# Political Sources of Urban Concentration in Latin America

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## Abstract

Latin American nations are highly urbanized around a small number of megacities that account for the majority of these nations' productivity and population. Scholars of urban planning and economics argue these cities may be overly large, leading to environmental, transportation, and housing issues that depress growth and increase economic inequality. We use fine-grained satellite data from 1992-2018 to document urban concentration. We focus on incentives generated by political decentralization as crucial determinants of spatial patterns of urbanization. We link our findings to a broader literature on economic geography, political institutions, and urbanization, with broader implications for the politics of economic growth.

**Keywords**: spatial concentration, decentralization, Latin America, remote sensing

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# 1 Introduction

Twentieth Century Latin America saw an explosion of urban growth, tied to a development strategy focused on increasing sectoral diversity in these nations' economies and decoupling growth from the boom and bust cycles of global commodity exports. With industrialization came mass migration to cities, particularly the primate city, as higher wages attracted primary sector workers from the nations' peripheries. Today Latin America is the most urbanized region in the world, according to the United Nations Human Settlement Program (UN, 2012). Urbanization in Latin America is expected to continue, with 90% of Latin America's population expected to live in urban areas by 2050.

Yet urban growth in Latin America and the rest of the newly industrializing developing world did not mimic urbanization in the first wave of industrialization in Europe and North America (Puga, 1998, Huang, Lu and Sellers, 2007). Dense urban populations in the developing world accumulated primarily in the largest city, a process known as urban concentration, which in many cases had populations larger than all other urban areas in the country combined. In contrast, urban development driven by industrialization in Western Europe spread populations between multiple cities, each city having an upper limit of growth constrained by the food supply of the surrounding area (Henderson, 2002). Urbanization in new industrializers occurred after technological innovations in transportation and refrigeration allowed food production to be disconnected from city growth, with supplies able to be transported cheaply and effectively into a city of any size (Henderson et al., 2018). The timing of industrialization thus shaped urban development, with megacities emerging in late industrializers as the dominant pattern (Beramendi and Rogers, 2022, Aroca and Atienza, 2016). Indeed the cities of the developing world in most cases dwarf the cities of early industrializers, both in terms of absolute size and population density (Jedwab and Vollrath, 2015). Only recently does it appear Latin American nations have started to deconcentrate, as they have moved away from import-substitution industrialization strategies (Portes, 1989) and greatly increased their openness to foreign trade, among other factors (Krugman and Elizondo, 1996).

Recent research suggests the tide may have turned, or at least abated, and urban concentration may be declining in much of the world, including Latin America (Angel et al., 2010, Frick and Rodríguez-Pose, 2018). In recent decades we have seen shifting urbanization patterns in Latin America, including some urban deconcentration after the height of urban primacy in the period of import substitution industrialization (Portes, 1989). Figure 1, below, shows some indication of urban deconcentration for the entire Latin American sample using the Herfindahl-Hirschman Index (HHI) of urban nightlight

concentration, described in detail below. The aim of this paper is to document urban concentration in Latin America and conceptualize and identify potential political incentives to limit urban concentration, despite strong pressures in favor of urban primacy in the region.

Figure 1: **Changes in Urban Concentration, 1992-2018**
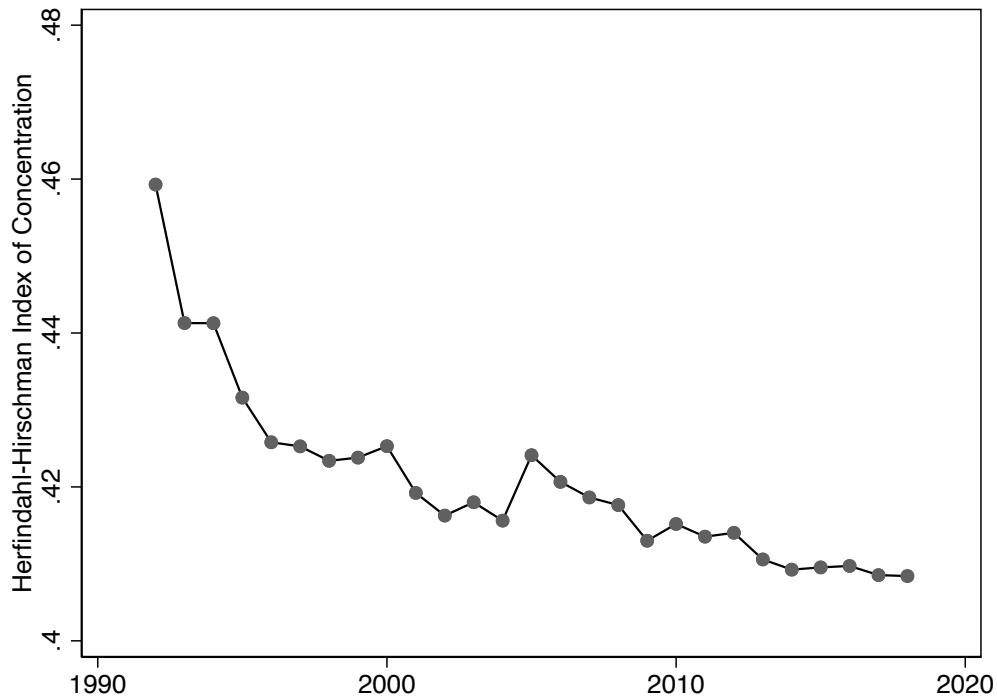


*Notes*: Mean of value for all nations in the sample, by year

We draw on political science theories of the political economy of decentralization to inform our expectations of city distribution. Latin America democratized before and during the period we examine, which brought greater political importance to decentralization in the region. We predict changes in urban concentration with measures of decentralization–both political representation of sub-national regions and powers held by those regions–which should in theory boost the political power of regions and cities outside the primate in both federal and non-federal nations. We argue that increased decentralization in Latin America has resulted in the (relative) spatial distribution of urban growth in the region. Political powers generated by decentralized political institutions and resources delegated to subnational regions, combined with the growth of "consumption cities" fueled by booming service sectors dependent on commodity exports, may have created an opening for secondary cities to grow in last several decades (Gollin, Jedwab and Vollrath, 2016, Jedwab and Vollrath, 2015). Yet

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research on the effects of decentralization in Latin America points out that the spatial distribution of resources, while it may fuel urban deconcentration, does not necessarily imply distributed economic development or vibrant political representation outside the primate city.

We approach this question with a new data set on urban extent and urban change from 1992-2018 in Latin America drawn from satellite data. We measure the urban extent of all Latin American cities with a population above 50,000 people to see whether and how they have grown in relation to other cities in the same country, measured with nightlight intensity and population. Importantly, by using remotely sensed data, we are not relying on government statistics, which are measured according to administrative boundaries that may artificially cut off growth outside the city core that nonetheless represents increased size of that urban area. Unlike most analyses of both decentralization and city size distribution we are able to employ time series data, with substantial cross-national and within country variation on both factors for our sample. We draw on research in geographic information systems, remote sensing, urban studies, and urban economics to guide our measurement choices and theoretical understanding of urbanization and urban growth. We link these fields with research in distributive politics and political economy.

Post (2018) argues that we need to understand much more about the political economy of urban growth. This research is part of that agenda seeking to explain urban growth and political and economic dynamics within nations. Much of the related literature is in the economics or urban studies tradition, and therefore de-emphasizes political institutions such as decentralization that may help explain variation in urban growth.

Our manuscript proceeds as follows. First, we consider the underlying economic sources of high urban concentration and we lay out our conceptual framework linking political incentives of decentralization to variation in urban concentration in Latin America. Third, we describe the construction of our nightlight data, as well as the concentration measures employed, and our decentralization measures and controls. Fourth, we visualize urban concentration in Latin America with nightlight data. Fifth, we show results of our analyses linking decentralization and urban concentration. In the final sections we discuss the limitations of our approach and opportunities for further research.

## 2 Sources of Urban Concentration in Latin America

Whether urban development is concentrated or distributed is not obviously important–should it matter that a country has one major city or multiple large urban centers? Should it matter that one city is

extremely populous relative to others? On the one hand, economists have documented the benefits of economic agglomeration, concentration of industries in particular cities, for growth and innovation (Krugman, 1991). However, research in urban studies suggests that urban concentration can reduce the quality of life of residents, in terms of traffic congestion, pollution, and housing costs that result in higher economic inequality (Portes and Roberts, 2005). Research in urban economics argues that "excess" primacy (population concentration in a single city) is linked to lower economic growth and less innovation (Henderson, 2002, George Wilkinson, McKenzie and Bolleter, 2022, Ioannou and Wójcik, 2021, Bluhm and Krause, 2022). Scholars in development economics worry that large urban centers fueled by gains from the agricultural sector undermine primary sector production, which lead to underproduction of commodities that feed the industrial economy as well (Baer, 1972, Bates, 2014). Political scientists see particular political difficulties of high urban concentration, including challenges with local public services, crime, and corruption (Post, 2018). Scholarship on the political geography of inequality worries that urban concentration is akin to wealth concentration in any other form, resulting in heightened distributive tensions between the largest city and the rest of the nation (Beramendi and Rogers, 2022). Conflict driven by uneven spatial development is associated with reduced state capacity, taxation, and spending in national governments (Beramendi and Rogers, 2018, Lee and Rogers, 2019). It may also result in under-investment in public goods throughout the space of the nation that could be a basis for human and physical capital-led development (O'Donnell, 1993).

Urban development is typically analyzed as an economic phenomenon, driven by decentralized firms and workers locating to maximize gains. Neoclassical economic theories expect firms to widely distribute in space to reduce the obvious concerns with congestion and high property costs, and for location decisions to be driven by jurisdictional competition as politicians from would-be beneficiaries of urban growth lure business away through low taxes and attractive public services (Tiebout, 1956, Jensen, Malesky and Walsh, 2015). The rise of "intermediate" or "secondary cities" have long been touted as a positive development, reducing primacy and increasing competition (Roberts et al., 2014, Rodríguez-Pose and Griffiths, 2021, Hardoy and Satterthwaite, 1986). Economists writing in the 1980s and 1990s revised these hypotheses, noting that urban concentration is far above what we would expect in pure market competition, and therefore there must be economic benefits to both urban concentration and economic agglomeration such as easy access to supply chains and labor, and innovation born of close proximity and collaboration (Krugman, 1991).

For the developing world in particular, investment in economic development (especially industrialization) has primarily come from the state, making politics critical to urban development. While

individual firms and workers make locational decisions, their options were and are strongly affected by choices made by interventionist states, in terms of direct investment in industries as well as placement of infrastructure. For industrialization to emerge in the developing world, governments had to decide to invest in this outcome and therefore had the choice of where to make those investments. In most countries the site of initial industrial investments was obvious–the most developed city, with existing transportation infrastructure, pools of educated workers, and financial centers. Importantly, these pre-industrial cities in the developing world were also the center of commodity production. Industrialization in Latin America largely consisted of mechanizing commodity production (Baer, 1972, Haber, 2005). The result was that the cities that had developed as urban agglomerations funded by gains from high-value export commodities saw their position reinforced and elevated by industrialization (Beramendi and Rogers, 2022). These cities pulled even farther ahead of the rest of the nation as a result of industrialization (Gwynne, 2017), with the result that Latin America has the highest urban primacy of any global region (UN, 2012).

## 2.1 Political Sources of Urban Concentration

Research from urban economics and urban planning does not tend to focus on the political implications of urban concentration, or its political origins.[1] We focus theoretically on whether political decentralization may be a factor in urban concentration.

In theory, it is not clear whether decentralization would favor more evenly distributed spatial development (Muringani, Dahl Fitjar and Rodríguez-Pose, 2019). On the one hand, we might expect centralized political institutions to encourage distributed development, due to stronger fiscal capacity in centralized states (Dincecco and Katz, 2016) and the encompassing interests to bring prosperity to the whole of the nation and to reduce urban blight in overcrowded cities (Lizzeri and Persico, 2001). Thus, more centralized systems might curry more resources for investment in infrastructure and technology. Politicians in centralized political institutions are not obviously wedded to gains in any particular urban location. Thus they may have a more technocratic approach, responding to economic incentives to reduce "excess" primacy.

On the other hand, the incentives of decentralization, especially ambitious subnational politicians pressing their policy demands to the central government, may push towards more distributed urban development. More decentralized political systems may lead to urban deconcentration because local

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[1]Most research on this topic of institutions is focused at the local level, especially in Europe (Ganau and Rodríguez-Pose, 2022, Charron, Dijkstra and Lapuente, 2014).

politicians have the incentives to invest in their constituencies (Aroca and Atienza, 2016). In this theoretical view, it is the ambition of local politicians that will drive local economic development, and thus expand cities throughout the territory. With local politicians competing for residents to boost their tax base, we should see businesses move away from the (expensive) primate city to pay cheaper rents, pay lower wages, and to capture tax benefits (Davis and Henderson, 2003, Hardoy and Satterthwaite, 1986). In this organic process of decentralized elections, cities will compete for business and the location market will create efficient distribution of urban growth (Oates, 1999). Thus political decentralization may be associated with lower levels of urban concentration.

After laying out the reasons why urban concentration remains high throughout the region of Latin America in both centralized and decentralized contexts, we argue that decentralization may be a driver of distributed urban development. Crucially, decentralization in Latin America most often takes the form of shared rule, in which central governments have provided significant political power and resources to areas other than the primate city through shared decisionmaking, in order to mitigate threats to their rule, and to advance their own policy interests. This has occurred in both federal and non-federal countries, as we discuss in country examples. Subnational political elites have been primary beneficiaries of this delegation, which has resulted in flows of resources from the central government that may have enabled growth in secondary cities.

### 2.1.1 Political Incentives to Concentrate Urban Development

While research in urban studies often considers concentrated economic development to be sub-optimal, economic elites in late industrial nations do not typically share the same view. From the perspective of agricultural and industrial elites, who are typically collaborators in the industrialization process in late developers, this geographic concentration shares the benefits of urban agglomeration pointed out by economists–suppliers, producers, labor, traders, and financiers are all proximate, and their transportation networks are efficiently concentrated (Paniagua, 2018, Hora, 2002). As elites, unless the congestion and housing prices prove threatening to the direct well-being of their businesses, they have little motivation to worry about excess urbanization (Pineda, 2009).

Even if economic elites find their cities too large, the political process to reduce primacy is hamstrung by personal incentives of elites in the primate city. Given that industrial (and thus urban) investment typically comes from the state, development in secondary cities would need to be given a strong nudge by the state for the "natural" economic processes of urban growth to take off. Individual firms will not locate in places without sufficient infrastructure (transportation, electricity, housing)

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and labor quality, even if the housing prices are cheaper and traffic is less (Feldman and Florida, 1994). The provision of that infrastructure is almost certain to come from the central government, with firms and skilled labor following those investments (Naude et al., 2008). The politics of investments in secondary cities are fraught because they take away resources that might be used to improve the primate city, where the existing elites (and a large percentage of country residents) already live and work. Creating competitor cities would also work against the economic goals of central economic elites, leading to outward investment and subsidizing those elites' possible competition. Thus the status quo setup for non-industrialized and late industrialized countries, such as those in Latin America, is highly concentrated urban development around a primate city.

The economic trends in the region, in general, have worked to reinforce urban concentration, with the exception of increased economic globalization (Krugman, 1991, Simmons et al., 2018, Alix-Garcia and Sellars, 2020, Ardanaz, Murillo and Pinto, 2013). Political incentives often differ from economic incentives, however. We argue that political developments, especially driven by changes in devolution starting in the 1990s, may help to explain differences in urban concentration in the region.

### 2.1.2   Political Incentives to Limit Urban Concentration

Our key argument is that political decentralization, especially that characterized as shared rule between national and regional politicians, encourages the growth of secondary cities. Political decentralization may be a strong political driver of reduced urban concentration because it provides regions outside the capital with political power to press for resources to flow to secondary cities (Sellers, 2002). These resources, in the forms of interregional transfers and direct investments in infrastructure, result in more government employment (Gibson and Calvo, 2000, Diaz-Cayeros, 2006, Wibbels, 2005) and more population settlement that increases city sizes. These resources benefit subnational politicians politically, by increasing their prospects for reelection and making the politicians themselves crucial nodes of political rents (Gervasoni, 2010).

Yet distributing these resources outward also benefits national governments. Spatially distributed development may be a way for the central government to fragment political power, reducing coordinated demands on the central government (Ricart-Huguet and Sellars, 2023), and appeasing demands from peripheral areas that may conflict with central priorities (Grossman and Lewis, 2014). Decentralized institutions provide mechanisms to trade policies preferred by the central government for resources desired by peripheral elites (Calvo and Murillo, 2004). Thus decentralization aligns the interests of politicians at both levels of government, those in the center who seek to limit excess pol-

icy demands and subnational politicians seeking resources to retain power (Beramendi and Rogers, 2023).

While the benefits of decentralization to subnational politicians may be clear, the benefits to national politicians of shared rule needs more explication. Incentives on the part of national politicians to reduce urban concentration may be found in the historical origins and transformations of decentralization in Latin America. Increased decentralization to subnational regions in Latin America has multiple motivations, but the most important ones are political, and driven by preferences in the central government (Eaton, 2013, Soifer, 2015). A primary intent has been to weaken the political power not of the primate city per se, but of the populace in the primate city, by delegating power to peripheral elites. Decentralization has been a political decision to weaken the political strength of particular urban areas, whether because they are worried about the revolutionary potential of the primate cities (Bates, 2014, Ricart-Huguet and Sellars, 2023), or worried about the urban left dominating elections in a one-person one-vote system and demanding redistribution (Gibson and Calvo, 2000, Calvo and Murillo, 2004). Political efforts to distribute growth outward are meant to diminish and fragment the political strength of urban areas by dispersing the population and its voting power (Beramendi and Rogers, 2023). Thus we expect decentralization to be associated with lower urban concentration in Latin America, and we examine this relationship in our empirical analysis.

# 3 Methods

## 3.1 Measuring Urban Concentration

Our analysis employs remotely sensed satellite nightlight brightness as our urbanization measure.[2] We focus on nightlight brightness, in particular, so that we can calculate city size without relying on information from governments. The challenge of government-provided city size data is that it uses administrative borders of the city for calculation. While administrative borders have value for temporal consistency, they may not capture the spatial extent of growth. If cities expand in geographic space, this will likely occur outside existing administrative borders and will not be accounted for in official population statistics. City population figures, unless highly disaggregated, also do not tell us where, and therefore how, the city is growing. Given that we are focused on the political dynamics between central and subnational governments, especially states and provinces, we want to capture the

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[2]Summary statistics for all of our variables are shown in the Online Appendix Section 1.

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full extent of growth under the subnational region's purview.[3]

Nightlight data is also annualized, allowing us to examine change over time in urban concentration. Most research on urban concentration examines cross-sectional data, showing how urban concentration varies across countries, especially those with different income levels or sectoral compositions. Only a select number of papers use over time data, and these are usually restricted to ten year periods (census years), and often only two time points. We are able to show changes that occur between national census periods and for a longer time period than most studies.

Our nightlight measures are aggregated from geographic grid cells. This provides us the flexibility to create the borders of urban areas that reflect the distributions of lights and population. We downloaded the maps for all cities from Esri's World Urban Areas. We match the maps for urban areas, nightlights, and population in order to calculate values for each area. Our GIS procedures are described in Online Appendix Section 2.

Consistent with existing research on urbanization, we define urban areas as those with a minimum population of 50,000 (Rodríguez-Pose, 2018). More conservative estimates define cities as urban ares with a minimum population of 100,000. We only have 3 cities in our data that have population less than 100,000 (Calabozo, VE - Copiapó, CL - San Rafael, AR). Figure 2 below visualizes our sample, which includes every city in Latin America with a population greater than 50,000 residents, for a total of 467 cities in 19 countries. Our Online Appendix Table 2 lists each city, by country.

To measure satellite nightlights, we use the harmonized global nighttime light dataset 1992–2018. "The harmonized global NTL time series data include the stepwise calibrated stable DMSP NTL observations from 1992 to 2013 and the simulated DMSP-like DNs from the VIIRS radiance data (2014–2018)" (Li et al., 2020). The measure goes from 0 to 63, with 0 having no discernable nightlight, and 63 with the brightest light the satellite sensors can capture.

Figure 3 demonstrates the nightlight data for city of Buenos Aires for the years 1992 (left side) and 2018 (right side). As the legend shows, the darker the color, the higher levels of nightlight brightness. Using the same urban extent, we can see how parts of the central city became more densely populated, and more peripheral areas of the city also saw considerable growth.

One important feature of the nightlight brightness measure that needs to be considered is that it is capped at 63. As we can see in the central parts of Buenos Aires, nightlights had already reached their maximum value in 1992. It is possible, even likely, that some parts of the city that show the

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[3]See Brenner and Schmid (2015) for a discussion on how to measure urbanization.
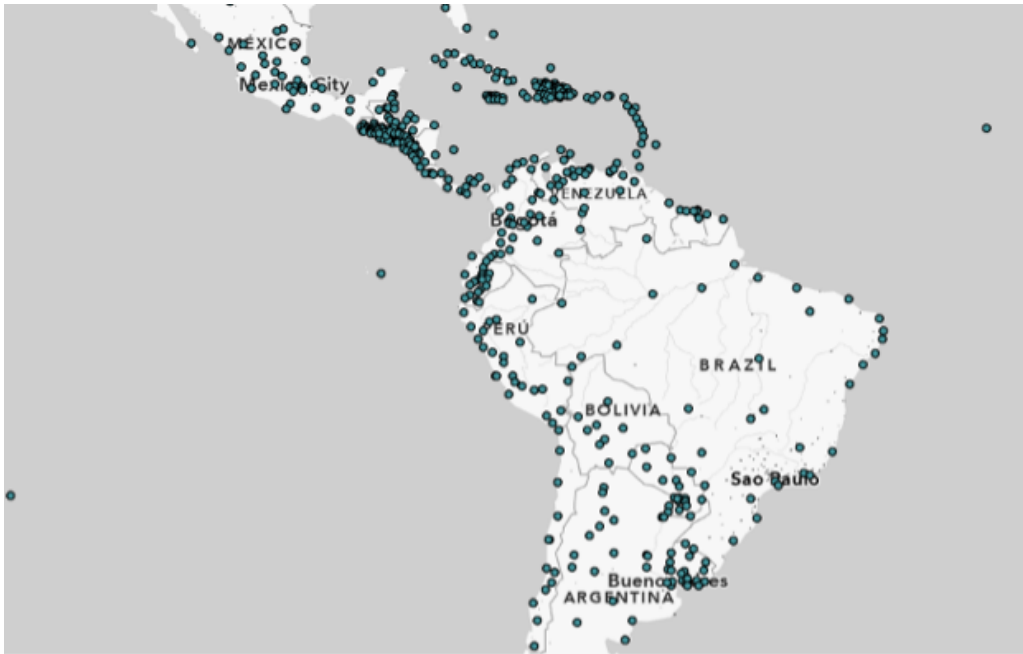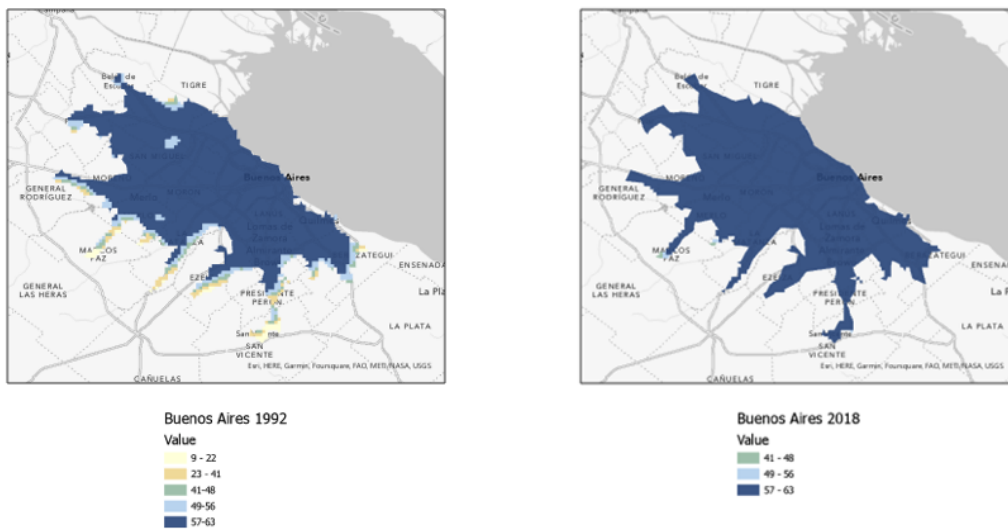
Figure 2: **City Sample**



Figure 3: **Change in Nightlight Brightness in Buenos Aires, 1992-2018**



brightest blue in Figure 3 saw population growth through increased density. This would, accordingly, underestimate city growth and likely urban primacy (Bluhm and Krause, 2022). We take several steps to address the truncation of the nightlight data is Section 5.1. Most notably, we run our analysis with gridded population data that is not truncated.

### 3.1.1 Concentration Measures

Research in urban economics does not agree on the best measure of urban concentration, but draws on a few measures (Uchida and Nelson, 2010).[4] We employ two of them to be sure we are accounting for different possible conceptualizations and measurements. We focus, in particular, on the Herfindahl-Hirschman Index of concentration, following Frick and Rodríguez-Pose (2018). The Herfindahl-Hirschman Index is a commonly used distribution measure of city size, and is justified as better describing the full city size distribution than other indicators (Henderson, 2003, Castells-Quintana and Royuela, 2015). It has been less commonly used than a ratio measure (which we show in our Online Appendix Section 4) because it is more demanding in terms of data required for calculation. It is calculated as follows:

$$HHI = \sum_{y=1}^{n_p} \left( \frac{X_y i p}{X_i p} \right)^2 \tag{1}$$

in which:

- $x_y i p$ = is the sum of lights of city $y$ in country $i$ in period $p$.

- $x_i p$ = total sum of urban lights in country $i$ in period $p$.

- $n$ = number of cities in country $i$ in the beginning of period $p$.

The HHI is the sum of the squared share of each city's share of total nightlights or population in that year. The values range between 1/n and 1, with 1 representing full concentration in one city.

## 3.2 Political Decentralization Measures

We use two indicators of political decentralization: Division of Power Index and Shared Rule. For decentralization, we use the Varieties of Democracy (VDEM) Division of Power Index, a measure of electoral decentralization (Coppedge et al., 2015). The variable is defined as follows, "Are there elected local and regional governments, and — if so — to what extent can they operate without interference from unelected bodies at the local level?" (p.312).[5] A low score indicates high levels of

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[4]See Uchida and Nelson (2010) for a cross-nationally comparable measure of urbanization that includes population density, the population of a large urban center, and travel time to that large urban city.

[5]VDEM provides additional detail on the indicator on page 312, "The lowest score would be reserved for a country that has no elected local or regional governments, or where all or nearly all elected offices are subordinate to non-elected offices at any local or regional level that exists. A high score would be accorded to a country in which both local and

centralization and little local power, a high score indicates high levels of electoral decentralization and decentralized decision-making.

We also use indicators of decentralization from the Regional Authority Index (Marks, Hooghe and Schakel, 2008), focusing on the the "Shared Rule" variable, which best captures our theoretical concept of decentralization in the Latin American context. The shared rule variable captures "the authority exercised by a regional government or its representatives in the country as a whole, which is the sum of Lawmaking, Executive Constraint, Fiscal Control, Borrowing Control, and Constitutional Control" (RAI codebook, p.6). We also show results with the subcomponent indicators of the Shared Rule indicator:

- Shared Lawmaking: "The extent to which regional representatives co–determine national legislation" (p.6).

- Executive Control: "The extent to which a regional government co–determines national policy in intergovernmental meetings" (p.6).

- Shared Fiscal Control: "The extent to which regional representatives co–determine the distribution of national tax revenues" (p.6).

- Shared Constitutional Control: "The extent to which regional representatives co–determine constitutional change" (p.6).

Figure 4 plots the values for our country samples for the VDEM decentralization measure and Shared Rule in the year 2000 to provide an idea of the variation in the sample. For the most part, these variables capture similar dynamics across countries, but there are some differences in the coding of decentralization versus Shared Rule for Colombia, for example, which has high values for decentralization but moderate values on the Shared Rule. Importantly, decentralization is not only present in federal nations. Colombia, Bolivia, Ecuador, Haiti–all formally unitary countries–have significant degrees of decentralization. This decentralization involved delegation to local governments, most notably in the 1990s, with the aim of increasing administrative efficiency (Beramendi, Rogers and Díaz-Cayeros, 2017).

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regional governments are elected and able to operate without restrictions from unelected actors at the local or regional level with the exception of judicial bodies. A medium score can be achieved in various ways: there are strong elected governments at the local level but not the regional level, or vice versa; or both local and regional governments elect an executive but not an assembly; or elected and non-elected offices are approximately equal in power at the local and regional levels; or various combinations of these scenarios."

Figure 4: Values of Decentralization and Shared Rule, Year 2000
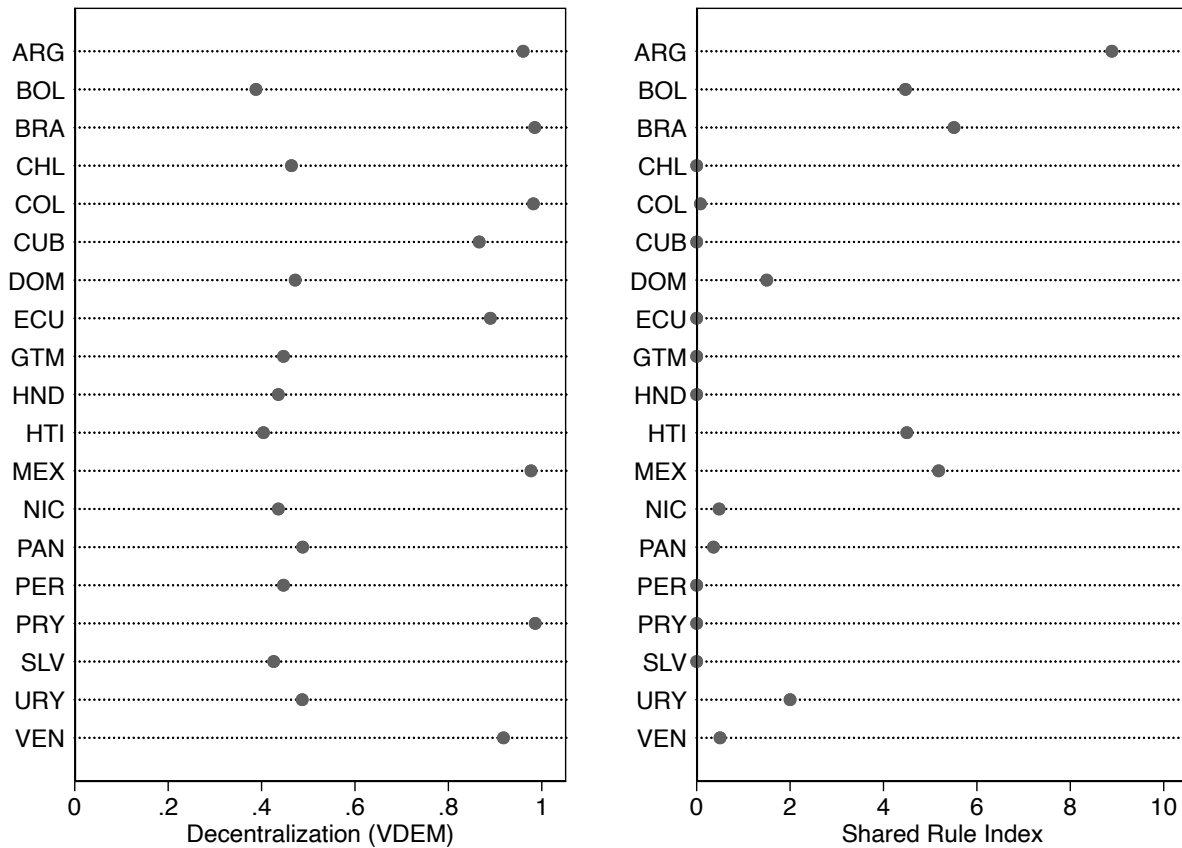


## 3.3 Economic and Historical Control Variables

We include standard control variables to predict urban concentration in our regression models. We include GDP per capita, taken from the World Development Indicators. Urbanization is part of a larger process of economic development in which workers shift from primary sector employment to work in the industrial and service sectors. Thus, levels of urbanization are associated with higher economic development. Also, urban concentration, as discussed above, tends to be higher in countries with relatively low levels of economic development. We also include the logged population value because smaller countries have fewer cities, and thus likely have more concentrated urban populations.

Second, we include additional controls for the nature of the economy, including whether the nation engages in a high degree of natural resource extraction (i.e., oil, natural gas, minerals), because

this might be associated with both geographically concentrated productivity and with government centralization. This measure, from the World Development Indicators, captures the percentage of GDP linked to resource extraction. We also include measures of the size of the agricultural sector and the service sector, relative to GDP, from the World Development Indicators.

A significant literature reflecting on economic and political changes in Latin America in the 1990s focuses on neoliberal reforms, especially increased openness to trade (Alix-Garcia and Sellars, 2020). We include a measure of international trade and globalization, because Krugman and Elizondo (1996) and others have argued that urban concentration in developing nations should dissipate as international trade induces competition amongst regions to win foreign direct investment. We use the economic globalization indicator from Dreher (2006). Ades and Glaeser (1995) and Davis and Henderson (2003) argue that democratization should affect urban primacy. We include the liberal democracy indicator from Coppedge et al. (2015).

## 4    Visualizing Urban Concentration in Latin America

In this section, we visualize our data to give an idea of the extent of urban concentration and dispersion in Latin America. Figure 5 shows the summary trends at the national level for our main indicator, the Herfindahl-Hirschman Index (HHI). The figure provides an overview of the dispersion in nightlight values in cross-national perspective, as well as changes during the period of our sample.

Overall we can see several patterns in our data. First, in all countries, nightlight concentration, measured with the HHI, decreased between 1992 and 2018. The extent of this reduction varied across countries. In Venezuela we see almost no difference during the period, even if nightlight concentration is slightly lower in 2018. Colombia, Bolivia, Brazil, and Mexico also saw minimal differences in their urban spread. In certain countries, such as Peru, Chile, Uruguay, and to a lesser extent Argentina, we see substantial reductions in urban concentration during this period. This evidence is consistent with patterns observed in population distributions during the same period (Frick and Rodríguez-Pose, 2018).[6] However, we do not see consistent patterns in our population data, shown in Online Appendix Section 3.

In Figure 6 we see the changes in mean values plotted for Uruguay, with cities' circles scaled by their number of grid cells. Montevideo (labeled MV) starts in 1992 close to the top of the possible

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[6]Latin America experienced significant electrification in the 1990s that should be reflected in nightlight values. The majority of this electrification was rural, and thus would not be captured in our urban measures in most cases (Giraudy and Luna, 2017, Aklin, Harish and Urpelainen, 2018).

Figure 5: **Change in Urban Concentration, 1992-2018**
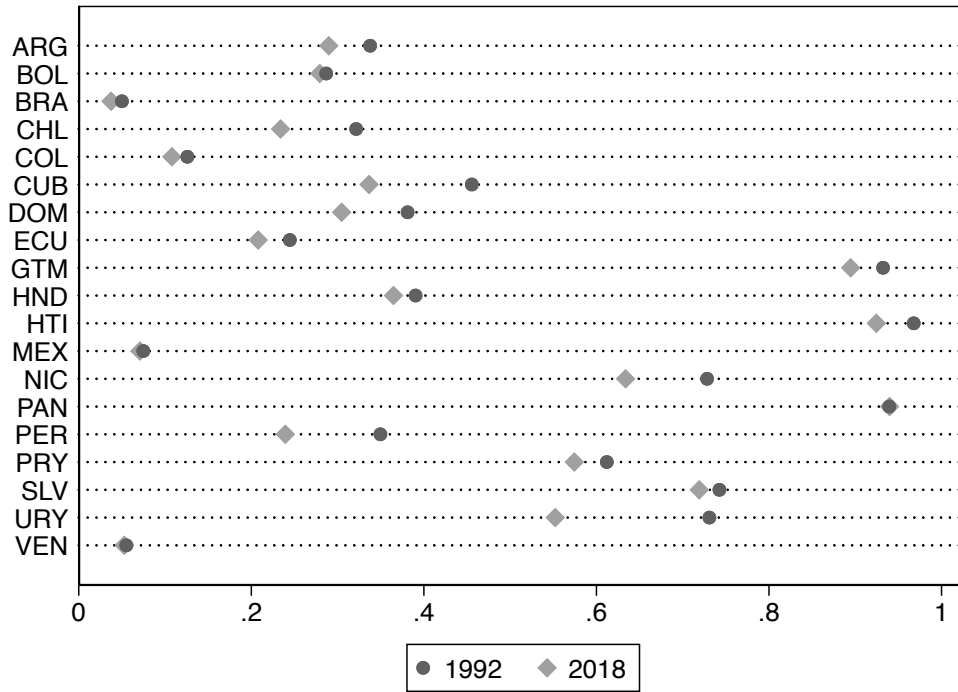
light value (57) and ends up at its top (63). Montevideo effectively has no room to grow based on the upper limit of the nightlight value at 63. In the meantime, Salto (S) and Ciudad de la Costa (CC) catch up to Montevideo in average light value in the period, but remain far smaller.

Figure 7 shows how these changes appear in nightlight maps for Uruguay during this period. We see evidence of increased development across much of the country, with the larger areas growing considerably brighter, but also Montevideo increasing in nightlight intensity.

# 5 Results

This section provides results from our data analysis, examining correlates of urban concentration. Our model is structured as follows:

$$C_{i,t} = \alpha + \beta D_{i,t} + X_{i,t} + \mu_i + \gamma_t + \epsilon_{i,t} \tag{2}$$

where $i$ indexes each country, $t$ indexes each year. $C_{i,t}$ is our measure of urban concentration, the Herfindahl-Hirschman Index of urban nightlight. $D_{i,t}$ is our measures of political decentraliza-

Figure 6: **Change in City Brightness in Uruguay, 1992-2018**
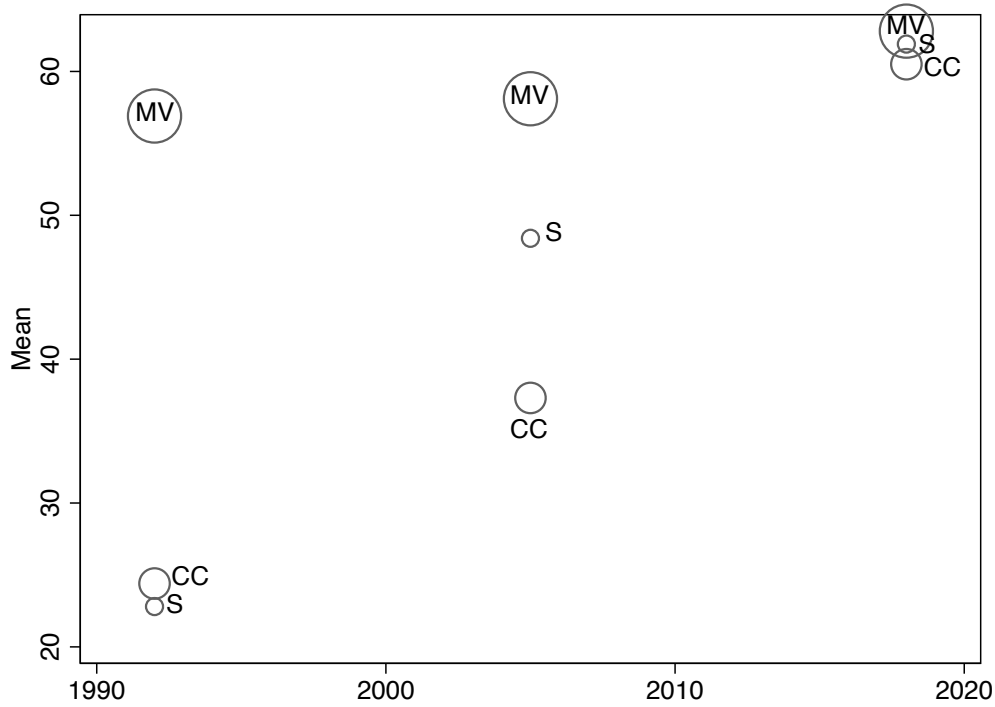


tion. $X_{i,t}$ is a vector of controls for observable characteristics: GDP per capita (logged), population (logged), globalization, primary sector share of the economy, service sector share of the economy, natural resource rents, and level of democracy. $\mu_i$ are country fixed effects, and $\gamma_t$ are year fixed effects. $\epsilon_{i,g}$ is a random error term. All standard errors are robust. Our models, featuring country and year effects and a battery of controls, are highly conservative estimates of the effects of the independent variables we examine.

Table 1 shows our main empirical results linking urban nightlight concentration to measures of political decentralization. In all models, decentralization and Shared Rule are negatively associated with urban nightlight concentration, suggesting that political decentralization creates incentives for lower urban concentration.

We show our results in three ways. First, with our political decentralization measures, year fixed effects, and no controls. Second, our political decentralization measures with year fixed effects and country fixed effects. Third, with our political decentralization measures, year fixed effects, country fixed effects, and a full battery of controls.[7] In all models we see that political decentralization, mea-

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[7]Our main results are also robust to including the lagged dependent variable. We do not include this in our main models

Figure 7: Map of City Brightness in Uruguay, 1992-2018



Uruguay 1992
Value

63

0



Uruguay 2018
Value

63

0
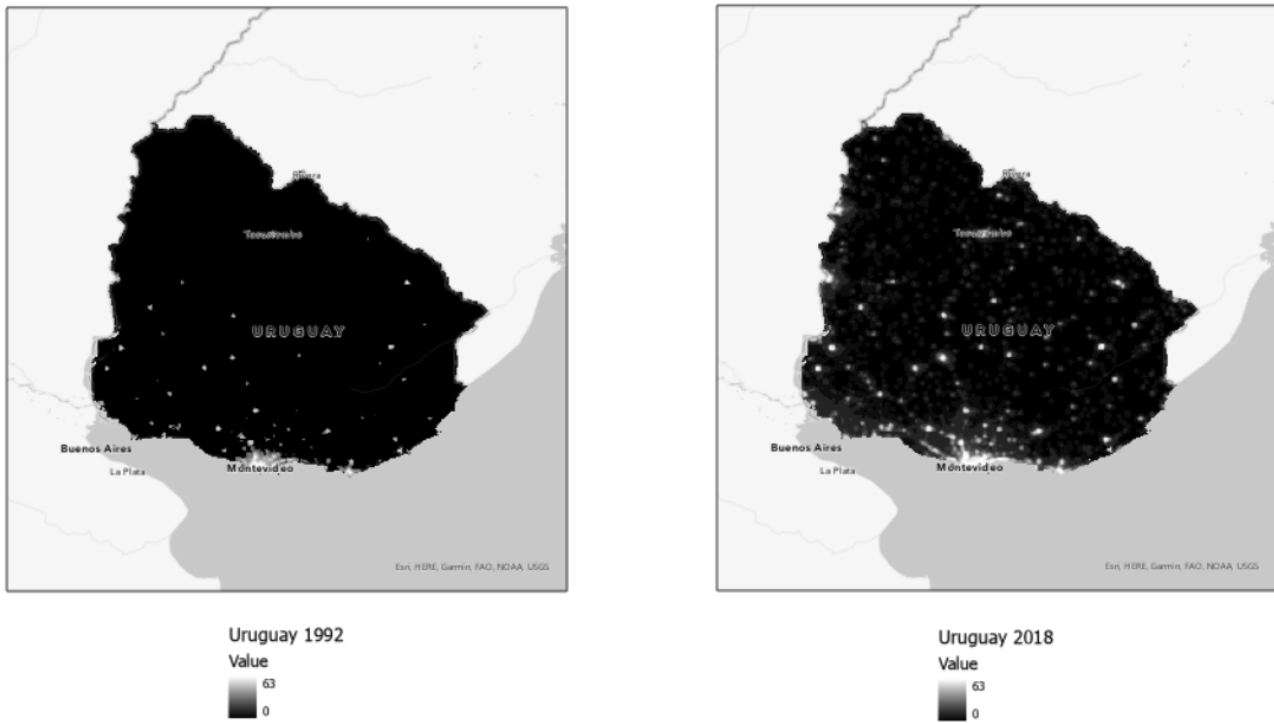
sured with both the VDEM decentralization indicator and the shared rule indicator, has a significant, negative effect on urban concentration.

With regard to controls, we see that democracy is associated with higher levels of urban concentration across all models. This is surprising because many scholars expected democratization to lead to lower spatial concentration in Latin America (Aroca and Atienza, 2016). These results suggest that democracy may not be a panacea for excess urban concentration. As expected, increased development, measured with GDP per capita, is associated with lower urban concentration across all models. Higher population is associated with higher urban concentration. We see that economic globalization is associated with lower urban concentration, but the effect is not significant in our models. Across our models, a larger service sector is the strongest economic indicator of lower urban concentration.

Table 2 shows very similar results with subcomponents of shared rule as our primary independent variables. As described above, the subcomponents capture different aspects of shared rule, including whether regional governments affect national policymaking in the legislative and executive branches,

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because so much of our variation is explained by year and country fixed effects.

Table 1: **Political Predictors of Urban Nightlight Concentration**

| Dependent variable: | HHI Urban Nightlight Concentration | | | | | |
|---|---|---|---|---|---|---|
| | (M1) | (M2) | (M3) | (M4) | | |
| Decentralization$_{t-1}$ | -0.702*** | -0.019*** | -0.023*** | | | |
| | (0.041) | (0.006) | (0.005) | | | |
| Shared Rule Index$_{t-1}$ | | | | -0.028*** | -0.005*** | -0.003*** |
| | | | | (0.005) | (0.001) | (0.001) |
| ln(GDP per Capita)$_{t-1}$ | | | -0.027*** | | | -0.027*** |
| | | | (0.005) | | | (0.005) |
| ln(Population)$_{t-1}$ | | | 0.105*** | | | 0.098*** |
| | | | (0.013) | | | (0.014) |
| Economic Globalization$_{t-1}$ | | | -0.000 | | | -0.000 |
| | | | (0.000) | | | (0.000) |
| Primary Sector (% GDP)$_{t-1}$ | | | 0.000 | | | 0.000 |
| | | | (0.000) | | | (0.000) |
| Service Sector (% GDP)$_{t-1}$ | | | -0.000** | | | -0.000* |
| | | | (0.000) | | | (0.000) |
| Natural Resources (% GDP)$_{t-1}$ | | | 0.000 | | | -0.000 |
| | | | (0.000) | | | (0.000) |
| Democracy$_{t-1}$ | | | 0.017*** | | | 0.015** |
| | | | (0.006) | | | (0.007) |
| Observations | 513 | 513 | 502 | 513 | 513 | 502 |
| R-squared | 0.379 | 0.998 | 0.999 | 0.064 | 0.998 | 0.999 |
| Controls | No | No | Yes | No | No | Yes |
| Country FE | No | Yes | Yes | No | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes.* Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

are involved with fiscal allocation of the national government, and have a say in changes to constitutional structure. We include models with year and country fixed effects (M1, M3, M5, M7) and year and country fixed effects with a full battery of controls (M2, M4, M6, M8).[8] In all cases, the shared rule indicators are associated with lower urban concentration. The results for the control variables are consistent with those shown in Table 1.

We also include results with an alternative measure of urban concentration, the share of urban nightlight found in the largest city in that nation, to demonstrate robustness. In Table 3 we show results for our main models with this ratio measure as our dependent variable. The results are very similar to those found in our main models in Table 1, with both the decentralization and shared rule indicators showing consistent, significant negative relationships with urban concentration.

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[8]The results are consistent in models with year fixed effect and no controls as well.

Table 2: **Predictors of Urban Nightlight Concentration, Components of Shared Rule**

| *Dependent variable*: | **HHI Urban Nightlight Concentration** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (M1) | (M2) | (M3) | (M4) | (M5) | (M6) | (M7) | (M8) |
| Lawmaking$_{t-1}$ | -0.016*** | -0.006 | | | | | | |
| | (0.005) | (0.005) | | | | | | |
| Executive Control$_{t-1}$ | | | -0.008** | -0.006** | | | | |
| | | | (0.003) | (0.003) | | | | |
| Fiscal Control$_{t-1}$ | | | | | -0.018*** | -0.013*** | | |
| | | | | | (0.005) | (0.004) | | |
| Constitutional Control$_{t-1}$ | | | | | | | -0.005*** | -0.002 |
| | | | | | | | (0.001) | (0.001) |
| ln(GDP per Capita)$_{t-1}$ | | -0.028*** | | -0.028*** | | -0.028*** | | -0.028*** |
| | | (0.005) | | (0.005) | | (0.005) | | (0.005) |
| ln(Population)$_{t-1}$ | | 0.104*** | | 0.100*** | | 0.096*** | | 0.102*** |
| | | (0.014) | | (0.014) | | (0.014) | | (0.014) |
| Economic Globalization$_{t-1}$ | | -0.000 | | -0.000 | | -0.000 | | -0.000 |
| | | (0.000) | | (0.000) | | (0.000) | | (0.000) |
| Primary Sector (% GDP)$_{t-1}$ | | 0.000 | | 0.000 | | 0.000 | | 0.000 |
| | | (0.000) | | (0.000) | | (0.000) | | (0.000) |
| Service Sector (% GDP)$_{t-1}$ | | -0.000 | | -0.000** | | -0.000** | | -0.000 |
| | | (0.000) | | (0.000) | | (0.000) | | (0.000) |
| Natural Resources (% GDP)$_{t-1}$ | | -0.000 | | -0.000 | | -0.000 | | -0.000 |
| | | (0.000) | | (0.000) | | (0.000) | | (0.000) |
| Democracy$_{t-1}$ | | 0.011* | | 0.008 | | 0.006 | | 0.013* |
| | | (0.007) | | (0.006) | | (0.006) | | (0.007) |
| Observations | 513 | 502 | 513 | 502 | 513 | 502 | 513 | 502 |
| R-squared | 0.998 | 0.999 | 0.998 | 0.999 | 0.998 | 0.999 | 0.998 | 0.999 |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes.* Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

## 5.1 Robustness Checks

In our Online Appendix, we demonstrate robustness in our empirical results. In our Online Appendix Section 3, we show our results with an HHI measure of population. As discussed above, this analysis helps address the concern that our results may be affected by the truncation of the nightlight data. We employ gridded population data from the UN WPP-Adjusted Population Count, v4.11, available from 2000-2020 in five year increments, that we matched with the Esri World Urban Areas boundaries using GIS. The sample sizes for these analyses are much smaller given the time limitations of this data source. Nonetheless, we find the HHI of nightlight brightness correlates with HHI of population at *r*=0.82 and our statistical results are consistent with those we find for nightlight brightness.

In Section 4 we show our models with HHI values constructed with other concepts than the sum of nightlight values for the urban areas. These alternative constructions may also help us to address the truncation of the nightlight values, and to see whether decentralization is related to other concepts of urbanization, such as population density. We employ two indicators: nightlight values per geographic grid cell and 90th percentile values, both calculated as HHI values. In both cases our results are

Table 3: **Political Predictors of Urban Nightlight Concentration (Ratio Measure)**

| *Dependent variable*: | **% of Urban Nightlight in Largest City** | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | (M1) | (M2) | (M3) | (M4) | (M5) | (M6) |
| Decentralization$_{t-1}$ | -0.633*** | -0.023*** | -0.023*** | | | |
| | (0.038) | (0.005) | (0.005) | | | |
| Shared Rule$_{t-1}$ | | | | -0.026*** | -0.004*** | -0.001 |
| | | | | (0.005) | (0.001) | (0.001) |
| ln(GDP per Capita)$_{t-1}$ | | | -0.031*** | | | -0.032*** |
| | | | (0.005) | | | (0.005) |
| ln(Population)$_{t-1}$ | | | 0.089*** | | | 0.086*** |
| | | | (0.011) | | | (0.012) |
| Economic Globalization$_{t-1}$ | | | -0.000 | | | -0.000 |
| | | | (0.000) | | | (0.000) |
| Primary Sector (% GDP)$_{t-1}$ | | | -0.000 | | | -0.000 |
| | | | (0.000) | | | (0.000) |
| Service Sector (% GDP)$_{t-1}$ | | | -0.000** | | | -0.000 |
| | | | (0.000) | | | (0.000) |
| Natural Resources (% GDP)$_{t-1}$ | | | 0.000 | | | -0.000 |
| | | | (0.000) | | | (0.000) |
| Democracy$_{t-1}$ | | | 0.011* | | | 0.005 |
| | | | (0.005) | | | (0.006) |
| Observations | 513 | 513 | 502 | 513 | 513 | 502 |
| R-squared | 0.365 | 0.998 | 0.999 | 0.066 | 0.998 | 0.999 |
| Controls | No | No | Yes | No | No | Yes |
| Country FE | No | Yes | Yes | No | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes.* Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

consistent with those found in our main analysis in Table 1. We also show results of the ratio measure for the subcomponents of Shared Rule.

In Section 5 we show our models with our nightlight values calculated as a gini coefficient. While this measure is not common in studies of urban concentration, it does capture variation in urban distribution. We find similar results with this measure as well.

In Section 6 we show our models with the smaller countries of Latin America excluded from the sample. Given the enormous land and population size differences between, for example, the Central American nations and Brazil, it is reasonable to consider that the results are driven by population concentration in these smaller nations. Our results in Section 6 show that decentralization is associated with lower urban concentration when excluding those small nations.

In Section 7 we demonstrate that our results are not driven by any particular country in our sample. We visualize the coefficients for our most conservative model (including year and country fixed effects

and all controls), excluding each country one by one. We find that no evidence that our results are driven by a particular country, or by federal nations.

# 6  Discussion and Limitations

Our results suggest political decentralization is one institutional device that may encourage urban deconcentration. Decentralization in Latin America is characterized by shared rule, in which national governments coordinate political powers and allocate resources to regional governments. This shared rule benefits subnational politicians' incumbency, providing resources for them to distribute locally that may also encourage urban growth in their regions. At the same time, national governments gain cooperation for preferred national policy objectives, and may stifle the political demands of residents of the primate city.

Yet, urban spatial deconcentration does not imply that economic growth is distributed, or that decentralization maximizes opportunities for representation and accountability of those outside the capital. In Latin America, decentralization is intertwined with the distribution of national resources to peripheral regions. Decentralization, and the associated institutions of territorial fiscal redistribution, are highly fraught political processes in Latin America (Eaton, 2004, 2013). Ultimately these resources may not result in greater economic growth and development if they are inefficiently distributed, or associated with clientelism, profligacy, and anti-competitive practices. A large literature on Latin American federalism has argued that interregional transfers create perverse incentives for subnational elites to overspend and undertax (Rodden and Wibbels, 2002, Rogers, 2014) and to deflect political accountability (Remmer and Wibbels, 2000). These resources may also keep poorly performing politicians and subnational autocrats in office (Gervasoni, 2010, Giraudy, 2015). Moreover, shifting resources away from the central city may not represent the political preferences of citizens in the nation, or the best economic growth strategy. Gibson, Calvo and Falleti (2004) in particular worry that these resources are part of a system of reallocative federalism that presses resources away from population centers. Thus urban deconcentration is not necessarily equivalent to spatially distributed economic growth. These resources may also fuel population growth and service sector growth in so-called consumption cities which may be disconnected from economic growth (Gollin, Jedwab and Vollrath, 2016, Jedwab and Vollrath, 2015). Consumption cities are dominant in much of Sub-Saharan Africa and the Middle East, making this an important topic to consider outside of the Latin American region as well. These questions should be examined in future research.

Most urban studies experts would argue that the costs and benefits of urban primacy and urban concentration are context dependent, including the country context, phase of economic development, and the technology available. Most scholars would advocate for urban sustainability, ensuring that urban life is consistent with healthy living, access to opportunity, and in pursuit of environmental goals. Future research could explore the extent to which urban deconcentration may be coinciding with greater urban sustainability.

## 6.1 Limitations

Our study has potential limitations based on our data structure and analysis. First, with gridded nightlight data that is designed specifically to capture the changes in urban extent, we cannot match our unit of analysis with existing city-level administrative data. This is a clear drawback of our approach, which means that we need to focus on data aggregated to the national or provincial levels in order to conduct data analysis. Thus, in this paper we have focused on the distribution of cities within the nation.

A second concern, that we hope to alleviate with additional data collection and robustness testing, is the potential sensitivity of our results to country or city samples. Given the relatively small number of countries involved, of which we have excluded certain countries for not having more than one city of greater than 50,000, we may worry that individual countries could be driving our results. We have taken steps to alleviate that concern with our country jackknife analysis in Online Appendix Section 7. Similarly, our sample includes all cities above 50,000 inhabitants. It is possible our results could be different if we cut the population threshold to 25,000 or raised it to 100,000. In a follow up article, we will examine the size of the cities that are experiencing growth in the recent period.

A third concern is one of external validity. We assume, based on existing research, that Latin American urban concentration is high in comparative perspective. In future research we will see whether our findings on urban concentration and the role of decentralization hold for other world regions, with particular interest in developing world regions such as Sub Saharan Africa and South Asia.

# 7  Conclusion

Our analysis documents urban concentration in Latin America in the period 1992-2018 using a detailed dataset of city distributions of nightlights measured by satellites. While urban concentration

is very high in Latin America, there is considerable variation across countries and over time. We find that political decentralization is a strong predictor of lower urban concentration. These results are highly stable across models with a full battery of theoretical controls, and country and year fixed effects.

Urban concentration is a very important topic for future research. Our current data structure treats the urban extent (geographic size) as fixed, so that we can observe changes in nightlight and population values for the same grid cells. Future studies could allow for changes in the urban extent. With this data arrangement, we could see the shape of city growth, whether growth has occurred through increased density in existing urban areas or sprawl in the outskirts of cities. We can also see the direction of the sprawl. These data could allow us to examine political predictors of the *nature* of city growth. Furthermore, future research could tell us more about whether urban deconcentration is occurring through relative population growth in one secondary city or multiple secondary cities. Case studies of city growth such as those done by Lanfranchi et al. (2018) in Argentina could greatly inform these types of analyses.

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