POLITICAL DETERMINANTS OF COMPETITION IN THE MOBILE TELECOMMUNICATION INDUSTRY

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Abstract

We study how political factors can shape competition in the mobile telecommunication sector. We show that the way a government designs the rules of the game has an impact on concentration, competition, and prices. Pro-competition rules reduce prices, but do not hurt the quality of services or investments. More democratic governments tend to design rule that are more pro-competition, while more politically connected operators are able to distort the rules in their favor, restricting competition. Government intervention has large redistributive effects: U.S. consumers would gain $65bn ($44bn) a year if U.S. mobile service prices were in line with Germany (Denmark).

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Corporate political connections are pervasive across the world (Faccio, 2006), and have been found to add to firm value through a variety of channels: preferred access to credit in normal times (Sapienza, 2003; Khwaja and Mian, 2005, Houston, Jiang, Lin, and Ma, 2014) and in times of financial distress (Faccio, Masulis, and McConnell, 2005); the award of procurement contracts and licenses (Goldman, Rocholl, and So, 2013, Beckman, 1999, Faccio and Hsu, 2017, Bunkanwanicha and Wiwattanakantang, 2009); influence over the antitrust review process (Mehta, Srinivasan, and Zhao, 2017); and leniency in enforcement (Fulmer, and Knill, 2012; Yu and Yu, 2011). A salient aspect that has been overlooked, and which we investigate in this paper, is the impact of corporate political connections on the degree of product market competition.

While product market competition is the endogenous outcome of market forces, it can be seriously affected by government regulation. Normally, we think about regulation as a barrier to entry that reduces competition (Stigler, 1971). Yet, government intervention can make a market more competitive as well and not just through antitrust intervention. Consider number portability in the mobile phone industry. Assigning the property of a phone number to a customer, rather than to the phone company, reduces switching costs and increases competition.

In this paper we study whether government intervention on competition is designed to serve the public interest (Pigou, 1938) or is distorted by political connections to favor the incumbents. We do so in the context of the mobile telecommunication industry, not because this problem is limited to the mobile telecommunication industry, but because it is easier to identify it in this industry. The mobile telecommunication industry is regulated at the country level in all of the countries in the world, and it is also heavily dependent upon a scarce resource controlled by the government: the electromagnetic spectrum used to transmit data. Thus, if there is a sector where the government can affect the degree of competition, the mobile telecommunication industry is one. Last but not least, for this industry there are high quality data available on market concentration and prices around the world. The arguments developed here, however, could easily apply to other industries like banking, insurance, and even generic digital platforms.

Employing data from the International Telecommunication Union (ITU) and Groupe Speciale Mobile Association (GSMA) encompassing 148 countries, we show that, when a government chooses rules that are more pro-competition, concentration and prices are lower. This is true both in the cross-section and in the time-series. In the cross-section, number portability on average reduces the market share of the two largest operators in a given country by

4 percentage points, reduces the price of a mobile-broadband internet plan with a 1GB volume of data by US$10 per month, and reduces the operators' EBIDTA margin by 4 percentage points. In the time series, the biggest change in the pro-competition regulatory score in our sample is Israel, whose regulatory score increased from 17.5 in 2010 to 52 (out of 88) in 2012. During the same period in Israel, the average revenue per user dropped by 33% and the local operators' EBITDA Margin dropped by 10 percentage points.[1]

Another large change in regulation happened in Mexico. Prompted by an OECD study showing that "insufficient competition has resulted in poor market penetration" and produced a welfare loss of $129.2 billion, in 2013 the Mexican government introduced a telecommunication reform aimed at promoting competition. Between 2014 and 2016, the wealth of Mexican telecom tycoon Carlos Slim dropped from US$79.6 billion to US$47.1 billion, at least in part because the "shares of his pan-Latin American mobile phone operator, America Movil, took a beating in 2015 and early 2016 in the wake of new Mexican telecom regulations."[2] Importantly from the Mexican consumers' standpoint, between 2012 and 2016, the average revenue per user dropped by 47% and mobile traffic increased by 59%. All these results indicate that regulation affects salient market outcomes.

One alternative interpretation of our finding so far is that intervention reflects consumeristic biases of governments, which try to reduce prices to gain popularity even at the cost of jeopardizing quality and investments. Yet, we do not find any evidence that rules that are more pro-competition lead to lower quality of service or decrease investments in the mobile sector. If any, the evidence is mildly supportive of the opposite claim. Thus, pro-competition rules clearly benefit consumers, while hurting producers.

We next study the political economy of pro-competition rules. We find that governments tend to be more favourable towards competition in more democratic countries, where citizens' preferences are likely to carry more weight and where politicians can buy consensus by introducing a pro-competitive regulation that lowers prices. By contrast, we find that rules appear to be tilted more in favor of incumbent carriers, limiting competition and new entry, when incumbents are more politically connected. Thus, regulation appears to be the outcome of the

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[1] Based on data from © GSMA Intelligence (2015).
[2] http://www.forbes.com/profile/carlos-slim-helu/?list=billionaires 2016.

pressure of multiple constituencies (Peltzman, 1976). These findings suggest a novel channel through which political connections can affect firm value.

Besides regulation, governments can also use antitrust enforcement to promote more competition. Unfortunately, it is more difficult to codify the level of antitrust activism across a large set countries and use it in empirical analysis. Therefore, we resort to a mini-case study of countries at very similar levels of income per capita and regulation, but different levels of antitrust activism. To this end we exploit the Atlantic divide between the United States and Europe. As shown by the European Union (EU) antitrust case against Google, the European Antitrust Authority is more pro-active than its U.S. counterpart. Thus, we compare the level of prices and quality between the U.S. and the two EU countries with levels of regulation closest to the United States (76.5): Denmark (76) and Germany (78.5).

The United States exhibits much higher average revenues per unique subscriber ($67.6 vs $31.01 in Denmark and $23.28 in Germany)[3] and a higher price for a standard basket of mobile phone calls and SMS messages: $35.62 vs $7.50 in Denmark and $17.47 in Germany. If U.S. consumers could enjoy the Danish (German) level of competition they would gain respectively $44bn ($65bn) a year. Yet, unlike the case of pro-competition rules, we do find that higher prices in the United States are associated with better quality. Thus not all of the computed difference represents a pure transfer: part of it might be a compensation for more investments.

To check the extent to which higher prices represent a pure transfer we look at the market capitalization of U.S. operators. Lindenberg and Ross (1981) associate the difference between the market value of assets and the book value of assets to the abnormal profits a firm can earn as a result of some stable market power position. We can apply this logic to the four major U.S. carriers (AT&T, Verizon, T-Mobile, and Sprint) to check whether any part of the transfer is capitalized in the market valuations. If all the $44bn ($65bn) difference went to shareholders, it could explain the entire difference between market and book value of the industry with discount rates between 8.6% and 14.6%. While this is certainly not proof that the entire amount of the tax imposed on consumers through higher prices is transferred to shareholders, it is certainly consistent with this hypothesis.

We are obviously not the first to study the effect of regulation on market outcomes. In

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[3] Based on data from © GSMA Intelligence (2015).

particular, Wallsten (2001), Alesina, Ardagna, Nicoletti, and Schiantarelli (2005), and Duso and Seldeslachts (2010) have studied the effect of privatization and lifting of restrictions in investments in the telecommunication industry. All of these papers look at the effect of deregulation and privatizations in the early phase of the development of the mobile industry. Our paper, instead, looks at the effect on competition and prices of active measures of the government to promote competition (like number portability). In this respect, our paper is similar to Cho, Ferreira, and Telang (2016). Their contemporaneous paper, however, limits their analysis to number portability and Europe.

We are also not the first to relate regulation to political institutions. Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002) document that countries with more democratic governments have less regulation of entry. This result could be interpreted as more democratic countries have less regulation or more democratic countries are more attentive to consumers' interest. Our finding confirms the latter interpretation. Consistently, Li and Xu (2004) document that democratic countries display a higher propensity to privatize incumbent telecom operators and allow more market entry. Duso and Röller (2003) and Duso and Seldeslachts (2010) document that countries with majoritarian electoral systems display higher levels of competition, while countries with presidential systems display less competition. Finally, Spiller (1990) and Henisz and Mansfield (2016), among others, investigate the role of various interest groups in shaping regulations. In this paper we provide novel evidence on the role that corporate political connections play in shaping regulatory choices.

The rest of the paper proceeds as follows. Section 1 presents the data used. Section 2 describes the uniqueness of the mobile telecommunication industry and the abnormal price variability across countries. Section 3 analyzes how regulatory choices affect concentration, competition, and prices. Section 4 investigates whether regulatory choices affect the quality of service, investments, and wages. Section 5 investigates the various hypotheses that could explain why some countries make regulatory choices that do not foster competition. Section 6 attempts to estimate the welfare transfer produced by lower competition in the United States. Section 7 concludes.

1. The Data

In this section we present the various datasets used in this study. We restrict our analysis to countries covered in both the ITU and the GSMA databases. We exclude territories. In unreported tests, we verify and confirm that our conclusions are robust to including each and every country or territory with available data.

1.1. Regulatory Data

The regulatory data come from the International Telecommunication Union's (ITU) *ICT Regulatory Tracker*. ITU is the U.N. specialized agency for Information and Communication Technologies. It relies directly on statistics and information provided by national telecommunication agencies. The *ICT Regulatory Tracker* covers various aspects of policy and regulation in the telecommunication sector in 157 countries and territories (150 countries) for a period of 11 years, starting in 2003. The regulatory data were collected annually through the "World Telecommunication/ICT Regulatory Survey"[4] and through information gathered by the ITU via internal research. Data were collected, validated, and harmonized by the ITU, and then published.

The *ICT Regulatory Tracker* covers 50 indicators that reflect the answers to the questions in the regulatory survey. Each answer is codified on a 0 to 2 scale where 0 is given to the most anticompetitive regulation and 2 to the most competitive one. For example, if a country does not require mobile number portability the answer is coded as zero, if a country requires it but it is not necessarily available to all subscribers, the answer is coded as one. If a country requires it and it is available to all subscribers, the answer is coded as two.

These indicators need to be interpreted broadly, since the questions in the survey include the way property rights are allocated (e.g., number portability and auctions), the openness to foreign competition, the independence of the telecom regulator, and even the degree of competition. Some of these measures regard the telecommunication industry as a whole, not just the mobile sector.

The ITU presents an overall regulatory score, which corresponds to the sum of the 50 indicators. We subtract the scores of the answers to questions 37 through 42 from the overall

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[4] The survey can be retrieved at http://www.itu.int/en/ITU-D/RegulatoryMarket/Documents/ITU Telecommunication-Regulatory-Survey-2016_E.pdf.

regulatory score. We do so because those questions reflect competitive outcomes, rather than regulatory variables, and/or deal with the (government) ownership of the main fixed line operator. The variables' definitions are summarized in Table 1, while the summary statistics are provided in Table 2.

Following ITU we group the sub-scores into 4 clusters. Cluster 1, which pertains to the independence of the regulator, includes the answers to questions concerning the existence, independence, and accountability of the regulator (questions 1-10). Cluster 2 pertains to the power of the regulator (vs. the power of the government and/or the operators) (questions 11-21). Cluster 3, which pertains to the economies of scale, includes the answers to questions concerning the ease of entry in the sector, i.e., regulations that enable the sharing of fixed costs (questions 22-36). Cluster 4, which pertains to foreign competition, includes the answers to questions concerning whether foreign ownership in facilities-based operators, spectrum-based operators, local service operators/long-distance service operators, international service operators, internet service providers, and value-added service providers is allowed (restricted, or forbidden), as well as two questions concerning the existence of a concept of market dominance and the criteria used to establish market dominance (questions 43-50). As with the overall regulatory score, the answers to questions 37 through 42 are ignored when constructing the index for Cluster 4.

1.2. Measures of Concentration and Competition

Data on concentration and competition come from Groupe Speciale Mobile Association (GSMA) and ITU. GSMA is an association of nearly 800 operators and more than 250 companies in the broader mobile sector. It provides extensive global mobile data for 237 countries and territories: data cover every mobile operator group, network, and mobile virtual network operator in every country worldwide. Data are updated daily. The type of information available comprises: prices of services, operators' financial data, data traffic, and market data (e.g., market penetration rates, number of unique subscribers, etc.). GSMA has data available starting in 2000.

©GSMA Intelligence (2015) computes each operator's market share as "[t]otal connections at the end of the period, expressed as a percentage share of the total market connections." We use this measure to compute (1) C2, the sum of the market shares of the two

largest operators in a given country and quarter,[5] and (2) the Herfindahl-Hirschman Index, the sum of the squared market share across all operators in a given country and quarter. The Herfindahl-Hirschman Index ranges from 0 to 10,000, where 10,000 denotes a monopoly.

Additionally, the ITU's *ICT Regulatory Tracker* reports a classification of the overall level of competition (i.e., "monopoly," "partial competition," or "full competition") in (i) the local and long distance fixed line services, (ii) IMT (3G, 4G, etc.) services, (iii) cable modem, DSL, fixed wireless broadband, (iv) leased lines, and (v) international gateways (questions 37-41 in the ICT Regulatory Tracker). We add up the answers to those 5 questions to construct a qualitative measure of competition.

1.3. Data on Mobile Phone Prices and Margins

Data on mobile phone prices come from multiple sources. In our main analyses we rely on data from ITU and ©GSMA Intelligence (2015). The ITU data are collected through an annual questionnaire addressed to the government agencies responsible for the telecommunication/ICT industry. Price data submitted refers to those offered by the largest national operator in terms of market share. A strict set of rules is provided in order to improve the accuracy and the degree of homogeneity in cross-country comparisons. When there are missing values (especially for countries that do not reply to the questionnaire), the ITU collects the information from government agencies' websites and from the operators' annual reports.

From ITU we employ (1) the price of a mobile cellular standard basket consisting of a "monthly usage for 30 outgoing calls per month (on-net, off-net to a fixed line, and for peak and off-peak times) in predetermined ratios, plus 100 SMS messages" and (2) the price of "a mobile-broadband USB/dongle-based postpaid tariffs with 1GB volume of data." These measures reflect the same usage of mobile services across the different countries. These prices are from the ITU's *"Measuring the Information Society"* annual reports. The first price bundle is available since 2008. However, due to a change in the composition of the basket implemented by ITU in 2010, to ensure consistency and comparability we only use data for the 5-year period 2010-2014. The second price bundle is available starting in 2012. A benefit of these price bundles is that they allow comparing similar baskets of mobile services.

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[5] We do not use the perhaps more popular C4, the sum of the market share of the four largest operators, because the mobile phone industry is highly concentrated and C4 has a mean of 96%.

The second source for mobile data prices is GSMA. From this source we gather operators' financial data. We focus on two metrics: (1) ARPU (average revenue per user) by Connection is the "[t]otal recurring (service) revenue generated per connection per month in the period. Despite the acronym, the metric is strictly the average revenue per connection, not per subscriber" and (2) EBITDA Margin, defined as the "[t]otal operating profit in the period, before interest, tax, depreciation and amortisation, expressed as a percentage of total revenue." Note that these two metrics only reflect the revenues and costs for the mobile phone segment; additionally, for multinational operators the data are reported separately for each country. The GSMA data are available starting in 2000. These measures reflect the actual demand of mobile services (i.e., they allow for the number of minutes of calls, number of SMS etc. to vary across countries depending on actual usage).

To compare the international variability of mobile prices with that of other goods and services we use Numbeo.[6] With 2,687,888 prices in 5,846 cities, entered by 307,465 contributors, Numbeo claims to be the world's largest database of user contributed data about cities and countries worldwide. Data collection relies on users' inputs and manually collected data from different sources, like websites of supermarkets, governmental institutions, newspapers articles, surveys, taxi company websites, etc. In order to control for noise, Numbeo removes outlier prices observed within a certain area and at a point in time. Numbeo reports prices for dozens of commodities and services.

1.4. Quality of Service and Other Outcomes

To measure the quality of the mobile service, we use the percentage of total connections that are 3G and 4G, as well as the percentage of the total market geographic surface area that is covered with 3G and 4G services. These data come from GSMA. We supplement them with data on the advertised maximum theoretical download speed, in Mbit/s, associated with a 1GB USB/dongle-based mobile broadband prepaid plan, as reported in the ITU's "*World Telecommunication/ICT Indicators Database*," 19th edition, 2015.

From GSMA we also collect data on a number of additional outcomes such as (1) the "total capital expenditure incurred in the period, including both intangible and tangible assets",

[6] http://www.numbeo.com

scaled by the "[t]otal revenue generated in the period, including both recurring (service) and nonrecurring revenue"; (2) the average number of "[t]otal deployed, and active, base stations on the network at the end of the period," scaled by revenues; (3) the number of "[t]otal employed head count (fulltime equivalent) for the telecoms business at the end of the period, and if applicable, only within mobile operations," scaled by revenues; and (4) "[o]perating expenditure incurred in the period related to the cost of employees, including salary costs," also scaled by revenues.

1.5. Auction Data

Spectrum auction data are from DotEcon Ltd, a U.K.-based consulting firm founded and owned by two former academic economists.[7] As of October 18, 2016, The *Spectrum Awards Database* assembled by DotEcon covered information on 15,186 licenses from 414 spectrum awards in 96 countries and territories. Those awards cover the frequency bands between 300MHz to 300GHz, which include the bands used for mobile telephones (e.g., 2G, 3G, and 4G services) as well as fixed and broadband wireless access. The database includes information on the date, type (e.g., auction, beauty contest, etc.) and duration of each license; the license price(s) in local currency; the spectrum endowment; the names of the license winner(s); a number of details about the award processes; as well as demographic and economic indicators.

The very first spectrum auction was held by the U.S. Federal Communications Commission **(**FCC**)** in 1994.[8] Not surprisingly, "*Auction 1 - Nationwide Narrowband (PCS)*" is also the first auction included in the DotEcon database. Based on the information provided in the DotEcon database we estimate that, globally, governments raised over $800bn from the spectrum auctions held through the end of 2014.

To compare the revenues raised by governments we rely on the license prices in local currency as provided by DotEcon. We convert those prices into U.S. dollars using the average exchange rate for the quarter (or year, if prior to 2000) in which the auction was held. We assume that a given government raised no revenues from auctions if DotEcon does not report any spectrum auctions in that given country. Exchange rates for each quarter during 2000-2015 are

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[7] http://www.dotecon.com/

[8] In the U.S., prior to 1982, the FCC used comparative hearings to allocate spectrum licenses. Lotteries were used between 1982 and 1993.

from GSMA. Average exchange rates for the years prior to 2000 are from the World Bank's "World Development Indicators" and Datastream.

For each country we determine the total revenues (in U.S. dollars) raised from all spectrum auctions covered in DotEcon through December 2014 (the last year for which we have data on telecom prices data from ITU). We alternatively consider the total revenues raised since 1999 (when the first 3G auction was held) and since 2011 (when the first 4G auction was held).[9]

1.6. Institutional Variables

As a measure of democracy we use an additive eleven-point scale (0-10) index from Polity IV. It captures the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders, the existence of institutionalized constraints on the exercise of power by the executive, and the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation.

As a second, alternative measure of democracy, we use constraints on the executive. This Polity IV variable refers to the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities. Such limitations may be imposed by any "accountability groups" – in Western democracies these are usually legislatures. Finally, Polity IV's political competition refers to the extent to which alternative preferences for policy and leadership can be pursued in the political arena.

From the World Economic Forum (WEF) we gather data on the prevalence of tax evasion in each country (in 2002). The WEF's index is based on surveys of corporate executives' assessments concerning the prevalence of tax evasion in their home country. We gather data on the corporate income tax rate and on the value added tax rates applicable to mobile operators from Deloitte's "Global Mobile Tax Review 2011" and Wikipedia. From the "Global Mobile Tax Review 2011" we also obtain data on the overall level of taxes as a proportion of the total cost of mobile ownership. The taxes reflected in this measure include consumer taxes such as VAT, GST and custom duties; telecom and/or mobile-specific taxes such as import taxes on

[9] We exclude spectrum actions whose only use is Fixed Wireless Access (FWA). Note that while DotEcon attempts to provide comprehensive coverage of spectrum auctions, it does not cover the revenues raised by governments through other allocation mechanisms, such as lotteries, comparative hearings, or private negotiations. While we are unaware of any database that provides comprehensive coverage of those other allocation mechanisms, the data on capital expenditures from GSMA (which includes tangible and intangible capital expenditures) should reflect those (and other) intangible capital expenditures.

handsets and other mobile devices; taxes for using mobile services; and so forth. The total cost of mobile ownership includes the cost of the handset, the connection cost, any rental expenses, and the cost of calls and SMS usage.

As a measure of corruption we use the Heritage Foundation's measure of corruption. This is based primarily on Transparency International's Corruption Perceptions Index (CPI), for 2011. The CPI is based on a 10-point scale in which a score of 10 indicates very little corruption and a score of 0 indicates a very corrupt government. In scoring freedom from corruption, the Index converts the raw CPI data to a scale of 0 to 100 by multiplying the CPI score by 10. For example, if a country's raw CPI data score is 5.5, its overall freedom from corruption score is 55. For countries that are not covered in the CPI, the Heritage Foundation determines the score by using the qualitative information from internationally recognized and reliable sources. This procedure considers the extent to which corruption prevails in a country. The higher the level of corruption, the lower the level of overall economic freedom and the lower a country's original corruption score. We rescale the index (=100-original index), so that a higher number denotes higher corruption.

The control variables, such as the logarithm of per capita GDP, the logarithm of population, the population density, and the rate of inflation are all from the World Bank's "World Development Indicators."

1.7. Political Connections

Extending Faccio (2006), we measure political connections by computing the fraction of top employees (including executives and board members) of each country's mobile phone operators who serve (or served) as heads of state, government ministers, or members of parliament in their country, or worked (in the government) for anybody in those positions. To do so, we first obtain the biographies of individuals covering top corporate positions in any of the "Telecommunication Services" firms covered in Capital IQ.[10] The Capital IQ sample includes

[10] The positions are: Chief Executive Officer; Co-Chief Executive Officer; Chairman of Management Board; Co-Chairman of Management Board; President; Co-President; Vice Chairman of Management Board; Co-Owner; Top Key Executive; Chief Financial Officer; Co-Chief Financial Officer; Chief Operating Officer; Co-Chief Operating Officer; Member of Management Board; Chief Investment Officer; Co-Chief Investment Officer; Chief Accounting Officer; Head of Investment Banking; Head of Corporate Finance; Head of Research; Chief Technology Officer; Chief Information Officer; Chief Scientific Officer; Chief Administrative Officer; Head of Investor Relations; Chief Compliance Officer; Chief Legal Officer; Head of Corporate Communications; Head of Corporate Development;

the biographies of 55,656 unique individuals affiliated with 5,890 firms in the "Telecommunication Services" industry, broadly defined. These include fixed line, mobile, and internet operators, as well as other firms. Capital IQ does not indicate whether a given company is a mobile phone operator. Therefore, we manually match the names of the firms in Capital IQ with the mobile telecom operators in the GSMA database. The matching yields a sample of 6,121 individuals affiliated with 410 mobile telecom operators with bios in Capital IQ, as of July 2015, and financial data in GSMA.

We employ a C# text parsing program to identify whether these individuals have political experience. To identify chiefs of state and government ministers we use the "political titles" reported in the "Chiefs of State and Cabinet Members of Foreign Governments" directory published by the CIA (https://www.cia.gov/library/publications/world-leaders-1/index.html). Examples of such titles include Emperor, Eternal General Secretary, Eternal President, Secretary of Commerce, Secretary for Communications, and Supreme Leader. We supplement the CIA database with the names of all Presidents, Chancellors, Chairmen, and Emirs ruling as of or after 1980, identified from http://www.rulers.org/index.html.

The parsing program extracts any sentence listing the political titles described above. We then read each of those sentences to verify that the person in question indeed covered a political position. We include both current and past political roles. Examples of political connections include (1) Laura D'Andrea Tyson (Board Member of AT&T Inc.) who, according to Capital IQ, "is a Member of President Barack Obama's Economic Recovery Advisory Board (PERAB)… [and] served as National Economic Adviser to the President of the United States from 1995 to 1996 and Key Architect of President Clinton's domestic and international policy agenda… [and] is a member of Secretary Hillary Clinton's Foreign Affairs Policy Board"; and (2) William E. Kennard (also Board Member of AT&T Inc.) who, according to Capital IQ, "is a Member of Secretary of State John Kerry's Foreign Affairs Policy Board and U.S. Department of State Foreign Policy Advisory Board."

Head of Marketing; Head of Sales; Head of Human Resources; Senior Key Executive; Controller; Secretary; Treasurer; Unit CEO; Unit President; Other Key Executive; Assistant Secretary; Assistant Treasurer; Consultant; Administrative Professional; Corporate Communication Professional; Corporate Development Professional; Equity Analyst; Finance and Accounting Professional; Fixed Income Analyst; Human Resources Professional; Investment Banking Professional; Investment Professional; Investor Relation Professional; Legal Professional; Marketing Professional; Operations Professional; Other Analyst; Other Professional; Sales Professional; and Technology Professional.

We use this information to build an indicator denoting whether a given individual held a political position at any point in her life. For each country, we then compute the fraction of individuals with political experience across all operators and employ that as a measure of political connections. Note that this variable is static.

2. Uniqueness of the Mobile Telecommunication Industry

2.1 Why the Mobile Telecommunication Industry Is Different

Inside the European Union there is unrestricted circulation of goods, services, capital, and people. In the subgroup of EU countries that signed the Schengen Treaty, even border controls have been removed, so travelling by car from Slovenia to Italy or from France to Belgium appears as seamless as travelling from Massachusetts to Rhode Island. Yet, there is a major difference: every time one crosses a national border in Europe the roaming company of the mobile phone changes. In spite of the European integration process, the mobile telecommunication industry remains segmented at the national level. This is not unique to Europe: throughout the world, the mobile telecommunication industry remains very much segmented by country.

The historical origins of this segmentation are complex. In part, it is a carryover of the national regulation of the wireline communication industry. The mobile telecommunication industry sprouted from the wireline communication industry in the early 1990s. While the natural monopoly and military strategic considerations of the wireline industry do not apply to wireless, being part of a regulated industry caused mobile telecommunication to be regulated as well.[11]

The governments' desire to collect tax revenues by auctioning off the right to use the spectrum played a big role in maintaining regulation of the industry. While the total number of

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[11] The fixed-line telecom markets in the nineteenth century were, in many countries, relatively competitive (Kingsbury, 1915, Wallsten, 2005). As pointed out by Wallsten (2005), the structure of the fixed-phone market was, at least in part, the heritage of how countries had structured the ownership of the telegraph service and how they viewed telephony versus telegraphy. Despite the fact that electrical telegraphs were in the mid-1800s mostly employed for military service, their ownership was not always in government hands. Denmark and Sweden were two notable countries in which telegraphs were not state-owned. At the turn of the twentieth century, Denmark, Sweden, and Norway were also the three European countries with the most pro-competitive regulations. Strikingly, by 1920 Sweden had almost 200 telephone networks. Those three countries also exhibited the highest telephone penetration in Europe.

spectrum bands available is determined by physics, the actual number available (after military and police uses have been taken out) is very much a political decision.

Finally, governments like to retain some control of wireless services to facilitate wiretapping both for military and police purposes.

For all these reasons, the mobile industry tends to be quite heavily regulated. Does this regulation affect the degree of competition? Before answering this question, we want to show that this amount of regulation does indeed make the mobile industry different from most others, at least in terms of price variability across countries.

2.2 International Price Variability

While travelling we have all experienced very different dollar prices for an identical product (a sandwich or a bottle of water) in different countries. One reason for this is the difference between flexible wholesale prices and more sticky retail prices, a difference well illustrated by the *The Economist's* "Big Mac" index, which compares the price of the McDonald's hamburger around the world as a measure of temporary currency over or undervaluation.

Another reason is that while water, bread, and meat are tradable goods, a sandwich or a bottle of water available to individual consumers is a bundle of goods, some tradable (like water, bread, and meat) and some not (like rent and local labor). Thus, differences in labor cost or in the costs of some inputs, possibly driven by specific geographical constraints, is another reason for this price variation.

Yet, there is a third reason why prices might be different: the different degree of competition of local markets. If the production cost is similar across countries, competition should lead to greater homogeneity of the retail price for the same product.

To illustrate how competitive conditions vary widely around the world, in Table 3 we compare the international price variability of different products and services, by exploiting the Numbeo dataset. In column 1 we consider the dollar prices. To account for possible differences in purchasing power parity, in column 2 we adjust the prices for differences in purchasing power parity across countries. In column 3 we perform this standardization using the McDonald's index, i.e., the local price of a Big Mac. We group all of the goods and services reported by

Numbeo into three categories: tradable, non-tradable non-regulated, and regulated (which are all non-tradable).

In Table 3 we compute the ratio of the 95th percentile of the distribution of prices for an item with the 5th percentile and then we average these ratios across commodities. Contrary to the Law of One Price, we find that prices – even purchasing power parity adjusted prices – vary greatly across countries: the 95th percentile of the distribution is roughly four times the 5th percentile. This is true not only in the tradable sector, but in the non-tradable sector (3.5) as well. Yet, it is even truer in regulated sectors: in these sectors the 95/5 ratio is 6.7, while in the telecom sector it is 7.5.

Thus, in regulated industries (and telecom in particular), prices vary more across countries, even after adjusting for differences in purchasing power parity. Since these differences cannot be easily explained in terms of differences in adjustment costs, they might be due to differences in the degree of competition. We will now explore where these differences in the degree of competition come from.

2.3 Why Differences in Competition

One hypothesis – often encountered in the lobbying material of the mobile operators – is that excessive competition reduces not only prices but also the capacity of the industry to invest in technology. According to this hypothesis, reduced competition enforcement is a policy variable to obtain more investment and higher quality of service in the mobile sector. In other words, regulations that restrict competition could reduce market failures by ensuring that operators provide the socially desirable quality of service and investment (Pigou, 1932).

A second hypothesis is that governments want to restrict competition so as to maximize the revenues they raise in spectrum auctions. A variation of the above argument is that governments do not want to promote full competition because they can raise more revenues by taxing monopoly (or oligopoly) profits. If this motivation was important, it would more likely play a role in countries where it is difficult to raise other forms of taxes (because of bad administration or tax evasion) or where profits are taxed more than consumption.

A final alternative is that regulation is the outcome of the pressure of multiple constituencies (Peltzman, 1976). On the one hand, the operators want to restrict competition to make more profits. Operators may be able to capture the regulator to extract rents for themselves.

According to this view, by restricting competition and increasing profits, regulations serve the interest of operators (Tullock, 1967, and Stigler, 1971). On the other hand, consumers want lower prices. Consistent with this hypothesis, governments would tend to be more favorable towards competition in more democratic countries, where citizens' preferences are likely to carry more weight.

3. Concentration, Prices, and Regulation

In Table 4, as a preliminary step, we explore how different rules of the game affect concentration, prices, and margins. That is, we start our analysis by documenting that the regulatory choices that we investigate have salient implications for consumers. As dependent variables in the various columns we have several measures of concentration, competition, and prices of mobile phone services. Besides some control variables, our main explanatory variable is a measure of how the rules existing in a country promote competition. Our first of such measures is the original 50-items ITU measure of regulation, where we have subtracted the answers to questions 37-41, which concern the assessment on the level of competition, as well as the answer to question 42, regarding the ownership status of the main fixed line operator. The overall regulatory score varies greatly across countries, ranging from 12 to 84.

In all of the cross-sectional models that follow, we compute the average of each variable during 2010-2014 (or a shorter period, depending on data availability). To mitigate the impact of outliers, we winsorize the price data and the financial variables at the 5^{th} and 95^{th} percentiles. (We confirm that the results are robust using the raw data.) To increase comparability in the international setting that we are employing prices are purchasing power parity adjusted in all following analyses using the World Bank (GDP) conversion factors.

As control variables we use the logarithm of per capita GDP (as a measure of economic development), the logarithm of population (as a measure of the potential size of the market), the level of population density (as a measure of the cost of serving the customers), and the level of inflation. Controlling for inflation is very important when the dependent variable is a nominal price level as in columns 5 and 6. Since in the cross-sectional specifications we are taking 5-year averages, nominal variables tend to appear lower in high-inflation countries. Hence we correct for average inflation. We insert this variable in the other specifications only for consistency, but excluding it does not change our conclusions.

In Table 4.A we report the cross-sectional OLS results. Higher values of the regulatory score (i.e., rules that are more pro-competition) are associated with lower levels of concentration, whether we measure it as C2 or with the Herfindhal index. The coefficient is statistically different from zero when concentration is measured with the Herfindhal index, but not when it is measured as C2 (probably due to the lack of variation in this measure). One standard deviation increase in the regulatory score is associated with 1/7 of a standard deviation decline in the Herfindhal Index.

Rules that are more pro-competition are also associated with higher levels of competition, as measured by the ITU. One standard deviation increase in the regulatory score is associated with a 1/3 of a standard deviation increase of the ITU measure of competition. The ITU convention is to replace an observation with a zero when the answer for a country is missing. We compute the score with and without this convention (columns 3 and 4), with similar results. This correlation is not surprising: it is just a check that ITU is measuring rules and outcomes consistently.

The same pattern is present when we use prices or profit margins of the mobile sector as left hand side variables. Higher values of the regulatory score are associated with lower prices and lower margins. The negative coefficient is statistically different from zero for three of the four measures. One standard deviation increase in the regulatory score is associated with 1/5 of a standard deviation decline in the price of mobile internet services. This result is in contrast to Duso (2005) who finds no effect of tariff regulation on prices in the U.S. mobile telecommunication industry in the 1980s.

In Table 4.B we use all of the panel data from 2003 to 2013 (for some specific variables and/or countries the time series is shorter due to lack of data). The specification is the same as in Table 4A, but we include country fixed effects. The pattern of the results is very similar. In fact, the statistical significance of the impact of the regulatory score on concentration and competition is stronger, while that of the impact of the regulatory score on prices and margins is slightly weaker. In particular, in Mexico, in the period 2012-2016 (i.e., around the introduction of the telecom reforms that were prompted by the OECD study mentioned in the introduction), the annual after-tax EBIT of Carlos Slim's Telcel (América Móvil's wireless telephone carrier) dropped by $768m. At a 10% discount rate this drop implies a reduction in value of $7.7bn. While Slim owns only 85% of América Móvil, the Mexican cell phone carrier represents only

part of Slim's investments in the Mexican telecommunication industry. Along the same line, Israel, the country that experienced a dramatic increase in the regulatory score during 2010-2012 saw the ARPU drop by 33% and EBIDTA margin of mobile operators drop by 10 percentage points during that period.

In unreported regressions we rerun the cross-sectional estimations by using the various subcomponents of the ITU regulatory score: independence of regulator, power of regulator, economies of scale, and foreign competition. All of these sub-components have effects on concentration, competition, prices, and margins similar to that of the overall index. The level of statistical significance varies across specifications, but we can not identify any single cluster as more or less important.

We then repeat the same exercise with each single sub-score. In the cross-section, the three measures that appear more important in reducing concentration and enhancing competition are (1) the portability of the mobile number, (2) the tradability of the spectrum licenses, and (3) the openness to foreign entry. The three measures that appear more important in reducing prices and margins are (1) the availability of voice over the internet, (2) the openness to foreign entry, and (3) number portability. These results are presented in Tables 3C-3F.

The results in this section show that, both in the cross-section and in the time-series, the regulatory variables used in this study explain salient market outcomes. This, in turn, makes it worthwhile attempting to understand the possible reasons why some countries opt for regulations that do not appear to promote competition. (This further investigation would not be warranted if the regulations in questions were "irrelevant" for market outcomes.)

Before moving to this investigation, however, in unreported falsification tests we verify that the results do not simply reflect a positive effect of "good institutions" on market outcomes. For this purpose, we re-run all the cross-sectional regressions in Table 4 after adding an indicator variable denoting countries with English legal origin. Those tests confirm the results of Table 4. Specifically, in no case does the regulatory variable lose its statistical significance once the English legal origin indicator is added to the specification. Additionally, in our models, the English legal origin indicator itself is never statistically significantly associated with better competitive outcomes. This falsification test is thus inconsistent with the notion that our results are a mere reflection of better institutions, generally speaking, being associated with better

competitive outcomes in the mobile telecommunication industry. It is rather the case that industry-specific regulations explain the market outcomes analyzed.

4. Is Concentration "Somehow" Good?

In the previous section we have shown that the design of the rules of the mobile industry appears to affect the degree of concentration, competition, prices, and margins. If this is the case, is it obvious that every government should try to maximize the ITU regulatory score, i.e., promote the maximum level of competition and the lowest level of prices?

In a static framework, it is well known that any deviation from competition creates a deadweight loss, often referred to as Harberger's triangle. Yet, Harberger (1964) himself showed that this triangle is generally small. Furthermore, dynamic considerations may make some deviations from perfect competition desirable. For example, one version of this argument – often found in industry lobbying material – is that lower prices lead to lower quality, which hurts consumers. Another variation is that lower prices lead to lower profits, which lead to lower investments, which hurts consumers. Thus, the industry does not dispute the kind of evidence presented in Table 4 (i.e., that rules may reduce concentration, increase competition, and lower prices);[12] it disputes only the welfare consequences of this outcome: in spite of low prices consumers are worse off because of the low quality of service.

4.1. Concentration and Quality

It is hard to test the welfare implication of this hypothesis, but we can test the impact that concentration, competition, and prices (or better the changes in concentration, competition, and prices induced by pro-competition rules) have on the quality of service and investments. This is what we do in Table 5. The specifications are similar to the ones used in Table 4. The left hand side variables here are different measures of quality of service: from the percentage of connections (or coverage) that are at least 3G or 4G to the speed of broadband internet. Besides the control variables, our main explanatory variable is a measure of concentration, competition, prices, or margins. This measure is instrumented by the ITU regulatory score. Thus, we are

[12] The result that rules that are more pro-competition lead to lower prices in the telecom industry is not new. In its annual "Measuring the Information Society Report," ITU (2014) reached a similar conclusion.

interested in assessing the effect of the component of competition due to the impact of pro-market rules.

To be clear, we do not employ this setting to address endogeneity concerns - - admittedly, it is not clear that the regulatory score satisfies the exclusion restriction. Rather, we follow this approach to test the claim, often advanced by the mobile operators' executives, that regulations promoting "excessive" competition will ultimately result in lower margins and thus inhibit the operators' ability to invest. (As such, quality will suffer.) We thus investigate whether the data support this type of claim.[13]

As Table 5.A shows, on average and in the range of regulation and competition outcomes that we observe, the effect of concentration on quality is negative. Quality is higher in more competitive markets. We repeat those regressions with the other measures of concentration, competition, and prices (the results are not tabulated to save space). When we do so we find that the impact of prices and margins on quality is negative and sometimes statistically significant at conventional levels. Thus, contrary to industry claims, markets with higher prices tend to exhibit lower, not higher, quality of services. The results are not exceedingly strong. Thus, we would not necessarily conclude that more competition leads to higher quality, but we can certainly reject the opposite claim: that less competition leads to higher quality. In particular, there is no evidence suggesting that a government should tilt the rules in a non-competitive dimension to enhance the quality of services. Thus, this evidence provides little support to public interest theories.

4.2. Concentration and Investments

We reach the same conclusion when we look at the impact of concentration, competition, and prices on investments (Table 5.B). The specifications are identical to Table 5.A, only with a measure of investment intensity (capex over revenues in Table 5.B, or number of base stations over revenues in Table 5.C) as the left hand side variables. As for Tables 4.B and 4.C, the measures of concentration, competition, prices, and margins are instrumented with the ITU regulatory score. Most of the coefficients in Table 5.B have the opposite sign of what the industry lobbying theory would suggest (i.e., that high profitability and prices lead to more

[13] In unreported tests we verify (and confirm) that our conclusions continue to hold when we regress our outcome variables against the regulatory score.

investment), albeit no coefficient is statistically different from zero. As before, we cannot conclude that more competition and lower profits lead to more investments, but we can certainly reject the opposite claim: that less competition and higher profits leads to more investments.

4.3. Concentration, Employment, and Wages.

Another possible reason why governments might want to reduce competition is to increase employment or wages. This hypothesis is especially credible in an industry – like the mobile industry – that has seen dramatic improvements in efficiency and less dramatic growth in revenues over the last 10 years, and hence has started to fire people. Since it is more difficult to fire workers in profitable companies, the government can design rules to limit competition in the hope of preserving employment.

Tables 4.D and 4.E explore this possibility. As with the previous two panels, the measures of concentration, competition, prices, and margins are instrumented with the ITU regulatory score. Once again, most of the coefficients have the opposite sign of what the prediction above suggests (i.e., that high profitability and prices lead to higher employment or higher wages), although no coefficient is statistically different from zero. The results so far are, instead, broadly consistent with a view of regulation as a mechanism to create rents for the incumbents and, possibly, politicians.

5. What Shapes the Regulatory Choices?

Given that in the mobile industry the design of the rules appears to affect concentration, competition, prices, and margins, but does not appear to affect the quality of service, investments, and employment, what explains regulatory choices that do not foster competition?

5.1. Auctions

A reason why a government may want to restrict competition is that it wants to maximize the revenue it obtains from spectrum auctions.[14] In the unlikely case mobile operators are able to use first degree price discrimination, this choice is also socially efficient. But even if it is not

[14] It is theoretically unclear whether restricting competition will increase or reduce the revenues raised from the spectrum auctions. On the one hand, less competition means a higher value of the auction to the few winners. On the other hand, less competition also possibly means fewer bidders participating to the auction. These two factors will push the auction revenues in opposite directions.

socially efficient, a government might want to pursue this strategy because it is constrained in its tax-raising or because it thinks this form of tax-raising is less politically costly.

In Table 6 we investigate whether that is the case. In column 1 the dependent variable is the total fees paid for spectrum auctions held in a given country through the end of 2014, scaled by aggregate revenues of the mobile operators. In column 2 we restrict our analysis to auctions held since 1999 (including all 3G and subsequent auctions). In column 3 we further restrict to auctions held since 2011 (so as to include all 4G auctions).

Contrary to the revenue raising hypothesis for restricting competition, we find that auction revenues are higher in countries that have more competition. To put it differently, allowing competition enables governments to extract higher revenues from the operators through the spectrum auctions.

The reason is simple: auctions do not work well with a limited number of bidders. Pro-competitive rules increase the number of major players in a market and thus the number of bidders. Hence, the idea that a government should restrict competition to increase its revenue is not supported in the data.

5.2. Taxation Hypothesis

A variation of the above argument is that governments allow concentration, high prices, and high margins in order to raise more revenues by taxing the incumbent operators. Taxation does not require multiple operators to be effective, thus this argument has potentially greater validity than the previous one. If this motivation was important, it would more likely play a role in countries where it is difficult to raise other forms of taxes (because of bad administration or tax evasion), or where profits are taxed more than consumption.

We investigate this hypothesis in Table 7, where we employ several proxies for a country's ability to raise taxes. In column 1 we estimate a regression where the left hand side variable is the pro-competitive regulatory score and the right hand side variables are our standard set of control variables and a measure of tax evasion. Consistent with the "taxation hypothesis," countries with poorer ability to raise taxes (measured by a higher level of tax evasion) exhibit a lower value of the pro-competition regulatory score, but the effect is not statistically significant.

In column 2, we re-estimate the same specification with the level of sales taxes on telecom operators (inclusive of VAT, GST and custom duties, and mobile-specific taxes) as a measure of the fiscal benefit of higher prices. Contrary to the "taxation hypothesis," countries

with higher sales taxes have more pro-competitive regulation and the coefficient is statistically different from zero at the 1% level.

In column 3, we re-estimate the same specification with the level of corporate taxes as a measure of the fiscal benefit of higher prices. Consistent with the "taxation hypothesis," countries with higher corporate taxes have less pro-competitive regulation, but the coefficient is not statistically different from zero.

Finally, in column 4, we use the proportion of taxes over the total cost of operating a mobile phone as a measure of the fiscal benefit of higher prices. Contrary to the "taxation hypothesis," countries with higher sales taxes have more pro-competitive regulation and the coefficient is statistically different from zero at the 5% level. Thus, overall we find no evidence in support of the "taxation hypothesis."

5.3. Ideology

In the rest of Table 7 we investigate the role of ideology in the choice of regulation. Governments strongly influenced by unions might favor concentration because concentration tends to increase wages and employment. In column 5 we use the percentage of the work force affiliated with labor unions as a right hand side variable (Botero et al., 2004). As expected, the sign of the coefficient is negative (more union, less pro-competition regulation), but it is not statistically significant.

In column 6 we use the fraction of years between 1928 and 1995 in which "the chief executive and the largest party in the legislature were leftist or centrist" as a measure of ideology. As expected, the sign of the coefficient is negative and statistically significant at the 5% level.

In column 7 we restrict the years to the 1975 and 1995 period. As expected, the sign of the coefficient is negative but not statistically significant. Thus, overall we find only weak evidence that the ideology matters for regulatory choices.

5.4. Regulatory Capture

If we analyze the regulatory choice from a political economy perspective (Stigler, 1971 and Peltzman, 1976) we obtain some clear predictions. Stronger connections between mobile industry executives and politicians will favor pro-business regulation, which will tend to limit competition and new entry. By contrast, in a democratic country, politicians can buy consensus

by introducing a pro-competition regulation that lowers prices. Thus, we expect regulation to be more pro-competition in more democratic countries and less pro-competition where there are more connections between mobile industry executives and politicians.

In Table 8 we regress our measures of regulation on our standard set of controls and our political economy variables. In columns 1-3 we use various measures of democracy from Polity IV. Regardless of whether we use the overall measure of democracy, the level of constraints on the executive, or the degree of political competition, we find that democratic countries are more likely to have regulation that favors competition in the mobile telecommunication industry.

This finding is further supported by the fact that 4 of the 10 countries with the most anti-competitive regulatory score (i.e., Kuwait, Belarus, Swaziland, and Cuba) have a democracy score of 0. By contrast, all 10 countries with the most pro-competition score have a democracy score of at least 8, with 8 out of 10 having a perfect score. Thus, the evidence is consistent with the idea that, in democratic countries, politicians cater more to consumers' interest.

In column 4 we focus on the diffusion of political connections, i.e., the role of operators' concentrated interests. We find that, when phone operators are more politically connected, regulations are less likely to favor competition.[15] A one standard deviation increase in the frequency of political connection reduces the regulatory score by 1/4 of its standard deviation. The percentage of politically connected employees of mobile operators is 5.35% in the countries with the most anti-competitive regulations (Belarus ranking first with a percentage of 16.67%), while this fraction is 4.76% in the countries with the most pro-competition regulations (with Poland having the highest percentage, 13.04%).

In column 5 we focus on the role of corruption. We find that more corrupt countries tend to have regulations that are less likely to favor competition. To what extent are corruption and political connections the same thing? To assess whether that is the case, we run a horse race between these variables. Although political connections are positively correlated with corruption, the correlation coefficient is surprisingly low (correlation coefficient = 0.0096). Political connections are on average less prevalent in democratic countries. Further democratic countries tend to be less corrupt. With this in mind, the results of the "horse race" specification, reported in

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[15] We are unable to investigate the role of lobbying or campaign contributions as those data are unfortunately available only for a very restricted number of countries.

column 6, show that political connections remain significant after controlling for corruption and democracy.

In unreported tests we check (and confirm) that our results are not specific to high (or low) income countries. Also, in column 7 of Table 8 we show that our conclusions are unchanged if we focus on middle income countries (i.e., if we focus on countries with per capita GDP between the 25th and the 75th percentile). By narrowing the variation in income per capita across countries, those tests mitigate the concern that our prior results might be polluted due to other sources of confounding variation.

Overall, the results discussed in this section are most consistent with the view that regulation is the outcome of different political pressures.

6. Antitrust and Competition

6.1 A Case Study

Thus far, we have only looked at regulatory measures that are easily quantifiable and have been codified by ITU. In more advanced countries (like the United States), Antitrust authorities play a major role in shaping competition and prices. It is, however, more difficult to codify the level of antitrust activism and use it in empirical analysis. Therefore, we resort to a mini-case study of countries at very similar level of economic development and income per capita, but different levels of antitrust activism. To this end we exploit the Atlantic divide between the United States and Europe. As shown by the E.U. antitrust case against Google, the European Antitrust Authority is more pro-active than its U.S. counterpart. Thus, we compare the level of prices and quality between the U.S. and the two EU countries with the level of regulation closest to the Unites States (76.5). These are Germany (78.5) and Denmark (76).

The United States exhibits much higher monthly revenues per unique subscriber ($67.6 in 2015:3 vs $23.48 Germany and $31.01 for Denmark), which implies U.S. cellular phone companies' annual revenues per customers are $530 higher than their German counterparts and $439 higher than their Danish counterparts. One reason for the large difference could be that the U.S. carriers tend to subsidize the headsets, or so they did until recently, while the European carriers do not. The typical subsidy for an iPhone is $500 dollars (they charge $199 for a phone worth $699). Even factoring in this difference, each U.S. customer pays $280 a year more than a

German customer and $189 a year more than a Danish one. Given the number of U.S. customers (233.2 million in 2015), this implies that U.S. operators enjoy a transfer of $65.2bn ($44.1bn) vis-à-vis the German (Danish) benchmark. Similar conclusions are reached based on EBITDA per subscriber - - with the estimated welfare transfer being $52bn vs. Germany and $47bn vs. Denmark.

Not all of this difference is a pure transfer. We do find better quality of service in the United States, where in 2013 4G connections represented 23.1% of the total connections and 4G coverage was 95.1% of the total coverage. In Germany, 4G connections represented 2.7% of the total and 4G coverage was 64.54%, while for Denmark, 4G connections represented 9.31% of the total and 4G coverage was 92.37%.

To explore to what extent this is a transfer to shareholders we look at the market values of U.S. operators. At the end of May 2016, the total market capitalization of the top four U.S. operators amounted to $486bn versus a total book value of $175bn. Lindberg and Ross (1981) associate the difference between the market value of assets and the book value of assets to the abnormal profits a firm can earn as a result of some stable market power position. If we apply this logic to the four major U.S. carriers (AT&T, Verizon, T-Mobile, and Sprint), the capitalized value of abnormal profits in the U.S. mobile industry should be equal to $311bn.[16]

If we assume that the abnormal profits are equal to the after tax transfer from consumer to producers, we can easily calculate the implicit rate at which these abnormal profits are capitalized, assuming they are fixed in perpetuity. These implicit capitalization rates vary between 8.6% and 14.6%. These are very reasonable rates. Thus, the magnitude of the transfer in welfare from consumer to producers is very plausible.

6.2 What Does Antitrust Have to Do With It?

The United States' mobile phone market started the new millennium highly fragmented as a result of two political decisions: the AT&T breakup of 1984 and the way the spectrum was auctioned off in the 1990s. As one can see from Figure 1, during the new millennium, concentration greatly increased thanks to three mergers: Bell Atlantic and GTE that formed Verizon Wireless in 2000, Cingular Wireless with AT&T in 2004, and Verizon Wireless

[16] This calculation assumes that the only source of abnormal profits is the mobile sector, while all the others the market value is equal to the book value.

Communications with Alltel Corporation in 2008. All three transactions faced the scrutiny of both the Department of Justice and the Federal Communication Commissions and all three had to spin off some assets to comply with the requirement. Thus, the consolidation of the U.S. mobile industry in the 2000s was enabled by a series of antitrust decisions.

The Antitrust presence was also important for the mergers that did not take place. In 2014 a U.S. industry source (FierceWireless) reported a declaration by the Department of Justice that "any wireless merger among the four Tier 1 carriers would face heightened scrutiny, a strong hint that any potential deal between Sprint and T-Mobile US would face an uphill battle with the DOJ."[17] Not surprisingly, this merger, previously rumored, did not take place.

It is difficult to establish a causal link between the higher margins of the mobile service industry in the United States and the behavior of its Antitrust authority vis-à-vis the United States. Note, however, that in Denmark an attempt to reduce the number of main operators from 4 to 3 was blocked by the European antitrust in 2015.[18] In Germany a similar attempt went through in 2014, but only after intense pressure by Angela Merkel.[19] Interestingly, between 2013:3 and 2015:3 Danish ARPU levels dropped by 28%, Germans by 20%, and U.S. ones by 3%.

7. Conclusions

Is product market competition determined solely by economic factors or is it affected by political factors as well? In this paper we provide some evidence on the importance of political factors in the degree of competition in the mobile service industry. In cross-country comparisons we show that concentration, competition, and prices are affected by the rules of the game designed by local governments. In addition, we show that this design seems to be affected more by political lobbying than by economic principles.

One interesting byproduct of our analysis is the lack of a negative relation between market competition and quality of service and level of investment in the mobile industry. Industry conditions under (partial) control of the government have large redistributive effects

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[17] http://www.fiercetelecom.com/telecom/report-says-microsoft-close-to-naming-satya-nadella-as-its-new-ceo-chinese-service

[18] "Brussels blocks Danish deal in blow to Three's £10.25bn O2 takeover", Daily Telegraph 11 Sep 2015.

[19] Daniel Thomas and Alex Barker "Telecoms: Europe's scrambled signal", Financial Times, June 30, 2014

between consumers and producers. The lack of empirical evidence of any benefit in transferring part of the consumer surplus to the operators should weigh in the current antitrust debate on both sides of the Atlantic.

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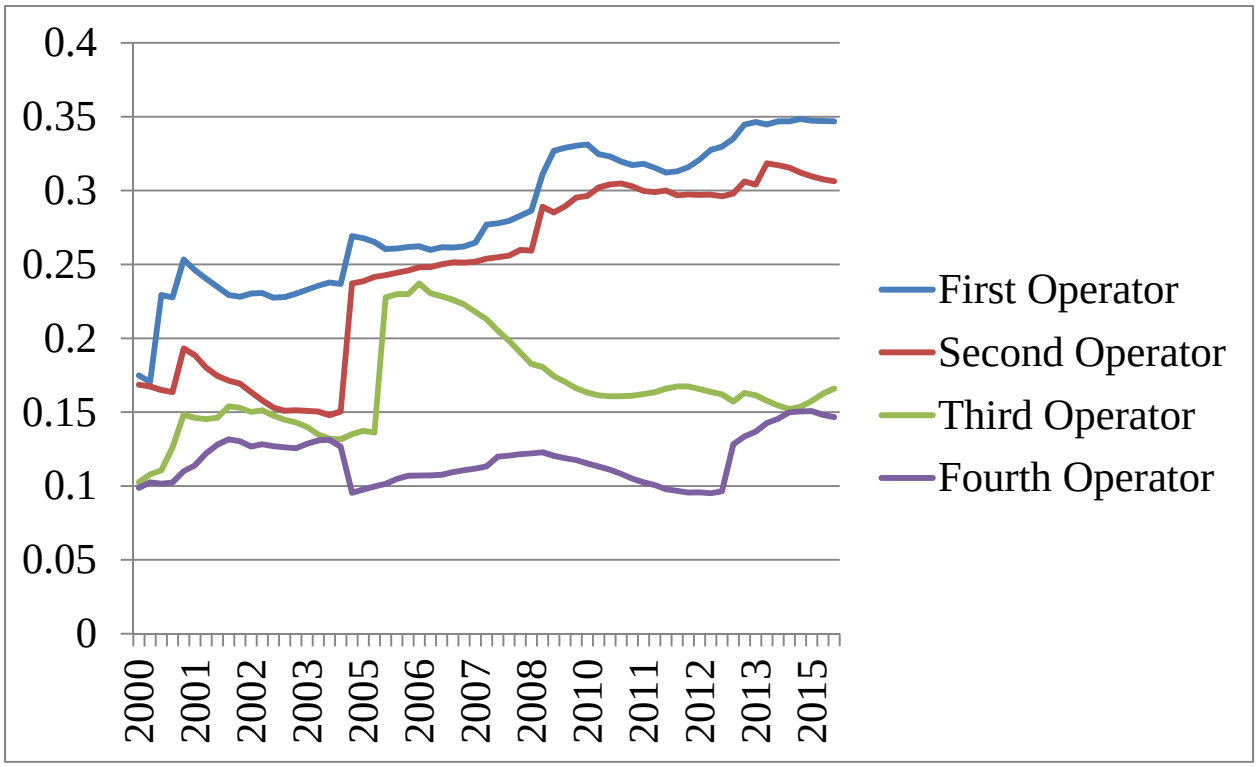
Figure 1: Increasing Concentration of the U.S. Mobile Industry

Q1 2000 through Q3 2015, based on © GSMA Intelligence (2015).



Note: The ranking of a given operator may change over time due to mergers and acquisitions, bankruptcies, etc.

Table 1. Variables Definitions

This table provides definitions and the data sources. The variables are grouped into the following categories: (1) Regulatory variables (2) Competitive structure and pricing; (3) Quality of the service and other outcomes; (4) Spectrum auctions, and (5) Institutional variables.

Variable Name:	Definition & Data Sources:
Regulatory Variables	
Regulatory Score	Overall regulatory score. It reflects the answers to 50 questions related to the regulation in place as well as some outcome variables. The questions relate to regulations concerning the fixed phone, mobile phone, internet, and broadcasting. From the original ITU regulatory score, we deducted the answers to questions concerning the level of competition in (i) the local and long distance fixed line services, (ii) IMT (3G, 4G, etc.) services, (iii) cable modem, DSL, fixed wireless broadband, (iv) leased lines, and (v) international gateways (questions 37-41) and the ownership status of the main fixed line operator (question 42) as those represent outcome variables rather than regulatory decisions. Source: ITU ICT Regulatory Tracker
Cluster 1	Cluster 1 as defined by the ITU. This cluster mostly includes the answers to questions concerning the existence and the independence of the regulator. Source: ITU ICT Regulatory Tracker
Cluster 2	Cluster 2 as defined by the ITU. This cluster mostly includes the answers to questions concerning the power of the regulator (vs. power of the government and/or operators). Source: ITU ICT Regulatory Tracker
Cluster 3	Cluster 3 as defined by the ITU. This cluster mostly includes the answers to questions concerning the ease of entry in the sector, i.e., regulations that enable the sharing of fixed costs. Source: ITU ICT Regulatory Tracker
Cluster 4	Cluster 4 as defined by the ITU. This cluster mostly includes the answers to questions concerning whether foreign ownership in (i) facilities-based operators, (ii) spectrum-based operators, (iii) local service operators/long-distance service operators, (iv) international service operators, (v) internet service providers, and (vi) value-added service providers is allowed (restricted, or forbidden), as well as two questions concerning the existence of a concept of market dominance and the criteria used to establish market dominance. Source: ITU ICT Regulatory Tracker
Number Portability	"Is number portability required from: b) Mobile operators?/ If yes, is this service currently available to subscribers?" Source: ITU ICT Regulatory Tracker
Individuals VoIP	"Are individual users allowed to make voice over IP (VoIP) or Internet telephony phone calls?" Source: ITU ICT Regulatory Tracker
Secondary Trading Allowed	"Is secondary trading allowed?" The question refers to secondary trading of the spectrum. Source: ITU ICT Regulatory Tracker
Foreign Participation	"Is foreign participation or ownership limited in the following market segment: Spectrum-based operators?" Source: ITU ICT Regulatory Tracker
Competitive Structure and Pricing	
C2	Market share of the two largest operators in a given country during a given period. Each operator's market share is the operator's "Total connections at the end of the period, expressed as a percentage share of the total market connections." Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Herfindahl-Hirschman Index	"A commonly accepted measure of market concentration, represented on a scale of 0 (evenly distributed competition) to 10,000 (no competition)." Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Lack Compet 5 Sectors	Sum of the answers to questions 37-41 in the ITU questionnaire. Those questions concern the level of competition in (i) the local

W/Replac	and long distance fixed line services, (ii) IMT (3G, 4G, etc.) services, (iii) cable modem, DSL, fixed wireless broadband, (iv) leased lines, and (v) international gateways. Missing values were not replaced. Source: ITU ICT Regulatory Tracker
Lack Compet 5 Sectors W/O Replac	Sum of the answers to questions 37-41 in the ITU questionnaire. Those questions concern the level of competition in (i) the local and long distance fixed line services, (ii) IMT (3G, 4G, etc.) services, (iii) cable modem, DSL, fixed wireless broadband, (iv) leased lines, and (v) international gateways. Missing values were replaced with zeros when ITU did so in computing the overall regulatory score. Source: ITU ICT Regulatory Tracker
Mobile Cellular Basket	"The mobile-cellular sub-basket refers to the price of a standard basket of mobile monthly usage for 30 outgoing calls per month (on-net/off-net to a fixed line and for peak and off-peak times) in predetermined ratios, plus 100 SMS messages." In USD. "The mobile-cellular sub-basket is based on prepaid prices, although postpaid prices are used for countries where prepaid subscriptions make up less than two per cent of all mobile-cellular subscriptions." When indicated, the price of the basket, as reported by ITU, was PPP adjusted using the WB (GDP) conversion factors. Source: ITU World Telecommunication/ICT Indicators Database, 19th edition 2015, and ITU "Measuring the Information Society" reports, 2009-2014.
Mobile Internet Basket 1GB	"Price of the plan, in USD, for a mobile-broadband USB/dongle-based postpaid tariffs with 1GB volume of data." When indicated, the price was PPP adjusted using the WB (GDP) conversion factors. Source: ITU World Telecommunication/ICT Indicators Database, 19th edition 2015.
ARPU by Connection	"Average revenue per user (ARPU). Total recurring (service) revenue generated per connection per month in the period. Despite the acronym, the metric is strictly average revenue per connection, not per subscriber." The ARPU is measured in USD and, when indicated, the indicator was PPP adjusted using the WB (GDP) conversion factors. Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/
EBITDA Margin	"Total operating profit in the period, before interest, tax, depreciation and amortisation, expressed as a percentage of total revenue." Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/
Quality of the Service and Other Outcomes	
Connections % 3G+	Sum of 3G and 4G connections, expressed as a percentage of total connections. 3G connections are defined as "3G unique SIM cards (or phone numbers, where SIM cards are not used) that have been registered on the mobile network at the end of the period. Thirdgeneration (3G) network technologies are listed under [help and definitions](/help/74/). Connections differ from subscribers such that a unique subscriber can have multiple connections." 4G connections are defined as "4G unique SIM cards (or phone numbers, where SIM cards are not used) that have been registered on the mobile network at the end of the period. Fourthgeneration (4G) network technologies are listed under [help and definitions](/help/74/). Connections differ from subscribers such that a unique subscriber can have multiple connections." Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Connections % 4G	4G connections, expressed as a percentage of total connections. 4G connections are defined as "4G unique SIM cards (or phone numbers, where SIM cards are not used) that have been registered on the mobile network at the end of the period. Fourthgeneration (4G) network technologies are listed under [help and definitions](/help/74/). Connections differ from subscribers such that a unique subscriber can have multiple connections." Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Network Coverage 3G+	Sum of 3G and 4G mobile coverage, expressed as a percentage of the total market geographic surface area. "3G mobile coverage, expressed as a percentage of the total market geographic surface area, at the end of the period. Thirdgeneration (3G) network technologies are listed under [help and definitions](/help/74/)." "4G mobile coverage, expressed as a percentage of the total market geographic surface area, at the end of the period. Fourthgeneration (4G) network technologies are listed under [help and

	definitions](/help/74/).” Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Network Coverage 4G	“4G mobile coverage, expressed as a percentage of the total market geographic surface area, at the end of the period. Fourthgeneration (4G) network technologies are listed under [help and definitions](/help/74/).” Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Speed, in Mbit/s	“Mobile broadband USB_1GB, prepaid, Speed, in Mbit/s - - Advertised maximum theoretical download speed, and not speeds guaranteed to users associated with a 1GB USB/dongle-based prepaid plan.” Source: ITU World Telecommunication/ICT Indicators Database, 19th edition 2015.
Total Capex/Revenues	CapexTotal is “Total capital expenditure incurred in the period, including both intangible and tangible assets.” Scaled by “Total revenue generated in the period, including both recurring (service) and nonrecurring revenue.” Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Number of Base Stations*100,000/Revenues	Base stations are “Total deployed, and active, base stations on the network at the end of the period.” Scaled by “Total revenue generated in the period, including both recurring (service) and nonrecurring revenue.” Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Number of Employees/Revenues	The number of employees is the “Total employed head count (fulltime equivalent) for the telecoms business at the end of the period, and if applicable, only within mobile operations.” Scaled by “Total revenue generated in the period, including both recurring (service) and nonrecurring revenue.” Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Cost of Personnel/Revenues	The cost of personnel is the “Operating expenditure incurred in the period related to the cost of employees, including salary costs.” Scaled by “Total revenue generated in the period, including both recurring (service) and nonrecurring revenue.” Source: © GSMA Intelligence (2015). Link: https://gsmaintelligence.com/subscribe/?ref=markets-data
Spectrum Auctions	
Proceeds from All Spectrum Auctions/Mobile Operators’ Aggregate Revenues	Total proceeds raised by a government from all the spectrum auctions run through 2014, divided by the average of the aggregate revenues of mobile operators, during 2010-2014. The operators’ revenues are the “Total revenue generated in the period, including both recurring (service) and nonrecurring revenue.” Sources: DotEcon and © GSMA Intelligence (2015). Links: http://www.dotecon.com/ and https://gsmaintelligence.com/subscribe/?ref=markets-data
Spectrum Auction Proceeds since 1999/ Mobile Operators’ Aggregate Revenues	Total proceeds raised by a government from the spectrum auctions run since 1999 (i.e., since the first 3G auction), divided by the average of the aggregate revenues of mobile operators, during 2010-2014. The operators’ revenues are the “Total revenue generated in the period, including both recurring (service) and nonrecurring revenue.” Sources: DotEcon and © GSMA Intelligence (2015). Links: http://www.dotecon.com/ and https://gsmaintelligence.com/subscribe/?ref=markets-data
Spectrum Auction Proceeds since 2011/Mobile Operators’ Aggregate Revenues	Total proceeds raised by a government from the spectrum auctions run since 2011 (i.e., since the first 4G auction), divided by the average of the aggregate revenues of mobile operators, during 2010-2014. Sources: DotEcon and © GSMA Intelligence (2015). Links: http://www.dotecon.com/ and https://gsmaintelligence.com/subscribe/?ref=markets-data
Institutional Variables	
Tax Evasion	“Executives' assessment of how important tax evasion is in their country (the lower the measure the more rampant is tax evasion).” As reported by Shleifer. The index was re-ranked so that a higher value denotes less tax evasion. Source: World Economic Forum. Link: scholar.harvard.edu/files/shleifer/files/tax_data_march2009.xls

Telecom Sales Tax Rate	Sales Tax Rate applicable to mobile telecom operators from Deloitte's “Global Mobile Tax Review 2011” if available; Otherwise tax rate from Deloitte online page http://www2.deloitte.com/global/en/pages/tax/solutions/global-indirect-tax-rates.html; otherwise tax rate from Wikipedia.
Telecom Corporate Tax Rate	Corporate Tax Rate applicable to mobile telecom operators from Deloitte's “Global Mobile Tax Review 2011” if available; Otherwise tax rate from Deloitte online page http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-corporate-tax-rates-2012-2016.pdf; otherwise tax rate from Wikipedia.
Taxes as a Proportion of TCMO	Level of tax as a proportion of total cost of mobile ownership (TCMO) in 2011. The TCMO consists of all price components associated with owning a mobile phone and purchasing mobile phone services. These cost components include: (1) Handset cost; (2) Connection cost; (3) Rental costs; and (4) Call and SMS usage rates. Taxes vary from standard consumer taxes such as VAT, GST and custom duty, to include telecom or mobile-specific taxes and include: (1) VAT or GST: these are consumer taxes incurred when purchasing every component of owning and using a mobile phone. These taxes are often expressed as a proportion of the value of the good or service (2) Custom duty and excise taxes on imported goods. In mobile telephony, users in developing countries typically pay import taxes on handsets and other mobile devices. These can either expressed as a proportion of the handset value or as a fixed sum or both; (3) Other telecoms specific taxes: as discussed in the main body of this report, a Number of Countries still impose specific taxes on consumers for using mobile services. These can include luxury item duties on handsets, SIM activation taxes or other taxes on connection, special communication taxes on mobile usage, and monthly contributions for post-pay customers. These have all been accounted for in these calculations. Source: Deloitte "Global Mobile Tax Review"
Union Density	“Measures the percentage of the total work force affiliated to labor unions in 1997. Source: ILO, Laborsta: <http://laborsta.ilo.org>, and The World Bank [2001].”
Left Wing	“Measures the percentage of years between 1928 and 1995, and, alternatively, between 1975 and 1995, during which both the party of the chief executive and the largest party in congress had left or center orientation. If the country was not independent in the initial year of the period, we use the independence year as the first period. For countries that were part of a larger country in the initial year of the period and subsequently broke-up, we include in calculations the political orientation of the political parties in the mother country in the pre-breakup period. In the case of military regimes, where political affiliations are unclear, we classify the regime based on its policies. Source: Authors’ calculations based on: Political Handbook of the World, Europa Yearbook, World Encyclopedia of Political Systems and Parties, Political Parties of the Americas: Canada, Latin America, and the West Indies, Encyclopedia of Latin American Politics, Political Parties of Europe, Political Parties of Asia and the Pacific, Statesmen database: <http://www.worldstatesmen.org>, Country Reports History: <http://www.countryreports.org>, Rulers database: <http://rulers.org/>, various regional and country sources.”
Democracy	“Institutionalized Democracy: Democracy is conceived as three essential, interdependent elements. One is the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders. Second is the existence of institutionalized constraints on the exercise of power by the executive. Third is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. Other aspects of plural democracy, such as the rule of law, systems of checks and balances, freedom of the press, and so on are means to, or specific manifestations of, these general principles. We do not include coded data on civil liberties. The Democracy indicator is an additive eleven-point scale (0-10).” Source: Polity IV. Link: http://www.systemicpeace.org/polity/polity4.htm
Executive Constraints	“Executive Constraints (Decision Rules): According to Eckstein and Gurr, decision rules are defined in the following manner: "Superordinate structures in action make decisions concerning the direction of social units. Making such decisions requires that supers and subs be able to recognize when decision-processes have been concluded, especially "properly" concluded. An indispensable ingredient of the processes, therefore, is the existence of Decision Rules that provide basic criteria under which

	decisions are considered to have been taken." (Eckstein and Gurr 1975, 121) Operationally, this variable refers to the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities. Such limitations may be imposed by any "accountability groups." In Western democracies these are usually legislatures. Other kinds of accountability groups are the ruling party in a one-party state; councils of nobles or powerful advisors in monarchies; the military in coup-prone polities; and in many states a strong, independent judiciary. The concern is therefore with the checks and balances between the various parts of the decision-making process. A seven-category scale is used." Source: Polity IV. Link: http://www.systemicpeace.org/polity/polity4.htm
Political Competition	"Political Competition: Concept variable combines information presented in two component variables: PARREG and PARCOMP (see variables 3.5 and 3.6 and Table 4.2 above). Political Competition concepts represent an alternative method for comprehending authority patterns and are explained in detail in Addendum C. "3.5 PARREG (all versions). Regulation of Participation: Participation is regulated to the extent that there are binding rules on when, whether, and how political preferences are expressed. One-party states and Western democracies both regulate participation but they do so in different ways, the former by channeling participation through a single party structure, with sharp limits on diversity of opinion; the latter by allowing relatively stable and enduring groups to compete nonviolently for political influence. The polar opposite is unregulated participation, in which there are no enduring national political organizations and no effective regime controls on political activity. In such situations political competition is fluid and often characterized by recurring coercion among shifting coalitions of partisan groups. A five-category scale is used to code this dimension…" "3.6 PARCOMP (all versions). The Competitiveness of Participation: The competitiveness of participation refers to the extent to which alternative preferences for policy and leadership can be pursued in the political arena. Political competition implies a significant degree of civil interaction, so polities which are coded Unregulated (1) on Regulation of Participation (PARREG, variable 2.5) are not coded for competitiveness. Polities in transition between Unregulated and any of the regulated forms on variable 2.5 also are not coded on variable 2.6. Competitiveness is coded on a five category scale…" Source: Polity IV. Link: http://www.systemicpeace.org/polity/polity4.htm
Political Connections	Fraction of the individuals affiliated with a given operator who have experience in the country's government (including as President) or in the parliament. Political "titles" are identified from the "Chiefs of State and Cabinet Members of Foreign Governments" directory published by the CIA (https://www.cia.gov/library/publications/world-leaders-1/SM.html). Names of all Presidents, Chancellors, Chairmen, Emirs ruling as of or after 1980 are identified from http://www.rulers.org/index.html. The experience is based on keyword searched in each person's biography, as reported in Capital IQ. Source: CapitalIQ (for bios) and other sources
Corruption	"Corruption erodes economic freedom by introducing insecurity and uncertainty into economic relationships. The score for this component is derived primarily from Transparency International's Corruption Perceptions Index (CPI) for 2011, which measures the level of corruption in 183 countries. The CPI is based on a 10-point scale in which a score of 10 indicates very little corruption and a score of 0 indicates a very corrupt government. In scoring freedom from corruption, the Index converts the raw CPI data to a scale of 0 to 100 by multiplying the CPI score by 10. For example, if a country's raw CPI data score is 5.5, its overall freedom from corruption score is 55. For countries that are not covered in the CPI, the freedom from corruption score is determined by using the qualitative information from internationally recognized and reliable sources.1 This procedure considers the extent to which corruption prevails in a country. The higher the level of corruption, the lower the level of overall economic freedom and the lower a country's original IEF score." We rescaled the index (= 100-original index), so that a higher number denotes higher corruption. Source: Heritage Foundation. Link: http://www.heritage.org/index/explore?view=byregioncountryyear
GDP per capita	"GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the

	United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current international dollars based on the 2011 ICP round." Source: World Bank, "World Development Indicators". Link: http://data.worldbank.org/data-catalog/world-development-indicators
Population	"Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The values shown are midyear estimates." Source: World Bank, "World Development Indicators". Link: http://data.worldbank.org/data-catalog/world-development-indicators
Inflation	"Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used." Source: World Bank, "World Development Indicators". Link: http://data.worldbank.org/data-catalog/world-development-indicators
Population Density	"Population density is midyear population divided by land area in square kilometers. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes." Source: World Bank, "World Development Indicators". Link: http://data.worldbank.org/data-catalog/world-development-indicators

Table 2. Summary Statistics

This table displays summary statistics for the variables used in the estimations. Price and financial variables were winsorized at the top/bottom 5%. Prices, all in US$s, are all PPP adjusted using the WB (GDP) conversion factors. Some of the variables are based on data from © GSMA Intelligence (2015). In all panels we report the average of a given variable in a given country during 2010-2014. For the definitions of the variables see Table 1.

Variable	No. Obs	Mean	Std. dev.	Min	Max
REGULATORY VARIABLES					
Regulatory Score	150	61.36	14.75	12.00	84.00
Cluster 1	150	15.92	3.87	0.00	20.00
Cluster 2	150	16.82	3.63	4.00	22.00
Cluster 3	150	17.56	6.34	1.00	28.00
Cluster 4	150	10.98	5.41	0.00	16.00
Number Portability	146	0.96	0.86	0.00	2.00
Individuals VoIP	141	1.78	0.61	0.00	2.00
Secondary Trading Allowed	148	0.40	0.75	0.00	2.00
Foreign Participation	119	1.83	0.42	0.00	2.00
COMPETITIVE STRUCTURE AND PRICING					
C2	182	83.30%	13.19%	38.66%	100.00%
Herfindahl-Hirschman Index	182	4,498	1,878	1,412	10,000
Lack Compet 5 Sectors W/Replac	150	2.81	2.99	0.00	10.00
Lack Compet 5 Sectors W/O Replac	120	1.85	2.41	0.00	10.00
Mobile Cellular Basket	182	$26.48	$10.64	$10.07	$47.25
Mobile Internet Basket 1GB	161	$38.85	$24.73	$11.24	$100.28
ARPU by Connection	182	$20.89	$10.42	$8.35	$48.74
EBITDA Margin	110	0.39	0.10	0.24	0.57
QUALITY OF THE SERVICE AND OTHER OUTCOMES					
Connections % 3G+	110	29.34%	22.51%	0.29%	95.11%
Connections % 4G	110	2.43%	4.32%	0.00%	26.54%
Network Coverage 3G+	173	58.87%	28.40%	10.50%	100.00%
Network Coverage 4G	104	33.62%	24.96%	1.16%	98.63%
Speed, in Mbit/s	119	16.61	21.99	0.00	149.00
Total Capex/Revenues	118	0.21	0.11	0.08	0.93
Number of Base Stations*100,000/Revenues	111	0.33	0.37	0.017	1.39
Number of Employees*1000/Revenues	131	0.02	0.02	0.00	0.08
Cost of Personnel/Revenues	58	0.09	0.05	0.03	0.29
SPECTRUM AUCTIONS					
Proceeds from all spectrum auctions/Mobile operators' aggregate revenues	182	0.08	0.16	0.00	0.55
Spectrum auction proceeds since 1999/ Mobile operators' aggregate revenues	182	0.08	0.15	0.00	0.55
Spectrum auction proceeds since 2011/ Mobile operators' aggregate revenues	182	0.04	0.07	0.00	0.25

INSTITUTIONAL VARIABLES					
Tax Evasion	61	3.40	1.10	1.90	6.30
Telecom Corporate Tax Rate	154	0.24	0.09	0.00	0.40
Telecom Sales Tax Rate	162	0.15	0.06	0.00	0.30
Taxes as a Proportion of TCMO	109	0.18	0.07	0.03	0.48
Union Density	67	0.32	0.23	0.01	0.90
Left Wing 1928 to 1995	82	0.58	0.33	0.00	1.00
Left Wing 1975 to 1995	82	0.56	0.37	0.00	1.00
Democracy	158	5.81	3.73	0.00	10.00
Executive Constraints	158	5.12	1.92	1.00	7.00
Political Competition	158	7.13	2.84	1.00	10.00
Political Connections	141	3.91%	7.15%	0.00%	50.00%
Corruption	176	59.92	20.75	6.20	87.50
GDP per capita	182	$16,842	$19,131	$659	$136,103
Population	182	37.9M	141M	9,860	1,350M
Inflation	174	5.16	5.20	0.00	35.63
Population Density	181	0.18	0.59	0.00	7.50

Table 3. International Price Comparisons

For the definitions of the variables see Table 1. All prices are averages 2010-2014. p95/p5 is the ratio between the 95th percentile of the cross country distribution of prices and the 5th percentile. McDonald's adjusted column is based on prices scaled by the price of a McMeal at McDonald's (in each country) as reported in Numbeo.

Variable	Actual prices		PPP adjusted		McDonalds adjusted	
	# Obs.	p95/p5	# Obs.	p95/p5	# Obs.	p95/p5
McMeal at McDonald's	98	2.9	98	3.2		
Tradable[20]	98	5.5	98	3.9	98	4.4
Non-tradable[21]	98	5.5	98	3.5	98	3.6
Regulated[22]	98	11.1	98	6.7	98	7.9
Utilities[23]	98	5.1	98	3.7	98	5.2
Telecom[24]	98	10.2	98	7.5	98	7.8
Taxi[25]	98	17.2	98	8.1	98	9.2
Transportation[26]	98	13.7	98	6.4	98	9.1

[20] Tradable goods include: (1) 1 Pair of Jeans (Levis 501 or Similar); (2) 1 Pair of Men Leather Business Shoes; (3) 1 Pair of Nike Running Shoes (Mid-Range); (4) 1 Summer Dress in a Chain Store (Zara, H&M,…) ; (5) Markets: Apples (1kg); (6) Markets: Chicken Breasts (Boneless, Skinless) (1kg); (7) Markets: Eggs (12); (8) Markets: Lettuce (1 head); (9) Markets: Loaf of Fresh White Bread (500g); (10) Markets: Local Cheese (1kg); (11) Markets: Milk (regular) (1 Liter); (12) Markets: Oranges (1kg); (13) Markets: Pack of Cigarettes (Marlboro); (14) Markets: Potato (1kg); (15) Markets: Rice (white) (1kg); (16) Markets: Tomato (1kg); (17) Markets: Water (1.5 liter Bottle); (18): Gasoline (1 liter); and (19) Volkswagen Golf 1.4 90KW Trendline (or Equivalent New Car).

[21] Non-tradable goods include: (1) Restaurants: Cappuccino (regular); (2) Restaurants: Coke/Pepsi (0.33L Bottle); (3) Restaurants: McMeal at McDonald's (or Equivalent Combo Meal); (4) Restaurants: Meal For 2 People, Mid-Range Restaurant, Three Course; (5) Restaurants: Meal, Inexpensive Restaurant; (6) Restaurants: Water (0.33L Bottle); (7) Cinema, International Release, 1 Seat; (8) Fitness Club, Monthly Fee for 1 Adult; and (9) Tennis Count Rent (1h on Weekend).

[22] Regulated goods include: (1) Transportation: Monthly Pass Transport (Regular Price); (2) Transportation: One-way Ticket (Local Transport); (3) Transportation: Taxi 1h Waiting (Normal Tariff); (4) Transportation: Taxi 1km (Normal Tariff); (5) Transportation: Taxi Start (Normal Tariff); (6) Utilities (Monthly): Basic (Electricity, Heating, Water, Garbage) for 82m2 Apartment, (7) Utilities (Monthly): Internet (10 Mbps, Unlimited Data, Cable/ADSL), and (8) Utilities (Monthly): 1 Minute of Prepaid Mobile Tariff Local (No Discounts or Plans).

[23] Utilities includes: (1) Utilities (Monthly): Basic (Electricity, Heating, Water, Garbage) for 82m2 apartment.

[24] Telecom includes: (1) Internet (10 Mbps, Unlimited Data, Cable/ADSL); and (2) 1 Minute of Prepaid Mobile Tariff Local (No Discounts or Plans).

[25] Taxi includes: (1) Taxi 1h Waiting (Normal Tariff); (2) Taxi 1km (Normal Tariff); (3) Taxi Start (Normal Tariff).

[26] Transportation includes: (1) Monthly Pass Transport (Regular Price); and (2) One-way Ticket (Local Transport).

Table 4. Concentration, Prices, and Regulation

This table shows the effect of regulation on concentration and prices, after controlling for economic and demographic factors. Panel A reports cross-sectional OLS regressions; Panel B reports time-series regressions at the country-level with country fixed effects; Panels C-F report cross-sectional OLS regressions results for the 4 regulatory measures that are most important in explaining concentration and prices. The sample is restricted to countries with available data for the ITU mobile phone basket as well as with available data in GSMA. Territories are excluded from the sample. In the cross-sectional tests, the unit of observation is the 2010-2014 average of each given variable in each country. In the time-series tests, the unit of observation is the annual average of each variable in each country. The sample starts in 2003 as the regulatory score is not available for previous years. Some of the variables are based on data from © GSMA Intelligence (2015). Robust standard errors are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Panel A. Cross-Sectional Country Level Regressions

	C2	Herfindahl-Hirschman Index	Lack Compet 5 Sectors W/Replac	Lack Compet 5 Sectors W/O Replac	Mobile Cellular Basket	Mobile Internet Basket 1GB	ARPU by Connection	EBITDA Margin
Ln(GDP per capita)	-0.0131	-187.2*	-0.0934	0.317	-1.119	-5.862***	5.857***	-0.0318***
	(0.00878)	(106.6)	(0.19)	(0.21)	(0.759)	(2.012)	(0.656)	(0.00942)
Ln(Population)	-0.0377***	-362.4***	-0.0594	-0.0387	-0.167	-0.634	-0.19	-0.00163
	(0.00537)	(70.1)	(0.1)	(0.0936)	(0.466)	(1.178)	(0.386)	(0.00583)
Population Density	-0.00790*	-40.88	-0.0436	-0.122	-2.499***	-0.73	2.542***	-0.00752
	(0.00458)	(61.42)	(0.104)	(0.0796)	(0.816)	(2.145)	(0.604)	(0.0244)
Inflation	0.00194	20.5	0.0495	0.203***	-0.617***	-0.564	-0.269***	-0.000466
	(0.00163)	(19.84)	(0.0372)	(0.0424)	(0.211)	(0.483)	(0.0912)	(0.00123)
Regulatory Score	-0.00106	-18.52*	-0.127***	-0.0916***	-0.0114	-0.322**	-0.0992*	-0.00106*
	(0.000701)	(11.04)	(0.0137)	(0.0196)	(0.065)	(0.137)	(0.0508)	(0.000584)
Intercept	1.596***	12717.3***	12.14***	4.405*	44.00***	124.6***	-22.14***	0.780***
	(0.103)	(1535.5)	(2.548)	(2.307)	(10.15)	(27.7)	(8.429)	(0.139)
Number of Countries	148	148	148	120	148	138	148	94
R-squared	0.363	0.283	0.44	0.402	0.109	0.147	0.505	0.196
F	16.89	8.06	26.63	13.82	4.616	4.649	36.97	3.492

Panel B. Time-Series Country Level Regressions

	C2	Herfindahl-Hirschman Index	Lack Compet 5 Sectors W/Replac	Lack Compet 5 Sectors W/O Replac	Mobile Cellular Basket	Mobile Internet Basket 1GB	ARPU by Connection	EBITDA Margin
Ln(GDP per capita)	-0.163***	-1869.3***	-0.825*	0.0948	-17.97***	-45.54	-25.19***	-0.0964***
	(0.017)	(219.7)	(0.427)	(0.522)	(5.233)	(45.17)	(2.639)	(0.0273)
Ln(Population)	-0.192***	-4611.3***	-6.371***	-7.405***	-39.93***	-187.4*	-101.6***	-0.0543

	(0.0339)	(438.2)	(0.852)	(0.847)	(12.65)	(106.4)	(5.258)	(0.0562)
Population Density	0.0621**	1192.1***	2.256***	1.963***	11.49	-1.021	20.77***	-0.0681
	(0.028)	(361.7)	(0.703)	(0.617)	(15.43)	(478)	(4.323)	(0.0679)
Inflation	0.000168	-7.678*	0.00988	0.00496	-0.0176	-0.217	-0.0647	0.000817
	(0.000349)	(4.517)	(0.00878)	(0.00974)	(0.0722)	(0.387)	(0.0541)	(0.000614)
Regulatory Score	-0.000346*	-4.660*	-0.0673***	-0.0502***	0.086	-0.238	-0.120***	-0.000278
	(0.000197)	(2.546)	(0.00495)	(0.00585)	(0.0576)	(0.484)	(0.0305)	(0.00032)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of Country-Year Obs.	1266	1266	1266	860	537	231	1262	694
R-squared	0.878	0.881	0.874	0.885	0.885	0.898	0.84	0.759
F	94.52	124.2	197.9	90.49	7.359	1.979	298	11.99

Panel C. Cross-Sectional Country Level Regressions - Is number portability required from: b) Mobile opeartors? If yes, is this service currently available to fixed subscribers?

	C2	Herfindahl-Hirschman Index	Lack Compet 5 Sectors W/Replac	Lack Compet 5 Sectors W/O Replac	Mobile Cellular Basket	Mobile Internet Basket 1GB	ARPU by Connection	EBITDA Margin
Ln(GDP per capita)	0.00116	-56.16	0.109	0.561**	-1.085	-1.025	6.308***	-0.0220*
	(0.0114)	(155.8)	(0.281)	(0.279)	(1.088)	(2.581)	(0.902)	(0.0111)
Ln(Population)	-0.0330***	-290.3***	0.0162	0.0134	-0.165	1.024	-0.103	-0.000953
	(0.0058)	(64.81)	(0.117)	(0.106)	(0.552)	(1.165)	(0.405)	(0.00477)
Population Density	-0.00819*	-49.17	-0.104	-0.15	-2.501***	-0.982	2.492***	-0.0113
	(0.00478)	(63.14)	(0.136)	(0.0991)	(0.812)	(2.044)	(0.606)	(0.019)
Inflation	0.00173	14.86	0.0838*	0.217***	-0.610***	-0.622	-0.238***	-0.00026
	(0.00161)	(18.5)	(0.0462)	(0.0482)	(0.212)	(0.447)	(0.0795)	(0.00103)
Number Portability	-0.0372**	-409.8**	-1.310***	-1.258***	-0.188	-9.537***	-1.388	-0.0373***
	(0.0153)	(191.5)	(0.341)	(0.344)	(1.599)	(3.541)	(1.119)	(0.0138)
Intercept	1.360***	9621.1***	2.248	-3.281	43.10***	42.19	-32.73***	0.656***
	(0.148)	(1886.3)	(3.416)	(3.174)	(14.47)	(34.42)	(11.24)	(0.131)
Number of Countries	145	145	145	119	145	135	145	93
R-squared	0.369	0.26	0.188	0.277	0.107	0.137	0.495	0.271
F	16.91	8.84	7.876	8.768	4.493	3.712	36.63	7.493

Panel D. Cross-Sectional Country Level Regressions - Are individual users allowed to make voice over IP (VoIP) or Internet telephony phone calls?

	C2	Herfindahl-Hirschman Index	Lack Compet 5 Sectors W/Replac	Lack Compet 5 Sectors W/O Replac	Mobile Cellular Basket	Mobile Internet Basket 1GB	ARPU by Connection	EBITDA Margin

Ln(GDP per capita)	-0.0167*	-272.3**	-0.351	0.168	-0.843	-5.953***	5.744***	-0.0401***
	(0.0085)	(114.1)	(0.217)	(0.161)	(0.765)	(1.95)	(0.59)	(0.00905)
Ln(Population)	-0.0398***	-392.9***	-0.218*	-0.118	-0.0956	-0.871	-0.298	-0.00247
	(0.0053)	(70.26)	(0.117)	(0.106)	(0.459)	(1.18)	(0.389)	(0.0058)
Population Density	-0.00869*	-60.12	-0.0433	-0.0918	-2.368***	-0.616	2.505***	-0.0047
	(0.00473)	(65.04)	(0.184)	(0.146)	(0.73)	(1.858)	(0.621)	(0.024)
Inflation	0.0027	32.75	0.0653	0.205***	-0.687***	-0.738*	-0.316***	-0.000729
	(0.00176)	(24.09)	(0.0591)	(0.05)	(0.183)	(0.404)	(0.101)	(0.00121)
Individuals VoIP	-0.00654	73.47	-1.864***	-1.773***	-2.991*	-11.00***	-2.732**	-0.0256
	(0.0186)	(254.7)	(0.482)	(0.483)	(1.555)	(3.909)	(1.351)	(0.0157)
Intercept	1.606***	12680.9***	12.21***	4.336**	44.95***	129.1***	-20.41**	0.856***
	(0.113)	(1635.9)	(2.832)	(2.161)	(10.67)	(27.63)	(8.601)	(0.137)
Number of Countries	140	140	140	116	140	130	140	89
R-squared	0.373	0.268	0.274	0.341	0.126	0.17	0.509	0.229
F	14.24	7.892	6.513	7.752	6.332	4.432	33.8	4.584

Panel E. Cross-Sectional Country Level Regressions - Is secondary trading (of the spectrum) allowed?

	C2	Herfindahl-Hirschman Index	Lack Compet 5 Sectors W/Replac	Lack Compet 5 Sectors W/O Replac	Mobile Cellular Basket	Mobile Internet Basket 1GB	ARPU by Connection	EBITDA Margin
Ln(GDP per capita)	-0.0107	-202.3*	-0.467**	-0.0399	-1.343*	-6.569***	5.670***	-0.0298***
	(0.00921)	(118.1)	(0.226)	(0.191)	(0.789)	(2.209)	(0.65)	(0.0102)
Ln(Population)	-0.0370***	-364.9***	-0.182	-0.13	-0.273	-0.943	-0.201	-0.000649
	(0.00559)	(70.61)	(0.126)	(0.117)	(0.484)	(1.243)	(0.394)	(0.00581)
Population Density	-0.00599	-25.43	-0.0304	-0.0668	-2.611***	-0.689	2.674***	-0.0147
	(0.00539)	(67.88)	(0.136)	(0.101)	(0.793)	(2.113)	(0.575)	(0.0242)
Inflation	0.00182	22	0.0994*	0.217***	-0.582***	-0.42	-0.254***	-0.000703
	(0.00162)	(20.45)	(0.0507)	(0.0547)	(0.208)	(0.475)	(0.0776)	(0.000984)
Secondary Trading Allowed	-0.0258**	-256.0**	-0.576**	-0.441**	0.988	-1.648	-1.33	-0.0289**
	(0.0117)	(111.2)	(0.263)	(0.209)	(1.311)	(2.249)	(0.897)	(0.0119)
Intercept	1.508***	11845.1***	9.557***	3.402	46.47***	115.7***	-26.08***	0.693***
	(0.12)	(1634.4)	(3.014)	(2.547)	(10.88)	(31.71)	(9.156)	(0.143)
Number of Countries	146	146	146	119	146	136	146	93
R-squared	0.371	0.271	0.161	0.224	0.11	0.111	0.489	0.238
F	18.07	8.972	8.401	8.267	4.844	3.301	40.11	7.365

Panel F. Cross-Sectional Country Level Regressions - Is foreign participation or ownership limited in the following market segment: Spectrum-based operators?

	C2	Herfindahl-Hirschman Index	Lack Compet 5 Sectors W/Replac	Lack Compet 5 Sectors W/O Replac	Mobile Cellular Basket	Mobile Internet Basket 1GB	ARPU by Connection	EBITDA Margin
Ln(GDP per capita)	-0.0217**	-357.8***	-0.657***	-0.205	-1.672*	-4.839**	5.699***	-0.0510***
	(0.00914)	(119.3)	(0.225)	(0.201)	(0.98)	(1.986)	(0.658)	(0.00931)
Ln(Population)	-0.0433***	-441.3***	-0.279**	-0.264**	0.207	-1.606	-0.635	-0.0124**
	(0.00567)	(70.05)	(0.119)	(0.11)	(0.564)	(1.136)	(0.464)	(0.0052)
Population Density	-0.0082	-13.42	0.0383	-0.024	-2.040***	-0.0584	2.445***	-0.0036
	(0.00571)	(70.99)	(0.141)	(0.0922)	(0.618)	(1.482)	(0.527)	(0.0217)
Inflation	0.00267	17.3	0.0832*	0.188***	-0.639**	-0.219	-0.220**	0.00118
	(0.00181)	(16.72)	(0.0423)	(0.0413)	(0.277)	(0.51)	(0.109)	(0.0011)
Foreign Participation	-0.0767***	-1690.0***	-2.292***	-2.540***	2.926	-15.61***	-5.310***	-0.0397*
	(0.0245)	(402.8)	(0.506)	(0.513)	(3.112)	(5.909)	(1.758)	(0.0205)
Intercept	1.835***	17536.6***	16.44***	11.40***	36.74**	135.1***	-10.65	1.141***
	(0.11)	(2099.1)	(3.249)	(2.872)	(16.83)	(30.02)	(11.32)	(0.109)
Number of Countries	119	119	119	101	119	111	119	78
R-squared	0.415	0.434	0.304	0.467	0.112	0.138	0.54	0.364
F	20.08	10.17	10.37	19.33	5.667	3.063	34.48	17.11

Table 5. Quality, Investment, and Employment

This table shows the effect of concentration, competition, and prices on other outcomes. Concentration, competition, and prices are instrumented with the ITU overall regulatory score. In Panel A the quality of the service is the dependent variable; in Panel B investment in capital expenditures is the dependent variable; in Panel C investment in base stations is the dependent variable; in Panel D employment is the dependent variable; in Panel E wages is the dependent variable. The sample is restricted to countries with available data for the ITU mobile phone basket as well as with available data in GSMA. Territories are excluded from the sample. The unit of observation is the 2010-2014 average of each given variable in each country. Some of the variables are based on data from © GSMA Intelligence (2015). Robust standard errors are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Panel A: Quality - - IV regressions

	Connections % 3G+	Connections % 4G	Network Coverage 3G+	Network Coverage 4G	Speed, in Mbit/s
C2	-1.819	0.0327	-2.955	-0.451	-189.2
	(1.533)	(0.216)	(2.089)	(1.135)	(269.9)
Ln(GDP per capita)	0.137***	0.0202***	0.134***	0.174***	-2.494
	(0.0302)	(0.00459)	(0.044)	(0.0238)	(6.818)
Ln(Population)	-0.0385	0.00818	-0.0791	-0.0125	-6.95
	(0.0619)	(0.00905)	(0.0823)	(0.0441)	(10.98)
Population Density	0.013	0.0110***	-0.0282	0.0279*	-1.655
	(0.0205)	(0.00312)	(0.0221)	(0.015)	(2.708)
Inflation	-0.00272	-0.00150*	0.00235	-0.00757***	0.16
	(0.00592)	(0.000831)	(0.00679)	(0.00236)	(0.78)
Intercept	1.053	-0.323	3.044	-0.754	303.6
	(2.364)	(0.34)	(3.321)	(1.748)	(450.2)
Number of Countries	97	97	145	91	103
R-squared	0.131	0.335	.	0.609	.
F	17.46	15.77	19.17	32.66	0.457

Panel B: Total Capex/Revenues - - IV regressions

Ln(GDP per capita)	-0.0375	-0.0367*	-0.0312***	-0.0298***	-0.0278**	-0.0499	-0.00916	-0.133
	(0.0239)	(0.021)	(0.00793)	(0.00971)	(0.0125)	(0.0873)	(0.061)	(0.537)
Ln(Population)	-0.0213	-0.019	-0.00727	-0.0081	-0.00668	-0.00658	-0.011	-0.0247
	(0.0475)	(0.0401)	(0.00673)	(0.00714)	(0.00678)	(0.00953)	(0.0148)	(0.115)
Population Density/1000	-0.00294	-0.00186	0.000789	-0.00146	0.00913	0.00216	0.00608	0.02
	(0.0149)	(0.0117)	(0.00629)	(0.00584)	(0.0252)	(0.00608)	(0.0147)	(0.0809)

Inflation	0.00276	0.00232	0.00214	0.00306	0.00355	-0.000791	0.00112	0.00133
	(0.00328)	(0.00214)	(0.00174)	(0.00279)	(0.00598)	(0.0116)	(0.00258)	(0.00401)
C2	-0.37							
	(1.139)							
Herfindahl-Hirschman Index		-0.0000355						
		(0.000108)						
Lack Compet 5 Sectors W/Replac			-0.00182					
			(0.00494)					
Lack Compet 5 Sectors W/O Replac				0.00359				
				(0.00788)				
Mobile Cellular Basket					0.00357			
					(0.0115)			
Mobile Internet Basket 1GB						-0.00498		
						(0.0216)		
ARPU by Connection							-0.00329	
							(0.00944)	
EBITDA Margin								-2.679
								(13.68)
Intercept	1.19	0.991	0.613***	0.611***	0.474	0.942	0.539***	2.751
	(1.883)	(1.254)	(0.152)	(0.15)	(0.392)	(1.579)	(0.191)	(11.52)
Number of Countries	105	105	105	87	105	99	105	101
R-squared	0.025	0.02	0.135	0.172	.	.	0.077	.
F	4.956	4.819	4.668	5.357	3.257	3.788	4.064	0.408

Panel C: Number of Base Stations*100,000/Revenues - - IV regressions

Ln(GDP per capita)	-0.0184	-0.017	-0.0254	-0.0131	-0.0275	-0.101	-0.0196	-0.0476
	(0.0338)	(0.0505)	(0.081)	(0.046)	(0.113)	(0.0966)	(0.0248)	(0.0362)
Ln(Population)	0.0915	0.0935	0.0838***	0.0872***	0.0850**	0.0799**	0.0843***	0.0948***
	(0.118)	(0.146)	(0.0268)	(0.0317)	(0.0359)	(0.0342)	(0.0304)	(0.0286)
Population Density/1000	0.00923	0.00935	-0.00338	0.00934	0.00374	0.272	0.00686	0.0205
	(0.0544)	(0.0558)	(0.141)	(0.0401)	(0.0495)	(0.182)	(0.0339)	(0.0328)
Inflation	0.00774	0.00774	0.00551	0.00762	0.00863	0.0116	0.00812	-0.00895
	(0.0107)	(0.0107)	(0.041)	(0.0066)	(0.00683)	(0.00713)	(0.00659)	(0.0127)

C2	0.201							
	(2.924)							
Herfindahl-Hirschman Index		0.0000361						
		(0.000523)						
Lack Compet 5 Sectors W/Replac			0.00133					
			(0.0196)					
Lack Compet 5 Sectors W/O Replac				0.0567				
				(0.04)				
Mobile Cellular Basket					-0.00387			
					(0.0551)			
Mobile Internet Basket 1GB						0.00189		
						(0.00994)		
ARPU by Connection							0.0011	
							(0.0161)	
EBITDA Margin								0.131
								(2.599)
Intercept	-1.222	-1.247	-0.754	-1.105	-0.901	-0.144	-0.939	-0.851
	(4.422)	(4.75)	(2.471)	(1.045)	(0.624)	(2.223)	(0.607)	(0.604)
Number of Countries	96	96	96	91	96	72	96	77
R-squared	0.178	0.184	0.239	0.094	0.169	0.308	0.182	0.193
F	3.031	3.028	3.659	2.665	3.162	6.965	3.203	3.331
Panel D: Number of Employees*1000/Revenues - - IV regressions								
Ln(GDP per capita)	-0.0104	-0.00641**	-0.00431***	-0.00452**	0.0038	-0.00866	0.00447	-0.0109
	(0.01)	(0.00319)	(0.0015)	(0.00221)	(0.026)	(0.00606)	(0.00575)	(0.0131)
Ln(Population)	-0.0112	-0.00577	-0.00229***	-0.00182**	-0.0027	-0.00295	-0.00360**	-0.00281
	(0.0134)	(0.00403)	(0.00082)	(0.000902)	(0.00486)	(0.00194)	(0.00141)	(0.00379)
Population Density/1000	-0.0000298	0.00097	0.00128*	0.00142**	0.0193	0.00148	0.00379**	0.00211
	(0.00244)	(0.000936)	(0.000682)	(0.000706)	(0.0607)	(0.00138)	(0.00177)	(0.00129)
Inflation	0.000425	0.000197	0.000197	0.000135	0.00291	-0.000553	-0.000193	-0.00018
	(0.000742)	(0.000367)	(0.000302)	(0.000665)	(0.00994)	(0.000658)	(0.000302)	(0.000324)
C2	-0.242							
	(0.335)							

Herfindahl-Hirschman Index		-0.0000109						
		(0.0000108)						
Lack Compet 5 Sectors W/Replac			-0.00114					
			(0.000737)					
Lack Compet 5 Sectors W/O Replac				-0.000382				
				(0.00121)				
Mobile Cellular Basket					0.00696			
					(0.0237)			
Mobile Internet Basket 1GB						-0.000954		
						(0.000997)		
ARPU by Connection							-0.00141	
							(0.000958)	
EBITDA Margin								-0.137
								(0.302)
Intercept	0.488	0.214	0.0973***	0.0904***	-0.16	0.181	0.0663**	0.213
	(0.571)	(0.132)	(0.0223)	(0.0264)	(0.838)	(0.116)	(0.0268)	(0.286)
Number of Countries	116	116	116	95	116	110	116	103
R-squared	.	.	0.092	0.092	.	.	0.005	.
F	0.758	2.091	3.887	3.276	0.125	1.092	2.71	1.869
Panel E: Cost of Personnel/Revenues - - IV regressions								
Ln(GDP per capita)	0.00542	0.0059	0.00861	0.0146	0.00843	-0.0109	0.021	0.00272
	(0.0173)	(0.0145)	(0.0106)	(0.012)	(0.0113)	(0.13)	(0.0439)	(0.02)
Ln(Population)	-0.0162	-0.0141	-0.00910***	-0.00760**	-0.00887***	-0.00317	-0.00991**	-0.00962**
	(0.0307)	(0.0208)	(0.00281)	(0.00295)	(0.00292)	(0.0285)	(0.00452)	(0.00374)
Population Density/1000	-0.000494	0.000208	0.000952	-0.000162	0.00328	0.0065	0.00268	0.00213
	(0.00747)	(0.00473)	(0.00294)	(0.00306)	(0.00764)	(0.0367)	(0.00541)	(0.00353)
Inflation	0.00204	0.00215	0.00177	0.00323	0.00184	-0.00436	0.00197	0.000883
	(0.00287)	(0.00288)	(0.00214)	(0.00248)	(0.00232)	(0.0361)	(0.00245)	(0.00321)
C2	-0.169							
	(0.698)							
Herfindahl-Hirschman Index		-0.0000163						
		(0.0000635)						

Lack Compet 5 Sectors W/Replac			-0.00109					
			(0.00366)					
Lack Compet 5 Sectors W/O Replac				0.00086				
				(0.00577)				
Mobile Cellular Basket					0.000948			
					(0.00338)			
Mobile Internet Basket 1GB						-0.00363		
						(0.0225)		
ARPU by Connection							-0.00144	
							(0.00484)	
EBITDA Margin								-0.0988
								(0.319)
Intercept	0.433	0.322	0.155	0.0642	0.128	0.371	0.0779	0.252
	(1.186)	(0.688)	(0.128)	(0.143)	(0.164)	(1.577)	(0.277)	(0.342)
Number of Countries	51	51	51	45	51	47	51	51
R-squared	.	0.013	0.115	0.117	0.063	.	0.081	0.08
F	2.627	3.206	4.53	4.991	3.426	1.051	4.796	4.339

Table 6. Regulation and Proceeds from Spectrum Auctions

This table shows the effect of regulation on the proceeds raised from spectrum auctions. In the first column, all auction proceeds, through 2014, reported in DotEcon are included. The second column only includes proceeds raised since 1999, i.e., when the first 3G auction was held. The last column only includes proceeds raised since 2011, i.e., when the first 4G auction was held. The sample is restricted to countries with available data for the ITU mobile phone basket as well as with available data in GSMA. Territories are excluded from the sample. Some of the variables are based on data from © GSMA Intelligence (2015). Robust standard errors are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	Y1 = Proceeds from All Spectrum Auctions/Mobile Operators' Aggregate Revenues	Y2 = Spectrum Auction Proceeds since 1999/ Mobile Operators' Aggregate Revenues	Y3 = Spectrum Auction Proceeds since 2011/ Mobile Operators' Aggregate Revenues
Ln(GDP per capita)	0.0410***	0.0398***	0.0101**
	(0.0101)	(0.0101)	(0.00448)
Ln(Population)	0.0342***	0.0332***	0.0115***
	(0.00686)	(0.00684)	(0.00342)
Population Density	-0.00521	-0.00461	0.00379
	(0.00748)	(0.00756)	(0.0052)
Inflation	-0.00271	-0.0026	-0.00182**
	(0.00189)	(0.00188)	(0.000883)
Regulatory Score	0.00280***	0.00280***	0.00118**
	(0.00088)	(0.000875)	(0.000521)
Intercept	-0.978***	-0.953***	-0.296***
	(0.142)	(0.142)	(0.0677)
Number of Countries	148	148	148
R-squared	0.373	0.362	0.216
F	14.24	13.58	8.281

Table 7. Public Interest and Regulation

This table investigates the impact of public interest related variables on the regulation in place in the telecommunication sector. The dependent variable is the regulatory score. For the definitions of the variables see Table 1. Robust standard errors are reported in parentheses. The sample is restricted to countries with available data for the ITU mobile phone basket as well as with available data in GSMA. Territories are excluded from the sample. The unit of observation is the 2010-2014 average of each given variable in each country. Robust standard errors are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(GDP per capita)	8.548***	4.317***	4.363***	6.196***	5.189***	3.000***	3.422***
	(1.668)	(1.085)	(1.141)	(1.158)	(1.336)	(1.03)	(0.992)
Ln(Population)	-0.896	1.117**	1.056	0.239	-0.927	-0.799	-0.759
	(0.917)	(0.531)	(0.732)	(0.692)	(1.205)	(0.884)	(0.907)
Population Density/1000	-0.275	0.893	0.484	4.12	-0.698	-0.459	-0.488
	(0.522)	(0.631)	(0.613)	(3.419)	(0.559)	(0.484)	(0.52)
Tax Evasion	-2.128						
	(1.276)						
Telecom Sales Tax Rate		46.03***					
		(15.89)					
Telecom Corporate Tax Rate			-6.235				
			(14.52)				
Taxes as a Proportion of TCMO				43.15**			
				(17.22)			
Union Density					-5.572		
					(6.215)		
Left Wing 1928 to 1995						-8.334**	
						(3.66)	
Left Wing 1975 to 1995							-3.677
							(3.565)
Intercept	6.989	-2.886	6.34	-4.887	35.54	57.70***	50.27**
	(23.44)	(13.74)	(14.33)	(18.09)	(25.44)	(18.7)	(19.67)
Number of Countries	55	140	132	95	61	75	75
R-squared	0.273	0.163	0.136	0.346	0.195	0.203	0.162
F	9.134	7.832	6.377	9.503	4.285	5.535	4.526

Table 8. Political Determinants of Regulation

This table investigates the impact of political factors on the regulation in place in the telecommunication sector. For the definitions of the variables see Table 1. Robust standard errors are reported in parentheses. The sample is restricted to countries with available data for the ITU mobile phone basket as well as with available data in GSMA. Territories are excluded from the sample. The unit of observation is the 2010-2014 average of each given variable in each country. Robust standard errors are reported in parentheses. Regressions in columns (1)-(6) are based on the whole sample; the regression in column (7) is based on middle income countries. * p<0.10, ** p<0.05, *** p<0.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(GDP per capita)	2.746**	3.085***	3.457***	4.937***	1.686	2.895	-3.509
	(1.122)	(1.082)	(1.038)	(1.179)	(1.607)	(1.929)	(2.644)
Ln(Population)	1.064*	0.979	1.102*	0.823	1.449**	1.078	1.994**
	(0.621)	(0.629)	(0.613)	(0.564)	(0.583)	(0.696)	(0.795)
Population Density/1000	2.097***	2.010***	2.689***	1.026	-0.168	2.098**	-17.72
	(0.715)	(0.714)	(0.797)	(0.772)	(0.564)	(0.823)	(12.86)
Democracy	1.579***					1.215***	1.545***
	(0.399)					(0.443)	(0.497)
Executive Constraints		2.879***					
		(0.744)					
Political Competition			2.221***				
			(0.52)				
Political Connections				-43.58**		-32.72*	-35.67**
				(18.98)		(19.33)	(17.40)
Corruption					-0.249***	-0.0562	-0.190
					(0.0784)	(0.0795)	(0.189)
Intercept	9.484	2.253	-4.428	5.388	37.40*	15.08	67.98**
	(13.58)	(13.94)	(13.93)	(13.92)	(19.55)	(24.05)	(33.63)
Number of Countries	132	132	132	124	148	116	56
R-squared	0.283	0.264	0.311	0.175	0.222	0.281	0.324
F	11.57	10.94	12.42	6.979	14.31	6.773	4.560