries that do not have competition laws include Syria, Yemen, and Libya.

It is noteworthy that the establishment of IRA appears more valuable when we test for its sequence. The prior presence of IRA before other reforms, such as privatization and competition, matters. However, we should differentiate between fixed sector and mobile sector. In the fixed market, regulation still works as an imperfect substitute for competition. However, it is not the case in the mobile market where competition leads to the expected benefits in the market. Such results are of great importance for policymakers in MENA countries, since it implies that setting rules for the regulatory framework is a priority and the main concern for policymakers should be the guarantee of its credibility and effectiveness. Thus, an independent regulator would be able to encourage investors and new entrants to improve sector performance. Moreover, we should ensure that good rules would be implemented. If the regulator fails to find an incentive contract scheme that encourages investors to realize productivity gains while maintaining a certain level of quality, such contract would be inefficient. New rules are needed to ensure effective telecom market, effective competition in fixed segments and better monitoring for newly privatized incumbents.

The results imply that the progress made towards pro-investment reforms has been minor. Since the investments in the telecom sector are highly specific, contracts between governments and investors must guarantee that the investor would be able to cover such sunk investments. But, in fact, contracts are mostly incomplete in MENA countries which may reduce the incentives to invest and to expand networks. Therefore, it would be interesting in further researches to test the effect of different reforms on telecom sector investment and to explore the contract scheme that will fit the regulatory nature in MENA countries, principally the incentive contracts. Finally, the results would be interesting for prospective investors, as well as for policymakers, who are concerned by encouraging investments in the country and increasing country competitiveness in the telecom sector.

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Table 1. MENA telecom sector in 2010

	Regulatory Authority (Creation Year)	**Privatization of the main incumbent operator**	**Competition Level in fixed telephone market**	**Competition Level in mobile cellular market**
Algeria	2000	State-owned	Monopoly	3 operators
Bahrain	2002	Partially Private	More than 6	3 operators
Djibouti	No independent regulator	State-owned	Monopoly	Monopoly
Egypt	1998	Partially Private	Monopoly	3 operators
Jordan	1995	Fully private	2 operators	3 operators
Kuwait	No independent regulator	State-owned	Monopoly	3 operators
Lebanon	2007	State-owned	Monopoly	Government Owned Duopoly
Libya	2006	State-owned	Monopoly	Government Owned Duopoly
Morocco	1998	Privatized	3 operators	3 operators
Oman	2002	Partially private	2 operators	2 operators
Qatar	2004	Partially Private	Monopoly	2 operators
Saudi Arabia	2002	Partially Private	2 operators	4 operators
Sudan	1996	Partially Private	2 operators	3 operators
Syria	No independent regulator	State-owned	Monopoly	Controlled Duopoly
Tunisia	2001	Partially Private	Monopoly	3 operators
United Arab Emirates	2004	Partially Private	2 operators	2 operators
Yemen	No independent regulator	State-owned	Monopoly	4 operators

Source: Ezzat (2015).

Table 2. Fixed and mobile penetration in MENA countries and other regions (1995-2011)

Country	Fixed telephone subscriptions per 100 people (1995)	Fixed telephone subscriptions per 100 people (2011)	Mobile cellular subscriptions per 100 people (2011)
Algeria	4.16	8.50	98.99
Bahrain	25.19	20.89	127.96
Djibouti	1.1	2.2	22.8
Egypt	4.4	11	105
Jordan	7.23	7.35	118.20
Kuwait	23.48	18.26	175.09
Lebanon	12.96	20.32	79.52
Libya	6.7	16.4	163.8
Morocco	4.19	11.05	113.26
Oman	7.61	10.10	168.97
Qatar	24.47	16.52	123.11
Saudi Arabia	9.30	16.50	191.24
Sudan	0.2	1.3	68.8
Syria	6.7	19.7	59.2
Tunisia	5.84	11.49	116.93
United Arab Emirates	28.7	20.5	131.4
Yemen	1.23	4.33	47.05
MENA (Average)	10.2	12.73	112,43
Latin America & Caribbean	8.98	17.88	104.72
East Asia & Pacific	8.1	21.47	83.27
Low- & middle-income countries	3.67	11.03	77.33
OECD	44.84	43.19	106.67

Source: World Development Indicators (2018)

Table 3. List of variables

Dependent variables	Description	Source of the data
Access	Log (number of fixed-lines in a country for each 100 inhabitants)	ITU database
	Log (number of mobile lines in a country for each 100 inhabitants)	ITU database
Productivity	Log {number of telephone subscribers in fixed and mobile telephone per employee (Total full-time Telecommunication employee)}	ITU database
Prices	Log (monthly subscription for residential telephone service)	ITU database
	Log (price of a 3-minute fixed telephone local call (off-peak rate) in US $)	ITU database
	Log (mobile cellular prepaid price of 3 minute local call (off-peak, on-net) in US $)	ITU database
Quality	Log (waiting list for fixed-lines)	ITU database
	Log (faults per 100 fixed-lines per year)	ITU database
	Log (percent of fixed telephone faults cleared by next working day)	ITU database
Reform variables		
	Regulation dummy variable	ITU database and different regulators websites
	Privatization dummy variable	By the author from ITU, incumbents operators' websites and Ministries of communications websites per country
	Competition index	By the author from ITU, different regulators and operators' websites and Ministries of communications websites per country
	Sequence (Regulation before privatization)	By the author
	Sequence (Regulation before competition)	By the author
Control variables		
	Log (GDP per capita in constant 2000 US$ at PPP)	World Development Indicators, the World Bank
	Log (population density)	World Development Indicators, the World Bank
Instrumental Variables		
	Polity IV Project's political regime indicator for democracy	Center for Systemic Peace Web site ("Polity IV")
	Legal origins - civil law or common - dummy variable	CIA World Factbook
	Total natural resources rents (% of GDP)	World Development Indicators, the World Bank
	Independence year	CIA World Factbook

Table 4. Summary statistics

Variable	Mean (Standard Deviation, Number of observations)						
	For the whole sample	**When IRA = 0**	**When IRA = 1**	**When Privatization = 0**	**When Privatization =1**	**When Competition = 0**	**When Competition >= 1**
Access indicators							
Fixed per 100 inhabitants	12.84 (8.68, 272)	13.34 (9.45, 148)	12.24 (7.67, 124)	10.7 (6.77, 166)	16.20 (10.19, 106)	13.13 (9.51, 164)	12.4 (7.26, 108)
Mobile per 100 inhabitants	37.31 (45.24, 272)	20.71 (34.27, 148)	57.14 (48.76, 124)			18.65 (30.6, 164)	65.66 (49.12, 108)
Productivity indicator							
Total Lines (Fixed and Mobile) per Employee	367.47 (429.4, 217)	155.94 (193.28, 116)	610.42 (493.78, 101)	171.26 (203.51, 125)	634.07 (506.47, 92)	92.16 (51.81, 137)	687.82 (514.78, 80)
Affordability indicators							
Monthly subscription for residential telephone service	5.96 (4.41, 235)	6.24 (5.06, 127)	5.64 (3.53, 108)	5.87 (4.87, 137)	6.089 (3.71, 98)	6.21 (4.67, 146)	5.56 (3.93, 89)
Price of a 3-minute fixed telephone local call (off-peak rate) in US $	0.06 (0.09, 243)	0.047 (0.054, 123)	0.08 (0.12, 120)	0.05 (0.06, 142)	0.08 (0.12, 101)	0.055 (0.058, 142)	0.078 (0.12, 101)
Fixed Basket	7.94 (6.29, 212)	7.7 (6.52, 110)	8.19 (6.05, 102)	7.54 (6.4, 120)	8.46 (6.13, 92)	7.88 (6.09, 125)	8.03 (6.61, 87)
Mobile cellular prepaid-price of 3-minute local call (peak) in US $	0.49 (0.45, 226)	0.53 (0.5, 123)	0.44 (0.34, 103)			0.51 (0.42, 142)	0.46 (0.5, 84)
Mobile cellular prepaid-price of 3-minute local call (off-peak) in US $	0.39 (0.42, 213)	.42 (0.51, 111)	.37 (0.29, 102)			.39 (0.37, 129)	.41 (0.49, 84)
Mobile Basket	8.69 (8.64, 211)	9.22 (10.34, 111)	8.09 (6.24, 100)			8.66 (7.77, 128)	8.74 (9.88, 83)
Quality indicators							
Waiting list for fixed-lines	397652 (768667, 150)	619083 (974601, 80)	144589 (258007, 70)	590904 (902189, 96)	54093 (119165, 54)	541719 (893905, 99)	117994 (271460, 51)
Faults per 100 fixed-lines per year	23.07 (27.63, 154)	30.88 (33.15, 80)	14.64 (16.49, 74)	32.63 (33.22, 86)	10.99 (8.84, 68)	30.44 (31.91, 97)	10.54 (9.27, 57)
Percent of fixed telephone faults cleared by next working day	83.42 (12.8, 116)	79.28 (15.58, 55)	87.16 (8.09, 61)	78.51 (14.22, 61)	88.88 (8.17, 55)	80.89 (14.57, 73)	87.7 (7.38, 43)

Notes. Source: Own calculations from ITU database and collected data.

(Continues)

Table 4. (Continued) Summary statistics

Variable	Mean (Standard Deviation, Number of observations)			
	IRA before Privatization =0	**IRA before Privatization =1**	**IRA before Competition =0**	**IRA before Competition =1**
Access indicators				
Fixed per 100 inhabitants	13.14 (9.35, 227)	11.33 (3.59, 45)	13.1 (9.2, 200)	12.13 (7.06, 72)
Mobile per 100 inhabitants	---	---	22.97 (34.79, 200)	77.15 (47.24, 72)
Productivity indicator				
Total Lines (Fixed and Mobile) per Employee	246.82 (296.61, 179)	935.8 (501.06, 38)	207.61 (229.3, 162)	838.36 (527.5, 55)
Affordability indicators				
Monthly subscription for residential telephone service	5.54 (4.42, 196)	8.11 (3.71, 39)	5.96 (4.64, 166)	5.98 (3.83, 69)
Price of a 3-minute fixed telephone local call (off-peak rate) in US $	0.05 (0.06, 199)	0.12 (0.16, 44)	0.48 (0.05, 174)	0.11 (0.14, 69)
Fixed Basket	7.04 (5.63, 174)	12.02 (7.51, 38)	7.43 (5.95, 144)	9.02 (6.88, 68)
Mobile cellular prepaid- price of 3-minute local call (peak) in US $	---	---	0.5 (0.49, 170)	0.46 (0.33, 56)
Mobile cellular prepaid- price of 3-minute local call (off-peak) in US $	---	---	0.39 (0.46, 157)	0.398 (0.31, 56)
Mobile Basket	---	---	8.7 (9.33, 156)	8.65 (6.37, 55)
Quality indicators				
Waiting list for fixed-lines	460608 (814933, 128)	19726 (232645, 22)	487424 (848808, 115)	102689 (238283, 35)
Faults per 100 fixed-lines per year	25.08 (29.66, 128)	13.18 (9.05, 26)	26.24 (30.66, 117)	13.06 (8.84, 37)
Percent of fixed telephone faults cleared by next working day	82.88 (13.87, 92)	85.52 (7.21, 24)	82.9 (14.17, 88)	84.79 (6.95, 28)

Notes. Source: Own calculations from ITU database and collected data.

Table 5. First stage estimation

First stage estimation for reform variables			
	Parameters'' estimates for reform variables using OLS estimation		
VARIABLES	**Establishment of a separate regulator**	**Privatization of the incumbent operator**	**Competition index**
Polity IV indicator	-0.387*	-1.518***	-0.633*
	(0.23)	(0.14)	(0.34)
Civil law	---	-0.229***	-0.165*
	---	(0.07)	(0.09)
Total natural resources rents of (% of GDP)	-0.015***	-0.0199***	-0.006
	(0.002)	(0.003)	(0.004)
Independence year	-0.007***	---	---
	(0.002)	---	---
Population density in log	-0.02	-0.011	0.048
	(0.027)	(0.02)	(0.03)
GDP per capita in constant 2000 US$ (PPP) in log	0.066*	0.129***	-0.05
	(0.04)	(0.03)	(0.05)
Observations	218	250	250
R-squared	0.37	0.46	0.43

Notes. Robust standard errors in parentheses, including year dummies (not reported). *** p<0.01, ** p<0.05, * p<0.1. Our results are robust when we eliminate the control variables (population density and GDP per capita) from the estimation.

Table 6. IV-2SLS estimation

	ACCESS		PRODUCTIVITY	AFFORDABILITY							QUALITY		
VARIABLES	**Fixed per 100 inhabitants (in log)**	**Mobile per 100 inhabitants (in log)**	**Total number of Lines per employee (in log)**	**Monthly subscription for residential telephone service**	**Price of a 3-minute fixed telephone local call (peak rate) in US $ (in log)**	**Price of a 3-minute fixed telephone local call (off-peak rate) in US $ (in log**	**Fixed Price Basket**	**Mobile cellular prepaid price of 3minute local call (peak) in US $ (in log)**	**Mobile cellular prepaid price of 3minute local call (off-peak) in US $ (in log)**	**Mobile Price basket**	**Waiting list for fixed-lines (in log)**	**Faults per 100 fixed-lines per year (in log)**	**Percent of fixed telephone faults cleared by next working day (in log)**
Separate regulator	1.58***	0.67*	1.09***	0.49	-0.606	-0.52	0.157	0.86*	0.49	0.63	22.91**	-4.16***	0.15
	(0.37)	(0.39)	(0.35)	(0.83)	(0.91)	(1.12)	(1.06)	(0.46)	(0.39)	(0.44)	(10.88)	(1.07)	(0.196)
Privatization	-1.399***	-0.095	0.204	1.297*	2.169**	2.56**	1.48	0.06	0.006	0.03	-11.54**	0.96	0.145**
	(0.38)	(0.42)	(0.22)	(0.77)	(0.997)	(1.14)	(0.91)	(0.40)	(0.33)	(0.38)	(5.19)	(0.75)	(0.07)
Competition Index	1.04	1.02	0.099	-2.88**	-4.06**	-4.537***	-3.15**	-1.86***	-1.424**	-1.68**	-18.85*	0.02	0.11
	(0.86)	(0.95)	(0.31)	(1.33)	(1.599)	(1.76)	(1.36)	(0.71)	(0.57)	(0.7)	(10.61)	(0.88)	(0.15)
Population density	0.11	0.19*	-0.01	0.045	-0.407	-0.379	0.06	0.309***	0.26***	0.28***	-0.203	-0.05	0.02
	(0.09)	(0.099)	(0.07)	(0.13)	(0.27)	(0.31)	(0.16)	(0.088)	(0.07)	(0.08)	(1.08)	(0.19)	(0.03)
GDP per capita	0.93***	1.03***	0.215***	0.002	0.42	0.42	-0.038	-0.128	-0.15*	-0.112	0.62	-0.94***	0.03
	(0.09)	(0.11)	(0.05)	(0.17)	(0.32)	(0.38)	(0.18)	(0.099)	(0.09)	(0.09)	(1.27)	(0.24)	(0.03)
Observations	218	213	173	184	164	153	171	175	165	163	105	134	98

Notes. Robust standard errors in parentheses. Estimations include year dummies (coefficients estimates not reported). Variables used as instruments are: "Polity IV democracy indicator", "Legal origin dummy variable", "Total natural resources rents (% of GDP)" and "Independence year from colonization".
*** p<0.01, ** p<0.05, * p<0.1.

(Continues)

Table 6. (Continued) IV-2SLS estimation

	ACCESS	PRODUCTIVITY	AFFORDABILITY				QUALITY		
VARIABLES	**Fixed per 100 inhabitants (in log)**	**Total number of Lines per employee (in log)**	**Monthly subscription for residential telephone service**	**Price of a 3-minute fixed telephone local call (peak rate) in US $ (in log)**	**Price of a 3-minute fixed telephone local call (off-peak rate) in US $ (in log)**	**Fixed Price basket**	**Waiting list for fixed-lines (in log)**	**Faults per 100 fixed-lines per year (in log)**	**Percent of fixed telephone faults cleared by next working day (in log)**
Effect of Regulation-Privatization Sequence									
Separate regulator	-2.35	3.25**	-1.014	-2.01***	-2.06***	-0.597	9.58**	-10.32***	0.587***
	(2.15)	(1.45)	(1.31)	(0.69)	(0.74)	(1.09)	(3.97)	(3.78)	(0.21)
Privatization	-0.996**	-0.265	0.24	0.64	0.78*	0.23	-4.34**	1.859	0.029
	(0.47)	(0.55)	(0.32)	(0.39)	(0.45)	(0.31)	(1.897)	(1.67)	(0.12)
Regulation-Privatization	5.326*	-2.51	2.12	2.135***	2.51***	1.40	-21.42***	7.614*	-0.53***
	(2.84)	(1.696)	(1.32)	(0.71)	(0.7)	(0.98)	(7.44)	(4.01)	(0.199)
Population density	0.197***	0.054	-0.05	-0.34**	-0.302**	-0.02	0.77	-0.84	0.088**
	(0.07)	(0.12)	(0.08)	(0.14)	(0.15)	(0.07)	(0.74)	(0.59)	(0.04)
GDP per capita	0.96***	0.22*	0.27***	0.599***	0.62***	0.196***	-0.60	-1.007**	0.015
	(0.12)	(0.11)	(0.09)	(0.159)	(0.175)	(0.07)	(0.51)	(0.46)	(0.04)
Observations	218	173	184	164	153	171	105	134	98

Notes. Robust standard errors in parentheses. Estimations include year dummies (coefficients estimates not reported). Variables used as instruments are: "Polity IV democracy indicator", "Legal origin dummy variable", "Total natural resources rents (% of GDP)" and "Independence year from colonization".
*** p<0.01, ** p<0.05, * p<0.1.

(Continues)

Table 6. (Continued) IV-2SLS estimation

	ACCESS		PRODUCTIVITY	AFFORDABILITY						QUALITY		
VARIABLES	**Fixed per 100 inhabitants (in log)**	**Mobile per 100 inhabitants (in log)**	**Total number of Lines per employee (in log)**	**Monthly subscription for residential telephone service**	**Price of a 3-minute fixed telephone local call (peak rate) in US $ (in log)**	**Price of a 3-minute fixed telephone local call (off-peak rate) in US $ (in log**	**Fixed Price Basket**	**Mobile cellular prepaid price of 3minute local call (peak) in US $ (in log)**	**Mobile cellular prepaid price of 3minute local call (off-peak) in US $ (in log)**	**Mobile Price basket**	**Waiting list for fixed-lines (in log)**	**Faults per 100 fixed-lines per year (in log)**	**Percent of fixed telephone faults cleared by next working day (in log)**
Effect of Regulation-Competition Sequence													
Separate regulator	2.099***	0.569	1.678***	-0.69	0.144	0.449	0.333	0.775	0.45	0.59	-2.735	-4.86***	0.25
	(0.59)	(0.45)	(0.37)	(1.34)	(0.37)	(0.42)	(0.85)	(0.52)	(0.48)	(0.53)	(4.13)	(0.93)	(0.19)
Competition Index	-0.97	0.87	0.005	-1.22**	-2.45***	-2.57***	-1.54***	-1.75**	-1.395**	-1.61**	6.46	-0.64	0.226*
	(0.98)	(0.65)	(0.35)	(0.55)	(0.45)	(0.53)	(0.36)	(0.69)	(0.54)	(0.69)	(4.13)	(0.81)	(0.13)
Regulation-Competition	-2.62***	0.14	-1.07*	3.71*	4.37***	4.919***	1.82	0.26	0.087	0.125	-17.81***	4.67***	-0.258***
	(0.80)	(0.70)	(0.59)	(2.13)	(0.91)	(1.06)	(1.41)	(0.89)	(0.795)	(0.87)	(6.71)	(1.06)	(0.09)
Population density	0.235**	0.195**	0.05	0.006	0.059	0.17	0.06	0.303***	0.26***	0.28***	-1.128*	0.006	0.013
	(0.11)	(0.09)	(0.06)	(0.09)	(0.099)	(0.12)	(0.05)	(0.09)	(0.07)	(0.08)	(0.63)	(0.197)	(0.03)
GDP per capita	0.65***	1.015***	0.225***	0.22***	-0.088	-0.23	0.148***	-0.12	-0.15**	-0.107	-1.478***	-0.61**	0.068***
	(0.08)	(0.08)	(0.05)	(0.06)	(0.16)	(0.19)	(0.05)	(0.08)	(0.07)	(0.08)	(0.33)	(0.26)	(0.02)
	218	213	173	184	164	153	171	175	165	163	105	134	98

Notes. Robust standard errors in parentheses. Estimations include year dummies (coefficients estimates not reported). Variables used as instruments are: "Polity IV democracy indicator", "Legal origin dummy variable", "Total natural resources rents (% of GDP)" and "Independence year from colonization".
*** p<0.01, ** p<0.05, * p<0.1.

Table 7. IV-2SLS estimation with cumulative sequences variables

	ACCESS	PRODUCTIVITY	AFFORDABILITY				QUALITY		
VARIABLES	**Fixed per 100 inhabitants (in log)**	**Total number of Lines per employee (in log)**	**Monthly subscription for residential telephone service**	**Price of a 3-minute fixed telephone local call (peak rate) in US $ (in log)**	**Price of a 3-minute fixed telephone local call (off-peak rate) in US $ (in log)**	**Fixed Price basket**	**Waiting list for fixed-lines (in log)**	**Faults per 100 fixed-lines per year (in log)**	**Percent of fixed telephone faults cleared by next working day (in log)**
Effect of Regulation-Privatization Sequence									
Separate regulator	-0.798	2.865***	0.175	-1.69***	-1.64***	0.44	9.04**	-9.59***	0.54***
	(1.29)	(1.08)	(1.08)	(0.53)	(0.57)	(0.94)	(3.78)	(2.86)	(0.20)
Privatization_incumbent	-1.38***	-0.02	0.157	0.37	0.43	0.14	-3.365*	1.42	0.07
	(0.32)	(0.45)	(0.25)	(0.33)	(0.39)	(0.25)	(1.98)	(1.38)	(0.12)
Regulation-Privatization	0.724*	-0.510	0.15	0.403***	0.48***	0.06	-5.76**	1.73*	-0.13**
	(0.385)	(0.33)	(0.22)	(0.12)	(0.13)	(0.17)	(2.31)	(0.89)	(0.06)
Population density	0.224***	0.017	0.006	-0.28**	-0.225*	0.03	0.66	-0.76	0.08**
	(0.05)	(0.11)	(0.06)	(0.12)	(0.13)	(0.05)	(0.68)	(0.49)	(0.04)
GDP per capita	0.96***	0.19*	0.212***	0.58***	0.59***	0.14**	-0.86*	-0.97**	0.009
	(0.09)	(0.11)	(0.08)	(0.14)	(0.15)	(0.07)	(0.49)	(0.42)	(0.04)
Observations	218	173	184	164	153	171	105	134	98

Notes. Robust standard errors in parentheses. Estimations include year dummies (coefficients estimates not reported). Variables used as instruments are: "Polity IV democracy indicator", "Legal origin dummy variable", "Total natural resources rents (% of GDP)" and "Independence year from colonization". *** p<0.01, ** p<0.05, * p<0.1.

(Continues)

Table 7. (Continued) IV-2SLS estimation with cumulative sequences variables

	ACCESS		PRODUCTIVITY	AFFORDABILITY							QUALITY		
VARIABLES	**Fixed per 100 inhabitants (in log)**	**Mobile per 100 inhabitants (in log)**	**Total number of Lines per employee (in log)**	**Monthly subscription for residential telephone service**	**Price of a 3-minute fixed telephone local call (peak rate) in US $ (in log)**	**Price of a 3-minute fixed telephone local call (off-peak rate) in US $ (in log**	**Fixed Price Basket**	**Mobile cellular prepaid price of 3minute local call (peak) in US $ (in log)**	**Mobile cellular prepaid price of 3minute local call (off-peak) in US $ (in log)**	**Mobile Price basket**	**Waiting list for fixed-lines (in log)**	**Faults per 100 fixed-lines per year (in log)**	**Percent of fixed telephone faults cleared by next working day (in log)**
Effect of Regulation-Competition Sequence													
Separate regulator	2.37***	0.59	1.84***	0.825	0.17	0.47	1.735	0.76	0.46	0.60	-3.55	-6.31***	0.33
	(0.87)	(0.50)	(0.43)	(1.11)	(0.38)	(0.41)	(1.47)	(0.64)	(0.56)	(0.60)	(3.35)	(1.18)	(0.21)
Competition Index	-1.21	0.88	-0.004	-1.34***	-2.29***	-2.345***	-1.76**	-1.73**	-1.398**	-1.62**	7.67**	-0.07	0.21
	(1.16)	(0.64)	(0.42)	(0.46)	(0.50)	(0.56)	(0.81)	(0.76)	(0.58)	(0.73)	(3.65)	(1.07)	(0.14)
Regulation-Competition	-0.568**	0.014	-0.27*	0.21	0.64***	0.74***	-0.08	0.05	0.01	0.019	-4.29***	1.13***	-0.09***
	(0.24)	(0.155)	(0.14)	(0.36)	(0.14)	(0.15)	(0.38)	(0.22)	(0.195)	(0.21)	(1.33)	(0.32)	(0.03)
Population density	0.23*	0.195**	0.06	0.06	-0.02	0.09	0.10	0.302***	0.257***	0.28***	-0.59	-0.25	0.025
	(0.13)	(0.09)	(0.06)	(0.06)	(0.11)	(0.11)	(0.11)	(0.09)	(0.07)	(0.09)	(0.46)	(0.24)	(0.03)
GDP per capita	0.59***	1.02***	0.21***	0.216***	0.19	0.08	0.12	-0.11	-0.15*	-0.11	-1.42***	-0.68**	0.062**
	(0.11)	(0.08)	(0.06)	(0.07)	(0.166)	(0.180)	(0.11)	(0.09)	(0.08)	(0.08)	(0.30)	(0.29)	(0.02)
Observations	218	213	173	184	164	153	171	175	165	163	105	134	98

Notes. Robust standard errors in parentheses. Estimations include year dummies (coefficients estimates not reported). Variables used as instruments are: "Polity IV democracy indicator", "Legal origin dummy variable", "Total natural resources rents (% of GDP)" and "Independence year from colonization".
*** p<0.01, ** p<0.05, * p<0.1.

Appendix

Figure1-6. Effect of IRA establishment on telecom performance

Figure 1.

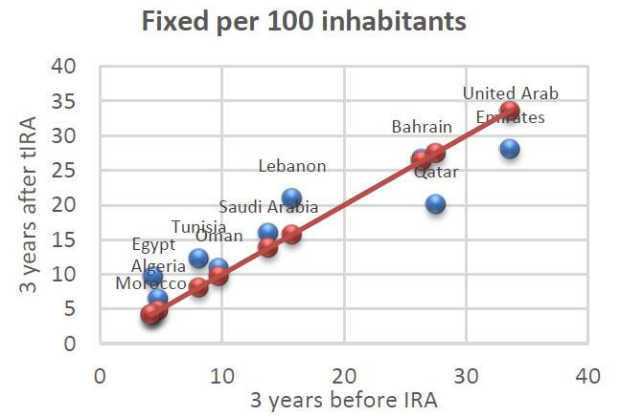


Figure 2.

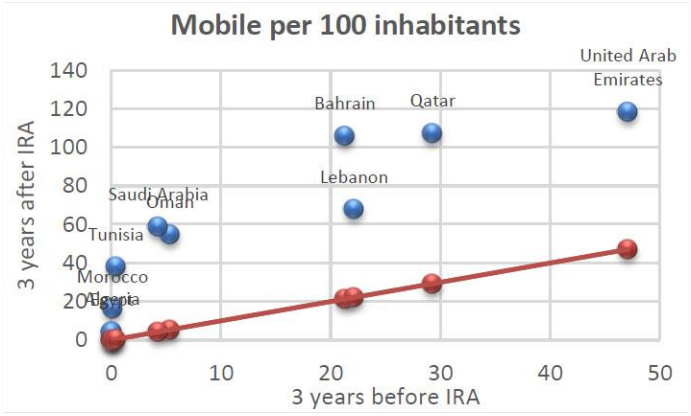


Figure 3.

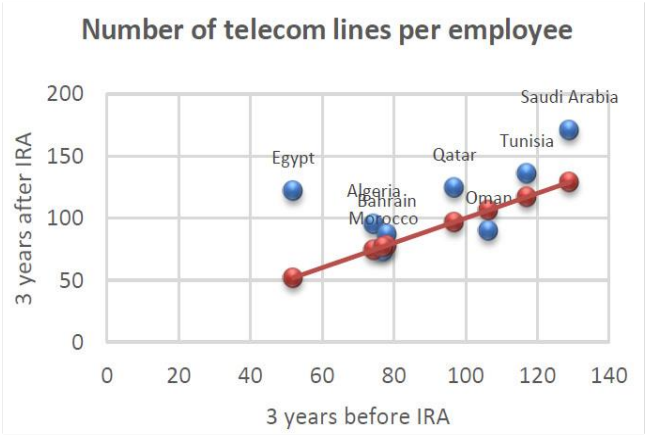


Figure 4.

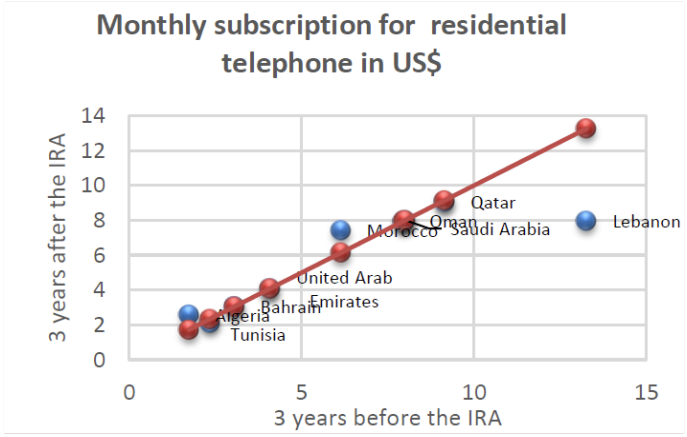


Figure 5.

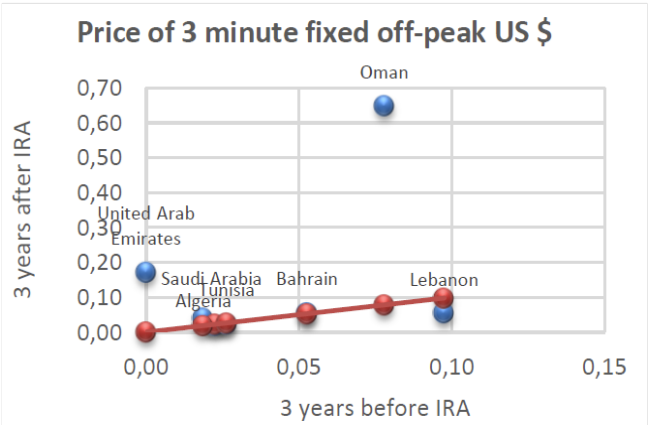
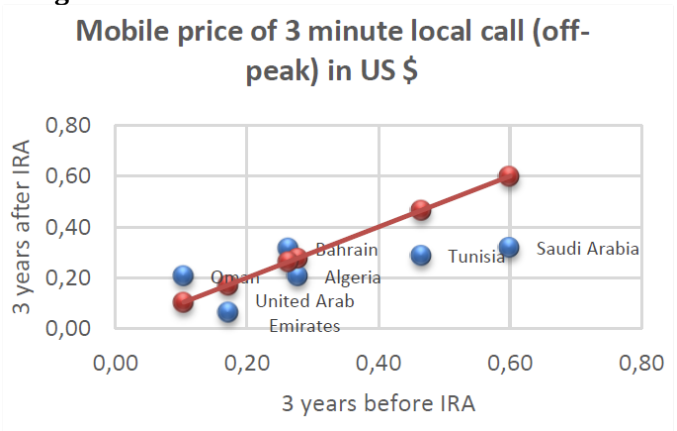


Figure 6.



Notes. Figure 1. The effect of an independent regulator on the fixed penetration three years before its establishment compared to three years after its establishment. **Figure 2.** The effect of an independent regulator on the mobile penetration. **Figure 3.** The effect of an independent regulator on the productivity measure. **Figure 4.** The effect of an independent regulator on the fixed monthly subscription. **Figure 5.** The effect of an independent regulator on the price of 3-minute fixed call three years. **Figure 6.** The effect of an independent regulator on the price of 3-minute mobile call.