

PROPERTY-PRICE DETERMINANTS IN INDONESIA

Matthew Gnagey*

Weber State University

Ryan Tans*

Emory University

Price formation provides critical insights into the attributes of fledgling property markets in developing countries. This article investigates asking-price formation across the Indonesian archipelago, including previously unstudied regional property markets. We compile a rich micro dataset of asking prices for residential, commercial, and undeveloped land from a nationwide classifieds database. Through a hedonic price analysis we identify the impact of property and advertisement attributes on asking prices for each type of property, using spatial fixed effects to control for spatially correlated unobservable characteristics at the district and city levels. Results indicate that property characteristics, land ownership status, and advertising method are all statistically significant indicators of asking price. We find considerable heterogeneity in asking-price formation in residential, commercial, and undeveloped land, and identify key differences between urban and rural markets.

Keywords: hedonic analysis, asking-price formation, property markets, developing countries, land tenure

JEL classification: O18, R12, R21, R30

INTRODUCTION

Property markets in developing countries function similarly to those in developed countries in many aspects. As a result, studies in developing countries have analysed similar questions to the myriad hedonic price models for housing in developed countries (Lim, Follain Jr., and Renaud 1984; Follain and Jimenez 1985; Danieri 1994; Lall, Lundberg, and Shalizi 2008; Takeuchi, Cropper, and Bento 2008; Brueckner 2013). However, there are a variety of unique obstacles to a full understanding of property markets in developing countries. First, these markets are often less established, due to the quantity of individuals leaving subsistence livelihoods and entering the market economy for the first time. Second, the lack of disclosure requirements, multiple listing services, or an organised association of realtors increase the difficulty of obtaining large property-price datasets, particularly outside the largest cities. Third, overall housing quality is lower in developing countries, and there is less land tenure security. We address these challenges by assembling a large, original dataset of Indonesian properties listed for sale in 2016

* We would like to thank those who gave us detailed comments on our drafts, including two anonymous reviewers and the *BIES* editorial team. We also thank Nicholas Irwin for his insights. All remaining errors are our own.

on an online classifieds website, using asking prices to estimate property values as a function of property attributes. Analysing these markets presents opportunities to enhance our understanding of the implicit prices of housing and other property characteristics in a large but under-examined region.

Often used to explore property market behaviour, asking prices can help in understanding the perceived price of housing (McGreal and de La Paz 2013) and in identifying the effects of time on the market on house prices (Knight, Cirmans, and Turnbull 1998; Anglin, Rutherford, and Springer 2003; Haurin et al. 2010). While there is concern over the potential bias from using asking prices instead of a market-transacted price, researchers have found that transaction prices and asking prices typically do not deviate much except during rapid boom and bust cycles; outside these cycles the average deviation is approximately 1% (McGreal, Brown, and Adair 2010; Haurin, et al. 2013). Moreover, even under atypical market conditions, asking prices are found to accurately represent changes to sale prices (Lyons 2013). In developing countries where there is evidence of massive overregulation in the formal housing market (De Soto 2003), using asking prices extracted from a large informal transaction market can capture certain attributes more accurately (Arnott 2009). And there are substantial benefits to using asking prices due to the ability to collect large datasets from online advertisement websites, which are increasingly used for property transactions in many developing countries.

The purpose of this article is to investigate Indonesian asking-price formation across the entire archipelago. We examine the determinants of property asking prices by including both property attributes as well as advertisement characteristics. Through a hedonic pricing method with spatial fixed effects, we are able to identify factors influencing prices, and we explore key differences between residential, commercial, and undeveloped property markets. The dataset for this study was collected through postings on the classifieds website OLX Indonesia (OLX.co.id), yielding 64,462 observations during the year 2016 from 449 districts and cities within Indonesia. Due to the size and spatial distribution of the dataset, we are able to investigate Indonesia's property markets as a whole, as well as to compare urban and rural markets.

Our research yields a variety of new insights into the workings of a developing country's property markets. These insights come from the spatial extent of the data, and our ability to examine three separate types of property: residential, commercial, and undeveloped land. Each property type has unique characteristics that influence prices, including land tenure. By using asking prices, we are able to examine the impact of seller attributes and attributes of the advertisement. We find that the technology used to upload the advertisement affects the asking prices. Additionally, advertisements specifying a willingness to negotiate are found to have significantly higher prices, while advertisements that indicate urgency or discounted prices have significantly lower prices.

This article offers two major improvements to the literature on property markets in developing countries. First, we were able to compile a large, and nearly spatially complete, property-price dataset for Indonesia, one of the largest developing countries in the world. The dataset includes a majority of observations from outside Jakarta and the other largest urban areas, including a substantial number of observations from far-reaching provinces and districts, allowing for an analysis of the rural Indonesian property market. For comparison, prior studies on Indonesian

home and land values have been limited in geographic scope by data availability, most frequently using small surveys in a single city, often Jakarta, or have used the Indonesia Family Life Survey (IFLS), a panel dataset with home values of 1,500 to 2,000 urban households (Yusuf and Koundouri 2005; Suparman, Folmer, and Oud 2014).

Second, we have data on three types of properties: residential, commercial, and undeveloped land. Each property type has its own unique set of attributes that influence property prices. Our analysis confirms previous research findings on the value homeowners place on environmental features such as access to water and transport, but it also allows us to expand our focus beyond housing markets. Whereas previous research focuses almost exclusively on markets for housing and residential land, we compare determinants of price across types of property. In particular, we show that land tenure is valued differently for different types of property, a finding that we believe reflects the costs of land tenure regulations in Indonesia.

This research makes several important contributions related to property markets in developing countries. First, the increased usage of online classified listings, such as OLX Indonesia, allows property markets to function more efficiently in developing countries, evinced by the well-identified estimates of the marginal implicit prices for property, location, and seller attributes. The mechanism for improved efficiency is through a larger available choice set and readily available information on prices for similar properties, giving sellers and buyers more accurate comparisons.

Second, we find large premiums for clearly delineated property rights. While the link between property market values and property tax revenue is complicated and mediated by local governments' capacities to assess property values and their willingness to update their assessments to keep pace with market value (Tans 2017), these premiums imply significant untapped potential property tax revenue from properties without secure land tenure. Therefore, successful efforts to provide outright property ownership in perpetuity have the potential to substantially increase tax revenue.

Last, we identify significant costs of the regulatory environment in Indonesia, particularly related to commercial properties. We find a positive premium for ownership rights in perpetuity for residential properties, but a discount for the same rights among commercial city properties. This has two potential effects: creating an incentive for businesses to buy untitled land and incentivising businesses to discourage land offices from registering new titles, which may be an unappreciated obstacle to land registration. These effects drive a wedge between valuations of residential and commercial properties, which discourages conversion of residential use to commercial use under outright ownership. We note that this wedge is consistent with the persistence of large low-density residential neighbourhoods in the middle of otherwise highly commercial downtown business districts.¹

1. For example, the neighbourhood of Embong Kaliasin in Surabaya and the neighbourhood of Setiabudi in Jakarta.

BACKGROUND

Previous research on Indonesian property markets has focused on three broad questions. First, several studies have estimated the prices of environmental features, especially public goods. This research has found that Indonesian households, like their counterparts elsewhere in the developing world, highly value public goods, including piped-in water (Crane, Daniere, and Harwood 1997; Yusuf and Koundouri 2005), clean air (Yusuf and Resosudarmo 2009), and road access (Dowall and Leaf 1991). Second, a series of articles have examined the land price gradient from the central business district (CBD) in Jakarta (Dowall and Leaf 1991; Han and Basuki 2001; Lewis 2007). These studies found that the price of land decreased as distance from the CBD increased, but that the effect diminished over time as expanding development made suburban communities more attractive to city dwellers. This pattern of development is in evidence not only in Jakarta but throughout both the developed and developing worlds. Third, researchers have studied informal housing markets, often with the goal of generating policy recommendations to improve the quality of slum housing. Struyk, Hoffman, and Katsura (1990, 9) found that the informal housing market in Indonesia during the 1980s was ‘highly responsive to consumer demand, reasonably efficient, and may work better than its counterpart in almost any other country’. Since then, the informal market has continued to step in for dysfunctional formal markets to meet consumer demand for housing (Monkkonen 2013; Brueckner 2013). Overall, the literature on property markets in Indonesia has shown that housing markets in major cities, especially Jakarta, respond reasonably efficiently to consumer demand for structural housing attributes.

The literature is largely silent, however, on market conditions outside of the major cities and in non-residential markets. This lack of research is largely the result of serious difficulties collecting property data. Actual market values are not available, because data on property transactions in Indonesia are not systematically collected or reported. The existent sales data should not necessarily be taken at face value, either. Property transactions are conducted with cash and difficult to track, and buyers and sellers have an incentive to underreport transaction prices to reduce tax obligations.²

Researchers have generally addressed this problem by using survey data. Early research on Indonesian property markets relied on appraised values collected from small-scale surveys of households (Crane, Daniere, and Harwood 1997) and real estate agents (Dowall and Leaf 1991). Han and Basuki (2001) expanded upon these data collection efforts by obtaining official property tax appraisals for all of Jakarta. Even so, the high costs of administering surveys confined this early research to major cities.

More recent research has exploited rental data (actual and imputed) collected in the IFLS, a longitudinal household and community survey conducted by RAND in several waves across 13 provinces. Yet even the IFLS does not cover the entire archipelago (coverage in Eastern Indonesia is especially patchy), and, as a household survey, it lacks data on commercial and undeveloped properties.

2. Lewis (2007) provides one of the few studies reporting actual sales data, collected as a part of a Ministry of Finance review of the accuracy of property tax appraisals in Jakarta.

While their quality has increased steadily over time, these data still have limits that, unfortunately, have left these studies blind to two important recent developments in rural land use patterns in Indonesia. First, rising palm oil prices have led to the large-scale conversion of forest and agricultural lands to palm oil production (Wicke, et al. 2011; Carlson, et al. 2012; Gatto, Wollni, and Qaim 2015). Second, urban sprawl has led to the conversion and development of agricultural land in urban hinterlands (Firman 1997, 1998; Firman 2000; Winarso 2002; König et al. 2010). A crucial step in studying these phenomena is to understand property markets, and in particular the market for undeveloped land in Indonesia's less developed districts.

DATA

We analyse an original dataset of 64,462 residential, commercial, and undeveloped properties listed for sale on the classifieds website OLX Indonesia. Online classifieds, like newspaper listings, provide a rich, accessible source of real estate data even in locations where other sources of data are limited (Kim 2004, 2007). Furthermore, the impersonal nature of online classifieds ensures that virtually every observation in our data describes an arm's-length transaction. OLX Indonesia hosts many thousands of unique listings, advertising properties for sale across the entire Indonesian archipelago. Not only do the property listings cover most of Indonesia, but they also describe in detail various attributes of the property, its tenure status and location, as well as characteristics of the advertisement itself. An important caveat is that OLX Indonesian property listings are not necessarily representative of all properties in Indonesia because we are only able to capture properties for sellers who have internet access and are capable of posting a classified advertisement online. Additionally, there may be some local property markets where OLX is not as frequently used, which may weaken the applicability of these results to every region within Indonesia.

Our sample includes listings from all 98 cities, including the 5 administrative cities in the Special Capital Region (Jakarta), as well as 351 districts spread across all of Indonesia's 34 provinces (including the administrative district of Seribu Islands in Jakarta). Appendix figure A1 maps the spatial distribution of the dataset. As of 2012, Indonesia had 399 districts, although that number has since increased as a result of ongoing district splitting (Pierskalla 2016). Thus, the dataset includes advertisements from all but 48 of the districts in existence in 2012, encompassing the geographical regions where 234 million Indonesians live, or 98% of the total population. The districts for which we lack data are in the provinces of North Sumatra; East Nusa Tenggara; North, Central, and Southeast Sulawesi; Maluku and North Maluku; and Papua and West Papua. Aside from North Sumatra, all of these provinces are in Eastern Indonesia, and by and large they are sparsely populated. For example, Papua and Maluku comprise over 25% of the land in Indonesia but make up just a little over 2% of Indonesia's population. Accounting for the population of cities there, these figures imply that the more rural areas on these islands are virtually unpopulated. Appendix figure A2 illustrates one aspect of Indonesia's population distribution by mapping the urban share of the population by each district and city. We tend to have more observations in urban regions, but there are many rural regions that still have significant numbers of observations.

The geographic coverage of the dataset varies somewhat when subsetted by type of property. Whereas observations of residential and undeveloped properties are more evenly distributed between cities and districts, commercial properties are, unsurprisingly, more concentrated in cities and urban districts. As a result, the dataset includes residential and undeveloped properties from 324 and 333 districts, respectively, but commercial properties from only 254 districts.

The dataset consists of 12,916 commercial, 30,207 residential, and 21,339 undeveloped properties. The online advertisements describe various attributes of a property, depending on its type. Table 1 provides descriptions of each attribute. Undeveloped lots are described by their address, acreage, and tenure status, while commercial properties also include information on building size, air conditioning, and type of commercial activity. Residential properties include the number of bedrooms and bathrooms. Land tenure status in Indonesia is particularly relevant due to the significant number of properties without ownership rights in perpetuity (*sertifikat hak milik*). The two other main types of land rights for which we have data are customary or informal land rights and building rights (*hak guna bangunan*).

The website organises property information in special fields, making it much easier to compile data that was comparable across a large number of listings. The website also provided a field for a general description of each property, and we derived additional attributes from this field (such as city water, landline, garage, and flooring type). For commercial properties, we searched for keywords to distinguish among various types of enterprises, including hotels, shops, kiosks, boarding houses, rental properties, restaurants, and eateries (*warungs*). We recorded attributes of the advertisements themselves, including the age of the advertisement in days, whether the advertisement was uploaded using a computer or a mobile phone, whether the poster communicated a willingness either to negotiate the price or to offer a discount, and whether the seller communicated a desire to sell the property quickly. Finally, addresses vary tremendously in format and rarely identify a property's exact location. As a result, the dataset does not easily facilitate spatial analysis within cities or districts. We dealt with this problem by identifying major street names, which are remarkably consistent across Indonesia.³ We used this information to create a dummy variable, 'downtown', which identifies properties on major thoroughfares. We recognise that this variable is only a rough proxy for the impact of location on property value. Distances or travel times to CBDs, schools, shopping areas, and other amenities significantly influence property prices. While we expect the 'downtown' variable to pick up some of the location effects, we acknowledge the measure is imperfect and likely understates the impact of location. Table 2 presents descriptive statistics for these variables for each of the three types of properties.

All of the advertisements were posted between January and October 2016 and collected between June and October 2016. The sample represents a subset of approximately one million property advertisements posted on the website in

3. The street names we identified were Sudirman, Diponogoro, Ahmad Yani, Merdeka, Alun-alun, and Balaikota.

TABLE 1 *Variable Names and Definitions*

Name	Definition
Area (ha)	The size of the lot measured as the number of hectares
Building (m ²)	The size of the building measured as square metres
Age of post (days)	The number of days the posting has been online
Mobile phone	DV denoting if the seller uploaded the posting via mobile phone
Negotiable price	DV denoting the seller specified the asking price is negotiable
Advertised 'cheap'	DV denoting the seller specified the property was cheap
Advertised 'sell fast'	DV denoting the seller indicated selling the property quickly
Customary land rights	DV denoting the seller owns customary traditional land rights (<i>girik, adat, dll</i>)
Building rights	DV denoting the seller owns building rights (<i>hak guna bangunan</i>)
Property owned outright	DV denoting the seller owns the property outright in perpetuity (Sertifikat Hak Milik)
Downtown	DV denoting the property is located on one of the most common main street names in Indonesia (Sudirman, Diponogoro, Ahmad Yani, Alun-Alun, or Balaikota)
Air conditioning	DV denoting the property has air conditioning
Granite flooring	DV denoting the floor is specified as granite
Cement flooring	DV denoting the floor is specified as cement
Ceramic flooring	DV denoting the floor is specified as ceramic
Tile flooring	DV denoting the floor is specified as tile
Hot water heater	DV denoting the property has a hot water heater
Swimming pool	DV denoting the property has a swimming pool
Curtains	DV denoting the property comes with curtains
Land line	DV denoting the property has a telephone land line
Indoor plumbing	DV denoting the property has indoor plumbing
Garden	DV denoting the property has an outdoor garden
Garage	DV denoting the property has a garage
Carport	DV denoting the property has a carport
Bathrooms	The number of bathrooms on the property
Bedrooms	The number of bedrooms on the property
Shop (<i>ruko</i>)	DV denoting the seller specified the property was a <i>ruko</i> for commercial properties
Store (<i>toko</i>)	DV denoting the seller specified the property was a <i>toko</i> for commercial properties
Kiosk (<i>kios</i>)	DV denoting the seller specified the property was a <i>kios</i> for commercial properties
Boarding house (<i>kos</i>)	DV denoting the seller specified the property was a <i>kos</i> for commercial properties
Hotel	DV denoting the seller specified the property was a hotel for commercial properties
Rental property	DV denoting the seller specified the property was a rental property for commercial properties
Food stall (<i>warung</i>)	DV denoting the seller specified the property was a <i>warung</i> for commercial properties
Restaurant	DV denoting the seller specified the property was a restaurant for commercial properties

Note: DV = Dummy variable.

that period.⁴ We collected the 600 most recent advertisements in each city and the 300 most recent advertisements in each district. If a city or district had fewer advertisements than our cut-off, we collected all available advertisements. After we removed duplicate and incomplete advertisements, this process yielded 64,462 usable observations.

METHODS

The classical hedonic pricing method presents the price as a function of a bundle of characteristics describing a differentiated good (Rosen 1974). In the context of properties, the price, $p(z) = p(z_1, z_2, \dots, z_n)$, is a function of the property attributes, including the land area, physical characteristics of the building, and locational attributes. The implicit price for each attribute of the property is calculated by the first derivate of the hedonic price function with respect to that particular attribute (Palmquist 1984).

We use a log-linear specification for our hedonic price model. However, following Cropper, Deck, and McConnell (1988) and Kuminoff, Parmeter, and Pope (2010), we specify additional models with a wide variety of commonly used function forms.⁵ The log-linear specification is

$$\ln P_{ij} = \alpha + \beta X_i + \gamma Z_j + \xi_j + \epsilon_{ij},$$

where the natural log of the property price is a linear function of the structural attributes, X_i , and location attributes, Z_j , of the property. Spatial fixed effects, ξ_j , control for any regional-specific characteristics, including local economic factors, air quality, and local political institutions. The benefit of using spatial fixed effects is that any unobservable variable that varies spatially across the country will be picked up by shifting the baseline price level for each region (Abbott and Klaiber 2011). Using spatial fixed effects is particularly advantageous when there are constant spatial effects within the specified region (McMillen 2010). The geographical variation in our data allows us to specify spatial fixed effects across relatively small geographical areas, increasing the likelihood that spatial effects are constant within each region.

RESULTS

The estimation results are shown in table 3. The first column presents the estimated coefficients and standard errors from the regression on residential property prices. There are 30,207 residential prices and 282 spatial fixed effects, yielding an average of 107.1 observations per location. The majority of the variables in the residential property regression are statistically significantly ($p < 0.01$) associated with the log price. Due to the large number of independent variables in the models, we analysed the variance inflation factor (VIF) for all property types, to address

4. We were not able to collect all the available observations, because OLX does not have an API to access the data. Following typical etiquette, we built a significant time lag into our code to avoid overloading their servers. We also limited the number of requests per 24 hours.

5. Results with different functional form specifications are available from the authors by request.

TABLE 2 *Summary Statistics*

	Residential properties (N = 30,207)		Commercial properties (N = 12,916)		Undeveloped land (N = 21,339)	
	Mean	SD	Mean	SD	Mean	SD
Price per m ² (Rp '000)	4,493	5,105	13,315	12,307	1,278	1,671
Area (ha)	0.024	0.059	0.066	0.236	0.514	1.618
Building (m ²)	135.49	234.69	398.30	836.33	—	—
Age of post (days)	38.42	44.81	46.35	46.10	40.58	46.06
Mobile phone	0.705	0.456	0.635	0.481	0.703	0.457
Negotiable price	0.687	0.464	0.721	0.448	0.717	0.451
Advertised 'cheap'	0.124	0.329	0.097	0.296	0.123	0.328
Advertised 'sell fast'	0.086	0.281	0.062	0.242	0.064	0.246
Customary land rights	0.055	0.229	0.050	0.218	0.190	0.392
Building rights	0.078	0.269	0.172	0.377	0.024	0.153
Property owned outright	0.866	0.340	0.778	0.416	0.786	0.410
Downtown	0.019	0.136	0.030	0.170	0.016	0.124
Air conditioning	0.185	0.388	0.223	0.416	—	—
Granite flooring	0.019	0.138	—	—	—	—
Cement flooring	0.014	0.118	—	—	—	—
Ceramic flooring	0.189	0.391	—	—	—	—
Tile flooring	0.005	0.070	—	—	—	—
Hot water heater	0.073	0.261	—	—	—	—
Swimming pool	0.034	0.180	—	—	—	—
Curtains	0.159	0.365	—	—	—	—
Land line	0.110	0.313	—	—	—	—
Indoor plumbing	0.521	0.500	—	—	—	—
Garage	0.433	0.496	—	—	—	—
Carport	0.464	0.499	—	—	—	—
Bathrooms	2.277	1.428	—	—	—	—
Bedrooms	3.137	1.527	—	—	—	—
Shop (<i>ruko</i>)	—	—	0.512	0.500	—	—
Store (<i>toko</i>)	—	—	0.119	0.324	—	—
Kiosk	—	—	0.037	0.189	—	—
Boarding house (<i>kos</i>)	—	—	0.073	0.259	—	—
Hotel	—	—	0.059	0.235	—	—
Rental property	—	—	0.064	0.244	—	—
Food stall (<i>warung</i>)	—	—	0.010	0.097	—	—
Restaurant	—	—	0.034	0.182	—	—

Note: SD = standard deviation.

potential multicollinearity concerns. The variable with the highest VIF was 2.81 in the residential regression, 3.73 in the commercial regression, and 1.74 in the land regression. As all explanatory variables had a VIF of less than 5.00, this suggests multicollinearity is not a major concern in these models.

TABLE 3 *Regression Results*

Variables	Parameter estimates					
	Residential coefficient	Standard error	Comm. coefficient	Standard error	Undev. land coefficient	Standard error
Log area (ha)	0.3252**	(0.012)	0.3330**	(0.016)	0.8054**	(0.008)
Log building (m ²)	0.2541**	(0.015)	0.4528**	(0.022)		
Age of post (days)	0.0001	(0.000)	-0.0007*	(0.000)	0.0002	(0.000)
Mobile phone	-0.0936**	(0.014)	-0.0791**	(0.020)	-0.0834**	(0.024)
Negotiable price	0.0658**	(0.010)	0.0420	(0.026)	0.0760**	(0.025)
Advertised 'cheap'	-0.2156**	(0.010)	-0.2110**	(0.030)	-0.2616**	(0.026)
Advertised 'sell fast'	-0.0748**	(0.014)	-0.0685*	(0.034)	-0.1207**	(0.030)
Customary land rights	-0.2678**	(0.026)	-0.3600**	(0.080)	-0.4908**	(0.029)
Building rights	-0.1032**	(0.019)	-0.0135	(0.030)	0.2467**	(0.073)
Downtown	0.1378**	(0.032)	0.2013**	(0.050)	0.5000**	(0.087)
Air conditioning	0.1782**	(0.011)	0.2182**	(0.030)		
Granite flooring	0.0923**	(0.024)				
Cement flooring	-0.3390**	(0.042)				
Ceramic flooring	-0.1351**	(0.010)				
Tile flooring	-0.1621**	(0.049)				
Hot water heater	0.1173**	(0.017)				
Swimming pool	0.1767**	(0.029)				
Curtains	-0.0621**	(0.012)				
Land line	0.1416**	(0.014)				
Indoor plumbing	0.0270*	(0.013)				
Garage	0.0382**	(0.013)				
Carport	0.1089**	(0.011)				
Bathrooms	0.1422**	(0.008)				
Bedrooms	0.0667**	(0.005)				
Shop (<i>ruko</i>)			0.2673**	(0.023)		
Store (<i>toko</i>)			-0.0460	(0.026)		
Kiosk			-0.2173**	(0.051)		
Boarding house (<i>kos</i>)			-0.0898	(0.047)		
Hotel			0.3454**	(0.036)		
Rental property			-0.1649**	(0.054)		
Food stall (<i>warung</i>)			-0.6667**	(0.108)		
Restaurant			0.2731**	(0.060)		
Constant	19.2577**	(0.085)	19.3793**	(0.163)	21.6925**	(0.043)
Observations	30,207		12,916		21,339	
R-squared	0.6866		0.6725		0.7040	
Location FE	Yes		Yes		Yes	

Note: Dependent variable is log price (Rp '000). Robust standard errors in parentheses. Comm. = commercial; Undev = undeveloped.

* $p < 0.05$; ** $p < 0.01$

Continuous coefficients for a logged dependent variable can be interpreted relatively straightforwardly, where the coefficient represents a percentage change in the price for a one-unit change in the independent variable. Dummy variables are interpreted similarly after applying a correction for the discontinuity of the dummy variable, where the percentage change in price equals $100 \times (\exp(c) - 1)$ when going from an independent variable value of 0 to a value of 1 (Halvorsen and Palmquist 1980). For example, houses with a garage have a 3.89% higher price, all else equal: $(\exp(0.0382) - 1) = 3.89$.⁶

Residential, Commercial, and Undeveloped Land Markets

Structural variables in the residential property regression tend to affect prices in the expected direction. For example, one additional bathroom is associated with a 15.28% higher price, while one extra bedroom is associated with a 6.90% higher price. Larger lots and larger buildings are also associated with higher prices. Structural variables that are valued as positive amenities include the presence of granite flooring, air conditioning, a hot water heater, a swimming pool, indoor plumbing, a landline, a garage, and a carport. The price premiums associated with these variables range from 2.74% (indoor plumbing) to 19.51% (air conditioning). Particularly notable is that the premium for indoor plumbing in housing expenditures is similar to the 3.60% of expenditure that Yusuf and Koundouri (2005) found that Indonesians are willing to pay for indoor plumbing. Lower-quality flooring (cement, ceramic, and tile) is associated with lower prices of between 14.47% (ceramic) and 40.35% (cement). Flooring variables are most likely important in determining the price because they act as a proxy for the type and quality of the house; assessor data that could measure the quality of construction or whether the property is well maintained are not available.

The second column presents results from the regression on commercial property prices. The spatial fixed effects in the commercial property regression are slightly different from the fixed effects in the other regressions because of the geographic clustering of commercial properties within cities, and the relative scarcity of commercial properties outside the cities. We aggregated commercial properties outside of cities to the provincial level to ensure enough observations within each fixed effect, because the fixed effect estimator relies on within variation for identification (Wooldridge 2007). The result of aggregation is 120 spatial fixed effects, with an average of 107.6 observations per fixed effect. The 120 fixed effects are composed of 32 of the 34 provinces for which we have data, and 88 of the 98 cities (including the five administrative cities in Jakarta).

The advertisements for commercial properties frequently included a description of the type of commercial property. Properties that the owner specified as a shop (30.64%), hotel (41.26%), or restaurant (31.40%) all have large price premiums. Lower-end commercial properties, such as kiosks (−24.27%) and food stalls (−94.78%), were associated with lower prices. Rental properties (−17.93%) exhibit

6. We also conducted a principal component analysis to cluster the independent variables. The findings largely support the importance of all three components discussed above: structural attributes, land tenure status, and advertisement attributes. These results are available from the authors upon request.

lower prices than non-rental properties, indicating that rental properties are lower in quality, perhaps due to differences in maintenance and upkeep between rental properties and owner-occupied properties (Wang 1991).

The third model in table 3 presents the results for the regression on undeveloped land prices. For the undeveloped land regression we use the same 282 spatial fixed effects as for the residential property regression. There are an average of 75.7 observations for each fixed effect for the regression. Undeveloped land in our data does not, by definition, have structures built on it, so there are no structural attributes to include in the regression. Unsurprisingly, due to the smaller number of other independent characteristics, lot size has a larger impact on the price (80.54%) of undeveloped land than it does on the price of residential (32.52%) and commercial (33.30%) properties.

Location is particularly important for determining price for all three types of properties. An indicator variable specifying if the property is located downtown (or on a main street) is statistically significant, with a premium of 14.77% for residential properties, 22.30% for commercial properties, and 64.87% for undeveloped land. Appendix figure A3 illustrates the spatial variation in baseline property values, calculated as the average location fixed effect from the three models in table 3. The values represent the difference in log price from a baseline of the city of Salatiga, with lighter shades representing higher baseline property values and darker shades representing lower baseline property values. Unsurprisingly, the highest values (denoted by the lightest shade on the map) are found in the regions of Jakarta, Bandung, Surabaya, and Bali. The lowest values are found in central and north Sulawesi and southwestern and central Sumatra.

Land Tenure Status

Land tenure is critical in a developing country like Indonesia. In Vietnam, the lack of property rights lowered home prices by 3%–10% during 1998–2001 in Ho Chi Minh City (Kim 2004). However, this effect varies within country (Kim 2007) and across countries. In India, for renters the premium for formal documentation is 19.2% (Nakamura 2017), and in the Philippines the premium for formal-sector dwellings is between 25% (Friedman, Jimenez, and Mayo 1988) and 58% (Jimenez 1984). Our findings suggest that in comparison with the left-out dummy variable denoting that the seller owns the property outright in perpetuity (*sertifikat hak milik*), customary or informal land rights are associated with a statistically significant lower price for residential properties (–30.71%), commercial properties (–43.33%), and undeveloped land (–63.36%). Tenure security can increase housing investments, reduce transaction uncertainty, empower owners (Durand-Lasserve and Selod 2009), and allow easier access to the mortgage market (Brueckner and Lall 2014), all potentially leading to higher asking prices.

Building rights (*sertifikat hak guna bangunan*), a type of land tenure that confers the right to develop land during terms of up to 50 years, are valued differently in different markets. There is a lower price associated with building rights for residential properties (–10.87%), but no effect on commercial properties, in comparison with owning the property outright in perpetuity. These results are not inconsistent with the limited duration of this type of land tenure, because ownership reverts back to the state after the deed expires (Ferguson and Hoffman 1993). In contrast, undeveloped land with building rights commands a large

premium (27.98%) because development potential outweighs the greater risk associated with a limited term of tenure.

We interpret this finding as evidence of the cost of regulation, especially as it relates to property developers. Specifically, we believe that ongoing land acquisition by property developers is driving the increased value of building rights. According to a strict interpretation of the law, corporations may not own property outright in perpetuity, hence the insignificance for commercial properties. Instead, the formal land registration and permitting process requires that developers obtain building rights for a master parcel before they may subdivide land into individual parcels for sale. In interviews, some developers have reported that this process is more costly than the land itself (Monkkonen 2013). Our evidence supports these claims by estimating that sellers ask for an additional 28% when advertising land with established building rights that would allow developers to avoid land registration.

Advertisement Attributes

There are five characteristics related specifically to the advertisement for which we have data: the length of time the post has been online, whether the advertisement was uploaded using a mobile phone or a computer, whether the seller specified that the price was negotiable, whether the seller specified the property was cheap, and whether the seller indicated they wished to sell the property quickly. The length of time the post has been online has no statistically significant relationship with the price, except for a very small relationship for commercial properties (a decrease of less than 0.1% for each additional day on the market). While this may appear surprising due to the tendency for higher list prices to be on the market longer (Anglin, Rutherford and Springer 2003), McGreal et al. (2016) challenge this, finding that business cycles are more important determinants of time on the market. Our finding could also be due to our inability to precisely measure time on the market, as sellers may delete their old post and repost the advertisement on a regular basis.

In all three property markets, if the seller uploads the advertisement with their mobile phone the asking price is between 8.23% and 9.81% lower than if they had uploaded the advertisement with a computer. There are a variety of hypotheses that might explain this effect. Having a personal computer in Indonesia is a sign of wealth, so those sellers who are able to use a computer are likely wealthier on average. Properties sold by wealthier individuals could be of higher quality in attributes that are unobservable to the researcher and thus have higher prices, corresponding to the literature that finds indicators of higher quality being highly valued in developing contexts (Follain and Jimenez 1985, Pasha and Butt 1996). Alternatively, wealthier sellers may be more inclined to ask for a higher price, as they may be more financially astute or have more information about the market.

The three remaining advertisement attributes provide clues about the relation between the asking price, the seller's preferences, and the market value of the property. Specifically, among advertisements in which the seller indicates that she is willing to negotiate the price, the asking price may overvalue the property in comparison to fair market value. For residential and undeveloped properties a negotiable price is between 6.80% and 7.90% higher than non-negotiable prices. Commercial properties do not have a statistically significant relationship ($p = 0.109$) for negotiable properties, but the sign of the effect is in the expected direction. In contrast, among advertisements in which the seller indicates that the asking price is

‘cheap’ or that the property must be sold quickly, the asking price may undervalue the property. For residential and commercial properties, ‘cheap’ asking prices are associated with a discount of 23.49% to 24.06%, while urgent advertisements are associated with a discount of 7.09% to 7.77%. The effects are even stronger for undeveloped land. Cheap prices are discounted by 29.90% while urgent prices are discounted by 12.83%. These advertisement attributes in our pricing model help to control for heterogeneity in seller disposition that may result in discrepancies between asking prices and market value.

Urban and Rural Property Markets

Table 4 presents the results of whether property markets in cities differ from property markets in districts. It includes a set of city-interaction effects in all three regressions. Wald tests comparing the interacted models with the corresponding models in table 3 reject the hypothesis that the parameters are identical for cities and districts ($p < 0.01$). For brevity, the reported regression results are for a sparser model that does not include city interaction effects that are statistically insignificant for all three property types.⁷ Each market has a few variables that exhibit an additional impact on prices by being located in a city. Residential properties in cities have an additional premium for larger buildings; however, air conditioning, swimming pools, and landlines are all less valuable in cities than in districts. Undeveloped properties in cities have an additional premium for larger lots compared with properties in districts. For commercial properties, there is less of a concern for customary land rights in cities than in districts, probably because corporations, which cannot own property outright in perpetuity, are concentrated and more active in cities. Commercial asking prices are also significantly higher in cities when the seller specifies the price as negotiable, highlighting a potential difference in corporate negotiation.

We use an alternative specification to test the difference between urban and rural properties (table 5). Instead of using a city dummy variable, we use an interaction term that is the share of the population living in an urban area for each district and city (appendix figure A2). We find similar results in magnitude and sign for most interactions, suggesting the differences between city and district properties are being driven by urban versus rural factors, rather than being something unique to incorporated cities in contrast to districts in Indonesia. Again, all three Wald tests reject the null hypothesis that the parameters are equal between more urban and less urban areas ($p < 0.01$). A few key differences are that for residential properties there is a statistically significant positive effect for the size of the lot in more urban areas. For commercial properties, the building size yields an additional positive and statistically significant effect for more urban areas. And for undeveloped land, the discount associated with customary land tenure increases as the population becomes more urban, reaching 60% in highly urban areas.

We interpret these results as reflecting three broad differences between property markets in urban and rural areas. First, different property attributes are valued as luxuries, as a result of differences in relative availability. Space is scarce in

7. Regression models with the full set of interaction variables can be found in the supplementary material, available at <http://dx.doi.org/10.1080/00074918.2018.1436158>.

TABLE 4 *Regression Results with City Interactions*

Variables	Parameter estimates					
	Residential coefficient	Standard error	Commercial coefficient	Standard error	Undev. land coefficient	Standard error
Log area (ha)	0.3223**	(0.013)	0.3303**	(0.019)	0.7872**	(0.010)
Log building (m ²)	0.2246**	(0.015)	0.4566**	(0.027)		
Age of post (days)	0.0001	(0.000)	-0.0007*	(0.000)	0.0002	(0.000)
Mobile phone	-0.0917**	(0.013)	-0.0746**	(0.019)	-0.0829**	(0.024)
Negotiable price	0.0681**	(0.015)	-0.0532	(0.038)	0.0539	(0.037)
Advertised 'cheap'	-0.2158**	(0.010)	-0.2126**	(0.030)	-0.2593**	(0.026)
Advertised 'sell fast'	-0.0738**	(0.014)	-0.0689*	(0.034)	-0.1203**	(0.030)
Customary land rights	-0.2403**	(0.036)	-0.5262**	(0.033)	-0.4573**	(0.037)
Building rights	-0.1058**	(0.019)	-0.0149	(0.029)	0.2471**	(0.073)
Downtown	0.1380**	(0.032)	0.2047**	(0.051)	0.4979**	(0.088)
Air conditioning	0.2183**	(0.017)	0.3279**	(0.042)		
Granite flooring	0.0916**	(0.024)				
Cement flooring	-0.3366**	(0.042)				
Ceramic flooring	-0.1340**	(0.010)				
Tile flooring	-0.1605**	(0.048)				
Hot water heater	0.1166**	(0.018)				
Swimming pool	0.2193**	(0.038)				
Curtains	-0.0607**	(0.012)				
Land line	0.1936**	(0.022)				
Indoor plumbing	0.0266*	(0.013)				
Garage	0.0390**	(0.013)				
Carport	0.1086**	(0.011)				
Bathrooms	0.1403**	(0.008)				
Bedrooms	0.0634**	(0.006)				
Shop (<i>ruko</i>)			0.2656**	(0.023)		
Store (<i>toko</i>)			-0.0426	(0.025)		
Kiosk			-0.2153**	(0.052)		
Boarding house (<i>kos</i>)			-0.0997*	(0.044)		
Hotel			0.3441**	(0.035)		
Rental property			-0.0286	(0.049)		
Food stall (<i>warung</i>)			-0.6439**	(0.112)		
Restaurant			0.2591**	(0.057)		
City × log area	0.0161	(0.017)	0.0057	(0.018)	0.0454**	(0.014)
City × log building	0.0690**	(0.020)	-0.0114	(0.024)		
City × negotiable price	-0.0040	(0.022)	0.1609**	(0.045)	0.0512	(0.047)
City × customary land rights	-0.0658	(0.048)	0.2639**	(0.095)	-0.0779	(0.060)
City × air conditioning	-0.0745**	(0.024)	-0.1717**	(0.052)		
City × swimming pool	-0.0867	(0.053)				
City × land line	-0.0970**	(0.031)				
City × rental property			-0.2317**	(0.077)		
Constant	19.3535**	(0.091)	19.4093**	(0.180)	21.6561**	(0.055)
Observations	30,207		12,916		21,339	
R-squared	0.6881		0.6749		0.7046	
Location FE	Yes		Yes		Yes	

Note: Dependent variable is log price (Rp '000). Robust standard errors in parentheses. Undev. = undeveloped.

* $p < 0.05$; ** $p < 0.01$

TABLE 5 *Regression Results with Urban Share Interactions*

Variables	Parameter estimates					
	Residential coefficient	Standard error	Commercial coefficient	Standard error	Undev. land coefficient	Standard error
Log area (ha)	0.3038**	(0.016)	0.3491**	(0.021)	0.7675**	(0.013)
Log building (m ²)	0.1551**	(0.018)	0.3556**	(0.035)		
Age of post (days)	0.0001	(0.000)	-0.0003	(0.000)	0.0002	(0.000)
Mobile phone	-0.0909**	(0.013)	-0.0706**	(0.018)	-0.0819**	(0.024)
Negotiable price	0.1088**	(0.024)	-0.1422*	(0.065)	-0.0226	(0.054)
Advertised 'cheap'	-0.2153**	(0.010)	-0.2130**	(0.027)	-0.2583**	(0.026)
Advertised 'sell fast'	-0.0735**	(0.014)	-0.0665	(0.035)	-0.1201**	(0.030)
Customary land rights	-0.2333**	(0.048)	-0.7639**	(0.106)	-0.3230**	(0.062)
Building rights	-0.1069**	(0.019)	-0.0344	(0.027)	0.2383**	(0.072)
Downtown	0.1364**	(0.032)	0.2139**	(0.050)	0.5009**	(0.088)
Air conditioning	0.2885**	(0.026)	0.4242**	(0.070)		
Granite flooring	0.0934**	(0.024)				
Cement flooring	-0.3420**	(0.041)				
Ceramic flooring	-0.1343**	(0.010)				
Tile flooring	-0.1588**	(0.048)				
Hot water heater	0.1168**	(0.018)				
Swimming pool	0.2406**	(0.083)				
Curtains	-0.0606**	(0.012)				
Land line	0.2889**	(0.036)				
Indoor plumbing	0.0271*	(0.013)				
Garage	0.0400**	(0.012)				
Carport	0.1094**	(0.011)				
Bathrooms	0.1380**	(0.008)				
Bedrooms	0.0615**	(0.006)				
Shop (<i>ruko</i>)			0.2675**	(0.024)		
Store (<i>toko</i>)			-0.0320	(0.026)		
Kiosk			-0.2118**	(0.052)		
Boarding house			-0.0954*	(0.046)		
Hotel			0.3482**	(0.033)		
Rental property			0.1601	(0.134)		
Food stall (<i>warung</i>)			-0.6481**	(0.112)		
Restaurant			0.2616**	(0.054)		
Urban × log area	0.0466*	(0.023)	-0.0068	(0.021)	0.0618**	(0.020)
Urban × log building	0.1595**	(0.030)	0.1072**	(0.033)		
Urban × negotiable price	-0.0641	(0.033)	0.2375**	(0.076)	0.1548*	(0.067)
Urban × customary land rights	-0.0527	(0.072)	0.4903**	(0.177)	-0.2748**	(0.093)
Urban × air conditioning	-0.1572**	(0.034)	-0.2537**	(0.084)		
Urban × swimming pool	-0.0880	(0.101)				
Urban × land line	-0.2097**	(0.047)				
Urban × rental property			-0.4030*	(0.160)		
Constant	19.4660**	(0.098)	19.8284**	(0.180)	21.6500**	(0.055)
Observations	30,207		12,916		21,339	
R-squared	0.6897		0.6787		0.7050	
Location FE	Yes		Yes		Yes	

Note: Dependent variable is log price (Rp '000s). Robust standard errors in parentheses. Undev. = undeveloped.

* $p < 0.05$; ** $p < 0.01$

cities, so the marginal value of an additional square metre of land or floor space is higher in cities than in rural areas. Conversely, amenities such as air conditioning and swimming pools are rare and valued more highly in rural areas. Second, telecommunications and other public infrastructure have not penetrated all regions of Indonesia equally, so landlines are highly valued in rural areas where access is limited.⁸ Third, the cost of informal property rights varies by location and type of property in ways that reflect differences in corporate demand for property across urban and rural markets. In residential property markets, where demand is dominated by individual buyers, informal property rights have similar effects on asking prices in both urban and rural areas. In contrast, in markets where corporations are more active buyers (that is, commercial and undeveloped land markets), informal property rights have varying effects on asking prices because, we hypothesise, corporations and individuals value informal property rights differently. First, corporations do not value outright ownership as highly as individuals do, because corporations are not eligible to own property outright. Second, they discount informal land rights less heavily than individuals do, because, on average, corporations are better equipped to absorb the costs of land registration. As a result, the effect of informal property rights on asking prices is diminished in areas where corporations are most active: urban markets for commercial property and rural markets for undeveloped land. In urban areas, corporations require developed commercial property for retail and office space; in rural areas, they seek undeveloped land for agribusiness.

CONCLUSION

We use an original dataset of Indonesian properties listed for sale during 2016 to examine asking-price formation among residential, commercial, and undeveloped properties in an emerging real estate market. We include attributes of the advertisements themselves in our pricing model in order to control for variation in the disposition of sellers. We find, consistent with the results of previous studies on property markets in developing countries, that desirable housing attributes, structural quality, advantageous location on major thoroughfares, and clear and secure land tenure all increase property asking prices.

In addition, our dataset allowed us to compare across types of property markets. Specifically, we find that price formation is similar in residential and commercial property markets, but that the commercial market places a premium on the size and type of building, while the residential market places a premium on lot size. In the market for undeveloped land, land tenure is priced differently from the other markets. Building rights are priced more highly than outright ownership, while customary rights are discounted more severely than in residential and commercial properties—especially in urban areas.

Finally, the broad geographic scope of our data has facilitated the first large-scale investigation of rural property markets in Indonesia. We find that, in contrast to

8. Alternatively, houses with landlines are more frequently found in small towns rather than villages, therefore the landline effect could simply indicate the property is in a more favourable location.

urban markets, rural markets price amenities, not space, as luxury attributes; place an additional premium on telecommunications access; and value informal property rights differently as a result of different patterns of corporate demand.

This research highlights several key implications for the Indonesian property market and for policymakers. Online classified listings for property transactions in developing countries provide useful information on the marginal implicit prices of property characteristics. Significant differences between urban and rural markets make comparison between properties of different market segments imperfect, but broad, nationwide trends exist that are valuable for buyers and sellers. Furthermore, we have found that seller attributes are related to prices, emphasising the role that seller heterogeneity and disposition play in asking-price formation.

Additionally, this research emphasises the value of secure property rights in Indonesia. Urban areas in particular could substantially increase property values and potential tax revenue by facilitating outright ownership rights. Interestingly, commercial properties in cities have lower discounts for informal property rights. Such discounts could relate to corporations' preferences for purchasing untitled land, as well as high land registration costs or uncertainty related to land registration. Observed urban development patterns consisting of residential communities remaining within downtown areas are consistent with these findings. The substantial differences between premiums for land tenure for different property types, and between urban and rural properties, highlight the difficulty in providing clear incentives to work towards securing property rights that align with the preferences of both property owners and local governments. This research also provides a jumping-off point for further research on property markets in Indonesia, including but not limited to identifying the cause of smaller discounts for commercial properties with informal rights in cities, exploring urban and rural development premiums for both commercial and residential properties, linking property-price data to land cover data to examine broad land use patterns, and applying the property values from this database to inform local tax collection measures and effectiveness.

REFERENCES

- Abbott, Joshua K., and H. Allen Klaiber. 2011. 'An Embarrassment of Riches: Confronting Omitted Variable Bias and Multiscale Capitalization in Hedonic Price Models'. *Review of Economics and Statistics* 93 (4): 1331–42.
- Anglin, Paul M., Ronald Rutherford, and Thomas M. Springer. 2003. 'The Trade-Off between the Selling Price of Residential Properties and Time-on-the-Market: The Impact of Price Setting'. *Journal of Real Estate Finance and Economics* 26 (1): 95–111.
- Arnott, Richard. 2009. 'Housing Policy in Developing Countries: The Importance of the Informal Sector'. In *Urbanization and Growth*, edited by Michael Spence, Patricia Clarke Annex, and Robert M. Buckley, 167–97. Washington, DC: Commission on Growth and Development.
- Brueckner, Jan K. 2013. 'Slums in Developing Countries: New Evidence for Indonesia'. *Journal of Housing Economics* 22 (4): 278–90.
- Brueckner, Jan K., and Somik V. Lall. 2014. 'Cities in Developing Countries: Fueled by Rural-Urban Migration, Lacking in Tenure Security, and Short of Affordable Housing'. In *Handbook of Regional and Urban Economics*, vol. 5, edited by Gilles Duranton, J. Vernon Henderson, and William C Strange, 1399–1455. Amsterdam: North-Holland.

- Carlson, Kimberly, Lisa Curran, Dessy Ratnasari, Alice Pittman, Britaldo Soares-Filho, Gregory Asner, Simon Trigg, David Gaveau, Deborah Lawrence, and Hermann Rodrigues. 2012. 'Committed Carbon Emissions, Deforestation, and Community Land Conversion from Oil Palm Plantation Expansion in West Kalimantan, Indonesia'. *Proceedings of the National Academy of Sciences* 109 (19): 7559–64.
- Crane, Randall, Amrita Daniere, and Stacy Harwood. 1997. 'The Contribution of Environmental Amenities to Low-income Housing: A Comparative Study of Bangkok and Jakarta'. *Urban Studies* 34 (9): 1495–512.
- Cropper, Maureen L., Leland B. Deck, and Kenneth E. McConnell. 1988. 'On the Choice of Function Form for Hedonic Price Functions'. *Review of Economics and Statistics* 70 (4): 668–75.
- Daniere, Amrita G. 1994. 'Estimating Willingness-to-Pay for Housing Attributes an Application to Cairo and Manila'. *Regional Science and Urban Economics* 24 (5): 577–99.
- De Soto, Hernando. 2003. *The Mystery of Capital*. New York: Basic Books.
- Dowall, David E., and Michael Leaf. 1991. 'The Price of Land for Housing In Jakarta'. *Urban Studies* 28 (5): 707–22.
- Durand-Lasserve, Alain, and Harris Selod. 2009. 'The Formalization of Urban Land Tenure in Developing Countries'. In *Urban Land Markets: Improving Land Management for Successful Urbanization*, edited by Somik V. Lall, Mila Freire, Belinda Yuen, Robin Rajack, and Jean-Jacques Helluin, 101–32. Dordrecht: Springer.
- Ferguson, Bruce, and Michael Hoffman. 1993. 'Land Markets and the Effect of Regulation on Formal-Sector Development in Urban Indonesia'. *Review of Urban and Regional Development Studies* 5 (1): 51–73.
- Firman, Tommy. 2000. 'Rural to Urban Land Conversion in Indonesia during Boom and Bust Periods'. *Land Use Policy* 17: 13–20.
- . 1998. 'The Restructuring of Jakarta Metropolitan Area: A 'Global City' in Asia'. *Cities* 15 (4): 229–43.
- . 1997. 'Land Conversion and Urban Development in the Northern Region of West Java, Indonesia'. *Urban Studies* 34 (7): 1027–46.
- Follain, James R., and Emmanuel Jimenez. 1985. 'The Demand for Housing Characteristics in Developing Countries'. *Urban Studies* 22 (5): 421–32.
- Friedman, Joseph, Emmanuel Jimenez, and Stephen K. Mayo. 1988. 'The Demand for Tenure Security in Developing Countries'. *Journal of Development Economics* 29 (2): 185–98.
- Gatto, Marcel, Meike Wollni, and Martin Qaim. 2015. 'Oil Palm Boom and Land-Use Dynamics in Indonesia: The Role of Policies and Socioeconomic Factors'. *Land Use Policy* 46:292–303.
- Halvorsen, Robert, and William D. Palmquist. 1980. 'The Interpretation of Dummy Variables in Semilogarithmic Equations'. *American Economic Review* 70 (3): 474–75.
- Han, Sun Sheng, and Ann Basuki. 2001. 'The Spatial Pattern of Land Values in Jakarta'. *Urban Studies* 38 (10): 1841–57.
- Haurin, Donald R., Jessica L. Haurin, Taylor Nadauld, and Anthony Sanders. 2010. 'List Prices, Sale Prices and Marketing Time: An Application to U.S. Housing Markets'. *Real Estate Economics* 38 (4): 659–85.
- Haurin, Donald, Stanley McGreal, Alastair Adair, Louise Brown, and James R. Webb. 2013. 'List Price and Sales Prices of Residential Properties during Booms and Busts'. *Journal of Housing Economics* 22 (1): 1–10.
- Jimenez, Emmanuel. 1984. 'Tenure Security and Urban Squatting'. *Review of Economics and Statistics* 66 (4): 556–67.
- Kim, Annette M. 2004. 'A Market without the 'Right' Property Rights'. *Economics of Transition* 12 (2): 275–305.
- . 2007. 'North versus South: The Impact of Social Norms in the Market Pricing of Private Property Rights in Vietnam'. *World Development* 35 (12): 2079–95.
- Knight, John R., C. F. Cirmans, and Geoffrey K. Turnbull. 1998. 'List Price Information in Residential Appraisal and Underwriting'. *Journal of Real Estate Research* 15 (1): 59–76.

- König, Hannes Jochen, Johannes Schuler, Utia Suarma, Desmond McNeill, Jacques Imbernon, Frieta Damayanti, Syarifah Aini Dalimunthe, et al. 2010. 'Assessing the Impact of Land Use Policy on Urban–Rural Sustainability Using the FoPIA Approach in Yogyakarta, Indonesia'. *Sustainability* 2 (7): 1991–2009.
- Kuminoff, Nicolai V., Christopher F. Parmeter, and Jaren C. Pope. 2010. 'Which Hedonic Models Can We Trust to Recover the Marginal Willingness to Pay for Environmental Amenities?'. *Journal of Environmental Economics and Management* 60 (3): 145–60.
- Lall, Somik V, Mattias K.A. Lundberg, and Zmarak Shalizi. 2008. 'Implications of Alternative Policies on Welfare of Slum Dwellers: Evidence from Pune, India'. *Journal of Urban Economics* 63 (1): 56–73.
- Lewis, Blane David. 2007. 'Revisiting the Price of Residential Land in Jakarta'. *Urban Studies* 44 (11): 2179–94.
- Lim, Gill-Chin, James Follain, Jr., and Bertrand Renaud. 1984. 'Economics of Residential Crowding in Developing Countries'. *Journal of Urban Economics* 16 (2): 173–86.
- Lyons, Ronan C. 2013. 'Price Signals and Bid-Ask Spreads in an Illiquid Market: The Case of Residential Property in Ireland, 2006–2011'. Working paper. <https://doi.org/10.2139/ssrn.2205742>.
- McGreal, Stanley, and Paloma Taltavull de La Paz. 2013. 'Implicit House Prices: Variation over Time and Space in Spain'. *Urban Studies* 50 (10): 2024–43.
- McGreal, Stanley, Louise Brown, and Alastair Adair. 2010. 'List Price and Sale Price Variation Across the Housing Market Cycle'. *International Journal of Housing Markets and Analysis* 3 (2): 89–99.
- McGreal, Stanley, Paloma Taltavul de La Paz, Valerie Kupke, Peter Rossini, and Paul Kershaw. 2016. 'Measuring the Influence of Space and Time Effects on Time on the Market'. *Urban Studies* 53 (13): 2867–84.
- McMillen, Daniel P. 2010. 'Issues in Spatial Data Analysis'. *Journal of Regional Science* 50 (1): 119–41.
- Monkkonen, Paavo. 2013. 'Urban Land-Use Regulations and Housing Markets in Developing Countries: Evidence from Indonesia on the Importance of Enforcement'. *Land Use Policy* 34:255–64.
- Nakamura, Shohei. 2017. 'Tenure Security Premium in Informal Housing Markets: A Spatial Hedonic Analysis'. *World Development* 89 (1): 184–98.
- Palmquist, Raymond B. 1984. 'Estimating the Demand for Characteristics of Housing'. *Review of Economics and Statistics* 66 (3): 394–404.
- Pasha, Hafiz A, and Mohammad S Butt. 1996. 'Demand for Housing Attributes in Developing Countries: A Study of Pakistan'. *Urban Studies* 33 (7): 1141–54.
- Pierskalla, Jan. 2016. 'Splitting the Difference? The Politics of District Creation in Indonesia'. *Comparative Politics* 48 (2): 249–68.
- Rosen, Sherwin. 1974. 'Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition'. *Journal of Political Economy* 82 (1): 34–55.
- Struyk, Raymond, Michael Hoffman, and Harold Katsura. 1990. *The Market for Shelter in Indonesian Cities*. Washington, DC: Urban Institute Press.
- Suparman, Yusep, Henk Folmer, and Johan H. L. Oud. 2014. 'Hedonic Price Models with Omitted Variables and Measurement Errors: A Constration Autoregression Structural Equation Modeling Approach with Application to Urban Indonesia'. *Journal of Geographic Systems* 16:49–70.
- Takeuchi, Akie, Maureen Cropper, and Antonio Bento. 2008. 'Measuring the Welfare Effects of Slum Improvement Programs: The Case of Mumbai'. *Journal of Urban Economics* 64 (1): 65–84.
- Tans, Ryan. 2017. 'Decentralization and the Politics of Local Taxation in Southeast Asia'. PhD diss., Emory University.
- Wang, Ko. 1991. 'The Impact of Rental Properties on the Value of Single-Family Residences'. *Journal of Urban Economics* 30 (2): 152–66.

- Wicke, Birka, Richard Sikkema, Veronika Dornburg, and Andre Faaij. 2011. 'Exploring Land Use Changes and the Role of Palm Oil Production in Indonesia and Malaysia'. *Land Use Policy* 28:193–206.
- Winarso, Haryo. 2002. 'Access to Main Roads or Low Cost Land? Residential Land Developers' Behaviour in Indonesia'. *Bijdragen tot de Taal-, Land-en Volkenkunde* 158 (4): 653–676.
- Wooldridge, Jeffrey M. 2007. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
- Yusuf, Arief Anshory, and Budy Resosudarmo. 2009. 'Does Clean Air Matter in Developing Countries' Megacities? A Hedonic Price Analysis of the Jakarta Housing Market, Indonesia'. *Ecological Economics* 68:1398–1407.
- Yusuf, Arief Anshory, and Phoebe Koundouri. 2005. 'Willingness to Pay for Water and Location Bias in Hedonic Price Analysis: Evidence from the Indonesian Housing Market'. *Environment and Development Economics* 10 (1): 821–36.

FIGURE A1 *Number of Price Observations by Location*

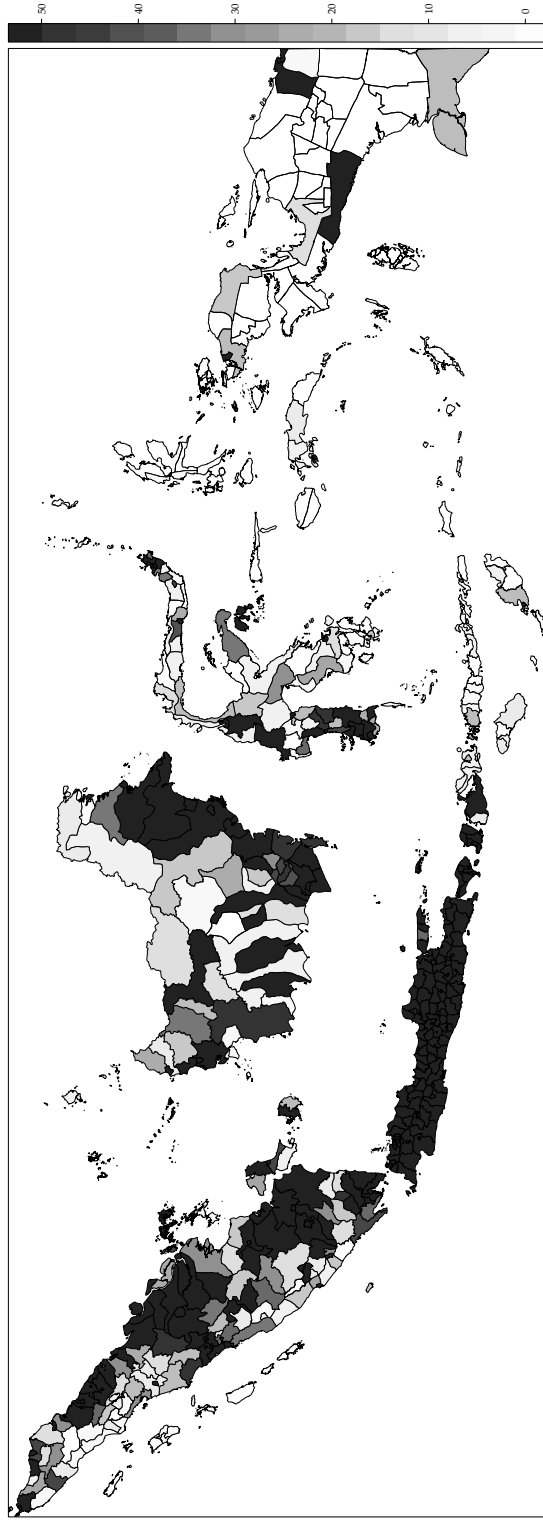


FIGURE A2 *Urban Share of Population by Location*

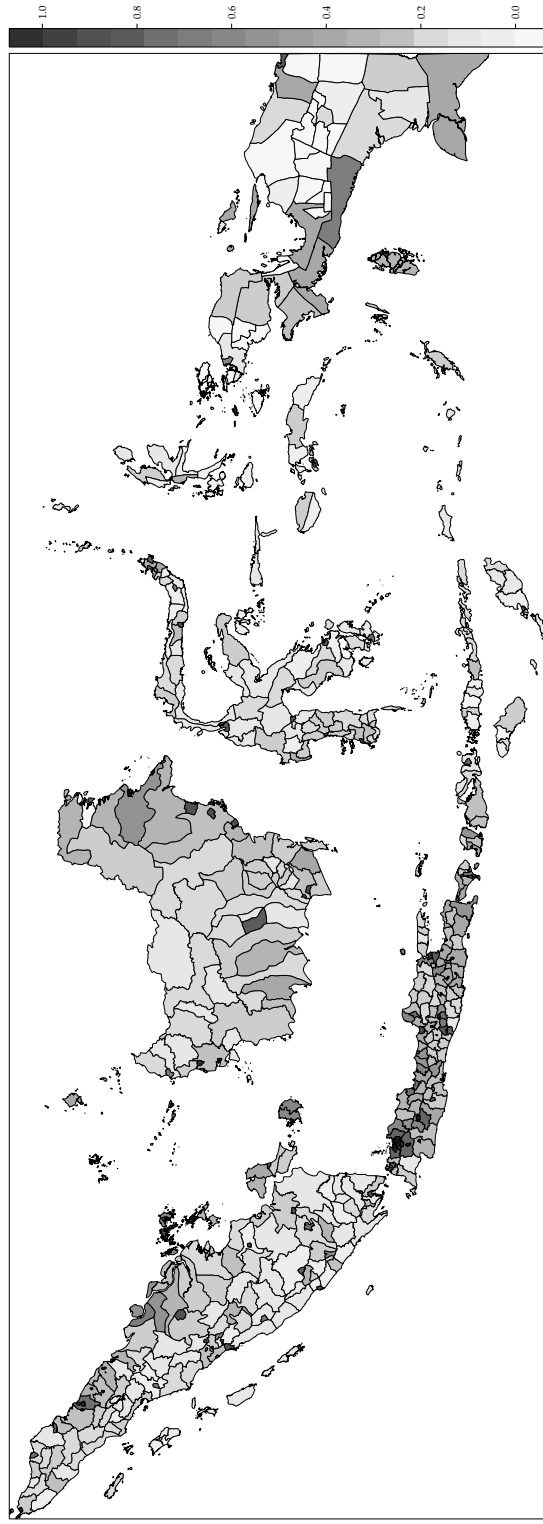
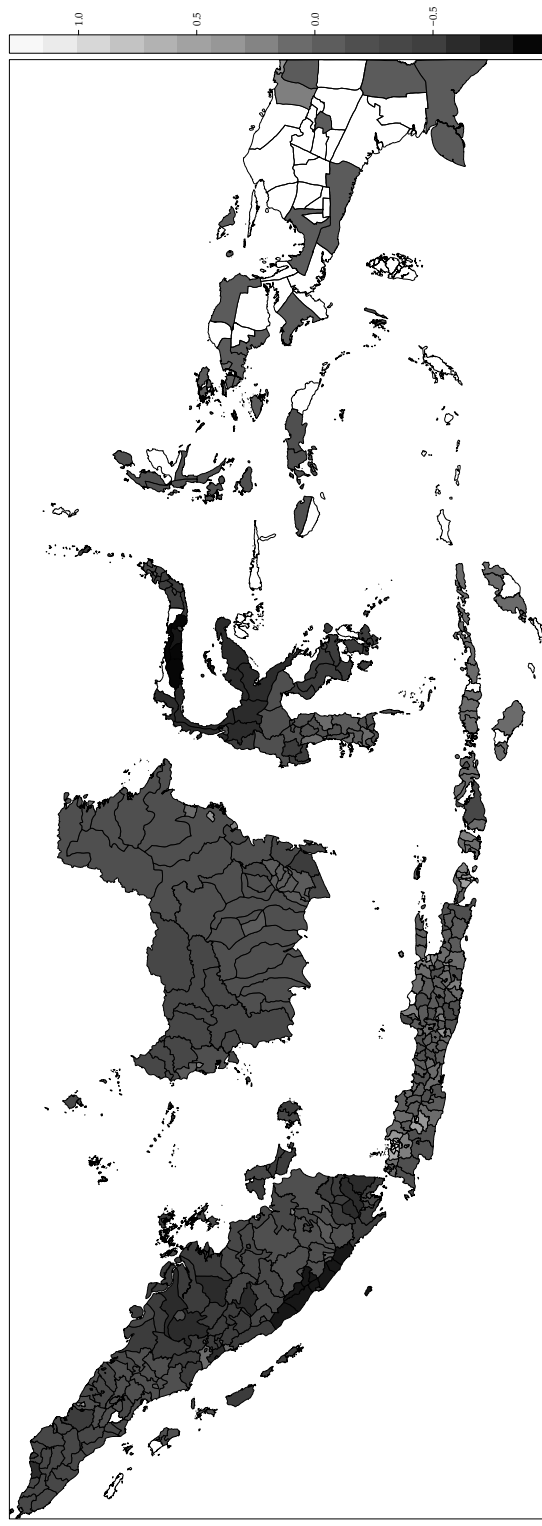


FIGURE A3 *Average Baseline Property Values from Spatial Fixed Effects*



Copyright of Bulletin of Indonesian Economic Studies is the property of Routledge and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.