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2015

working paper series

**DO TELECOM RESTRICTIVE POLICIES MATTER
FOR TELECOM PERFORMANCE?
EVIDENCE FROM MENA COUNTRIES**

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Working Paper No. 949

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October 2015

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First published in 2015 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

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Abstract

The past decade has witnessed a significant transformation in the trade and regulatory policies of the telecom sector across the MENA region. Many countries committed to opening up their telecom sector to trade and investment under WTO commitments. However, these commitments do not always reflect actual policies. Although some MENA countries started easing telecom market restrictions and tended to adopt more open policies, other countries are still reluctant to change and continue to adopt highly restrictive policies limiting foreign ownership and control in the market. This paper empirically assesses the impact of the existing telecom restrictions on landline and mobile sector performance, using the World Bank Services Trade Restrictiveness Database (STRD), with a focus on MENA countries. We use three-stage least squares-Seemingly Unrelated Regression (3SLS-SUR) to test for the effect of restrictions and the level of competition in the telecom sector on selected performance indicators. Our findings suggest that restrictive telecom policies are more likely to affect landline rather than mobile communications. Moreover, being a MENA country affects the level of competition in the landline market. MENA countries are very protective of their incumbent operators, irrespective of the stipulated legal restrictions in place.

JEL Classification: F13, F14, L96, O50, C31

Keywords: Services Trade policy, telecommunications, developing countries, MENA region, Simultaneous equations

ملخص

شهد العقد الماضي تحولا كبيرا في السياسات التجارية والتنظيمية لقطاع الاتصالات في جميع أنحاء منطقة الشرق الأوسط. وقد التزمت العديد من البلدان بفتح قطاع الاتصالات على التجارة والاستثمار في إطار التزامات منظمة التجارة العالمية. ومع ذلك، فإن هذه الالتزامات لا تعكس دائما السياسات الفعلية. وعلى الرغم من أن بعض دول المنطقة بدأت في تخفيف القيود المفروضة على سوق الاتصالات وتميل إلى تبني سياسات أكثر انفتاحا، فإن بلدانا أخرى لا تزال مترددة في التغيير والاستمرار في اعتماد سياسات تقييدية للغاية للحد من الملكية الأجنبية والتحكم في السوق. تقوم في هذه الورقة بالتقييم التجريبي لتأثير القيود على الاتصالات الموجودة على الهاتف الثابت والمحمول على أداء القطاع، وذلك باستخدام قاعدة بيانات خدمات البنك التجاري العالمي التقييد (STRD)، مع التركيز على دول المنطقة. نقوم باستخدام ثلاث مراحل المربعات الصغرى على ما يبدو لا علاقة لها الانحدار (3SLS-SUR) لاختبار تأثير القيود ومستوى المنافسة في قطاع الاتصالات على مؤشرات الأداء المحددة. النتائج التي توصلنا إليها تشير إلى أن سياسات الاتصالات تقييدية وأكثر عرضة للتأثير الهاتف الثابت بدلا من الاتصالات المتنقلة. وعلاوة على ذلك، كونها دول منطقة الشرق الأوسط وشمال افريقيا فذلك يؤثر على مستوى المنافسة في سوق الهاتف الثابت. تحمى دول منطقة الشرق الأوسط وشمال افريقيا مشغليها الحاليين، بغض النظر عن القيود القانونية المنصوص عليها في المكان.

1. Introduction

Since the 1980s, the services sector is gaining increasing importance worldwide, with its growing contribution to global output. Trade in services has also largely evolved due to technological advances and deeper global integration in the past two decades. However, among the most protected sectors are those highly sensitive to national security or national sovereignty considerations, such as telecommunications, air and maritime transport, finance, public utilities and media (Golub, 2003).

The telecommunications sector is subject to a set of relatively complicated regulations due to its specificities in terms of high level of investments, economies of scale and natural monopoly conditions. For developing countries, the telecom sector is particularly known for high barriers to entry, including difficult and costly licensing procedures, restrictions on foreign ownership, and high restrictions on operations, such as difficult interconnection conditions. Since the 1980s, developing countries have been carrying out a series of reforms to their telecom sector by establishing independent regulators, privatizing incumbent operators, and liberalizing the telecom market. As developing countries, MENA countries pursued these reforms, yet with a time lag: countries in the region have only started reforming their sector since the mid-90s. Within this context, some countries are still reluctant to change. According to the World Bank, MENA oil-rich States have the most protected markets, whereas some of the poorest countries of the region are remarkably open.

The objective of our paper is therefore to assess the impact of telecom restrictions on sector performance. We also seek to find out whether GATS commitments serve as a guarantee for better sector performance, and, finally, whether telecom restrictions affect MENA and non-MENA markets in a similar way.

We believe our study is important since services restrictions are not well explored for developing countries due to the scarcity of resources. With the exception of Borchert *et al.* (2012), no recent study has – to our knowledge – tested for the effect of telecom policy restrictions on a micro level for a large set of developing countries¹, or included more than a few MENA countries in the analysis. Hence, we enlarge the scope in this paper by studying a larger set of developing countries, with a focus on MENA.

While previous studies mainly rely on GATS commitments to estimate the degree of market openness, it is not uncommon that these provide a poor reflection of reality. Actual policies are sometimes less restrictive than GATS commitments. In other cases, commitments to liberalization tend to be offset by restrictive behind-the-border regulations. We therefore use the World Bank Services Trade Restrictiveness Database (STRD), which provides a more comprehensive coverage of *actual* trade policies and internal regulations for a set of 24 developed and 79 developing countries. We also address the endogeneity problem of telecom policies that tended to be overlooked in most previous studies, by adopting a 3SLS estimation procedure.

The paper is organized as follows. Section 2 provides an overview of telecom restrictions with a focus on MENA countries. The review of previous studies is presented in Section 3. Section 4 provides the data and the empirical model we adopt. In section 5, we discuss the results of the model. Finally, we provide some concluding remarks and policy recommendations in Section 6.

¹ According to our knowledge, three older studies (Boylaud and Nicoletti 2001, Doove et al. 2001 and Fink et al. 2003) tested for the effect of restrictive policies on a micro level, however, they are not relevant for developing countries and they use less comprehensive restrictiveness indexes.

2. The Telecom Sector in MENA Countries

The past decade has witnessed a significant transformation in the trade and regulatory policies of telecom sector across the MENA region, opting for open markets and a more efficient provision of these services. Although the MENA region can be considered as one entity in terms of geographical expansion, political challenges and cultural and historical characteristics; MENA countries show differences in terms of their income level, demographics, and in terms of different reform paces and different levels of market openness.

Prior to the reforms, the telecom sector has often been characterized by two main features: the absence of separation between regulation and provision, and the predominant role of the State. As far as the MENA region is concerned, the sector suffered from the monopoly of a state-owned incumbent operators and the absence of an independent regulatory body until the mid-nineties. These two features have resulted in a modest level of sector performance in the region. The inability of the incumbent operator to expand its network, in addition to the increasing demand for landlines, resulted in an increasingly unmet demand and long waiting lists. Additionally, installation fees were relatively high by international standards and the quality of maintenance was low. In Egypt, for example, in 1997, Ghoneim (2008) cites a waiting list of two years, and installation fees reaching up to US\$ 1180 to get an operating line. In 1995, the average unmet demand in MENA countries reached 448,843 lines on the waiting list. Additionally, the number of faults reached up to 40.9 per 100 lines per year².

In light of technological developments leading to the boom in telecommunications and their increasing role in the world economy, the modest performance of the telecom sector in MENA countries highlighted the need for deep-sector reform, including the establishment of an independent regulator, the privatization of state-owned operators and increasing competition in telecom markets. The first independent regulatory authority in the region, the “Telecommunications Regulatory Commission (TRC),” was established in Jordan in 1995, followed by Morocco in 1997 and Egypt in 1998. The most recent independent regulator was established by Qatar in 2004 (ITU, 2014). To date, three of the 14 MENA countries studied in this paper still suffer from the lack of regulatory independence: in Kuwait and Yemen, the Ministry of Communications is in charge of regulatory functions, and in Iran, the regulator is subordinate to the ministry. The regulatory framework in the remaining MENA countries also reveals some drawbacks: with the exception of Jordan, the decisions of the regulator are not fully independent from the government, and, in some cases, from state-owned operators. In Egypt, for example, the regulator (though structurally independent) is headed by the Minister of Communication and Information Technology, and the members of its board of directors (BoD) are appointed and dismissed by the Prime Minister. In other countries, key decisions affecting competition in telecom markets, such as licensing of new operators, are either exclusively taken by the Ministry of Communications (like in the case of Tunisia) or are taken jointly by the ministry and the regulator (the case in Morocco, Oman, Qatar and Algeria). The same applies to financial independence, which affects the ability of the regulator to make independent decisions (El Haddad and Attia, 2012). In this context, there are some successful experiences. The Bahraini regulator, for instance, enjoys full financial autonomy. On the other extreme, the Lebanese regulator fully relies on funds allocated by the government. In Oman and Saudi Arabia, regulators are partially funded by the government (ITU, 2014).

The second component of sector reform, privatization, has started recently. As shown in table 1, with the exception of Jordan’s operator, privatization of the state-owned incumbent has only been partial for 8 out of 14 countries, while in the remaining countries (Iran, Lebanon, Algeria, Kuwait, and Yemen), the incumbent is still fully owned by the State. For instance, only 20%

² Waiting lists and number of faults are calculated as a simple average for the 14 MENA countries studied in this paper. Data on these two indicators are from the ITU regulatory database (2010).

of the Egyptian incumbent, Telecom Egypt, has been privatized, although a share of 49% is stated in Egypt's schedule of specific commitments.

In most MENA countries, sector reforms have been accompanied by liberalization of domestic telecom markets. In this context, six MENA countries have signed the Basic Telecom Agreement (BTA)³. As shown in table 1, these countries are Egypt, Morocco, Tunisia, Jordan, Turkey and Oman. However, some of these countries are still reluctant to changes and, despite their commitments, reveal high levels of protection. The market for fixed telephony in MENA countries currently has five monopolies. A successful example for liberalization is that of Bahrain, with a highly competitive market of more than six landline operators. Most liberalization achievements have taken place in the mobile sector. Since the late nineties, the mobile market was opened for a number of operators and foreign equity limits have been largely relaxed. In this context, Egypt was the first to liberalize the mobile market with the licensing of two mobile operators in 1998, followed by Kuwait in 1999, Jordan and Morocco in 2000. The mobile market in most MENA countries has three operators, and four in the case of Saudi Arabia and Yemen. There is, however, an obvious gap in the degree of openness of the mobile market among MENA countries. Table 2 shows that GCC countries generally adopt less open trade policies with restrictions on foreign equity participation, nationality of BoD members and the legal form of establishment. The Qatari market is completely closed to foreign investments and foreign equity participation. To the contrary, non-GCC countries, such as Egypt, Turkey, Jordan, Tunisia and Morocco are generally more open to foreign investments and have less or no limits on licensing and foreign capital participation. They tend, however, to protect historic landline operators from competition by imposing restrictions to entry, and to maintain their ownership by limiting the privatization of public entities to less than 50%. As depicted in table 2, the maximum foreign equity participation in the Egyptian and Bahraini state-owned incumbent is 49%, while in Kuwait, Oman and Qatar, no foreign equity participation is allowed.

The analysis of the telecom sector in the 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. Commitments to adopt more open policies did not necessarily guarantee more open markets, and, in other cases, did not guarantee better performance. To the contrary, some countries with a highly protected market, such as Qatar, tend to reveal better performance indicators.

Current fixed and mobile penetration indicators for MENA countries in 2011 are depicted in table 3. Between 1995 and 2011, MENA countries have witnessed an increase in landline penetration from an average of 11.49 to 15.26 lines per 100 inhabitants, compared to 11.03 for low and middle income countries and 44.84 for OECD countries. The average landline penetration in the region tends to be overestimated due to the performance of higher income countries like Turkey and some GCC countries with penetration rates of over 20%. Meanwhile, remaining MENA countries suffer from significantly lower landline penetration, where limited network expansion could be justified by the large geographical size and relatively lower income levels. A deeper look into the data shows that there are two main trends among MENA countries. First, most middle-income MENA countries witness an increase in landline penetration. In Egypt, Morocco and Tunisia, landline penetration has increased from an average of 4% in 1995 to around 11% in 2011. In Iran, the number of lines jumped from 8.52 to 37.12 per 100 inhabitants in the same time period. Second, with the exception of Oman and Saudi Arabia, GCC countries and Turkey witnessed a decrease in landline penetration to about an average of 20 lines per 100 inhabitants. A possible justification to this phenomenon might be

³ The Fourth Protocol of the GATS, also known as the Basic Telecommunications Agreement was issued in 1997 and entered into force one year later. According to this agreement, member countries are to list their specific commitments regarding basic telecommunication services, as well as any exemptions from GATS Article II on the principle of the Most Favored Nation.

the initial state of the network and geographical conditions. In small GCC countries, network expansion was quickly established in the past, while it took other MENA countries relatively more time to expand their networks due to their larger territories and limited resources.

Mobile services have been introduced and quickly expanded throughout the region since the late nineties. In over half of MENA countries, the market is oversaturated: nine out of 14 countries have a mobile penetration rate of over 100%. The average mobile penetration rate for the region is 116%, which is higher than averages in OECD countries and low- and middle-income countries (106% and 77% respectively). Increased mobile penetration is not only specific to GCC countries, but also to middle-income countries, such as Egypt, Jordan and Morocco. Table 2 shows that non-GCC countries adopt more open policies to attract investments to the sector, while in GCC countries, most of the companies are owned by nationals. In GCC countries, the increasing use of mobile services has been accompanied by a decrease in landline penetration. This is not the case for the other MENA countries that initially suffered from limited landline penetration, and where the boom in mobile services has initially been accompanied by an increase in landline penetration.

Comparing indicators of performance to other groups of countries allows for a number of general remarks. Between 1995 and 2011, landline market performance in the MENA region has improved. Landline penetration in the region is generally higher than in low- and middle-income countries, but remains significantly lower than OECD countries. In the context of the present analysis, this performance gap has two main explanations. First of all, landline penetration has decreased in GCC countries, where fixed telephony is likely to have been substituted by the use of mobile services. Second, most of the other MENA countries have been unable to increase their network penetration above a ceiling of 11%⁴, either because of the lack of investment in infrastructure, the expansion of alternative mobile services, or due to regulatory problems such as the failure of the regulator to set suitable interconnection terms and the problem of the regulatory capture by the incumbent operator (El-Haddad and Attia, 2012).

3. Policy Restrictions: Determinants and Effects

In the following section, we explore the political determinants of regulatory restrictions. Then, we analyze how such restrictive policies affect the level of competition in the telecom market, before finally providing a brief review of the literature on the impact of restrictions on a number of performance indicators.

3.1 Do more democratic countries adopt less restrictive policies?

We argue that political determinants explain the degree of restrictions implemented by developing countries in general, and MENA countries in particular. The endogeneity of telecom restrictions is an important issue that tended to be overlooked in most previous studies. Borchert *et al.* (2012) argue that policy choices depend on local market structure and sector performance, and that political institutions affect market outcomes through trade policy choices, whereas democracy is unlikely to have a direct effect on market structure and performance other than through the policy choices.

We therefore argue that the level of democracy affects the level of policy restrictions, and that democracy is unlikely to have a direct effect on telecom market performance other than through its effect on the policies. Moreover, telecom restrictions are sufficiently micro-measured, thus,

⁴ In Egypt, the current landline penetration rate reflects a failure of the plan by the Ministry of Communication and Information Technology to raise landline penetration to 14% by 2010. This could be explained by the lack of expansion in network infrastructure by the incumbent (as reported by a number of internet providers) in addition to increased substitution by mobile services.

it is not possible that such reforms would alter the level of democracy. Hence, we will use the democracy level as an instrumental variable for telecom policy restrictiveness.

Hypothesis 1. A more democratic country is more likely to adopt less restrictive policies.

3.2 Restrictive policies, competition and sector performance: Evidence from empirical studies

A number of theoretical contributions link barriers to entry and competition through different channels. Bain (1957) focuses on the direct impact of barriers on competition and concludes that when barriers to entry are lower, competition seems more “workable” as there is a threat of potential competition. Moreover, market performance may tend to be jointly determined by the level of the barrier to entry, as well as the level of competition in the market. Empirically, industries with very high barriers to entry and seller concentration tend to have *unworkable* performance. Cowling and Waterson (1976) define a theoretical model of the relationship between both barriers and market structure on performance. Only those barriers to entry that are not already reflected in the concentration measure are taken into account, in addition to the growth in countervailing power. Their model suggests that the profit-revenue ratio is directly related to the Herfindahl index of concentration in the industry, whereas barriers to entry and countervailing power affect the model by altering the actual market power. Moreover, Khalilzadeh-Shirazi (1974) considers the seller concentration, barriers to entry, demand growth, and the role of international trade and FDI as main determinants for price-cost margins.

Most of the previous empirical studies focus on the impact of policy restrictions on trade in telecom services, with the objective of quantifying such impact in a way comparable to trade in goods. Hence, the objective of these studies is to estimate a “tariff-equivalent” of the impact of the presence of trade and regulatory barriers in services. On the other hand, fewer studies explore the impact of policy restrictions on sector performance at the micro level. Regardless of the final objective, the common procedure is to explore the impact of restrictions on one or more performance variables, which we briefly review below.

An early study by Warren (2000) estimates the impact of impediments to trade and investment in telecommunications on fixed and mobile penetration, using an ITU cross country survey to compile an indicator of the state of ownership, market structure and trade policy openness. Results suggest a significant impact of trade and regulatory policies on network penetration in both subsectors, highlighting the need for developing countries to open their markets to competition, so as to increase their low levels of network expansion in fixed and mobile sectors. Trewin (2000) uses the same indicator to investigate the price-impact of restrictions in 37 countries over the period 1982-1992, and finds that restrictive policies in general, and FDI restrictions in particular, contribute significantly to increased telecommunication costs and, consequently, increased prices. Dee (2003) adapts the STRI method suggested by Warren (2000) to Southeast European Countries and, similarly, he concludes that barriers to competition and investment have a significant negative impact on landline and mobile penetration. More specifically, there is a need to adopt more pro-competitive policies in the mobile market, while in the landline market it is necessary to allow for foreign equity participation.

In the context of the OECD research project on regulatory restrictions on services, Boylaud and Nicoletti (2000) introduce a set of six different regulatory indicators for long distance and mobile communications in OECD economies between 1991 and 1996 and estimate the impact of these indicators on prices, labor productivity and quality of telecommunications. The overall conclusion is that competition significantly affects quality, prices and productivity, whereas other indicators related to prospective privatization, state ownership and internationalization of domestic markets have less clear-cut effects for the industry as a whole. Doove *et al.* (2001) draw on the previous methodology to produce similar price effects for individual telecom

services (mobile, international, trunk and leasing sectors), as well as for the telecom industry as a whole. They are able to conclude a weak but positive relationship between telecom regulation and prices. Fink *et al.* (2003) analyze the impact of liberalization, privatization and the presence of independent regulators on penetration and productivity in basic telecommunication services, using panel data for 86 developing (of which 10 are MENA countries) countries between 1985 and 1999. Not only do they investigate the impact of each policy component separately, but their sequence and interaction are also taken into account. The study concludes that privatization and increased competition have positively contributed to increased performance. Additionally, the presence of independent regulatory bodies is likely to further increase productivity gains in the sector.

Enhanced restrictiveness indices and price-impact measures are introduced by Dihel and Shepherd (2007), who use a two-stage approach to control for firm- and country-level determinants of performance and highlight an overall cost-increasing effect of trade policies. Bottini and Marouani (2009) use the previous methodology to estimate the impact of trade restrictions on price-cost margins in landline and mobile services in four MENA countries (Egypt, Lebanon, Jordan and Morocco). The study highlights the importance of opening the market for investments, mode 3 being the main feature for trade and provision of telecom services. The overall STRI results show that for fixed telephony, trade restrictions tend to increase price-cost margins, which suggests the creation of rents captured by the domestic incumbent. The mobile STRI is, however, associated with lower price-cost margins, suggesting that restrictions tend to increase cost of operation for service providers. Fontagné and Mitaritonna (2013) introduce enhancements to the econometric estimation and control for additional variables to estimate the impact of telecom restrictions in 12 emerging countries (of which three are MENA countries, namely Egypt, Morocco and Tunisia) on prices. Telecom restrictions are found to have a significant, mostly cost-increasing effect on price-cost margins.

Borchert *et al.* (2012) use the World Bank STRI database to estimate the impact of trade policy restrictiveness on market structure and access to fixed and mobile communications for 103 countries, with a particular focus on 22 landlocked countries. This study is the first to raise the problem of endogeneity of policy restrictiveness as a variable that is likely to depend on local market structure and sector performance. To solve the endogeneity problem, the Polity IV Project's political regime indicator is used to instrument for the STRI. Results suggest that less open countries are on average characterized by a more concentrated market structure. Moreover, the findings indicate an overall negative relationship between restrictive trade policies and teledensity in both sectors.

Hypothesis 2. Lower restrictive policies are associated with higher market competition.

Hypothesis 3. Lower telecom restrictive policies and higher market competition lead to better telecom performance in terms of penetration, productivity and prices.

4. Econometric Specification

In this paper, we estimate the impact of telecom policy restrictions on selected indicators of performance for 24 developed and 79 developing countries. We proceed in two ways. The first is to assess the direct impact of restrictions on performance, and the second is to assess the indirect impact of policy restrictions on performance through the channel of competition.

4.1 Empirical model

Our main set of variables, policy restrictiveness, competition, and performance, are examined within a system of three simultaneous equations for fixed and mobile services respectively. For each subsector, we estimate the following system of simultaneous equations:

$$STRi_i = \beta_0 + \beta_1 Polity_i + \beta_2 BTA_i + \beta_3 Z_i + \beta_4 DV_i + \mu_i \quad (1)$$

$$\text{Competition}_i = \alpha_0 + \alpha_1 \text{STRI}_i + \alpha_2 \text{BTA}_i + \alpha_3 Z_i + \alpha_4 \text{DV}_i + \varepsilon_i \quad (2)$$

$$\text{Performance}_i = \delta_0 + \delta_1 \text{Competition}_i + \delta_2 \text{STRI}_i + \delta_3 \text{BTA}_i + \delta_4 Z_i + \delta_5 \text{DV}_i + v_i \quad (3)$$

Where STRI_i is the Services Trade Restrictiveness Index per country, Polity_i is the Polity IV indicator for democracy, BTA_i is the BTA dummy variable, Competition_i is the competition variable (the competition index, the fixed competition index or the mobile competition index), Performance_i is one of the selected performance indicators, Z_i is a vector of control variables (GDP, GDP per capita and population density) and DV_i is the set of selected dummy variables (developing countries or MENA countries).

As mentioned previously, both the level of policy restrictiveness and the degree of competition tend to be endogenous variables. Low levels of telecom performance may encourage governments to seek a more open sector and pursue sector reform; or – to the contrary – high profitability of national operators may give governments a justification to not allow entry. There might also be a correlation between the level of policy restrictiveness and participation in international agreements. For instance, a country signing the BTA may carry out less restrictive regulatory policies in the telecom sector.

We therefore estimate a system of three simultaneous equations by using 3SLS-SUR due to the presence of right hand side endogenous variable in our system of equations. The 3SLS estimation uses an IV approach to produce consistent estimates and a GLS method to account for the correlation structure in the disturbance across the equations. The seemingly unrelated regressions “SUR” technique is used to take into account cross section variance⁵. To ensure the exogeneity of our variables, we also take lead values of our performance indicators to eliminate their possible effect on the competition index and the level of policy restrictiveness.

4.2 Data

Data about the different policy measures and the level of their restrictiveness is obtained from the World Bank’s Services Trade Restrictions Database (STRD).⁶ The data available for the telecom sector covers only restrictions on commercial establishments 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 BoD, restrictions on establishing international gateways (IG) and the use of Voice over Internet Protocol (VOIP) technology.

A total of 14 MENA⁷ countries are included in the database⁸. These are Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, Turkey⁹ and Yemen. The database provides three indicators of restrictiveness: an aggregate telecom index, an index for fixed services and an index for mobile services.

⁵ In the Seemingly Unrelated Regression “SUR,” linking the equations by their error terms in the regression increases the efficiency of the results. SUR performs regression estimation by FGLS even if the dependent variables for some equations appear as regressors in other equations; it indicates that all right-hand side variables are to be treated as exogenous. SUR models are joint estimates from several regression models, each with its own error term.

⁶ The STRI is the translation of the different policy measures provided by the database into a quantitative, cross-country indicator. The database covers five major sectors, and covers data for 103 countries, 24 OECD developed countries and 79 developing countries. Thus, 75% of the countries included in our sample are developing countries.

⁷ Other MENA countries are not included in the STRI database as: Djibouti, Libya, Sudan, Syria and UAE.

⁸ MENA countries studied in this paper have different income levels; lower-middle-income (Egypt, Morocco, Qatar and Yemen), upper-middle-income (Algeria, Iran, Jordan, Lebanon, Tunisia and Turkey) and high-income (Bahrain, Kuwait, Oman and Saudi Arabia).

⁹ Although Turkey is an OECD member, it is a developing country according to WDI database 2014.

4.2.1 Dependent variables

Our main variable of interest is the Services Trade Restrictiveness Index (STRI) of the telecom sector. The STRI ranges from 0 and 100, which we rescale in our econometric specification to range between 0 and 1. Policy regimes are ranked into five broad categories according to the magnitude of restrictions. These categories and their STRI equivalent scores are:

- Completely open (0);
- Virtually open but with minor restrictions (0.25);
- Major restrictions (0.5);
- Virtually closed with limited opportunities to enter and operate (0.75); and
- Completely closed (1).

To reflect the level of competition in the market, we construct a competition dummy variable for the fixed and the mobile sector. The competition variable takes the value of 0, 1 and 2 respectively if the sector is a monopoly, partially competitive or fully competitive, yet without any details regarding the number of competitors. We also construct an aggregate competition index for the telecom sector, which takes the values of 0, 1 and 2 as follows:

- 0 if both segments are monopolistic;
- 1 if at least one of the segments is competitive; and
- 2 if both segments are competitive.

Data are collected from the ITU survey in 2009, which reflects the level of competition in 2008 or prior to this year.

Our selected performance indicators are access rates, productivity and prices. We refer in the choice of our indicators to Estache *et al.* (2006) and we use different proxy variables to reflect these indicators.

Data on fixed and mobile access rates are extracted from the ITU database, where we use penetration rates (the number of fixed and mobile telephone lines in a country for each 100 inhabitants) as dependent variables to reflect access. Productivity is measured by using two different proxies to ensure the robustness of our results. The first measure is the number of telephone subscribers in fixed and mobile telephone per each full-time telecom employee¹⁰. The second measure is telecom revenue¹¹ in dollars per each full-time telecom employee. Data on telecommunication revenue and employees are also extracted from the ITU database. We measure the overall productivity since the number of telecom employees per segment is not available.

To measure prices we construct price baskets, as suggested by the ITU (2012): a price basket for landline services and a price basket for mobile services. The 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 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

¹⁰ “Total full-time Telecommunication employee” is the total full-time staff employed by telecommunication network operators in the country for the provision of public telecommunication services, including fixed, mobile and Internet services. This should include all operators (both network and virtual operators) offering services within the country. Also, this should exclude staff working in national broadcasting networks if they offering only the traditional broadcasting services. Part-time staff should be expressed in terms of the fulltime staff equivalent.

¹¹ This is the total (gross) telecommunication revenue earned from all (fixed, mobile and data including Internet) operators (both network and virtual operators) offering services within the country.

and weekend periods), plus 100 SMS messages (50 on-net and 50 off-net)¹². The data on prices are available at the ITU database.

4.2.2 Independent variables

To correct for the possible endogeneity of telecom market restrictions, we use the Polity IV Project's political regime indicator for democracy, following Borchert *et al.* (2012). We find this indicator more accurate than a dummy variable for the type of regime.¹³

We construct a set of dummy variables to use in our estimation. The first takes the value of 1 if the country has signed the BTA; and 0 otherwise. The data are obtained from the WTO website. We also use data from the World Bank to construct a dummy variable for developing countries, since 75% of our sample belongs to this group. We include a final dummy variable for MENA countries.

Finally, we control for demographic and macroeconomic variables, such as GDP in constant 2005 U.S. dollars in 2008, GDP per capita based on Purchasing Power Parity (PPP) in constant 2005 international \$ for 2008 and the population density for the year 2008. The data are extracted from the World Development Indicators database of the World Bank and all variables are used in log form.

4.3 Descriptive statistics

Table 4 provides basic analysis of the data, allowing for a number of observations. First, telecom restrictions – measured by the fixed, mobile and aggregate telecom STRI – are higher for MENA countries, developing countries and for countries that did not sign the BTA. Regional characteristics, the development level and participation in WTO agreements are therefore considered as important inputs to be taken into consideration in our analysis to validate or nuance such correlations. It is noteworthy that the highest STRI for the group of developed countries is 0.5, meaning that developed countries are neither virtually closed nor completely closed¹⁴.

Among MENA countries, Qatar has a totally closed fixed and mobile market. Conversely, Turkey has a completely open telecom sector. Half of the MENA countries are characterized by a virtually open telecom sector with minor restrictions. This group includes Algeria, Egypt, Jordan, Lebanon, Morocco, Tunisia and Saudi Arabia. Some GCC countries such as Kuwait, Oman, Qatar, in addition Iran, remain completely closed to foreign investment in landline services.

The basic data analysis on the telecom sector performance¹⁵ depicted in Table 5 highlights that MENA countries tend to have lower fixed access and higher mobile access, which might be explained by a possible substitution effect between landline and mobile communications. Developing countries show lower fixed and mobile access rates as compared to developed countries. Moreover, countries that have signed the BTA have higher access rates, but also higher prices. Being a MENA country, a developing country or a country that has signed the BTA has different effects across different productivity measures.

¹² Due to the lack of some price indicators, we calculate the mobile basket as $10 * (\text{Mobile price of local call per minute off-net at peak rate} + \text{off-net at off-peak rate} + \text{on-net at peak rate} + \text{on-net at off-peak rate} + \text{to-fixed at peak rate} + \text{to-fixed at off-peak rate}) + 100 \text{ SMS messages (50 on-net and 50 off-net)}$. As in ITU (2012), the mobile basket is equivalent to 50.87 minutes.

¹³ The Polity IV Project rates the levels of both democracy and autocracy for each country and year. It ranges from -10 (fully institutionalized autocracy) to +10 (fully institutionalized democracy). We normalize the variable to be in the range from 0 to 1 to be more meaningful in terms of interpretation. These data are available at the Center for Systemic Peace Web site.

¹⁴ The most restrictive developed countries with major restrictions in the fixed segment are Canada, Republic of Korea and Mexico; in the mobile sector, they are Canada, Republic of Korea and New Zealand.

¹⁵ It is important to keep in mind that this analysis is about correlation, not about causality. Therefore, this initial basic analysis needs to be validated by the econometric analysis.

When comparing MENA countries with telecom commitments to those without commitments (Table 6), we notice that MENA countries that have signed the BTA have lower fixed access, higher mobile access and higher prices. The same observation is valid for developing countries.

However, descriptive statistics do not necessarily hold for the econometric specification. We therefore conduct an econometric analysis to validate or nuance these previous conclusions. Since previous studies focusing on a large number of MENA countries mostly rely on descriptive and graphical representation, such as Bressie *et al.* (2005), it is better to conduct the empirical estimation to confirm or invalidate such results.

4.4 Results

The results from equation (1) confirm our hypothesis about democracy and policy restrictiveness. The impact of democracy on lowering the degree of restrictions holds for the landline and the mobile market, as well as for the aggregate telecom sector, and is significant and robust across various specifications. Concerning the impact of telecom commitments on the level of policy restrictiveness, the BTA dummy is found to have a negative significant effect on the STRI. Again, these results are robust across different specifications, and imply that WTO commitments in the telecom sector are reflected in lower levels of telecom restrictions. Yet, this effect is not translated into actual policies in terms of higher level of competition for all our performance indicators (equation 2): the BTA variable has an insignificant effect on the level of competition for different specifications (productivity, mobile access and mobile price indicators). The impact of the BTA variable is only positive and significant for competition in the landline market, when we test for the fixed market in terms of fixed penetration and fixed prices. WTO commitments are hence found to affect the fixed rather than the mobile market.

Our findings from equation (2) suggest that the impact of policy measures (the STRI) is negative and significant on landline competition (in the specifications for fixed penetration and prices). This means that moving from one level of restriction to another lower level, for example from an STRI value of 0.75 to that of 0.5, is associated with increased competition in the landline market. This effect is robust to the inclusion of the MENA or the developing dummies. However, the negative effect of STRI on competition becomes weaker when we control for the developing countries and even weaker when we control for MENA countries. Moreover, being a MENA country reduces the level of landline competition in a significant manner (in the specifications for fixed access). For the mobile sector, we find that the STRI has a negative effect on the level of competition across different specifications, with no specificity for MENA countries. Concerning the productivity system of equations, the effect of the STRI is negative and highly significant on the level of competition, and this effect remains robust across different specifications. Thus, the results on the effect of the STRI on competition validate our hypothesis (2).

Concerning the effect of the STRI, as well as the level of competition on the level of performance in equation (3), our findings are somehow surprising. Although the effect of STRI is significant for fixed penetration, it becomes insignificant when we control for MENA countries. For mobile services, the STRI effect on mobile penetration is negative, but mostly insignificant. The STRI is negative and significant for telecom prices. Additionally, the effect of competition is mostly insignificant, which may be because its effect is already captured in the STRI coefficient. However, the inclusion of the STRI is crucial when testing the effect on the market performance. Thus, hypothesis (3) has not been completely validated. MENA country or developing country dummies have a negative and highly significant effect on prices in the fixed market.

5. Discussion

We find that the democracy level affects the level of restrictions in the telecom sector. Democratic countries are therefore associated with more open trade and regulatory policies.

This emphasizes the importance of the political system as an important factor that shapes the country's policy reforms and affects the degree of policy restrictiveness. This may partially explain why MENA telecom markets are more restricted than telecom markets in other groups of countries. Autocratic regimes tend to reduce the opportunity for opening the market and for carrying out liberal policies.

It is interesting to test the impact of international commitments on the level of restrictions in place. Bressie *et al.* (2005) test this relationship but data limitations prevent them from conducting any statistically significant analysis. In fact, the BTA matters for the level of restrictions in place, since it is likely to be associated with a lower level of market restrictions. Investors should thus be more willing to invest in countries with international commitments. However, our findings suggest that commitments in the telecom sector do not matter for most of the performance indicators when their effect is tested on the level of competition. These findings are in line with the idea highlighted by several studies on the limited capacity of telecom commitments to reflect actual policy, as shown by *Conférence des Nations Unies sur le commerce et le développement* (2006). Additionally, GATS commitments do not address problems of market failure; their objective is to ensure that trade is not restricted by internal regulations, which does not necessarily guarantee a pro-competitive outcome of the liberalization process (Ghoneim, 2009). Consequently, WTO commitments mostly reflect formal rather than actual policies, and therefore do not guarantee the telecom market liberalization. Thus, important measures should be considered and adopted by international organizations, such as the WTO, to guarantee more efficient implementation of such commitments.

Our findings from the fixed market regressions suggest that lower restrictions are associated with higher competition. This result holds more for the fixed rather than the mobile market, and can be explained by the fact that the provision of landline services generally relies on investment in infrastructure. Therefore, the increase in the level of competition depends on increasing the level of investments in the fixed network, increasing network capabilities or improving the quality of existing networks. Lower restrictions facilitate entry of investments, and, accordingly, higher competition. When we control for MENA, however, the effect of STRI is weaker on the level of competition. This suggests that MENA telecom markets are still incontestable. In the market for landline services, in addition to high entry costs, lack of networks and difficult network sharing between the incumbent and the new operators, MENA countries remain very protective of their domestic incumbents, irrespective of their stipulated legal restrictions, which reduces market contestability.

Lifting restrictions on market entry is therefore not a sufficient condition to guarantee a significant impact on competition. One of the region's biggest challenges is the extent to which the regulator protects the national incumbent. In Egypt, for instance, introducing a second landline operator with fair access rates to Telecom Egypt infrastructure is a must, as well as allowing Mobinil¹⁶ the international gateway license it applied for (El Haddad and Attia, 2012).

The same logic applies to the mobile market. The results suggest that restrictions have negative, yet weaker effect on the mobile competition than on the landline competition. This might be due to the fact that governments and national investors have higher incentives to invest in the mobile market as a highly growing industry. Moreover, the mobile segment mostly relies on the existing fixed network and infrastructure, and therefore requires less investment than the fixed sector. The mobile market is therefore less dependent on heavy investments and is less

¹⁶ The Egyptian mobile market currently consists of three operators: Vodafone, Etisalat and Mobinil. While the first operator is 45% owned by the landline incumbent Telecom Egypt and therefore has access to international gateways, and the second has obtained the license to establish its own international gateway, the third remains unable to establish its gateways due to the refusal of the regulator to grant a gateway license to the operator, who is denied access to any international gateway other than the incumbent's, and with relatively high rates (Aboushady, 2013).

likely to be characterized by economies of scale as in the case of the market for landline services. Mobile telecommunication networks can be deployed quickly since their establishment requires less large-scale civil engineering than a fixed network (Gruber 2001).

Concerning the impact of the telecom restrictions on our selected performance indicators, we find that lower restrictions increase access to telecom services. However, the coefficient is not significant for the fixed penetration when MENA countries are controlled for. For the mobile sector, the coefficient has a negative sign, yet is not always significant. We also surprisingly find that lower restrictions are associated with lower productivity, which is difficult to interpret and might result from measurement errors due to lack of data on productivity. Finally, we find that lower restrictions are associated with higher telecom prices. This effect may be due to collusive agreements between new entrants and existing operators. These findings are in line with those of Lommerud and Sørsgard (2001), who find that the stability of collusion depends on the level of trade costs; and with lower trade costs due to liberalization, the scope for a collusive outcome between firms increases.

The specificities of MENA countries are mainly obvious in our findings on fixed communications. The negative effects of being a MENA country on competition in the landline market show that problems in MENA telecom sector are not only due to the presence of restrictive policies, but also due to the lag in the telecom reform adoption in MENA region compared to the other developing countries. However, this conclusion does not hold for other developing countries. These results highlight problems of high protection of the incumbent operators, poor network quality, difficult interconnection terms and regulatory capture by the incumbent operator. The negative effect might also be due to possible substitution between fixed and mobile services.

The state of the landline market is an outcome of the captured regulator who mainly protects the incumbent by not granting additional licenses. In Egypt, for instance, exclusivity was granted up to 2005 yet the landline market remains a monopoly because no additional licenses were offered. The regulator is, however, unable to entirely protect the incumbent from competition with mobile operators and from the progressive substitution of landlines by mobile services. Regulatory capture and high protection of the incumbent operators therefore remain the main differences between MENA countries and developed countries.

6. Conclusion

Our paper is one of the few recent papers to investigate the effect of telecom restrictions on a micro level, and – to our knowledge – is the only paper to cover a large sample of MENA countries.

According to our findings, telecom restrictive policies are likely to have a greater effect on the market for landline rather than the market for mobile services, due to the specificities of the first, including high levels of investment and high entry costs.

One of the main challenges facing the telecom sector in the MENA region is the increased protection of domestic incumbents by regulators. For about half of the MENA countries in our sample, the market for landline services is still a monopoly, while the mobile market is a rather competitive one. Opening the landline market for competition is a necessary but not a sufficient condition to guarantee entry of other operators and better performance. High barriers to entry, such as the cost of building a network in MENA countries, difficult interconnection agreements and excessive licensing conditions, are likely to limit or ban the entry of new competitors. Therefore, our results reveal an important feature of the telecom sector, especially in MENA countries, which is the incontestability of the market. Policymakers are therefore required to guarantee better entry conditions for investors through the revision of the regulatory framework of the sector and the lifting of burdensome behind-the-border policies.

Thus, problems in the MENA telecom sector are not only due to the presence of restrictive policies, but also due to regulatory capture and high protection of the incumbent operators. Such problems remain the main obstacles hindering a more open landline market in MENA countries.

Finally, the existing gap between official trade policies and actual openness of the market can also be filled by not only committing to actual liberalization, but also by enhancing regulatory independence and enforcing pro-competitive practices, for instance by allowing access to the incumbent networks by facilitating the interconnection agreements or by leasing the incumbent network, such as in the case of Morocco.

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Table 1: MENA Telecom Sector Summary 2010: Regulation, Privatization, and Competition

	Regulatory Authority (Creation Year)	Privatization of the main incumbent operator	BTA signed	Competition Level in Fixed telephone market	Competition Level in mobile cellular market
Algeria	2000	State Owned	No	Monopoly	3 operators
Bahrain	2002	Partially Private	No	More than 6	3 operators
Egypt	1998	Partially Private	Yes	Monopoly	3 operators
Iran	2003	Partially Private	No	Monopoly	3 operators
Jordan	1995	Fully private	Yes	2 operators	3 operators
Kuwait	No separate regulator	State Owned	No	Monopoly	3 operators
Lebanon	2007	State Owned	No	Monopoly	Government Owned Duopoly
Morocco	1998	Privatized	Yes	3 operators	3 operators
Oman	2002	Partially private	Yes	2 operators	2 operators
Qatar	2004	Partially Private	No	2 operators	2 operators
Saudi Arabia	2002	Partially Private	No	2 operators	4 operators
Tunisia	2001	Partially Private	Yes	2 operators	3 operators
Turkey	2000	Partially Private	Yes	Monopoly	3 operators
Yemen	No separate regulator	State Owned	No	Monopoly	4 operators

Source: Ahmed Ezzat (2015)

Table 2: Foreign Equity Limits and Other Restrictions in MENA Countries

Country	Maximum foreign equity share in fixed (%)	Maximum foreign equity share in mobile (%)	Additional restrictions
Algeria	100	100	Foreign equity participation is not applicable to public entities
Bahrain	49	49	A nationality requirement may be applicable to Board of Directors
Egypt	100	100	Maximum foreign equity participation in the state-owned incumbent is 49%; operators must be locally incorporated
Iran	0 (100 % in Free Trade Zones)	49 (100% in Free Trade Zones)	Restrictions on the repatriation of earnings: approval of the Foreign Investment Board needed
Jordan	100	100	Restrictions on the number of licenses applies to foreign providers only
Kuwait	0	49	Company must be registered as a Kuwaiti Stock Company and chair of the BoD must be Kuwaiti
Lebanon	66	66	The majority (51%) of the BoD must be Lebanese
Morocco	100	100	
Oman	0	70	
Qatar	0	0	
Saudi Arabia	60	60	Operators must be locally incorporated
Tunisia	100	100	
Turkey	100	100	A company must be incorporated as a joint-stock or limited liability company
Yemen	0 (50% only through joint-ventures)	100	At least 50% of the members of the BoD must be Yemeni

Source: World Bank Services Trade Restrictions Database (2013)

Table 3: Landline and Mobile Penetration in MENA Countries (1995)

Country	Number of mainlines per 100 people (1995)	Number of mainlines per 100 people (2011)	Number of cellular lines per 100 people (2011)
Algeria	4.16	8.50	98.99
Bahrain	25.19	20.89	127.96
Egypt	4.38	10.56	101.08
Iran	8.52	37.12	74.93
Jordan	7.23	7.35	118.20
Kuwait	23.48	18.26	175.09
Lebanon	12.96	20.32	79.52
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
Tunisia	5.84	11.49	116.93
Turkey	22.30	20.66	88.70
Yemen	1.23	4.33	47.05
MENA average	11.49	15.26	116.07
Low & middle income	3.67	11.03	77.33
OECD members	44.84	43.19	106.67

Source: World Development Indicators (2013)

Table 4: STRI Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
When MENA = 1					
Fixed index	14	.46	.38	0	1
Mobile index	14	.36	.23	0	1
Aggregate telecom index	14	.41	.27	0	1
When MENA = 0					
Fixed index	89	.26	.28	0	1
Mobile index	89	.23	.23	0	1
Aggregate telecom index	89	.25	.24	0	1
When developing = 1					
Fixed index	79	.35	.31	0	1
Mobile index	79	.29	.23	0	1
Aggregate telecom index	79	.32	.25	0	1
When developing = 0					
Fixed index	24	.10	.18	0	.5
Mobile index	24	.09	.18	0	.5
Aggregate telecom index	24	.01	.17	0	.5
When BTA = 1					
Fixed index	67	.19	.24	0	1
Mobile index	67	.18	.197	0	.5
Aggregate telecom index	67	.19	.20	0	.625
When BTA = 0					
Fixed index	36	.47	.33	0	1
Mobile index	36	.37	.26	0	1
Aggregate telecom index	36	.42	.27	0	1

Table 5: Performance Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
When MENA = 1					
Fixed penetration 2008	14	15.95	7.77	4.25	34.31
Mobile penetration 2008	14	82.26	34.49	28.48	137.58
Productivity (lines/employee) 2008	10	1193.58	538.39	672.54	2144.82
Productivity (revenue/employee) 2008	10	339924.8	201677	72345.8	730683
monthly subscription for residential service in \$ 2008	14	6.18	4.51	.03	15.48
Price of a 3-minute fixed local call at peak rate in \$ 2008	14	.07	.07	0	.26
Mobile prepaid price per minute at peak rate 2008	14	.59	.49	.12	1.57
Mobile 3 minute local call price at peak rate in \$ 2008	14	.24	.19	.07	.63
When MENA = 0					
Fixed penetration 2008	89	19.94	17.92	.06	60.99
Mobile penetration 2008	89	76.88	39.28	2.46	150.84
Productivity (lines/employee) 2008	51	1142.92	900.16	232.61	4921.04
Productivity (revenue/employee) 2008	41	357949.3	268121	26245.8	1239385
monthly subscription for residential service in \$ 2008	80	11.3	9	.71	37.13
Price of a 3-minute fixed local call at peak rate in \$ 2008	80	.14	.12	0	.8
Mobile prepaid price per minute at peak rate 2008	76	.73	.56	.03	2.61
Mobile 3 minute local call price at peak rate in \$ 2008	79	.32	.22	.015	1.03
When developing country = 1					
Fixed penetration 2008	79	12.08	10.12	.06	38.41
Mobile penetration 2008	79	67.28	36.79	2.46	149.49
Productivity (lines/employee) 2008	41	1307.8	979.6	232.6	4921.04
Productivity (revenue/employee) 2008	32	245021	193495.4	26245.8	740245.4
monthly subscription for residential service in \$ 2008	70	6.69	5.13	.03	21.76
Price of a 3-minute fixed local call at peak rate in \$ 2008	70	.12	.13	0	.8
Mobile prepaid price per minute at peak rate 2008	66	.59	.47	.03	2.28
Mobile 3 minute local call price at peak rate in \$ 2008	69	.26	.19	.01	1.03
When developing country = 0					
Fixed penetration 2008	24	43.48	11.59	18.52	60.99
Mobile penetration 2008	24	111.61	20.74	66.29	150.84
Productivity (lines/employee) 2008	20	830.17	298.43	345.66	1422.49
Productivity (revenue/employee) 2008	19	538657.7	242173.9	231752.6	1239385
monthly subscription for residential service in \$ 2008	24	21.74	6.95	4.72	37.13
Price of a 3-minute fixed local call at peak rate in \$ 2008	24	.17	.08	0	.32
Mobile prepaid price per minute at peak rate 2008	24	1.01	.64	.22	2.61
Mobile 3 minute local call price at peak rate in \$ 2008	24	.45	.23	.096	1
When BTA agreement = 1					
Fixed penetration 2008	67	22.29	17.73	.06	60.99
Mobile penetration 2008	67	85.36	34.01	13.29	150.84
Productivity (lines/employee) 2008	42	1146.34	860.03	284.83	4921.04
Productivity (revenue/employee) 2008	35	400019.2	264240.4	26245.79	1239385
monthly subscription for residential service in \$ 2008	61	12.697	9.18	1.04	37.13
Price of a 3-minute fixed local call at peak rate in \$ 2008	61	.13	.09	0	.32
Mobile prepaid price per minute at peak rate 2008	58	.78	.62	.04	2.61
Mobile 3 minute local call price at peak rate in \$ 2008	60	.35	.25	.01	1.03
When BTA agreement = 0					
Fixed penetration 2008	36	14.029	14.02	.17	46.53
Mobile penetration 2008	36	63.19	42.69	2.46	139.37
Productivity (lines/employee) 2008	19	1162.04	843.79	232.61	3268.46
Productivity (revenue/employee) 2008	16	254655.9	206272.6	28111.71	730683
monthly subscription for residential service in \$ 2008	33	6.53	5.88	.03	27.06
Price of a 3-minute fixed local call at peak rate in \$ 2008	33	.13	.16	0	.8
Mobile prepaid price per minute at peak rate 2008	32	.56	.35	.03	1.54
Mobile 3 minute local call price at peak rate in \$ 2008	33	.23	.12	.06	.51

Table 6: Interaction Variables Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Developing countries with BTA agreement					
Fixed penetration 2008	45	11.998	8.52	.06	28.84
Mobile penetration 2008	45	73.05	32.33	13.289	149.49
Productivity (lines/employee) 2008	23	1406.9	1069.88	284.83	4921.04
Productivity (revenue/employee) 2008	17	251837.8	192528.7	26245.8	740245.4
monthly subscription for residential service in \$ 2008	39	7.72	5.85	1.04	21.76
Price of a 3-minute fixed local call at peak rate in \$ 2008	39	.1	.08	0	.3
Mobile prepaid price per minute at peak rate 2008	36	.65	.57	.04	2.28
Mobile 3 minute local call price at peak rate in \$ 2008	38	.29	.24	.01	1.03
Developing countries without BTA agreement					
Fixed penetration 2008	34	12.18	12.04	.17	38.41
Mobile penetration 2008	34	59.63	41.22	2.46	139.37
Productivity (lines/employee) 2008	18	1181.27	863.96	232.61	3268.46
Productivity (revenue/employee) 2008	15	237295.3	201049.3	28111.71	730683
monthly subscription for residential service in \$ 2008	31	5.39	3.73	.033	15.81
Price of a 3-minute fixed local call at peak rate in \$ 2008	31	.14	.17	0	.8
Mobile prepaid price per minute at peak rate 2008	30	.52	.31	.03	1.41
Mobile 3 minute local call price at peak rate in \$ 2008	31	.22	.12	.06	.51
MENA countries with BTA agreement					
Fixed penetration 2008	6	13.62	5.84	8.87	24.68
Mobile penetration 2008	6	85.87	23.05	52.71	122.08
Productivity (lines/employee) 2008	6	1350.63	573.71	855.52	2144.82
Productivity (revenue/employee) 2008	6	292234.5	139097.2	98580.94	457683.4
monthly subscription for residential service in \$ 2008	6	7.71	5.13	2.17	15.48
Price of a 3-minute fixed local call at peak rate in \$ 2008	6	.1	.09	.02	.26
Mobile prepaid price per minute at peak rate 2008	6	.69	.63	.12	1.57
Mobile 3 minute local call price at peak rate in \$ 2008	6	.3	.25	.07	.63
MENA countries without BTA agreement					
Fixed penetration 2008	8	17.69	8.93	4.25	34.31
Mobile penetration 2008	8	79.56	42.55	28.48	137.58
Productivity (lines/employee) 2008	4	958.01	444.63	672.54	1617.65
Productivity (revenue/employee) 2008	4	411460.2	280004.1	72345.78	730683
monthly subscription for residential service in \$ 2008	8	5.03	3.94	.03	9.29
Price of a 3-minute fixed local call at peak rate in \$ 2008	8	.04	.04	0	.097
Mobile prepaid price per minute at peak rate 2008	8	.51	.38	.197	1.41
Mobile 3 minute local call price at peak rate in \$ 2008	8	.19	.12	.09	.47

Table 8: Log Fixed Penetration Estimation 2009

VARIABLES	SUR								
	Fixed Index	Fixed Competit ion	Fixed Penetrati on	Fixed Index	Fixed Competit ion	Fixed Penetrati on	Fixed Index	Fixed Competit ion	Fixed Penetrati on
Polity variable	-0.019*** (0.004)			-0.019*** (0.006)			-0.017*** (0.005)		
GDP (in log)	0.022 (0.02)	0.105** (0.05)	0.096* (0.05)	0.02 (0.02)	0.087* (0.05)	0.09* (0.05)	0.032* (0.02)	0.08 (0.05)	0.137** (0.05)
Population Density (in log)	-0.026 (0.02)	0.08 (0.05)	0.06 (0.05)	-0.025 (0.019)	0.09* (0.05)	0.06 (0.05)	-0.023 (0.019)	0.079 (0.05)	0.06 (0.05)
GDP per capita (in log)	-0.04 (0.03)	-0.04 (0.07)	0.956*** (0.08)	-0.04 (0.0299)	0.014 (0.076)	0.97*** (0.08)	-0.026 (0.0287)	-0.064 (0.08)	1.004*** (0.08)
BTA agreement	-0.2*** (0.06)	0.35** (0.17)	-0.03 (0.179)	-0.2*** (0.06)	0.34** (0.17)	-0.03 (0.18)	-0.202*** (0.06)	0.36** (0.17)	-0.05 (0.18)
Fixed Index		-1.04*** (0.25)	-0.471* (0.28)		-0.79*** (0.26)	-0.41 (0.28)		-0.92*** (0.26)	-0.64** (0.28)
Fixed competition			-0.047 (0.105)			-0.06 (0.1)			-0.02 (0.1)
MENA dummy				-0.001 (0.09)	-0.46** (0.2)	-0.13 (0.23)			
Developing dummy							0.11 (0.09)	-0.26 (0.23)	0.45* (0.24)
Observations	96	96	96	96	96	96	96	96	96
R-squared	0.36	0.36	0.79	0.36	0.39	0.79	0.37	0.37	0.79

Note. Constant term not reported. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Log Mobile Penetration Estimation 2009

VARIABLES	SUR								
	Mobile Index	Mobile Competition	Mobile Penetration	Mobile Index	Mobile Competition	Mobile Penetration	Mobile Index	Mobile Competition	Mobile Penetration
Polity variable	-0.014*** (0.003)			-0.014*** (0.004)			-0.012*** (0.004)		
GDP (in log)	0.015 (0.014)	0.067* (0.04)	-0.014 (0.03)	0.015 (0.014)	0.06 (0.037)	-0.01 (0.0271)	0.02 (0.015)	0.06 (0.04)	0.03 (0.03)
Population Density (in log)	-0.02 (0.015)	-0.096** (0.04)	-0.012 (0.03)	-0.02 (0.015)	-0.09** (0.0409)	-0.0136 (0.0301)	-0.02 (0.015)	-0.096** (0.04)	-0.01 (0.03)
GDP per capita (in log)	-0.046** (0.02)	-0.16*** (0.06)	0.38*** (0.04)	-0.045** (0.02)	-0.13** (0.06)	0.371*** (0.0445)	-0.039* (0.022)	-0.17*** (0.06)	0.42*** (0.04)
BTA agreement	-0.11** (0.05)	0.091 (0.13)	0.1 (0.09)	-0.113** (0.0465)	0.077 (0.13)	0.109 (0.0911)	-0.12** (0.05)	0.0938 (0.13)	0.09 (0.08)
Mobile Index		-0.85*** (0.25)	-0.26 (0.19)		-0.69*** (0.26)	-0.312 (0.194)		-0.799*** (0.26)	-0.51*** (0.18)
Mobile competition			-0.01 (0.07)			-0.00139 (0.0724)			0.004 (0.07)
MENA dummy				-0.003 (0.0780)	-0.25 (0.17)	0.09 (0.12)			
Developing dummy							0.077 (0.07)	-0.097 (0.18)	0.48*** (0.12)
Observations	98	98	98	98	98	98	98	98	98
R-squared	0.32	0.18	0.64	0.32	0.197	0.64	0.329	0.18	0.69

Note. Constant term not reported. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Log Productivity Estimation 2009 (First proxy)

VARIABLES	SUR								
	Overall Telecom Index	Competition Index	Productivity	Overall Telecom Index	Competition Index	Productivity	Overall Telecom Index	Competition Index	Productivity
Polity variable	-0.017*** (0.004)			-0.024*** (0.007)			-0.013*** (0.005)		
GDP (in log)	0.018 (0.02)	-0.086* (0.05)	0.11 (0.069)	0.008 (0.02)	-0.11** (0.046)	0.15** (0.07)	0.03 (0.02)	-0.12** (0.05)	0.16** (0.07)
Population Density (in log)	-0.023 (0.02)	0.029 (0.04)	0.002 (0.06)	-0.02 (0.02)	0.04 (0.04)	-0.014 (0.06)	-0.0165 (0.0219)	0.02 (0.04)	0.01 (0.06)
GDP per capita (in log)	-0.03 (0.03)	0.05 (0.06)	-0.32*** (0.09)	-0.009 (0.035)	0.097 (0.06)	-0.39*** (0.096)	-0.0206 (0.0316)	0.027 (0.06)	-0.28*** (0.09)
BTA agreement	-0.2*** (0.07)	0.07 (0.15)	0.06 (0.22)	-0.206*** (0.07)	0.12 (0.15)	-0.02 (0.21)	-0.209*** (0.0656)	0.10 (0.15)	0.017 (0.21)
Overall Telecom Index		-1.298*** (0.26)	1.14*** (0.43)		-1.05*** (0.26)	0.89** (0.42)		-1.02*** (0.27)	0.88** (0.43)
Competition index			0.56*** (0.2)			0.66*** (0.2)			0.65*** (0.2)
MENA dummy				-0.16 (0.13)	-0.296* (0.16)	0.45* (0.23)			
Developing dummy							0.12 (0.099)	-0.32* (0.18)	0.44 (0.28)
Observations	51	51	51	51	51	51	51	51	51
R-squared	0.39	0.34	0.31	0.41	0.4	0.37	0.41	0.396	0.36

Note. Constant term not reported. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Log Productivity Estimation 2009 (Second proxy)

VARIABLES	SUR								
	Overall Telecom Index	Competition Index	Productivity	Overall Telecom Index	Competition Index	Productivity	Overall Telecom Index	Competition Index	Productivity
Polity variable	-0.015*** (0.004)			-0.02*** (0.007)			-0.0119** (0.005)		
GDP (in log)	0.006 (0.02)	-0.105** (0.05)	0.11 (0.08)	-0.005 (0.02)	-0.12** (0.05)	0.14* (0.08)	0.02 (0.02)	-0.13*** (0.05)	0.07 (0.08)
Population Density (in log)	0.0009 (0.02)	0.06 (0.05)	0.01 (0.08)	-0.002 (0.02)	0.06 (0.05)	0.004 (0.08)	0.0099 (0.02)	0.04 (0.05)	-0.006 (0.08)
GDP per capita (in log)	-0.03 (0.03)	0.09 (0.07)	0.299*** (0.11)	-0.002 (0.04)	0.12 (0.07)	0.244** (0.12)	-0.0177 (0.03)	0.06 (0.07)	0.27** (0.12)
BTA agreement	-0.297*** (0.07)	-0.01 (0.19)	-0.06 (0.28)	-0.28*** (0.07)	0.04 (0.18)	-0.15 (0.28)	-0.29*** (0.07)	0.04 (0.18)	-0.042 (0.28)
Overall Telecom Index		-1.45*** (0.31)	1.22** (0.55)		-1.22*** (0.32)	0.984* (0.55)		-1.16*** (0.33)	1.37** (0.56)
Competition index			0.85*** (0.23)			0.91*** (0.23)			0.8*** (0.24)
MENA dummy				-0.18 (0.12)	-0.24 (0.17)	0.31 (0.26)			
Developing dummy							0.12 (0.11)	-0.32 (0.22)	-0.35 (0.35)
Observations	41	41	41	41	41	41	41	41	41
R-squared	0.52	0.42	0.48	0.55	0.45	0.5	0.54	0.46	0.49

Note. Constant term not reported. *** p<0.01, ** p<0.05, * p<0.1.

Table 12: Log Fixed Prices Basket Estimation 2009

VARIABLES	SUR								
	Fixed Index	Fixed Competition	Fixed Price Basket	Fixed Index	Fixed Competition	Fixed Price Basket	Fixed Index	Fixed Competition	Fixed Price Basket
Polity variable	- (0.004)			-0.02*** (0.01)			- (0.005)		
GDP (in log)	0.02 (0.02)	0.08* (0.05)	0.03 (0.06)	0.02 (0.02)	0.07 (0.05)	0.01 (0.06)	0.03 (0.02)	0.07 (0.05)	-0.06 (0.06)
Population Density (in log)	-0.02 (0.02)	0.12** (0.05)	-0.13* (0.07)	-0.03 (0.02)	0.12** (0.05)	-0.11* (0.07)	-0.02 (0.02)	0.12** (0.05)	-0.14** (0.07)
GDP per capita (in log)	-0.05* (0.03)	0.05 (0.08)	0.26*** (0.1)	-0.05 (0.03)	0.09 (0.08)	0.34*** (0.098)	-0.04 (0.03)	0.037 (0.09)	0.13 (0.1)
BTA agreement	-0.21*** (0.06)	0.33* (0.18)	0.09 (0.23)	-0.22*** (0.06)	0.34* (0.18)	0.13 (0.22)	-0.22*** (0.06)	0.34* (0.18)	0.16 (0.22)
Fixed Index		-0.89*** (0.26)	-1.21*** (0.35)		-0.7*** (0.27)	-0.83** (0.34)		-0.84*** (0.27)	-0.83** (0.33)
Fixed competition			0.02 (0.14)			-0.04 (0.13)			-0.01 (0.13)
MENA dummy				-0.05 (0.12)	-0.35 (0.22)	-0.83*** (0.27)			
Developing dummy							0.07 (0.0949)	-0.13 (0.24)	-1.01*** (0.28)
Observations	87	87	87	87	87	87	87	87	87
R-squared	0.36	0.39	0.32	0.36	0.41	0.39	0.37	0.4	0.42

Note. Constant term not reported. *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Log Mobile Prices Basket Estimation 2009

VARIABLES	SUR								
	Mobile Index	Mobile Competition	Mobile Price basket	Mobile Index	Mobile Competition	Mobile Price basket	Mobile Index	Mobile Competition	Mobile Price basket
Polity variable	-			-			-		
	0.014*** (0.003)			0.014*** (0.004)			0.011*** (0.004)		
GDP (in log)	0.01 (0.01)	0.067* (0.038)	0.06 (0.05)	0.014 (0.01)	0.06 (0.04)	0.06 (0.05)	0.02 (0.01)	0.06 (0.04)	0.0003 (0.05)
Population Density (in log)	-0.01 (0.02)	-0.09** (0.04)	0.106** (0.05)	-0.01 (0.02)	-0.08** (0.04)	-0.11** (0.05)	-0.01 (0.02)	-0.09** (0.043)	0.11** (0.05)
GDP per capita (in log)	-0.05** (0.02)	-0.15** (0.06)	0.19** (0.08)	-0.05** (0.02)	-0.12* (0.07)	0.19** (0.08)	-0.04* (0.02)	-0.15** (0.07)	0.13 (0.08)
BTA agreement	-0.14*** (0.05)	0.11 (0.14)	-0.18 (0.16)	-0.14*** (0.05)	0.09 (0.14)	-0.18 (0.17)	-0.14*** (0.05)	0.11 (0.14)	-0.15 (0.16)
Mobile Index		-0.89*** (0.27)	1.03*** (0.35)		-0.74*** (0.28)	1.02*** (0.35)		-0.88*** (0.28)	-0.68* (0.35)
Mobile competition			0.05 (0.13)			0.04 (0.13)			0.04 (0.12)
MENA dummy				-0.01 (0.08)	-0.22 (0.17)	-0.004 (0.21)			
Developing dummy							0.097 (0.07)	-0.01 (0.19)	-
Observations	92	92	92	92	92	92	92	92	92
R-squared	0.35	0.19	0.30	0.35	0.20	0.30	0.37	0.19	0.35

Note. Constant term not reported. *** p<0.01, ** p<0.05, * p<0.1.