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Land Use Regulations and Urbanization in the Developing World: Evidence from over 600 Cities

Paavo Monkkonen
University of California, Los Angeles, USA
Lucas Ronconi
Centro de Investigación y Acción Social, Argentina

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ABSTRACT

Theoretical predictions of negative impacts of stringent land use regulation on urbanization outcomes have contributed to reform efforts around the world. However, there is limited empirical evidence internationally on the relationship between regulation and urbanization, especially in developing countries. In this report, we present a series of stylized facts about the prevalence, determinants and impacts of land use regulation in Asia, Latin America, and the rest of the world. In order to do this, we combine several data sources, including surveys of regulation from the World Bank, remote sensing data, and data from various countries' censuses. Asian cities have more stringent land use regulation in some areas compared to Latin American cities, but the opposite occurs in other areas. The largest variation in regulations is across countries rather than across continents or within countries. Economic development is negatively correlated with land use regulations, even after controlling for the general regulatory environment. Cities that are more constrained by water and mountains tend to have more regulations. Other major determinants are legal systems and urbanization pressures. Although land use regulations are not clearly associated with population density or urban compactness, they do seem to restrict business expansion and household formation, though only to a minor degree.

1. Introduction

The importance of the connection between urbanization and development sometimes overshadows the diversity of urbanization processes around the world. Urban forms vary dramatically across and within countries and the quality of urbanization – both in terms of living conditions and urban efficiency – is an increasingly recognized input to economic development, in addition to being an outcome of it. The regulation of urban development is theorized to affect different aspects of urbanization, for example, cities with more stringent regulation of land-use are predicted to have higher housing prices, and reduced opportunities for household formation, which can in turn reduce the benefits of agglomeration. Additionally, regulations are thought to be critical determinants of urban form, with restrictions on development considered to lead to lower densities and more sprawling cities. Yet evidence on the determinants and impacts of land use regulation is relatively limited outside of developed countries as is comparison between countries, and regions.

This project examines the determinants of land use regulation and their relationship to various urban outcomes. One reason work in this area is limited is the data challenge. We use survey using data from the Doing Business project of the World Bank (including the Enterprise Surveys) that measure several aspects of land use regulations in almost 700 cities in over 180 countries around the world. The measures mostly focus on the regulatory process, such as costs or delays in obtaining permits, rather than rules such as minimum lot sizes or growth controls. Thus, they provide a proxy for the regulatory environment rather than a comprehensive picture.

We match the data on regulation to publically available geographic data, and census microdata from the Integrated Public Use Microdata Series (Minnesota Population Center, 2011). The geographic coverage varies in different sections of the report due to data availability from these different sources. Although regulatory data is available for hundreds of cities, certain variables are only available for some cities. The coverage of other sources of data, like census microdata, is even more limited. Nonetheless, we are able

to come to several stylized facts describing land use regulations, their determinants and association with on urban outcomes such as urban form, business expansion, and household formation.

The evidence presented in this report should not be taken as causal, yet the stylized facts presented move research on the topic forward and can inform policy in rapidly urbanizing Asia and predominantly urban Latin America. The theoretical relationships between regulations and urbanization have not been widely empirically tested in these regions, yet they influence policy (Buckley and Kalarickal, 2005). Thus, efforts to empirically assess the impacts of land use regulation and the extent to which they affect urbanization are important. Given that the analysis in the report is limited in part by the incompleteness of the regulatory data, the non-random nature of the cities for which data is available, and the rough measures of outcomes such as business expansion and urban form, we hope this is only an initial effort of a larger body of research.

The organization of the report is as follows. A literature review in the next section is followed by a description of the different databases we use. Afterwards, we present three sets of stylized facts about land use regulation. First, we describe the prevalence of regulations and compare them between and within Asia and Latin America. Then we present an analysis of the determinants of regulation. Finally, we examine the relationship between land use regulations and outcomes such as business expansion, household formation, and urban form.

2. Literature Review

There is a relatively large body of research on the impacts of land-use regulations on housing markets and urbanization in developing countries (e.g. Dowall, 1992; Bertaud and Malpezzi, 2001; Bertaudand Brueckner, 2005; Sridhar, 2010; Monkkonen and Ronconi,

2013), yet little of the research is comparative or comprehensive as data is limited. In fact, most studies are case studies of only one or two cities. Data limitations also constrain the type of analysis carried out. Thus, we first review literature on the topic from the US in order to highlight some methodological challenges before turning to existing literature from Asia and Latin America.

Urban development regulations are the various rules and requirements that govern the conversion of agricultural land to urban use and the construction of buildings and infrastructure. They include such measures as building height restrictions, minimum lot sizes, construction quality standards, land donations, environmental impact approvals, and growth management measures such as green belts. Several taxonomies of urban development or land-use regulations have been created in the United States - a literature review can be found in Quigley and Rosenthal (2005). Roughly there are five categories of regulation commonly used; limits on development density and intensity, controls on growth, design and quality standards for buildings, withdrawal of land from developable supplies, and costs imposed on developers - including both monetary costs and time delays (Deakin, 1989). It is this latter category for which international data are available.

Although this study uses data on only one of five categories of land-use regulation, several studies focused on measuring on land-use regulations in the United States found that measures of regulations in the different categories are highly correlated (Glickfeld and Levine, 1992; Gyourko *et al.*, 2008; Quigley *et al.*, 2009).

There is a general agreement that urban development should be regulated due to market failures associated with spatial externalities and public goods, but scholars emphasize that regulations must be appropriate and not overly strict (Dowall, 1992; Buckley and Kalarickal, 2005). Of course, determining when a regulation is *too* strict is a challenge that most of the research on the topic does not attempt to meet, instead focusing simply on the relationship between stringency and outcomes.

Standard economic theory predicts that strict land use regulations impact housing markets in two ways; they increase the price of finished housing directly through fees, raising the price of housing due to minimum standards and indirectly by increasing the time and uncertainty in the housing development process (Malpezzi and Mayo, 2001). Second, regulations are theorized to reduce the price elasticity of supply, lowering the steady state level of construction and reducing market responsiveness to demand shocks (Mayer and Somerville, 2000). These restrictions on the housing market are hypothesized to impact urban growth, population densities, household formation, productivity, and migration decisions.

In the US, empirical tests of the relationship between land-use regulation and housing markets have become more sophisticated in recent years. They do not reject the hypothesis that cities with more stringent regulations of land-use and urban development have lower housing supply elasticities, higher housing and land prices, and higher market volatility (Ihlanfeldt, 2007; Glaeser and Ward, 2009; Hilber and Vermoulen, 2010; Kok *et al.,* 2010; Saiz, 2010). Due to data requirements, however, rigorous tests have been undertaken only in the United States and the United Kingdom. The empirical analysis is also complicated because models should account for the motivation of regulation, which in many regulatory systems results in an endogenous relationship (Hilber and Robert-Nicoud, 2009; Kok *et al.,* 2010; Saiz, 2010). Cities with tighter housing markets may regulate urban development more strictly, creating a two-way relationship.

The state of the art empirical approach is a model of housing prices or other urban outcomes as a function of various city level characteristics, including natural land supply constraints. Models mostly account for the endogenous relationship between urbanization outcomes and regulations, through an instrumental variables approach. For example, Saiz (2010) uses initial economic and population characteristics, and weather variables to describe amenities, whereas Kok *et al.,* (2010) also include indicators of the political tendencies of different jurisdictions, using party affiliation as a proxy for inclinations to support regulation.

However, the nature of the causal relationship between regulations and housing markets or urbanization is likely to differ across countries, and a general theory has not been fully developed. The two-way relationship between regulations and housing prices is known as the home voter hypothesis in the United States, where the idea is that home-owners will vote to limit development in their jurisdiction in order to keep their home prices high (Fischel, 2001). Saiz (2010) recently extended this hypothesis to the proposition that naturally land constrained cities will regulate development more strictly due to the scarcity, and thus should have lower supply elasticities and higher housing prices due to natural and regulatory restrictions. Hilber and Vermoulen (2010) have proposed a more general theory that posits regulation as the outcome of a competitive game between owners of developed land, who seek to limit further development, and owners of undeveloped land, who seek to make development easier.

To some extent, the international focus on regulatory constraints in property markets began in Latin America with work by De Soto (1986), who argued that overly stringent regulation of property in urban areas limits people's ability to access the true value of their assets. However, empirical work on land use regulations in developing countries has been primarily comprised of single case analyses (e.g., Green *et al.*, 1994; Buckley and Mathema, 2007) or a comparison of a handful of cases (Malpezzi and Mayo, 1997; Dowall and Monkkonen, 2007). The limited comparative study of land-use regulation means that a description and empirical analysis of land use regulations and factors correlated with them is an important contribution. Additionally, incorporating a variable describing physical constraint to urban development is significant.

Some recent studies have empirically examined in developing countries the theories put forth and previously tested in the US. Often, results are very different. For example, Monkkonen and Ronconi (2013) find that in Argentina, stringent land use regulations are associated with lower prices for land at the municipal level. They argue that this is due to lower levels of enforcement in more strictly regulated areas which results in negative externalities and a less valuable environmental quality.

There has been even less empirical work on the impacts of land use regulation in Asian countries using the same theoretical models as in the US or the UK. To some extent this is due to the greater diversity in the powers and actions of government vis-à-vis urbanization in Asia. For example, in Indonesia, the government does not exert great influence over property registration in most urban parcels through the agency designated to do so, leaving much land management to the informal sector (Struyk et al., 1990). In strong developmental states like China, the relationship between regulation and urbanization is also greatly complicated by the oftentimes inconsistent implementation of rules, which is argued in many cases to result from deliberate institutional ambiguity (Ho, 2001).

3. Data and Measurement

We combine data from several sources, starting with two sources of survey data on regulations from the Doing Business project of the World Bank. At least some of these data are available for almost 700 cities, thus we seek to collect other sources of data on as many of these cities as possible. Some of these sources are limited, most notably the data on headship. However, data on urban form was obtained for more than 600 cities. Table 1 (in the Annex) shows the number of countries and cities for which different variables are available. In the remainder of this section we describe in detail the data we use and the way in which indicators are calculated.

Table 1. Coverage of different data sources

Variable	Number of countries with data				Number of cities with data			
	Total	**Latin America**	**Asia**	**Other**	**Total**	**Latin America**	**Asia**	**Other**
Construction permits (Enterprise Surveys)	116	29	26	61	383	73	140	170
Construction Permits (Doing Business)	183	33	48	102	394	87	118	189
Registering property (Doing Business)	182	33	47	102	443	99	153	191
Land a constraint to business	137	31	32	74	437	75	166	196
Zoning a constraint to business	60	15	8	37	203	52	29	122
Tax Enforcement	136	31	32	73	436	75	166	195
Fire & Building Enforcement	59	8	16	35	113	8	69	36
Bribe obtain construction permit	115	29	24	62	395	73	147	175
Land availability	183	33	47	103	648	121	241	286
Population Density	182	32	48	102	612	120	236	256
Compactness	182	32	48	102	612	120	236	256
Headship	18	8	3	7	166	79	61	26

Source: Doing Business; Enterprise Surveys; Authors with LandScan Global and Minnesota Population Center

3.1 Measuring Land Use Regulation

We employ two sources of data for regulations. Since 2006, the World Bank has been collecting data on regulatory constraints to doing business in two ways, the Doing Business project and the Enterprise surveys. The former are collected in a collaborative manner from public officials and the private sector, whereas the latter are collected through surveys of registered firms only. As mentioned previously, these data only cover one of five aspects of regulation. However, given high correlation between different categories of regulation, we take them as a proxy for the overall regulatory environment of a city.

The more highly promoted element of the Doing Business project is data gathered through focus groups on several aspects of regulation. Among them is one on the difficulty in obtaining construction permits and another on the difficulty in transferring property between two parties. They are gathered through focus groups of local surveys of public officials, property developers, property lawyers, notaries and other relevant stakeholders. These groups go over the procedures necessary to get a construction permit or transfer property, and the time and cost of each step. The indicators are not strictly *de jure* indicators, but they can be thought of as measures of formal regulation. They do not consider either the existence of extra-legal payments or the extent of enforcement, which are important components of the regulatory framework.

The Doing Business surveyors recognize the importance of the characteristics of a specific building in the permitting process so the regulation numbers are estimates for a warehouse of a given size and quality across countries. They also recognize that the entity requesting a permit matters and so they have a hypothetical company with size and value; also consistent across countries. This hypothetical project approach is one way of alleviating potential biases in the data; however, it might be criticized for not reflecting the reality of every context. If the hypothetical project is not something that is actually built frequently, the interviewees would not be able to provide accurate account of pertinent regulations.

Figure 1 below shows the location of the 683 cities for which some measure of land use regulation is available, either from the Doing Business focus groups or the Enterprise Surveys. They are not a random sample of cities, however, as both sets of surveys first gathered data in the biggest city in almost every country (roughly 180 countries). Additionally, the Doing Business focus groups have later been carried out in almost a dozen countries that were interested in participating. These cover 20 cities on average in a given country. In Asia, the countries with sub-national data include Bangladesh, China, India, Indonesia, Pakistan, and the Philippines, and in Latin America, Brazil, Mexico, and Colombia.

Figure 1: Map of 683 Cities with at least one Measure of Urban Development Regulation between 2002 and 2012
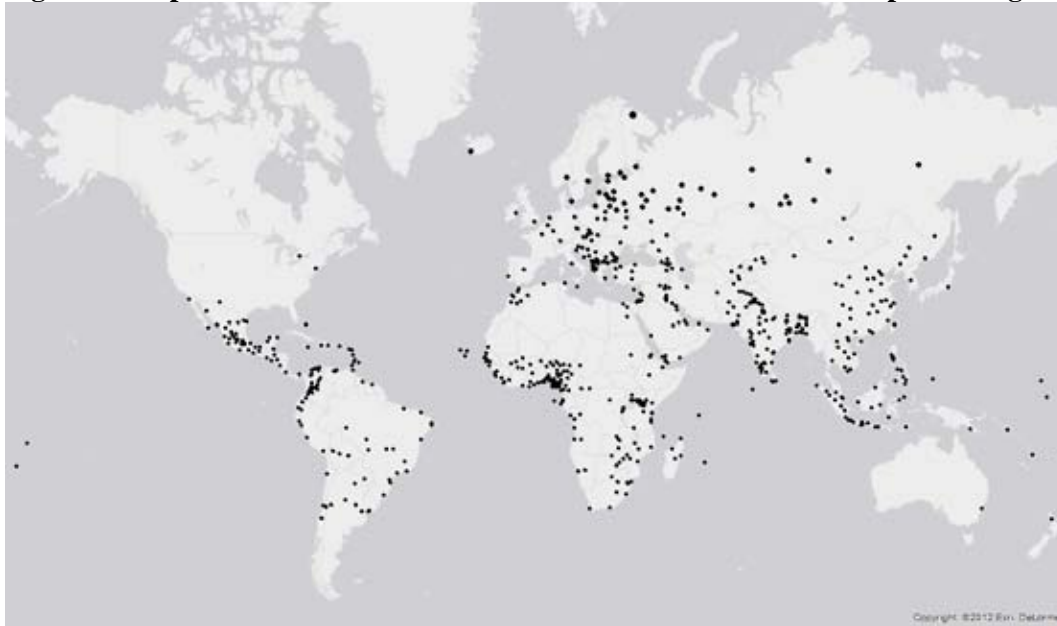
Source: Authors with World Bank (2012a; 2012b)

The Enterprise Surveys are surveys of business owners and top managers of registered firms.[1] It includes several questions that are particularly useful to measure the regulatory framework. In particular, business owners and top managers report whether they have requested a construction permit during the last two year and how many days they waited to receive it. They also provide their opinions regarding the stringency of zoning regulations. Finally, they report whether a gift or informal payment was asked for or expected to obtain a construction permit, and whether the firm was inspected by tax officials and building inspectors during the last year. These measures have several limitations. First, they are exclusively based on the opinions of business owners. Although they are important stakeholders, they are not the only group affect by regulations. Second, some measures such as enforcement and corruption are likely to have large measurement error because interviewees are unlikely to report their true behavior.

*3.2 Measuring Determinants of Land Use Regulation*

We consider four potential determinants of land use regulation in the analysis; the origins of a country's legal system, urbanization pressures, Gross Domestic Product (GDP), and the extent to which a city's development is constrained by natural barriers (water and steep slopes). The origin of a country's legal system has been used in other research on regulations, most notably work by La Porta et al. (1997). La Porta and colleagues make the argument that a country's legal system, which in many cases has been imposed on them through colonialism, plays a strong role in determining the quality of investor protections and therefore, significantly impacts levels of investment. By the same logic, legal systems determine the stringency of land use regulation to a large extent and in many cases were exogenously imposed during a colonial period.

In order to measure the availability of developable land for urban expansion, we follow Albert Saiz (2010) work in the measurement of natural constraints to growth. To estimate the extent to which a city's expansion is constrained by land, we make an indicator of the

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[1] The Enterprise Survey is a stratified random sample with replacement, and usually includes 1,500 firms in large countries, 360 firms in medium-sized economies, and 150 interviews in small economies. For more details see the website https://www.enterprisesurveys.org/

availability of developable land by first drawing a circle of 40 km radius around the city center and then estimating the percent of land within this circle on which urban development is physically possible. We remove the land that is either underwater, steeply sloped, or in a different country. This is the first time, to the best of our knowledge, that this variable has been measured for such a large sample of cities all around the world.

Figure 2. Developable Land in Tijuana, Mexico
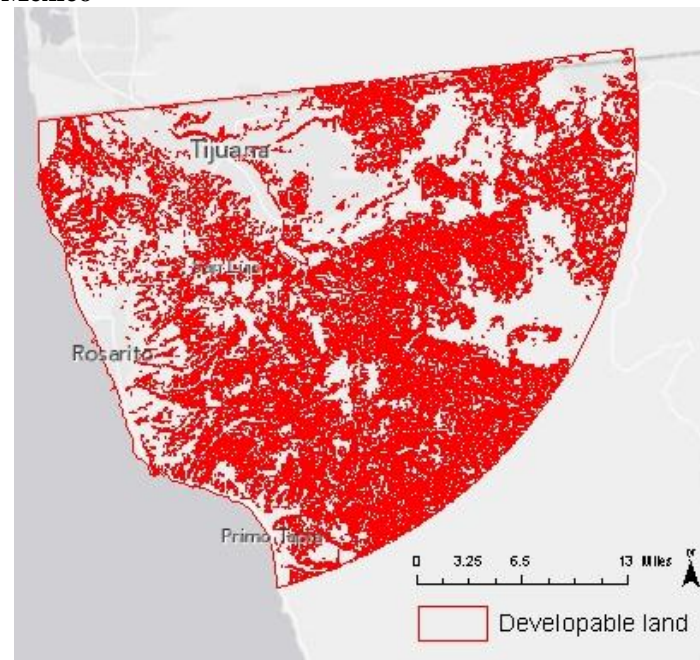
Source: Authors' calculation

Figure 2 above shows an example of developable land in Tijuana, Mexico, which is one of the more land constrained cities in the sample. It is on the coast, shares an international border with the United States, and has a very mountainous topography that prevents

development to a large extent. Only 23 percent of the land within 40 kilometers radius of the city center – the land outlined in red on the map - is considered developable.

3.3 Measuring Impacts

We consider three possible impacts of land use regulation; business expansion, household formation, and urban form. The first is the most simple. The Enterprise Surveys provide information on whether access to land is an important obstacle for the growth of business. This variable can take five values; 0 if access to land is no obstacle, 1 if minor, 2 if moderate, 3 if severe, and 4 if very severe obstacle.

In order to measure household formation, we estimate age-specific headship rates for as many cities as possible. Headship rates in this case refer to the percent of a certain age group that was classified either as a household head or spouse in the census. Other household positions include child, parent, or other family. We consider headship of "young" people, aged 20 to 30, and "middle-aged" people, aged 30 to 40. Recent,[2] individual level records are available from the censuses of 166 cities in 19 countries; eight in Latin America and four in Asia. Headship rates are used as a proxy for housing market conditions. Price data is notoriously difficult to acquire in developing countries. Headship reflects housing affordability conditions because beyond the primary force of culture determining when a person will form a new household, otherwise similar but more affordable cities will see a higher rate of headship and vice versa.

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[2] The oldest census from which we use data is the year 2001, the most recent 2010.

We calculate a consistent measure of population density and urban form for over 600 cities around the world[3] using the LandScan Global Population Database, from the United States Department of Energy's Oak Ridge National Laboratory.[4] This is a global population database that shows the distribution of population at a one-kilometer resolution over an average day, generated with an algorithm based on spatial data, imagery analysis, and census data by administrative boundaries.

Figure 3 compares two images of Buenos Aires, Argentina; one from the LandScan Global Population Database that shows the concentration of population across space and the other a land use classification carried out by the authors using a Landsat image that simply identifies urban vs. non-urban land. Thus, they represent different data. In order to calculate measures of urban form using the LandScan Global Population Database, we select only cells with population densities greater than 750 people per square kilometer to highlight the urbanized locations. Another difference between the two sources of data is the resolution, with the LandScan being comprised of pixels of 0.0083 degrees and LandSat images of 30 meters. This poses some problems for the estimation of some urban form measures, yet not for the two of primary interest, population density and urban compactness. In spite of its disadvantages, the LandScan data is available for the whole world and is thus preferable.

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[3] Initially we intended to rely on land use classification of urban land carried out with Landsat satellite imagery at a 30 meter resolution. The process of classification was extremely time consuming and after classifying more than 150 cities we had to switch to a quicker process of using the LandScan global population data set.
[4] This product was made utilizing the LandScan (2011)™ High Resolution global Population Data Set copyrighted by UT-Battelle, LLC, operator of Oak Ridge National Laboratory under Contract No. DE-AC05-00OR22725 with the United States Department of Energy.

Figure 3. LandScan Image, 2011, (left) and Land Use Classification from LandSat Image, 2010, (right) of Buenos Aires, Argentina
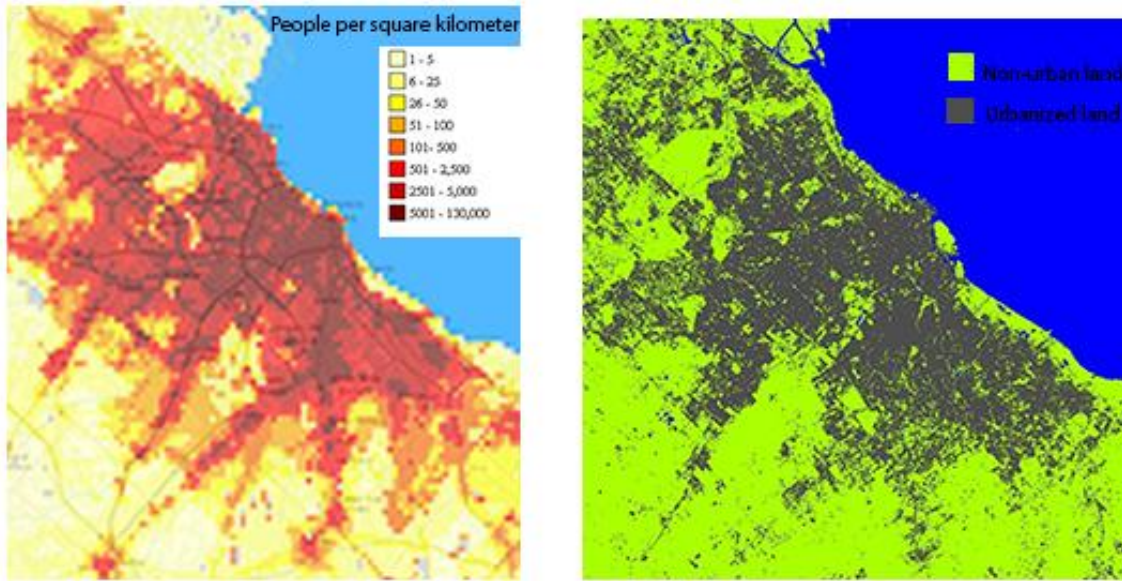
Source: LandScan Global (2011) and NASA (2010)

We measure urban form in two ways; a simple measure of population density, people per square kilometer, and a measure of compactness. The metric of compactness is borrowed from Angel and colleagues (Angel et al., 2010), and referred to in their work as the proximity index. The measure is a ratio that is defined first by drawing an "equal area circle", which takes the center of the city as its center and is the area that would be occupied if the city's urban area formed a perfect circle around this point. The proximity index thus a ratio of the average distance of the pixels in this equal area circle to the actual average distance of the city's pixels to the center. It ranges from 0 to 1 with 1 being more compact, i.e. a perfect circle. We consider this superior to other metrics of compactness and fragmentation proposed by Angel and colleagues due to its simplicity and ease of interpretation.

4. Comparing the Regions

4.1 Differences in Regulatory Environment

Table 2 (in the Annex) is a summary table of the various measures of regulation from both the Doing Business and Enterprise Survey datasets.[5] The sample is restricted to the main city in each country. The table also includes the standard "starting a business" measure of general regulation from Doing Business. It juxtaposes Latin American and Asian countries as well as other regions. It is clear that on average getting a construction permit requires many more steps and time than registering property. On average, it takes 16 procedures and about 5 months to obtain a permit while registering property only takes about 7 steps and 2 months. Costs are normalized in different ways in the Doing Business data thus are harder to compare (i.e., the cost of obtaining a construction permit is measured as a percentage of income per capita while the cost of registering property is measured as a percentage of the value of the property).

The Doing Business data show that Asian countries have more procedures needed to obtain construction permits and these are much more costly compared to Latin America. Yet costs in both Latin America and Asia are lower than in other regions.[6] When it comes to property registration systems, however, Latin American countries have more time consuming and expensive regulations compared to Asian countries.

The Enterprise Surveys also ask firms about delays in obtaining construction permits. Firms in Latin America report longer waiting time to obtain a construction permit compared with firms in Asia, though both are lower than the Doing Business measure. This could

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[5] The Doing Business indicators are available in a yearly basis from 2006 to 2013. Throughout this paper, however, we use averages over this time period in order to capture the general regulatory environment of each city. We leave for further work an analysis of the dynamic relationship between regulations and urban outcomes.

[6] This is mainly explained by the very high cost in several African countries.

be due to a number of factors, starting with the fact that different samples of cities are covered. Additionally, Enterprise Surveys includes any type of construction permit, whereas Doing Business is for a warehouse of specific size and quality. The Enterprise Survey provides measures of the actual time to obtain a permit which can be shorter than the stipulated time in Doing Business due to a number of factors such as paying a bribe to speed the process.

According to the opinion of business owners, zoning regulations are a slightly larger obstacle to business expansion in Asia than in Latin America and other countries. The average value all around the world, however, is close to 1 meaning that zoning is in general a minor obstacle.[7]

The enforcement of regulations and the extent of corruption are important additional elements of the regulatory environment. These variables are usually hard to measure in part because people do not tend to report their true behavior. Taking into account these caveats, we observe that, business owners and high-level managers in Latin America are much less likely to report having had to pay a bribe to obtain a construction permit – only 11 per cent of the time compared to 45 per cent in Asia. Additionally, firms located in Asia are on average more likely to be inspected by tax officials and much more likely to be inspected by fire safety officials.

Therefore, the findings show that some areas are more heavily regulated in Asia while others are more heavily regulated in Latin America. This is quite different from what occurs with general business regulations. Asian countries have much speedier and cheaper set of procedures for starting a business on average, almost half as fast and one third as costly.

Finally, the evolution over time of the Doing Business measures of urban regulation show a general tendency towards simplification and cost reduction. Between 2006 and 2013, the six measures have declined. The number of procedures experienced a small reduction

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[7] Zoning can take 5 values: 0 if zoning regulations are no obstacle for business expansion, 1 if minor, 2 if moderate, 3 if severe, and 4 if very severe obstacle.

(i.e., 8% for obtaining construction permits and 5% for registering property); but the time and cost shows a large drop (i.e., days declined 70% for registering property and 18% for construction permits, and cost declined 20% for registering property and more than 100% for construction permits).[8]

4.2 Differences in Determinants of Regulation

Potential determinants of urban regulations are population pressures, geographic constraints and legal origin. Using the sample of the main city in each country, we observe that cities in Asia are more populated and with higher density than in Latin America; and both regions have higher figures compared to the rest of the world (Table 3 Panel A).

Table 3. Summary of Selected Outcome and Control Variables in the Main City

	Latin America		**Asia**		**Other regions**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Panel A						
Population	3.35	5.12	6.17	7.10	2.28	3.06
Pop. Density	5.77	3.35	6.80	3.35	5.15	3.32
Land Availability	43.15	28.36	62.20	26.98	66.55	29.96
Common Law	0.38	0.49	0.36	0.48	0.28	0.45
Religious Law	0.00	0.00	0.13	0.34	0.02	0.14
Panel B						
Compactness	0.47	0.23	0.52	0.18	0.46	0.17

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[8] These figures are computed using the sample of 180 countries with complete data for the entire period.

Land obstacle	0.94	0.34	1.02	0.59	1.06	0.47
Headship young	0.38	0.08	0.32	0.09	0.39	0.14
Headship mid-age	0.73	0.08	0.65	0.06	0.72	0.13

Notes: Population is reported in millions, Density is in thousands of people per kilometer.

Land availability is particularly severe in Latin America. This is in part because several countries are small islands. Even after excluding the Caribbean countries, however, land availability is still relatively scarce in the region (i.e., 59.6% for continental Latin America compared to 62.2% for Asia and 66.6% for the rest of the world).

4.3 Differences in Urban Outcomes

Panel B in Table 3 above presents a summary comparison of the three outcome areas this study focuses on; urban form, household formation, and business expansion. Asian cities are, on average, more compact than cities in Latin America and other continents. As we show below, however, this is mainly explained by the fact that Asian cities are larger. Conversely, average headship rates are lower in Asia.

Finally, access to land appears to be a minor obstacle for business expansion according to the opinions of business owners and top managers in both Asia and Latin America, although it is slightly more problematic in the former region.

4.4 Variation within regions

In this section we explore variation within regions and within countries, and thus, we use the entire sample instead of restricting to the main city in each country as in the previous sections. There are larger differences in regulatory environments and urban outcomes across cities within regions. This is not surprising given that both Asia and Latin America includes very heterogeneous countries. In order to appreciate the variation we present kernel density functions showing the distribution of the variables separated by region; Asia, Latin America and the rest of the world.

Figure 4 shows the distribution of four of the Doing Business measures of land use regulation; the cost and days to obtain a construction permit and to register property. There are cities in both Asia and Latin America with high and low levels of regulations in this sample, though in general Asian cities have higher averages and more variation. The variation in property registration costs and delays is smaller than construction permits in most regions.

Figure 4. Density Distribution of Doing Business Measures of Land Use Regulation
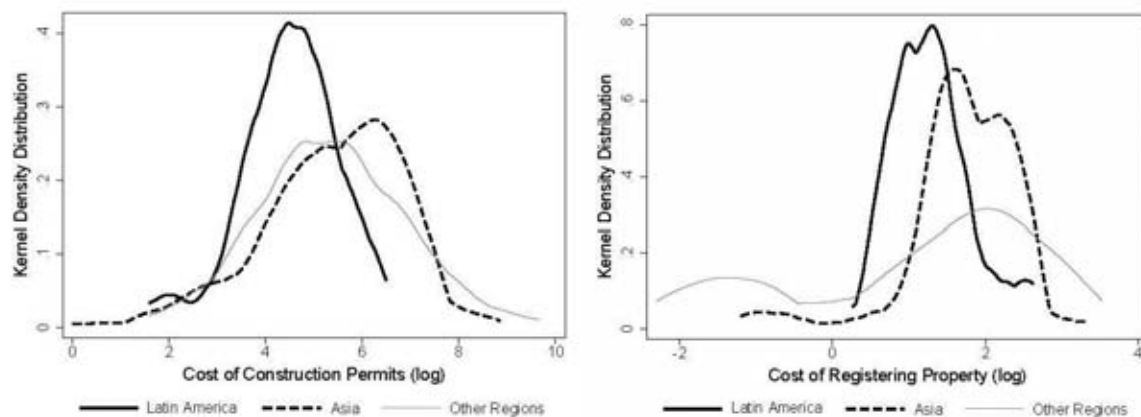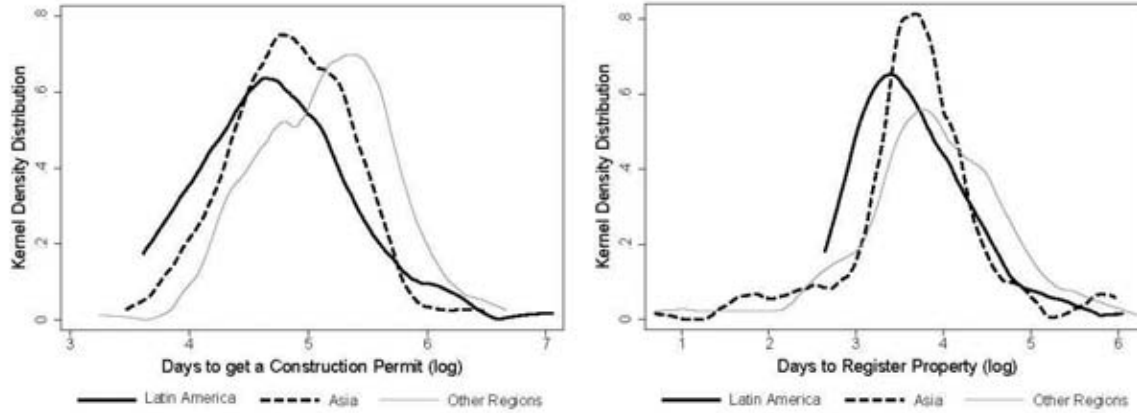
Source: World Bank (2012a).Note: Measures of land-use regulations are from different years depending on the country, ranging from 2007-2012

Figure 5 shows the distribution of the measures of land use regulation from the Enterprise Surveys; one an estimate of delays in obtaining construction permits and the other an estimate of the prevalence of bribery in obtaining construction permits. As previously, the measure of delays in construction permits in the Enterprise Survey sample is different between Asia and Latin America, in this case the latter has a higher average and larger variation. In terms of bribery, Asian cities have much higher shares, and much greater variation.

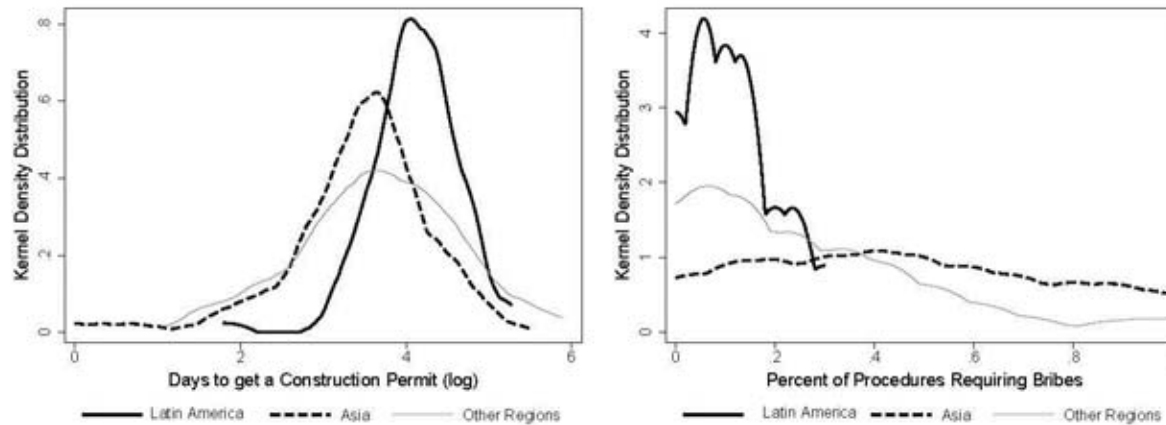**Figure 5. Density Distribution of Enterprise Survey Measures of Land Use Regulation**

Source: World Bank (2012b).Note: Measures of land-use regulations are from different years depending on the country, ranging from 2002-2012

The great majority of variation in the entire sample is explained by differences between countries and this is truer within Asia. For example, 80 per cent of the variation in costs of construction permitting in Latin America is explained by country level differences and 87 per cent in Asia.

Nonetheless, there is substantial variation within countries. For example, in the Philippines, construction permits can be obtained within less than two months in the least regulated city but longer than five months in the most regulated. Similarly, in Mexico the process can take between one month and six depending on the city. Capital cities tend to have more regulations than other cities in the same country. For example, the number of procedures, days and cost of permits is 12 per cent, 33 per cent and 47 per cent higher in the capital city respectively.

Figure 6. Density Distribution of City Populations and Land Availability Measure, 2011
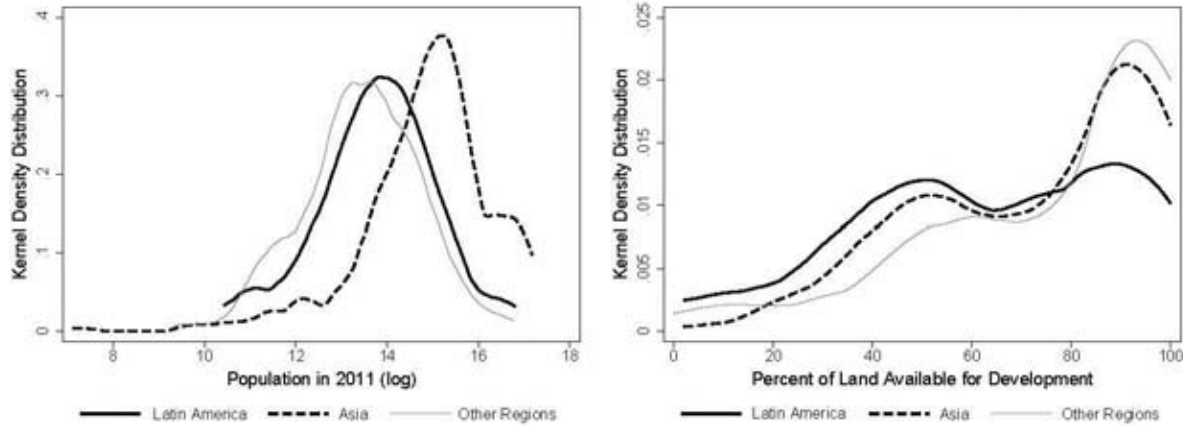
Source: Authors with LandScan Global (2011)

Turning to other urban characteristics, Figure 6 shows the distribution of city populations and the measure of land availability we have calculated for the sample of over 600 cities. Asian cities in this sample have a larger population on average, though the distribution is less normally shaped – some very small cities are included as are some very large ones. In terms of land availability, it is Latin American cities in the sample that stand out as compared to Asian cities and cities in other regions with less land available for development on average. The large number of Asian cities built in areas without natural constraints to expansion reflects the large number of cities in India and Pakistan rather than cities in countries like Indonesia or the Philippines, which tend to be more land constrained.

Figure 7. Density Distribution of City Population Density and Compactness, 2011
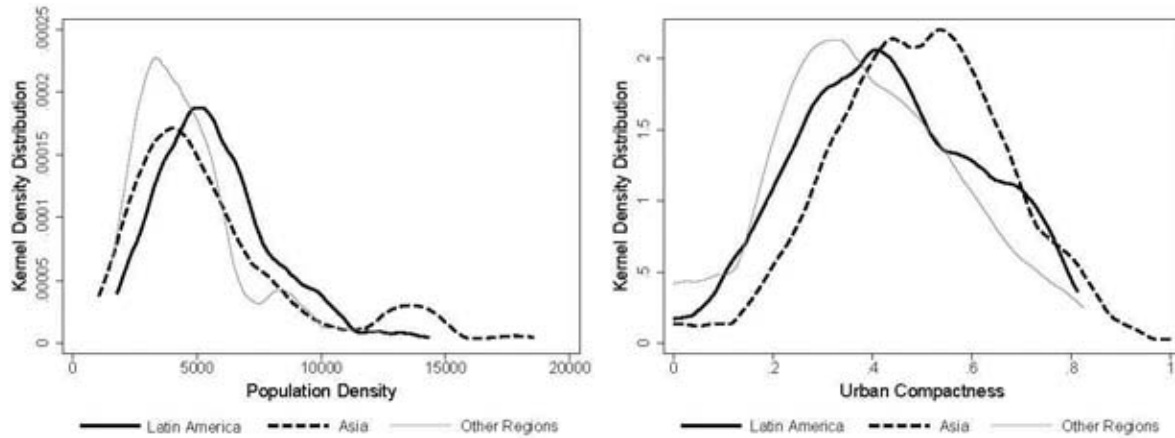
Source: LandScan Global (2011)

Figure 7 shows the distribution of city population density and compactness. The distribution of cities in the sample by population density is fairly similar for Asian and Latin American cities, and those in other regions. Latin American cities have a higher median population density but there is a cluster of Asian cities with very high densities. Asian cities tend to be more compact. Once we control for population, however, there are no significant differences in compactness between cities in Asia, Latin America and the rest of the world.

Figure 8. Density Distribution of Headship Rates
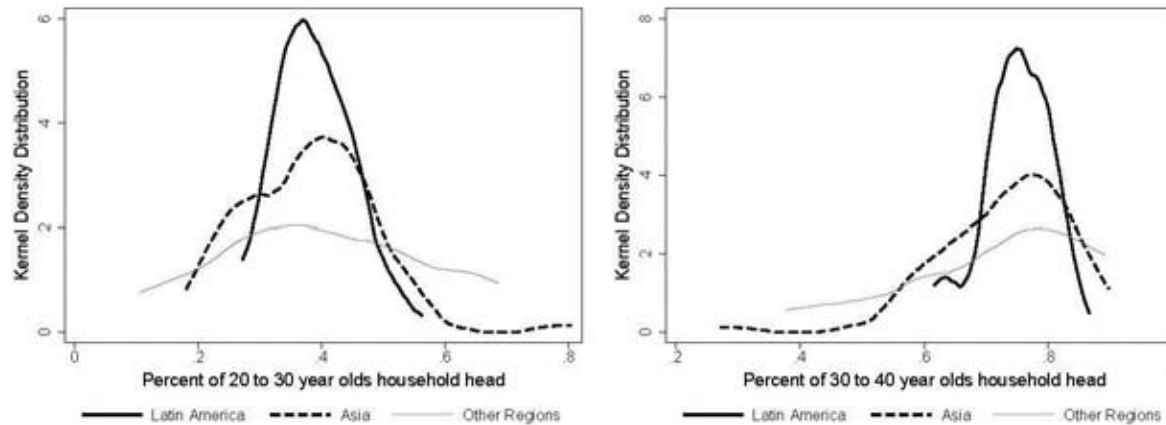
Source: Minnesota Population Center (2011).Note: Year of data varies by country, range from 2001 to 2011

Figure 8 shows the distribution of headship rates estimated for cities in Asia, Latin America and other regions. The three regions have similar average values but Latin America has substantially lower variation across cities.

5. The Determinants of Regulation

This section focuses on the determinants of land-use regulation. One of the most salient characteristics of the land use regulation measures in Doing Business is a strong negative correlation with economic development. As shown in Figure 9, it is much more expensive and time consuming to obtain a construction permit and to register property in poorer countries. An important note is that in three of the four cases presented in Figure 9, the strong correlation persists even when controlling for the general regulatory environment. In regressions, which use the cost and time of obtaining construction permits and registering property as dependent

variables, and control for the cost and time of registering a business, GDP per capita is a significant predictor of all land use regulation measures other than the cost of registering property.[9]

There are several potential explanations for the negative correlation. First, poorer countries tend to have more polluted cities, and hence are more likely to have more stringent land-use regulations. Second, poorer countries have lower quality political institutions, and regulations might have been enacted to allow government officials to obtain bribes. Third, poorer countries have lower administrative capacity to collect income taxes, and hence are more likely to rely on other means to obtain revenues such as higher fees to grant a construction permit and to register property. Fourth, countries with a common law legal origin tend to be economically richer, and it is usually argued that common law countries have a legal tradition of less regulation.

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[9] Similarly, city size is significantly positively correlated with all land use regulation measures other than the cost of registering property, even when controlling for the general regulatory environment and even in regressions with country fixed effects. This can be explained in part by the larger administrative burden faced by large cities.

Figure 9. Correlation between GDP per capita and Land Use Regulations
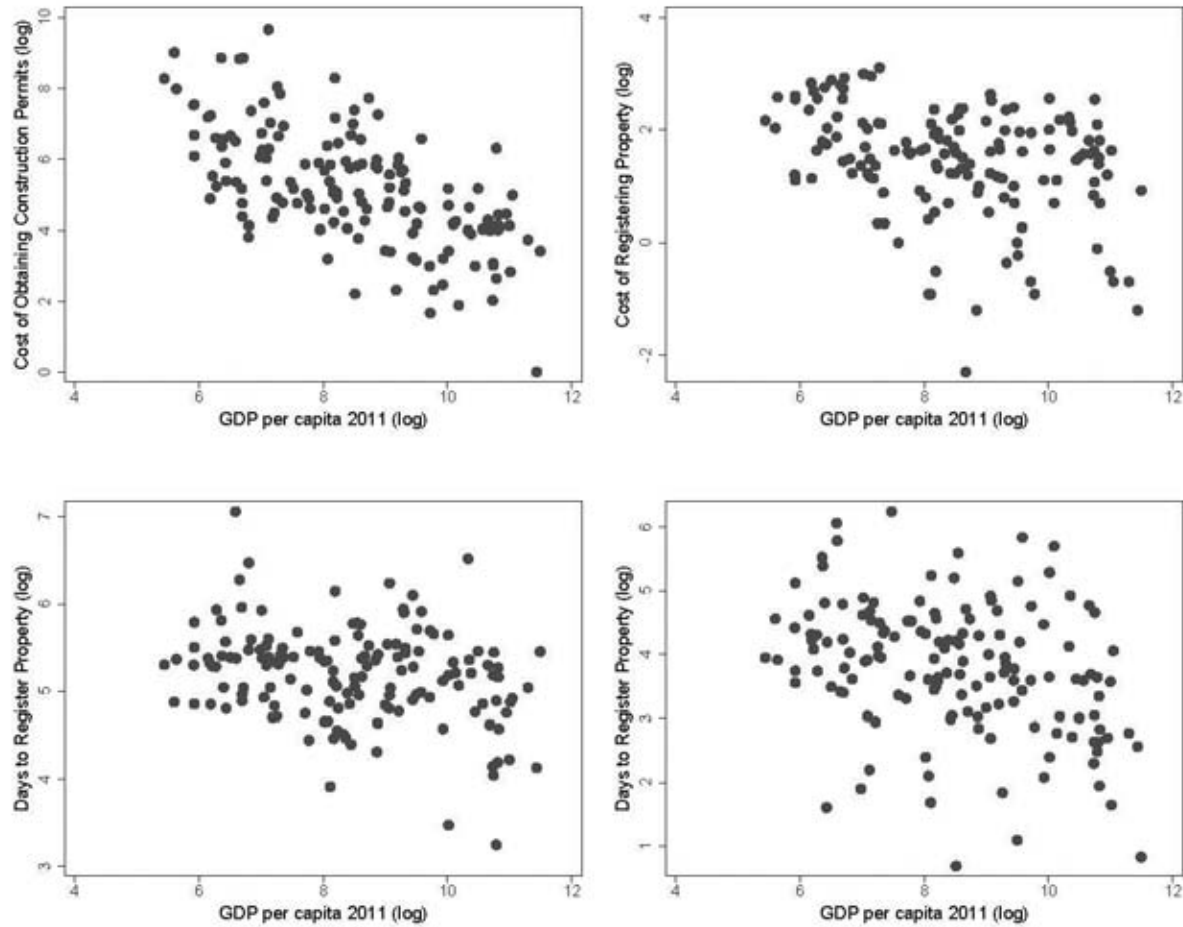
To obtain further insight into the determinants of land use regulation we explore the importance of natural constraints to urban expansion and also consider level of outdoor air pollution, urban growth pressures, and legal origins. Outdoor air pollution is

measured using the PM10 (i.e. particulate matter with diameter of 10μ or less) data collected by the World Health Organization. In order to reflect legal origin we include dummies for countries with common law and religious legal systems (where the remaining category is civil law). We use four measures of regulations: Cost of obtaining a construction permit (log), cost of registering property (log), a bureaucracy index (the standardized sum of the time and number of procedures to obtain a construction permit and register property), and the stringency of zoning regulations. We estimate the following OLS model where the subindex i is for city and j for country.

(1) $Regulation_{ij} = \beta Land\ Availability_{ij} + \delta Pollution_{ij} + \delta Population_{ij} + Legal\ origin_j + \varepsilon_{ij}$

Table 4 (in the Annex) shows the results. In columns 1, 4, 7 and 10 we estimate correlations across countries by restricting the sample to the main city in each country, and only include the land availability and population measure. In columns 2, 5, 8 and 11 we add the other covariates.

Land availability is significantly negatively correlated only with the cost of registering property, while it tends to be positively correlated with the other three measures of regulation. Therefore, it appears that, across countries, cities with less land available for development in general do not tend to have more stringent urban regulations. Conversely, countries with a civil law legal origin tend to have more stringent regulations compared to common law countries; and more polluted cities tend to have more costly regulations although the coefficients are usually statistically insignificant.

In columns 3, 6, 9 and 12 we explore variation within countries by restricting the sample to countries with sub-national data and including country fixed effects. We exclude the legal origin indicators because they do not present variation within countries and also exclude the pollution measure because of lack of sub-national data. Interesting, there is now substantial evidence that cities with less

land available for development tend to have more costly and cumbersome regulations (i.e., the coefficients are always negative and in two cases are statistically significant). Finally, there is a positive correlation between population and regulation.

6. Regulatory Constraints and Urbanization

The objective of this section is to explore the effect of regulations on three urbanization outcomes: business physical expansion, household formation and urban form. We begin with business growth.

6.1 Business expansion

Are zoning, construction permit and property registration regulations an obstacle for the physical growth of businesses? In order to answer this question, we estimate the following equation:

$$(2) \qquad Y_{ij} = \beta Regulation_{ij} + X_{ij}\delta + \varepsilon_{ij} \,,$$

where the dependent variable Y is a variable that can take five values: 0 if access to land is no obstacle for the growth of business, and 4 if it is a very severe obstacle. $Regulation_{ij}$ is any of the four measures of regulation in city i and country j described before and X is a vector of controls. Table 5 (in the Annex) presents the results using an ordered probit model . In columns 1 to 4 we only include the two main explanatory variables (i.e., a measure of regulation and land availability) and control for the (log) population of the city; in column 5 to 8 we also control for the general regulatory index of Doing Business.[10] In all these models we exploit variation across

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[10] This variable is measured by an index that combines standardized values of the steps, time and costs of starting a business – the most generic indicator of regulation measured by the Doing Business project.

countries using as a sample the main city in each country. Finally, in column 9 we exploit variation within countries by using a sample of countries with subnational data and including country fixed effects.[11]

The estimated correlations are consistent with the idea that regulations introduced by the government are a significant barrier for the physical growth of businesses (particularly zoning restrictions), while geographic impediments (i.e., less availability of developable land for urban expansion due to steep slopes and water) are not.

6.1 Household formation

The second outcome we consider is headship, as a proxy for housing market conditions. Headship reflects to some extent housing affordability conditions because beyond the primary force of culture determining when a person will form a new household, otherwise similar but less affordable cities will see a lower rate of headship and vice versa. Figure 10 shows scatterplots (based on the entire sample of 166 cities in 19 countries for which headship data is available) describing the relationship between headship rates for people aged 30 to 40 and the costs of registering property and obtaining construction permits. The relationship appears to be negative.

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[11] We can only estimate this model for the zoning measure of regulation (which is obtained from the Enterprise Survey) because there is no match between the subnational data for the dependent variable and the subnational data in Doing Business.

Figure 10. Correlations between Land Use Regulations and Middle-Aged Headship
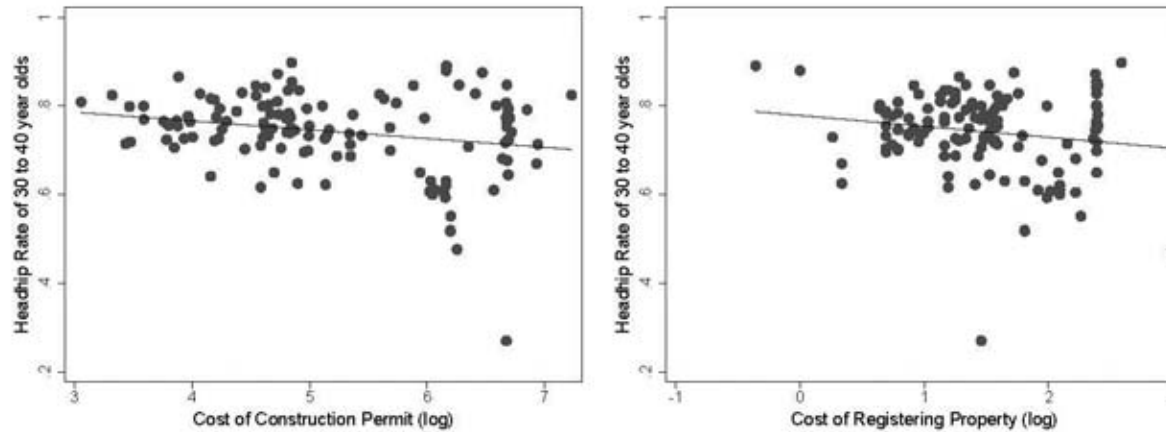
Source: World Bank (2012a) and Minnesota Population Center (2011)

To obtain some further insight we compute within country estimates in part because the number of countries for which headship data is available is small and also to remove cultural factors that could be driving household formation. Table 6 presents OLS estimates of equation (2) where we use the two measures of headship defined in section 3.3 (i.e., young and middle-age headship) as dependent variables; and *Regulation* is any of the four measures described before. In columns 1 and 3 we only include country fixed effects and in columns 2 and 4 we also control for land availability and the city's population. Each cell represents a separate regression.

Table 6. Regulations and Household formation within countries

	DV = Young headship		DV = Middle-age headship	
	(1)	(2)	(3)	(4)
Permits costs	-0.006	-0.004	-0.027**	-0.011
	(0.019)	(0.015)	(0.009)	(0.008)
Property costs	-0.020	-0.020	-0.017	0.001
	(0.026)	(0.018)	(0.018)	(0.016)
Bureaucracy index	-0.007**	-0.010***	-0.012**	-0.008*
	(0.003)	(0.002)	(0.005)	(0.004)
Zoning	-0.056	-0.071	-0.017	-0.020
	(0.049)	(0.052)	(0.033)	(0.043)

Notes: Each cell represents a separate model. The sample refers to countries with subnational data. All models include country FE; columns 2 and 4 also control for population and land availability. Robust standard errors clustered by country are in parentheses. *, **, *** indicate significance at 0.10, 0.05, and 0.01 levels.

Although the estimates are imprecise, they are in almost all cases negative as expected and in some cases statistically significant. These correlations are consistent with the idea that cities with more costly and cumbersome regulations tend to have less affordable housing and hence lower household formation. Of course, it is impossible to make any strong claim until gathering and analyzing comparable price data though the results are provocative.

6.1 Urban form

Finally, we examine the relationship of regulations and urban form. For the over 300 cities with data, there is a statistically significant correlation between some measures of urban form and land use regulations. Specifically, population density is positively associated with both the Bureaucracy Index and the cost of obtaining a construction permit, and urban compactness is significantly associated with the cost of obtaining construction permits. Figure 11 shows these relationships in scatterplots.

Figure 11. Correlations between Land Use Regulations and Urban Form
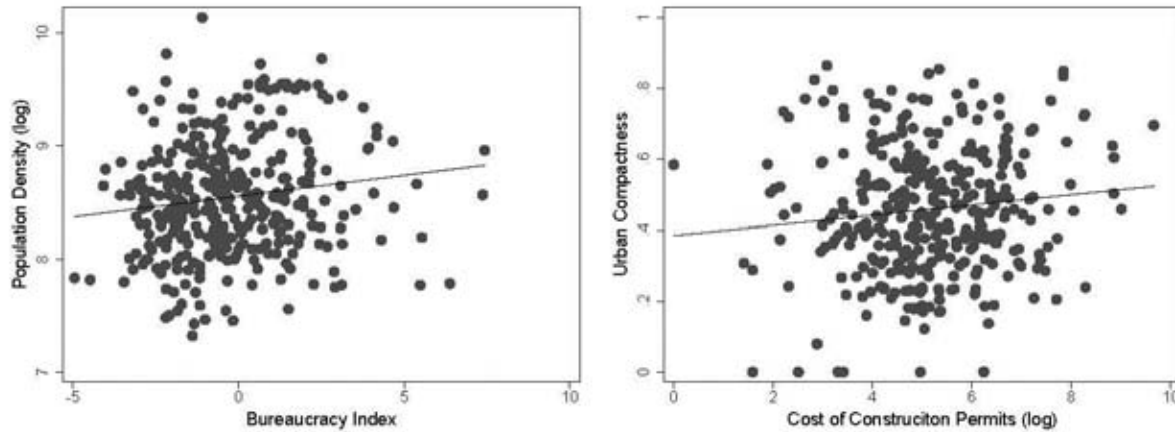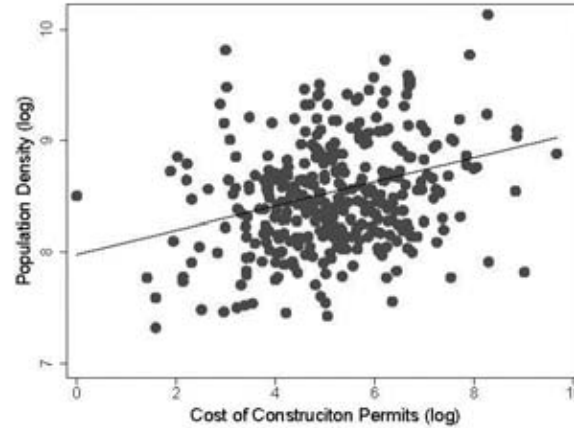
Source: World Bank (2012a) and LandScan Global (2011)

The simple bivariate relation could be due to intervening or other variables connected to both regulations and urban form characteristics, such as land availability or simply city population. In order to test whether the relationship between regulations and population density and urban compactness is significant in spite of the other major determinants of the latter outcomes, we estimate OLS models of equation (2) where the dependent variable Y_{ij} is either (log) *Population Density* or *Urban Compactness* in city i and country j.

Results are in Table 7. Each cell represents a separate regression. In columns 1 and 3 we exploit variation across countries restriciting the sample to the main city in each country, and as controls we include population, land availability and the general regulatory index of Doing Business. In columns 2 and 4 we exploit within country variation restricting the sample to countries with subnational data and including country fixed effects.

There is a positive and significant correlation between the cost of obtaining a construction permit and population density, but only across the main city in each country. The correlation becomes insignificant within countries. The other measures of regulation do not appear to be correlated with density either across or within countries.

The cross country correlations between regulations and urban compactness are suprisingly negative and in two cases statistically significant. When we exploit variation within countries, however, the coeficients become positive and significant for the bureaucracy index suggesting the presence of omitted varaibles in the cross country comparison.

Table 7. Density, compactness and regulations across and within countries

	DV = Population Density (log)		DV = Urban Compactness	
	(1)	(2)	(3)	(4)
Permits costs	0.042**	0.045	-0.012**	0.004
	(0.018)	(0.041)	(0.005)	(0.008)
Property costs	0.033	-0.039	-0.007	0.034
	(0.025)	(0.061)	(0.008)	(0.032)
Bureaucracy index	-0.016	0.016	-0.009**	0.0012*
	(0.011)	(0.014)	(0.004)	(0.004)
Zoning	0.153	-0.031	-0.013	-0.013
	(0.099)	(0.033)	(0.028)	(0.022)

Notes: Each cell represents a separate model. The sample in columns 1 and 3 is the main city in each country, while in columns 2 and 4 the sample includes countries with subnational data. All models control for population and land availability; columns 1 and 3 also control for general business environment while columns 2 and 4 include country FE. Robust standard errors clustered by country are in parentheses. *, **, *** indicate significance at 0.10, 0.05, and 0.01 levels.

7. Conclusions

Land use regulations play an important role in the quality of urbanization, but the exact nature of the role is a complex question. Theories that predict an impact on housing markets, for example, are often used to frame policies in developing countries in spite of less rigorous evidence for them in these contexts. This report is a first step towards a greater understanding of an important phenomenon; whether and how land use regulations affect urbanization in developing countries. Unpacking the relationships between different factors that affect land use regulations and the outcomes they are expected to impact is extremely challenging because many relationships are endogenous. Nonetheless, we are able provide an initial description of the phenomenon by combining data for over 600 cities in more than 180 countries on land use regulations, natural constraints to urban expansion, legal systems, economic development, household formation, and urban form in order to assess relationships between these factors in an international, comparative perspective.

We summarize next the main stylized facts found in this project, with a focus on a comparison between Asian and Latin American cities.

- All around the world, it takes, on average, 16 procedures and about 5 months to obtain a construction permit while registering property takes about 7 steps and 2 months. The cost of obtaining a construction permit is about 450% of income per capita and the cost of registering property represents 7% of the property value.
- All these regulations have declined substantially between 2006 and 2013. Particularly the days and cost of obtaining a construction permit.

- Zoning restrictions are a minor problem for business expansion according to the opinions of top managers. But, bribery to obtain a construction permit is pervasive and enforcement of building safety is low, although the latter two variables are likely to have substantial measurement error.

- Some aspects of the regulatory environment are more cumbersome and costly in Asia cities compared to Latin American cities (e.g., days and cost of permits), but the opposite occurs for other measures (e.g., days and cost of registering property) which are more costly in Latin America. This is different compared to the general regulatory environment, which tends to be more flexible in Asian cities.

- The largest variation in regulations is not between but within regions. There are countries in both Asia and Latin America with very high and low levels of regulation. There is also some variation within countries (although smaller than across countries). In particular, capital cities tend to be more regulated mainly due to more population pressures.

- Economic development is strongly negatively associated with land use regulation, even after conditioning on the general regulatory environment.

- Capital cities in Latin America are significantly more constraint by water and mountains compared to capital cities in the rest of the world. This is mainly because several Latin American countries are small islands located in the Caribbean.

- There is little association between natural constraints to urban development and constraints imposed by regulations across capital cities. Within countries, however, more naturally land constrained cities tend to be more regulated.

- Legal systems matter, with civil law countries regulating urban development more heavily.

- There is evidence of a positive correlation between urban growth pressures (i.e., population and pollution) and regulations.

- Firms operating in more regulated cities are more likely to report that access to land is an obstacle for their growth. This is true both across and within countries.

- We find that cities with more regulations tend to have lower rates of household formation, although the evidence is only based on variation across cities for a small number of countries due to data limitations.

- Finally, there is little evidence of a positive correlation between regulations and population density and urban compactness.

These results cannot be interpreted as causal relationships by any means, but they confirm the importance of land use regulations. We find that regulations negatively impact business expansion to some extent, and that there is an association with household formation. This latter finding likely reflects the constraining impact of regulations on housing markets. Thus, though the results do match findings on the negative impacts of land use regulations from the United States, we do not interpret them as implying a need to dramatically reduce regulations by any means.

Policy implications of these stylized facts must be considered carefully. The strongest association we find – regulations are more cumbersome in poorer countries – is one that suggests that land-use regulation is yet another component of economic development that should be reformed but will also probably change on its own as a country grows. One benefit of regulatory reform is that since strict regulations are associated with higher levels of bribery, lowering legal requirements might reduce opportunities for opportunism. Another set of findings promotes more caution in deriving policy implications. Internationally, land use regulations are in part determined by similar factors as in the United States; factors that make assessing their impacts empirically challenging due to their endogenous relationship to urban land and housing markets. Internationally, cities with less land restrict growth more as do growing cities. This means that further analysis is needed to determine whether there is a causal impact of land use regulations.

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Annex

Table 2. Summary of Land Use Regulations in the Main City of Latin America, Asia and Other Regions

	Latin America		Asia		Other regions	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Construction permit						
Steps	13.92	5.93	18.43	6.92	15.57	6.20
Days	235.82	195.90	186.19	109.99	200.44	110.32
Cost	192.19	191.40	417.89	1083.44	931.41	2054.84
Registering Property						
Steps	6.93	1.71	5.63	2.07	5.97	2.31
Days	77.23	81.37	55.44	70.96	77.25	80.12
Cost	6.14	3.84	4.95	4.89	7.26	5.47
Enterprise Survey						
Zoning	0.86	0.37	0.94	0.40	0.69	0.48
Days construction permit	87.11	41.43	59.92	47.19	68.21	53.59
Bribes	0.11	0.09	0.45	0.26	0.24	0.18
Enforcement Tax	0.53	0.17	0.72	0.20	0.69	0.22
Enforcement Fire & building	0.18	0.19	0.84	0.19	0.83	0.29
Starting a Business						
Steps	9.44	3.11	7.91	3.47	7.60	3.43
Days	60.91	122.56	31.09	31.16	30.88	35.28
Cost	34.41	42.14	21.04	27.88	57.82	105.85

Source: Doing Business, nd; Enterprise Survey, nd. The number of observations is available in table 1.

Table 4. Determinants of regulations across and within countries

	DV = Permits Cost (log)			DV = Property Cost (log)			DV = Bureaucracy index			DV = Zoning		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Land Availability	0.012**	0.004	-0.003**	-0.006*	-0.007**	-0.001	0.001	-0.003	-0.008*	0.001	0.003	-0.001
	(0.005)	(0.005)	(0.002)	(0.003)	(0.003)	(0.001)	(0.007)	(0.007)	(0.004)	(0.003)	(0.002)	(0.002)
Population	0.110	0.047	0.233**	0.033	-0.025	0.005	0.090	0.065	0.276**	0.051	0.007	-0.005
	(0.089)	(0.099)	(0.065)	(0.062)	(0.053)	(0.017)	(0.139)	(0.153)	(0.136)	(0.065)	(0.057)	(0.049)
Air pollution	-	0.010**	-	-	0.003	-	-	0.004	-	-	-0.001	-
		(0.004)			(0.002)			(0.004)			(0.001)	
Religious law	-	-0.108	-	-	-1.024*	-	-	0.201	-	-	-	-
		(1.215)			(0.600)			(1.091)				
Common law	-	-0.613*	-	-	-0.085	-	-	-0.843**	-	-	-0.698***	-
		(0.334)			(0.087)			(0.421)			(0.081)	
Sub-national data and country FE	NO	NO	YES	NO	NO	YES	NO	NO	YES	NO	NO	YES

Notes: Columns 3, 6, 9 and 12 restrict the sample to countries with subnational data and includes country FE; the other columns use a sample of the main city in each country. Robust standard errors clustered by country are in parentheses. *, **, *** indicate significance at 0.10, 0.05, and 0.01 levels.

Table 5. The effect of regulations and land availability on business physical growth

DV = Access to land is an obstacle for the growth of business

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Land Availability	-0.003	0.001	-0.001	-0.009	-0.002	0.001	-0.001	-0.007	0.003
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)
Permits costs	0.196**	-	-	-	0.184**	-	-	-	-
	(0.065)				(0.068)				
Property costs	-	0.198*	-	-	-	0.148	-	-	-
		(0.109)				(0.111)			
Bureaucracy index	-	-	0.077	-	-	-	0.047	-	-
			(0.050)				(0.052)		
Zoning	-	-	-	0.630**	-	-	-	0.702**	1.914***
				(0.259)				(0.269)	(0.271)
Subnational data and country FE	NO	NO	NO	NO	NO	NO	NO	NO	YES

Notes: The sample refers to the main city in each country in all columns except column 9. All columns control for (log) population. Columns 5 to 8 also include the general regulatory environment. Column 9 restricts the sample to countries with subnational data and includes country FE. Robust standard errors cluster by country are in parentheses. *, **, *** indicate significance at 0.10, 0.05, and 0.01 levels.