

# Beyond the Surface: Uncovering the Complex Interplay of Intra-Urban Inequality in Developing Countries

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**Abstract:** Through a comprehensive review of the literature, rigorous analysis of empirical data, and innovative spatial analytics such as satellite image analysis and cellphone based mobility assessment, this paper offers a multifaceted exploration of the critical and persistent issue of intra-urban inequality in developing country cities. This structural problem is exacerbated by population growth and is linked to a range of interrelated urban challenges, including limited education and employment opportunities for people in poor neighborhoods and low productivity in the city. Furthermore, unplanned and uncoordinated urban plans and policies contribute to the misallocation of municipal resources. The paper's insights into the complex nature of intra-urban inequality are i) Intra-urban inequality is a result of the mutual relationship between the city population and welfare, ii) Small cities' population growth exacerbates intra-urban inequality more than large cities, and cities in developing countries would face rising intra-urban inequality, and iii) Planning reform requires incremental steps over time and coordination of existing rules, regulations, and emerging challenges, rather than a one-time implementation.

**JEL codes:** O18, R11, R12

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# 1. Introduction

## 1. 1. Why is intra-urban inequality a critical issue?

1. **Cities are places of opportunity for prosperity and upward mobility; however, this opportunity is not shared equally.** Over the past decades, rapid urbanization has led to growing concerns about spatial inequalities. Urban areas are now recognized as spaces where high levels of wealth and severe poverty coexist side by side. In theory, urban residents can benefit from new opportunities for jobs, education, and amenities regardless of where they live. However, the cities of developing countries do not ensure that all inhabitants have equal access to quality services and opportunities. Instead, urban spatial divisions limit economic opportunities, function as a barrier to growth, and serve as a source of instability and social unrest in the cities.
2. **Urbanization is one of the major driving forces of inequality by leading to the transmission of disadvantage from one generation to the next.** The World Social Report 2020<sup>2</sup> documented that income inequality has increased in most developing countries, and such highly unequal societies are less effective at reducing poverty than those with low levels of inequality. These unequal societies face more challenges systemically to provide proper service and amenities to keep up with economic growth, innovation, and social mobility. These uneven opportunities and associated spatial inequalities make it difficult for people to break the vicious cycle of poverty.
3. **Large cities in developing countries exhibit a higher level of intra-urban inequality (Fig 1).** Globally, the relationship between cities' population and GINI index displays a U-shaped curve. In particular, large cities in upper middle income (e.g., Cape Town, Johannesburg, Mexico City, Rio de Janeiro, and Bogota) prove that intra-urban inequality increases with population increase in a cross-country comparison.
4. **This paper provides a first look at inequalities within cities from a global perspective.** The paper starts with an overview of the literature on spatial inequalities within cities, providing a discussion of the possible effects of such inequalities on economic and social outcomes, stressing why a focus on inequalities within cities matters. The following section provides typologies of intra-urban inequalities based on empirical evidence. Ultimately, by using case studies in global cities, the paper identifies the key challenges and provides policy implications.

**Figure 1.** Global intra-urban inequality (GINI index)



Source: Global Monitoring Database (GMD), World Bank Team for Statistical Development, using the Datalibweb Stata Package. Note: see Box 1 for the data construction and details.

<sup>2</sup> United Nations, 2020. *World Social Report. Inequality in a Rapidly Changing World*. United Nations, Department of Economics and Social Affairs.

## 1. 2. Overview of intra-urban spatial inequality

5. **Inequality has been a widely studied phenomenon in recent decades due to its increasing relevance and negative consequences.** Inequality has been one of the most debated and analyzed issues in economics and social sciences in the last decades, following the seminal work of Amartya Sen<sup>3</sup> and more recently due to the global influence of Thomas Piketty's research on the subject.<sup>4</sup> The recent focus on the subject stems from the observation that while global inequality is decreasing (although remaining very high) as many developing nations become wealthier, inequality within countries is strongly rising.<sup>5</sup> Moreover, as shown in the USA, inequality has adverse effects on innovation, infrastructure, and public service provision. It increases crime and is a self-reinforcing force due to the ability of the wealthy to use their money to influence policy to their (financial) advantage.<sup>6</sup> Through this cycle, particularly in the urban space, current inequality trends widen the income gap and re-sort the space in terms of class, race, and ethnicity.<sup>7</sup>
6. **Regional inequalities have also attracted the attention of policymakers and academics, but much less is known about intra-urban inequalities in developing countries.** Recent work for advanced economies suggests that within countries, regions that lag in economic performance often have worse health outcomes, lower labor productivity, and greater employment shares in agriculture and industry sectors than other within-country regions.<sup>8</sup> Other work suggests that lagging areas often have higher mortality rates, more crime, and can be hotbeds for political extremism<sup>9</sup>, and they can be a drag on economic growth at the national level.<sup>10,11</sup> Much less is known about intra-urban inequalities and the challenges they may pose or impacts they may have. This is mainly due to the fact that inequality analysis is mainly focused on national/regional trends with aggregated national/regional data.
7. **Despite being less studied, inequality within-city is critical as it can negatively affect citizens' well-being across different dimensions and may hamper cities' contribution to growth.** Various global studies (e.g., Europe, China, and India) found that economic development and increases in urban inequality have gone hand in hand.<sup>12</sup> Given that this increased inequality is a multifaceted phenomenon, a careful review is needed to assess the complex within-city inequality better. As is the case for global and regional inequality, intra-urban spatial inequality is associated with an array of negative consequences.<sup>13</sup> Three main impacts are found in the literature: i) *economic consequences*: both at the individual level (such as worse career outcomes for children growing up in poor neighborhoods) and at the aggregate level (poorer city performance), ii) *social consequences*: social unrest (e.g., increased crime levels) and further marginalization of the vulnerable population, and iii) *environmental consequences*: poor households are

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<sup>3</sup> Sen, A., 1992. *Inequality reexamined*. Oxford University Press.

<sup>4</sup> Piketty, T., 2018. *Capital in the twenty-first century*. Harvard University Press.

<sup>5</sup> Bourguignon, F., 2015. *The globalization of inequality*. Princeton University Press.

Milanovic, B., 2016. *Global inequality*. Harvard University Press.

<sup>6</sup> Stiglitz, J.E., 2012. *The price of inequality: How today's divided society endangers our future*. WW Norton & Company.

<sup>7</sup> Nijman, J. and Wei, Y.D., 2020. Urban inequalities in the 21st century economy. *Applied Geography*, 117, p.102188.

<sup>8</sup> World Economic Outlook 2019.

<sup>9</sup> See for example de Groot, H. (2019), 'Growth and Shrinkage: Challenges for Governance and Solidarity', in Bock B., de Groot H., Hospers G-J., van Leeuwen E., and Cörvers F. (eds), *Towards a Cohesive Country: Population Decline and Regional Equality of Opportunity*, The Hague, Platform31, 30–49. [Google Scholar; Dijkstra, L., Poelman, H., and Rodríguez-Pose, A. (2020), 'The Geography of EU Discontent', *Regional Studies*, 54(6), 737–53.

<sup>10</sup> de Dominicis, L. (2014), 'Inequality and Growth in European Regions: Towards a Place-based Approach', *Spatial Economic Analysis*, 9(2)

<sup>11</sup> Panzera, Domenica and Postiglione, Paolo 2021. The impact of regional inequality on economic growth: a spatial econometric approach. *Regional Studies*, DOI: 10.1080/00343404.2021.1910228

<sup>12</sup> See for example in special issue edited by Nijman and Wei (2020): *Applied Geography*, 117

<sup>13</sup> Glaeser, E.L., Resseger, M. and Tobio, K., 2009. Inequality in cities. *Journal of Regional Science*, 49(4), pp.617-646.

often further marginalized from green space and amenities and become more vulnerable to climatic risks. While these three mechanisms are interlinked, we present them here, separated for clarity.

### *Economic Consequences*

8. **Inequality generates both direct and indirect negative consequences for the economy of cities.** Higher inequality negatively impacts cities that are brought on by a combination of direct and indirect mechanisms. On an aggregate level, unequal cities are found to have lower growth in terms of income and population. In terms of the spatial distribution of income, inequality may directly increase segregation.<sup>14</sup> Indeed, living in an affluent neighborhood represents a valuable amenity that leads to increasing rental costs,<sup>15</sup> forcing poorer households to move to less desirable neighborhoods or increase their share of income devoted to housing.<sup>16</sup> Segregation also represents the indirect channel through which inequality can create low intergenerational mobility, negatively impacting the future economic outcomes of poorer city dwellers.<sup>17</sup>
9. **Inequality affects the overall level of development of the city, hindering economic growth and human capital accumulation.** Empirically, there is evidence of a positive relationship between income inequality and city growth, as city productivity increases with the variation in the level and type of skills available.<sup>18</sup> Accordingly, large and diverse metropolitan areas in the US increase the productivity of both high-skill and low-skill workers as the latter provide services that allow the former to dedicate themselves to their most productive occupation.<sup>19</sup> However, controlling for the skill level results in more unequal cities underperforming in terms of both income and population growth, implying that the individual level costs of inequality are reflected in the aggregate performance of the city.<sup>20</sup> As mentioned earlier, inequality also leads to segregation which can be harmful by hampering local innovation and economic performance.<sup>21</sup> A diverse city can aid the spread of ideas and innovation and serve as an incubator for young enterprises.<sup>22</sup> Income segregation, therefore, has adverse effects on skill-based and knowledge-based urban growth, which is critical for the economic vibrancy of cities.<sup>23</sup>
10. **Inequality in cities may lead to income segregation, which has a wealth of negative consequences exacerbated by the interrelation between the two.** One of the main negative consequences of urban

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<sup>14</sup> Segregation unlike inequality focuses on the spatial distribution/concentration of different groups. The most common used measure in the literature is the dissimilarity index, which indicates the level of unevenness of the presence of two distinct groups (for example, the rich and the poor) across geographical areas. Fogli and Guerrieri (2021) measure income segregation (defining the rich as those with income above the 80<sup>th</sup> percentile of the distribution) at metropolitan area level as  $D(j) = \frac{1}{2} \sum_i [x_i(j)/X(j) - y_i(j)/Y(j)]$  where  $x_i(y)$  represent the number of poor (rich) living in census tract  $i$  of metro area  $j$  and  $X$  ( $Y$ ) the total number of poor (rich) in metro area  $j$ .

<sup>15</sup> Guerrieri, V., Hartley, D. and Hurst, E., 2013. Endogenous gentrification and housing price dynamics. *Journal of Public Economics*, 100, pp.45-60.

<sup>16</sup> As a result, the poor are worse off. Couture et al. (2019) estimate that the resulting spatial sorting is responsible for 1.7 pp of the 19 pp increase between 1990 and 2014 in the welfare differential between the top and bottom deciles. Couture, V., Gaubert, C., Handbury, J. and Hurst, E., 2019. Income growth and the distributional effects of urban spatial sorting (No. w26142). National Bureau of Economic Research.

<sup>17</sup> Durlauf, S.N. and Seshadri, A., 2018. Understanding the great gatsby curve. *NBER Macroeconomics Annual*, 32(1), pp.333-393.

<sup>18</sup> Glaeser, E.L., Resseger, M. and Tobio, K., 2009. Inequality in cities. *Journal of Regional Science*, 49(4), pp.617-646.

<sup>19</sup> Eeckhout, J., Pinheiro, R. and Schmidheiny, K., 2014. Spatial sorting. *Journal of Political Economy*, 122(3), pp.554-620.

<sup>20</sup> Glaeser, E.L., Resseger, M. and Tobio, K., 2009. Inequality in cities. *Journal of Regional Science*, 49(4), pp.617-646.

<sup>21</sup> Florida, R. and Mellander, C., 2020. The creative class and national economic performance. In *Development Studies in Regional Science* (pp. 553-575). Springer, Singapore.

<sup>22</sup> Duranton, G. and Puga, D., 2001. Nursery cities: urban diversity, process innovation, and the life cycle of products. *American Economic Review*, 91(5), pp.1454-1477.

<sup>23</sup> Nijman, J. and Wei, Y.D., 2020. Urban inequalities in the 21st century economy. *Applied Geography*, 117, p.102188.

inequality is its indirect effect on individuals' economic prospects through segregation. Social interactions within the neighborhood affect behaviors and outcomes through several mechanisms such as information sharing and human capital accumulation.<sup>24</sup> A rich US-centric literature has uncovered several advantages of living in better neighborhoods during childhood, such as higher future earnings, a higher likelihood of going to college, a lower chance of being incarcerated, or a teenage pregnancy.<sup>25</sup> Moreover, the negative indirect effects of inequality through segregation are multiplied by their mutually reinforcing relationship: as segregation restricts the economic opportunities of the poor, it leads to further inequality.<sup>26</sup> Fogli and Guerrieri claim that income segregation in US metropolitan areas contributed to a sizeable increase in within-city inequality, which they estimate to be ranging from 22 to 38 percent.<sup>27</sup>

11. **Individuals growing up in poorer neighborhoods face worse career prospects and lower future earnings.** Empirical studies in the US tracking individuals from childhood to adulthood have shown that the neighborhood's socioeconomic characteristics (e.g., schools, community, local amenities, economic opportunities) can affect future earnings.<sup>28</sup> For example, Chetty and Hendren (2018a) calculated that a child moving to a richer neighborhood see their adult income converge to that of other residents in the new neighborhood at a rate of 4 percent a year, implying that in 12 years, the income gap would almost be halved, regardless of the age of the move. This is due to multiple mechanisms at play, such as school quality, social norms, and peer effects.
12. **Neighborhood effects as a form of social networks and isolation from jobs continue affecting poorer individuals well into adulthood.** The location within cities does not only affect individuals during their formative years. For example, residential networks strongly affect hiring and generating worker-employee matches, above all for low-skilled workers.<sup>29</sup> Segregation also limits individuals' economic opportunities through the mechanism of spatial mismatch. People living in poorer neighborhoods often face higher commuting times,<sup>30</sup> as shown by Rospabe and Selod (2006) in Cape Town (South Africa) and Haddad

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<sup>24</sup> Topa, G. and Zenou, Y., 2015. Neighborhood and network effects. In Handbook of regional and urban economics (Vol. 5, pp. 561-624). Elsevier.

<sup>25</sup> Chetty, R., Hendren, N., Kline, P. and Saez, E., 2014. Where is the land of opportunity? The geography of intergenerational mobility in the United States. *The Quarterly Journal of Economics*, 129(4), pp.1553-1623. Chetty, R., Hendren, N. and Katz, L.F., 2016. The effects of exposure to better neighborhoods on children: New evidence from the Moving to Opportunity experiment. *American Economic Review*, 106(4), pp.855-902. Chetty, R. and Hendren, N., 2018. The impacts of neighborhoods on intergenerational mobility I: Childhood exposure effects. *The Quarterly Journal of Economics*, 133(3), pp.1107-1162. Chetty, R. and Hendren, N., 2018. The impacts of neighborhoods on intergenerational mobility II: County-level estimates. *The Quarterly Journal of Economics*, 133(3), pp.1163-1228.

<sup>26</sup> Fogli, A. and Guerrieri, V., 2019. The end of the american dream? inequality and segregation in us cities (No. w26143). National Bureau of Economic Research.

<sup>27</sup> The size of the effect depends on the strength of the assumed neighbourhood exposure effects identified by Chetty and Hendren. Fogli, A. and Guerrieri, V., 2019. The end of the american dream? inequality and segregation in us cities (No. w26143). National Bureau of Economic Research. Chetty, R. and Hendren, N., 2018. The impacts of neighborhoods on intergenerational mobility I: Childhood exposure effects. *The Quarterly Journal of Economics*, 133(3), pp.1107-1162. Chetty, R. and Hendren, N., 2018. The impacts of neighborhoods on intergenerational mobility II: County-level estimates. *The Quarterly Journal of Economics*, 133(3), pp.1163-1228.

<sup>28</sup> See footnote 25.

<sup>29</sup> Hellerstein, J.K., McInerney, M. and Neumark, D., 2011. Neighbors and coworkers: The importance of residential labor market networks. *Journal of Labor Economics*, 29(4), pp.659-695. Hellerstein, J.K., Kutzbach, M.J. and Neumark, D., 2019. Labor market networks and recovery from mass layoffs: Evidence from the Great Recession period. *Journal of Urban Economics*, 113, p.103192.

<sup>30</sup> Kilroy, A., 2009. Intra-Urban Spatial Inequality: Cities as "Urban Regions".

(2020) in Belo Horizonte (Brazil).<sup>31</sup> As a result, they are more isolated and disconnected from job opportunities, which increases their unemployment rate.<sup>32</sup>

13. **The negative effects of income inequality fall disproportionately on women and minorities.** Cities that suffer from income inequality and resulting segregation often burden the most vulnerable demographics. Income segregation often coincides with racial segregation as minorities live isolated from jobs and experience higher unemployment rates.<sup>33</sup> Women from poorer backgrounds could also be disproportionately affected by the spatial mismatch as they bear a higher cost of commuting compared to men, as they are less likely to have access to private transport and carry a higher burden of responsibilities in the household.<sup>34</sup> The Covid pandemic has also shown how urban inequality can exacerbate vulnerabilities as households in neighborhoods disconnected from economic opportunities have been hit the hardest by the lockdown measures restricting their movement.<sup>35</sup>

### *Social Consequences*

14. **Unequal cities suffer from more social unrest, such as higher crime rates.** Empirical studies show a strong association between inequality in cities and crime. For example, murder rates in US metropolitan areas show a strong correlation with city income inequality.<sup>36</sup> Similarly, in Mexican municipalities, a 1-point increase in the inequality GINI coefficient in Mexican municipalities is associated with a 36 percent higher number of drug-related homicides.<sup>37</sup> Two potential mechanisms can explain the relationship between urban inequality and crime. The first is that the low returns of the market activity of poorer households provide incentives to devote their time to stealing from high earners. Such low opportunity costs tend to drive higher crime rates. The second provides a rationale for violent crime, which is the product of latent frustration and grievances due to the success of the better-off individuals living in the same city.<sup>38</sup>
15. **People living in unequal cities are unhappier.** Inequality can also have a direct negative welfare effect on the poor. Originating from the seminal work of Easterlin,<sup>39</sup> a rich literature in behavioral economics has postulated that individual self-perceived well-being does not depend on own income but rather its relative value to that of other people.<sup>40</sup> Empirical studies confirm the existence of a negative relationship between

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<sup>31</sup> Rospabe, S. and Selod, H., 2006. Does city structure cause unemployment? The case of Cape Town. *Poverty and policy in post-apartheid South Africa*, pp.262-287. Haddad, M.A., 2020. Residential income segregation and commuting in a Latin American city. *Applied Geography*, 117, p.102186.

<sup>32</sup> Gobillon, L., Selod, H. and Zenou, Y., 2007. The mechanisms of spatial mismatch. *Urban studies*, 44(12), pp.2401-2427.

<sup>33</sup> Hellerstein, J.K., Neumark, D. and McInerney, M., 2008. Spatial mismatch or racial mismatch?. *Journal of Urban Economics*, 64(2), pp.464-479. Gobillon, L., Rupert, P. and Wasmer, E., 2014. Ethnic unemployment rates and frictional markets. *Journal of Urban Economics*, 79, pp.108-120.

<sup>34</sup> Roberts, J., Hodgson, R. and Dolan, P., 2011. "It's driving her mad": Gender differences in the effects of commuting on psychological health. *Journal of health economics*, 30(5), pp.1064-1076. Gimenez-Nadal, J.I. and Molina, J.A., 2016. Commuting time and household responsibilities: Evidence using propensity score matching. *Journal of Regional Science*, 56(2), pp.332-359.

<sup>35</sup> Boza-Kiss, B., Pachauri, S. and Zimm, C., 2021. Deprivations and Inequities in Cities Viewed Through a Pandemic Lens. *Frontiers in Sustainable Cities*, 3, p.15.

<sup>36</sup> Glaeser, E.L., Resseger, M. and Tobio, K., 2009. Inequality in cities. *Journal of Regional Science*, 49(4), pp.617-646.

<sup>37</sup> Enamorado, T., López-Calva, L. F., Rodríguez-Castelán, C., & Winkler, H. (2016). Income inequality and violent crime: Evidence from Mexico's drug war. *Journal of Development Economics*, 120, 128-143.

<sup>38</sup> Kelly, M. (2000). Inequality and crime. *Review of economics and Statistics*, 82(4), 530-539.

<sup>39</sup> Easterlin, R.A., 1974. Does economic growth improve the human lot? Some empirical evidence. In *Nations and households in economic growth* (pp. 89-125). Academic Press.

<sup>40</sup> Clark, A.E. and Oswald, A.J., 1996. Satisfaction and comparison income. *Journal of public economics*, 61(3), pp.359-381. Ferrer-i-Carbonell, A., 2005. Income and well-being: an empirical analysis of the comparison income effect. *Journal of public economics*, 89(5-6), pp.997-1019.

inequality and happiness across the world, as the former embodies the existence of persistent unfairness.<sup>41</sup> This can translate into negative aggregate effects as lower happiness has been shown to be a cause of low productivity.<sup>42</sup> The relationship between unhappiness and productivity is also a further endogenous mechanism for how inequality self-reinforces, as less productive workers in equilibrium will draw lower wages. Finally, unhappiness is also thought to be one of the mechanisms for inequality to trigger more violent crime.<sup>43</sup>

### *Environmental Consequences*

16. **Spatial segregation in cities often means that poorer households face deeper negative environmental amenities and are exposed to higher environmental risks.** Another consequence of income segregation in cities is that the poorest neighborhoods are often in vulnerable areas with lower (or even negative) environmental amenities and higher exposure to environmental hazards.<sup>44</sup> After environmental shock (e.g., flood), poorer households struggle more to recover due to limited access to coping and recovery mechanisms.<sup>45</sup> Poorer households often have access to less urban green spaces,<sup>46</sup> are more exposed to heatwaves,<sup>47</sup> and face higher pollution levels.<sup>48</sup> Living in a poorer neighborhood with lower air quality is also associated with worse health, as shown by a higher prevalence of asthma in children and cardiovascular disease in adults.<sup>49</sup> Accordingly, empirical studies confirm the existence of a positive relationship between income inequality and mortality at the city level.<sup>50</sup>
17. **Unintended consequences of urban policies may end up increasing environmental inequalities within cities if their indirect effects are not accounted for.** Many cities worldwide are taking steps towards reducing carbon impact and increasing environmental resilience. However, such policies often lead to a form of *eco-gentrification* or *climate gentrification*, which perpetuates urban inequality as desirable neighborhoods become increasingly unaffordable for the poor who move to worse locations. On the one hand, public and private climate pledges encourage higher-income residents to live near public transport in

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<sup>41</sup> Graham, C. and Felton, A., 2006. Inequality and happiness: insights from Latin America. *The Journal of Economic Inequality*, 4(1), pp.107-122. Oishi, S., Kesebir, S. and Diener, E., 2011. Income inequality and happiness. *Psychological science*, 22(9), pp.1095-1100. Huang, J., 2019. Income inequality, distributive justice beliefs, and happiness in China: Evidence from a nationwide survey. *Social Indicators Research*, 142(1), pp.83-105.

<sup>42</sup> Oswald, A.J., Proto, E. and Sgroi, D., 2015. Happiness and productivity. *Journal of labor economics*, 33(4), pp.789-822.

<sup>43</sup> Glaeser, E.L., Resseger, M. and Tobio, K., 2009. Inequality in cities. *Journal of Regional Science*, 49(4), pp.617-646.

<sup>44</sup> Erman, A.E., Tariverdi, M., Obolensky, M.A.B., Chen, X., Vincent, R.C., Malgioglio, S., Maruyama Rentschler, J.E., Hallegatte, S. and Yoshida, N., 2019. Wading out the storm: The role of poverty in exposure, vulnerability and resilience to floods in Dar Es Salaam. *World Bank Policy Research Working Paper*, (8976).

<sup>45</sup> Erman, A., Motte, E., Goyal, R., Asare, A., Takamatsu, S., Chen, X., Malgioglio, S., Skinner, A., Yoshida, N. and Hallegatte, S., 2020. The Road to Recovery the Role of Poverty in the Exposure, Vulnerability and Resilience to Floods in Accra. *Economics of Disasters and Climate Change*, 4(1), pp.171-193.

<sup>46</sup> Wolch, J.R., Byrne, J. and Newell, J.P., 2014. Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and urban planning*, 125, pp.234-244.

<sup>47</sup> Chakraborty, T., Hsu, A., Many, D. and Sheriff, G., 2019. Disproportionately higher exposure to urban heat in lower-income neighborhoods: a multi-city perspective. *Environmental Research Letters*, 14(10), p.105003.

<sup>48</sup> Houston, D., Wu, J., Ong, P. and Winer, A., 2004. Structural disparities of urban traffic in Southern California: implications for vehicle-related air pollution exposure in minority and high-poverty neighborhoods. *Journal of Urban Affairs*, 26(5), pp.565-592.

Marshall, J.D., Brauer, M. and Frank, L.D., 2009. Healthy neighborhoods: walkability and air pollution. *Environmental health perspectives*, 117(11), pp.1752-1759. Zhou, Z., Dionisio, K.L., Verissimo, T.G., Kerr, A.S., Coull, B., Arku, R.E., Koutrakis, P., Spengler, J.D., Hughes, A.F., Vallarino, J. and Agyei-Mensah, S., 2013. Chemical composition and sources of particle pollution in affluent and poor neighborhoods of Accra, Ghana. *Environmental Research Letters*, 8(4), p.044025.

<sup>49</sup> Yitshak-Sade, M., James, P., Kloog, I., Hart, J.E., Schwartz, J.D., Laden, F., Lane, K.J., Fabian, M.P., Fong, K.C. and Zanobetti, A., 2019. Neighborhood greenness attenuates the adverse effect of PM<sub>2.5</sub> on cardiovascular mortality in neighborhoods of lower socioeconomic status. *International journal of environmental research and public health*, 16(5), p.814.

<sup>50</sup> McLaughlin, D.K. and Stokes, C.S., 2002. Income inequality and mortality in US counties: does minority racial concentration matter?. *American journal of public health*, 92(1), pp.99-104.

walkable and connected neighborhoods, pricing out poorer households.<sup>51</sup> On the other hand, local interventions to build green infrastructure turn into another form of climate injustice as vulnerable groups with low access to environmental amenities (e.g., green spaces) face higher hazards. They have fewer resources (i.e., private capital and social networks) to adapt to the risk of being displaced in the medium term as rental costs rise.<sup>52</sup> Moreover, higher-income groups can better lobby for investment in environmental amenities. As a result, less-privileged neighborhoods often do not benefit from public investment in environmental planning.

## 2. Global overview of intra-urban spatial inequalities

18. **The city dataset built from GMD survey responses can be leveraged to provide a characterization of global trends of intra-city inequality.** The dataset of cities derived from Global Monitor Database (GMD) surveys responses (Box 1) can be used to provide insights on global trends of inequality within cities. The representativeness of survey responses at the city level (which is the condition for the cities to be included in the sample) allows for calculating city population and level of welfare, which, in turn, can be used to measure intra-urban inequality.
19. **The GINI index is used as the baseline measure of inequality,** conforming to the prevailing approach in the literature (e.g., Gleaser et al., 2008; Chetty et al., 2014; Fogli and Guerrieri, 2019). The properties that make such a measure attractive are its invariance to scale. It continuously decreases (implying higher equality) when transferring resources from rich to poor and provides a 0-1 score, allowing comparing inequality measures built using data that is not consistent across countries<sup>53</sup>. The GINI is calculated based on the welfare measure from GMD surveys.<sup>54</sup> All results are checked for robustness using Theil and Atkinson indices. In line with Trapeznikova (2019) 's findings, the specific method used to measure inequality does not affect the relative stance of different cities in the sample derived from GMD surveys responses, hence not affecting the results.

### Box 1. Global urban inequality index

One of the main gaps in the economics literature on inequality is the lack of a global characterization of within-city inequality due to the unavailability of an internationally consistent measure. The solution employed in this paper is to exploit survey responses from the Global Monitor Database (GMD) surveys, a multitopic World Bank's collection of income and expenditure surveys, typically collected by the country statistical office but later harmonized and compiled in a uniform format. By matching administrative area and GHS-Urban Center Database (GHS-UCDB), we compiled 376 observations from 100 cities in 61 countries. Multiple surveys are available for 46 cities, with a global average of 6.8 observations per city (12.4 when excluding single-survey cities). This consolidated dataset allows the construction of different inequality measures based on the relevant measure of welfare in the survey

<sup>51</sup> Rice, J.L., Cohen, D.A., Long, J. and Jurjevich, J.R., 2020. Contradictions of the climate-friendly city: new perspectives on eco-gentrification and housing justice. *International Journal of Urban and Regional Research*, 44(1), pp.145-165.

<sup>52</sup> Anguelovski, I., Connolly, J.J., Pearsall, H., Shokry, G., Checker, M., Maantay, J., Gould, K., Lewis, T., Maroko, A. and Roberts, J.T., 2019. Opinion: Why green "climate gentrification" threatens poor and vulnerable populations. *Proceedings of the National Academy of Sciences*, 116(52), pp.26139-26143.

<sup>53</sup> Another popular set of inequality measures is decile ratios (90/10, 90/20, Palma ratio) that are better suited at capturing the effective disparities between the richest and poorest individuals in the society but toss out all the remaining information on the income distribution. Finally, there are the generalized entropy indexes that better capture distributional aspects of inequality. In particular, the Theil index, normally used to decompose between- and within-inequality, and the Atkinson index which attaches to different parts of the distribution. This work focuses on measures of inequality that rely on the overall income distribution using GINI as survey data are ill-suited at precisely measuring welfare of a specific part of the distribution.

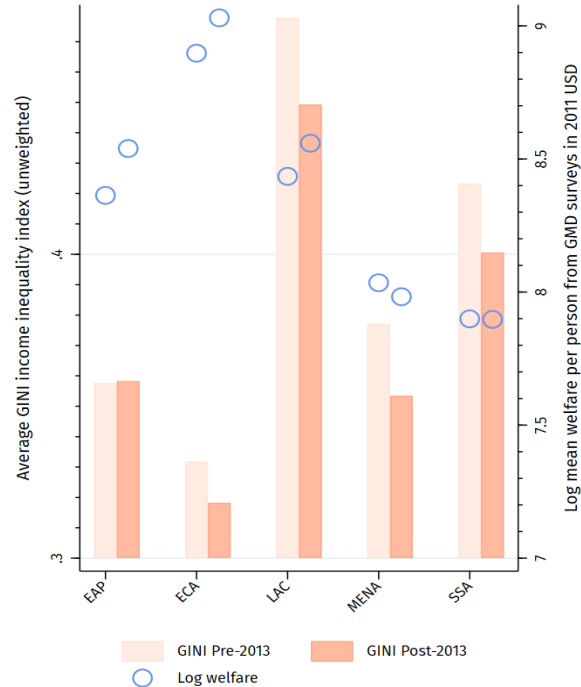
<sup>54</sup> The income was used for measuring inequality in LAC and the consumption expenditures were used for other regions.



(income or expenditure) and within-city differential in service provision.<sup>55</sup> The matching with GHS-UCDB also enables us to investigate the relationship between inequality and other city characteristics, such as the type of urban form.

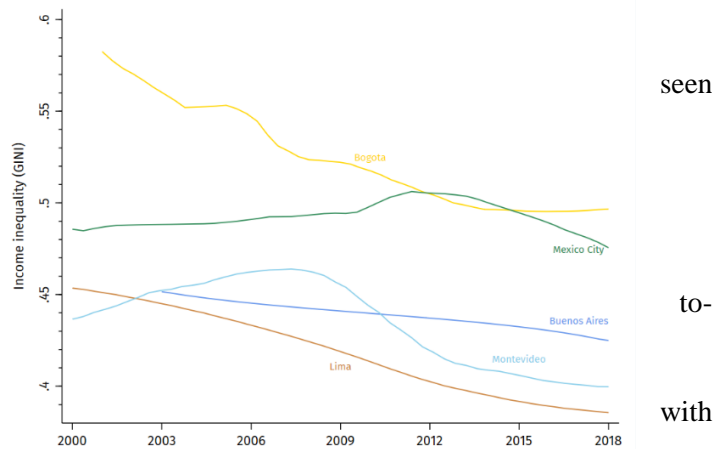
20. **Intra-urban inequality has had a tendency to decline in the last two decades in all regions except for East Asia Pacific.** A comparison of the average GINI index by region shows that urban centers have become more equal than in the previous decade (Figure 2). The threshold year of 2013 was chosen to maximize the sample size for each region, as only cities with at least one observation on either side of the threshold. The decrease in average cities' inequality ranges from 4% in Europe and Central Asia to 6.2% in the Middle East and North Africa, where Tunis's 14% fall in inequality is one of the largest globally. The largest falls in inequality are found in ECA (Nur-Sultan; 31%) and SSA (Francistown, 25%; Nairobi, 25%; Gaborone, 24%; Lagos, 20%) but are balanced out by some of the biggest increases (7% in Madrid, 8% Bishkek in ECA; 19% in Dar es Salaam, 42% in Luanda in SSA). The only exception is East Asia and Pacific, which saw a slight increase (1%) in average inequality.<sup>56</sup>

Figure 2. Intra-urban inequality by regions



21. **A close look at cities of LAC found that intra-urban inequality is not static; rather, it is dynamic and often changes over time.** All large LAC capitals have a decrease in inequality in the last two decades (Figure 3)<sup>57</sup>. The decreasing trends vary across cities. Bogota and Buenos Aires saw the steepest total inequality reductions (17% and 19%, respectively) and the largest average year-year fall in inequality (1.5% and 1.3%). Mexico City displays one of the overall decreases in inequality, which coincides it being the only city witnessing a negative average yearly growth in welfare in the sample.

Figure 3. Time-series intra-urban inequality (GINI index)



<sup>55</sup> The algorithm relied on the World Bank datalibweb

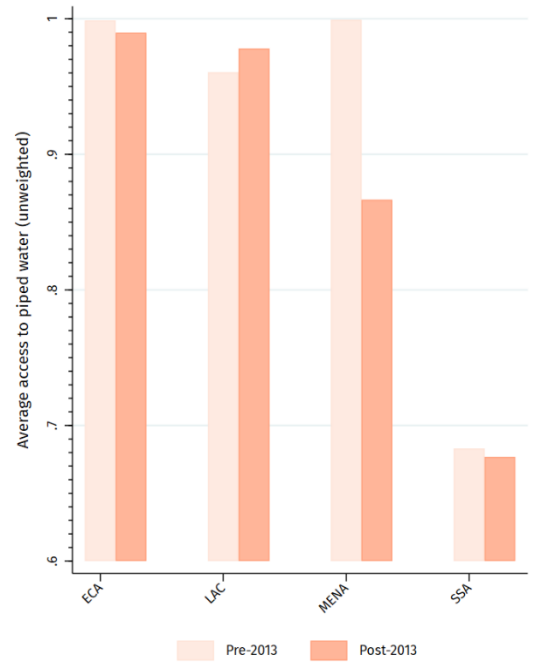
([https://github.com/worldbank/GLAD/blob/master/00\\_documentation/Datalibweb\\_Guidelines.md](https://github.com/worldbank/GLAD/blob/master/00_documentation/Datalibweb_Guidelines.md)) data system

<sup>56</sup> However, the East Asia Pacific region data results is strongly dependent on the reduced sample of cities that have at least one observation on either side of the threshold year considered: Bangkok, Jakarta, and Ulaanbaatar.

<sup>57</sup> Due to limited long-term surveys in other regions, we selected LAC region to show this decreasing trends in a temporal manner.

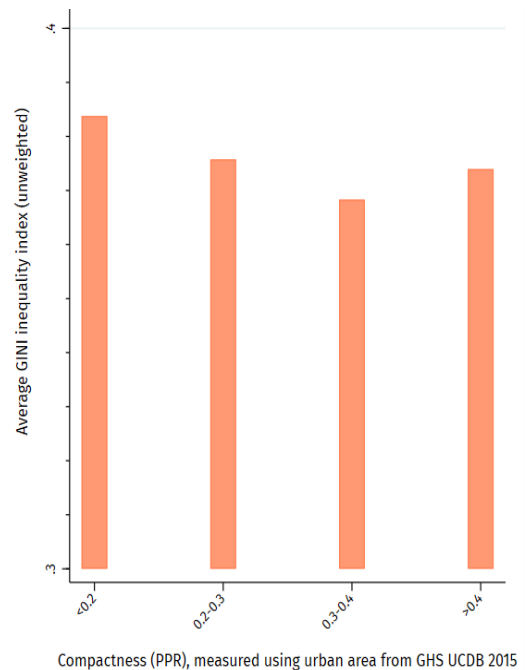
22. **However, the reduced intra-urban inequality does not seem to be associated with enhanced service provision and quality of life.** We used the level of access to piped water as a proxy for urban service provision (Figure 4). There is no positive relationship between the level of access to piped water and welfare increase. The change in the MENA is particularly striking, with a fall in access of approximately 12 pp. This indicates how armed conflict affects the coverage of urban services. For example, the Yemeni cities of Aden and Sana'a have experienced violent conflicts in the past decade, a critical factor in deteriorating the quality of living. Moreover, the war in Yemen has generated many internally displaced people that relocated to cities where the infrastructure failed to catch up with the number of incomers. Indeed, a closer look at the data of Sana'a shows that the share of people with piped water access fell from 100% in 2005 to 61% in 2014. Excluding Yemen, the MENA regional average change in piped water provision modifies to a 0.1 pp increase.

**Figure 4.** Access to services (i.e., piped water) across different regions



23. **The sprawled city shows a higher level of intra-urban inequality.** The sprawled and fragmented urban development is often associated with higher commuting costs and limited services and amenities. Figure 5 indicates that as the city becomes more compact, the level of inequality decreases. Polsby-Popper Ratio (PPR) is designed to measure the compactness of areas ranging from 0 to 1 (maximal compactness as a score of 1). This is calculated based on the ratio of the area to the area of a circle whose circumference is equal to the perimeter of the area. Based on GHS-UCDB, we retrieved urban areas defined by the degree of urbanization and calculated the compactness of each urban area.

**Figure 5.** Intra-urban inequality and compactness



24. **The intra-urban inequality is a result of the mutual relationship between the city population and welfare.** As city size depends on its economic development and *viceversa*, the two city characteristics can hardly be studied separately. That is, the relationship between city size and inequality may vary with the city's level of development.<sup>58</sup> At the same time, the city's average income may depend on the city's size. For example, agglomeration effects that increase city welfare but disproportionately benefit high-skilled workers and

<sup>58</sup> Castells-Quintana, D., 2018. Beyond Kuznets: Inequality and the size and distribution of cities. *Journal of Regional Science*, 58(3), pp.564-580.

increase inequality are more likely to be found in larger cities.<sup>59</sup> For these reasons, the models studied in regression analysis will focus on the effect of city size and welfare as well as their interaction.

25. **In a time series, the growth of welfare increases intra-urban inequalities, but small cities become more unequal than larger cities.** The availability of multiple surveys for 46 cities also allows looking at the effect of city size and welfare on inequality within cities, namely how population and income growth affect inequality over time. Both city characteristics are positive predictors of inequality. But, more importantly, the coefficient for the interaction has the opposite sign (statistically significant), pointing out how as the population increases, the positive effect of income on inequality is dampened and *vice versa*. That is, the small cities become more unequal as they become richer, while the same effect cannot be witnessed for large cities.

**Table 1.** Panel regression results for GINI inequality index

	Panel
Log population	0.168 (0.116)
Log welfare	0.532*** (0.195)
<b>Log population x Log welfare</b>	<b>-0.0354***</b> <b>(0.013)</b>
Cities	46
Observations	322
FE	City
R <sup>2</sup> (within)	0.226

### 3. Intra-urban inequalities for selected cities

26. **The cause of intra-urban inequality varies and is linked to different underlying mechanisms associated with how a city is planned, built, and used.** Mainly, the gaps in being planned, built, and used lead to a vicious circle of urban challenges. Moreover, the misallocation of planning resources results in a parallel rise in intra-urban inequality (e.g., spatial divisions). This has continuously contributed to the consequences of economic, social, and environmental inequalities in the cities. While different national and regional contexts of cities may influence trajectories of intra-urban inequality, we could observe a similar phenomenon in developing countries. Thus, the following section reviews four cities' spatial organization and their impacts on spatial inequality as a first step into understanding intra-urban inequalities.
27. **The reviews of four selected cities reveal underlying mechanisms of forming intra-urban inequalities.** We selected four cities as case studies to highlight intra-urban inequalities echoing three different consequences. Amman exhibits how the spatial segregation of neighborhoods enforces economic isolation. Amman also illustrates how external shock (e.g., armed conflicts in neighboring countries) and associated migration affect the spatial organization of cities. Second, Ulaanbaatar points out how low-dense and sprawled urban development limits access to jobs and amenities. Third, in the case of Manila, empirical evidence finds that low education attainment contributed to limited upward social mobility. Finally, Mexico City exhibits that the spatial division within cities is inherently fixed through time and, therefore, likely would not be changed much, even though the overall level of services and amenities have been improved.
28. **More importantly, while urbanization in selected cities presents an enormous opportunity for promoting prosperity and economic opportunities, low-density urbanization with limited public services and amenities hampers its growing potential.** Instead of leveraging the benefits of agglomeration and densification (Table 2), the cities host a large portion of the poor and struggle with limited basic services and unemployment.

<sup>59</sup> Baum-Snow, N. and Pavan, R., 2013. Inequality and city size. *Review of Economics and Statistics*, 95(5), pp.1535-1548.

Behrens, K. and Robert-Nicoud, F., 2014. Survival of the fittest in cities: Urbanisation and inequality. *The Economic Journal*, 124(581), pp.1371-1400.

**Table 2.** Socioeconomic characteristics of four selected cities.

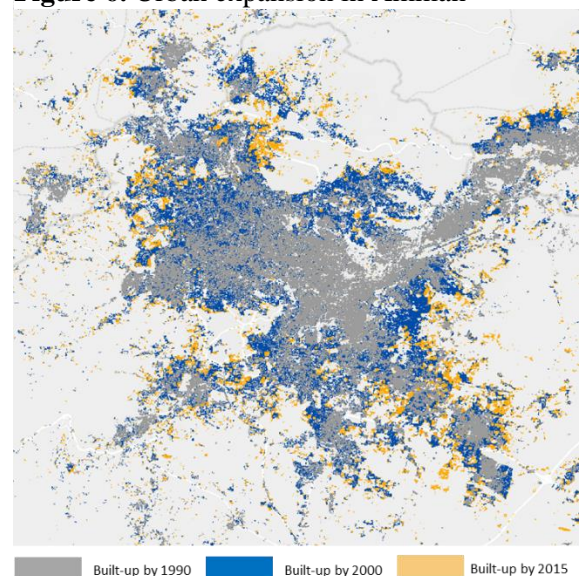
	<b>Amman, Jordan</b>	<b>Ulaanbaatar, Mongolia</b>	<b>Manila, Philippines</b>	<b>Mexico City, Mexico</b>
GDP per capita	9755	5730	8247	13118
Share of national GDP (%)	65.7 %	62.5 %	37.3 %	23.1 %
Population (Million)	2502	1380	12919	20021
Share of the national population (%)	32.9 %	46.1%	12.8 %	16.5 %
Annual urban population growth rate from 2000 to 2015	2.2 %	3.7%	1.6 %	1.0 %
Poverty rate (%)	15.4 %	23.1%	29.9%	18.6%

*Note:* National and urban Gross Domestic Product (GDP) and population retrieved from Oxford Economics (2016); Poverty rate—\$5.5 a day per person—retrieved from Global Subnational Poverty Atlas (2021).

### 3.1. Amman, Jordan: Spatial segregation and economic isolation

29. **Amman's population is currently hosting 28 percent of all Syrian refugees, making up 8 percent of its population.<sup>60</sup> Such rapid influx made the city prone to rising inequalities, emerging from pressure on services, jobs and the environment.** From 1990 through 2015, the population in Amman grew by 214 percent, and built-up areas have increased by 171 percent.<sup>61</sup> Most of the built-up expansion are occurred as horizontal expansion and leap-frogged development (78 percent), with only a small share of infill development (22 percent) (Figure 6).<sup>62</sup> This rapid growth is largely exacerbated by the waves of incoming refugees from the Iraq war in 2003 and the Syrian crisis in 2011. Such unexpected, rapid urbanization accompanied by weak governance made it difficult for the city to plan and manage urban growth (Alnsour, 2016; GAM, 2017). It led to a high increase in public debt (83 percent), youth unemployment rate (30 percent), and demand for water (40 percent). The influx of refugees also adds additional burdens to urban services. For example, after approving Syrian students' attendance in Jordanian public schools in 2012, a double shift was made in 209 public schools to suffice the needs.

**Figure 6.** Urban expansion in Amman



30. **Current planning practices based on the Greater Amman Master Plan for 2025, enacted in 2008, are outdated and need to be reviewed.** While the 2025 master plan was focused on promoting compact development, integrated land use, and use of public transit, only 20 percent of the plan has been implemented.

<sup>60</sup> The total number of Syrian refugees in Amman are about 200,000 (UNHCR, 2022).

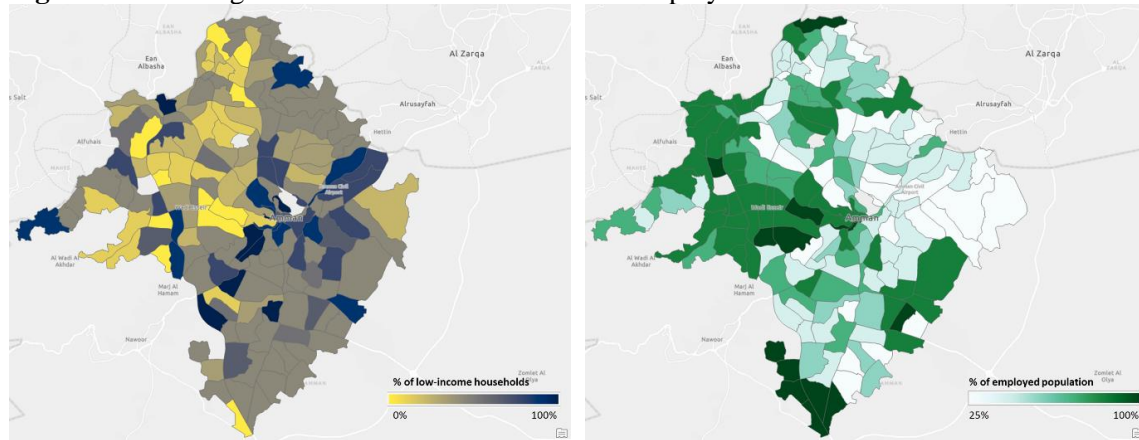
<sup>61</sup> The data is retrieved from Global Human Settlement – Urban Center Database (GHS-UCDB): [https://ghsl.jrc.ec.europa.eu/ghs\\_stat\\_ucdb2015mt\\_r2019a.php](https://ghsl.jrc.ec.europa.eu/ghs_stat_ucdb2015mt_r2019a.php)

<sup>62</sup> The infill and leap-frogged urban developments are identified based on Landscape Expansion Index (LEI). LEI calculates how much new urban areas are overlapping to buffers (300m) from existing urban areas. For example, new urban areas are considered as infill development (greater than 80% of the area is covered by ring buffers from existing city), leapfrogged development (less than 20%), and horizontal expansion (between 20% to 80%).



Additionally, since it was designed in 2008 before the arrival of refugees, the master plan cannot serve the recent influx of refugees and associated pressure on housing and service provisions. The Greater Amman Municipality (GAM) recently adopted the Amman Resilience Strategy (2017) and Amman Climate Plan (2019) to address core urban challenges such as climatic events and refugee crisis; however, a spatial lens has not been placed for the planning yet. A lack of public transportation access in poor neighborhoods, including refugees, is critical to participating in the urban labor market. Considering low wage for unskilled workers, high transportation costs due to longer commutes are highly unaffordable to the poor. The socioeconomic characteristics of neighborhoods exhibit that Amman is divided into East and West as this snapshot of misled spatial planning. The Westside of Amman is well-off compared to the eastside regarding the percentage of low-income households and employment rates (Fig 7). This represents how the economic isolation of poor neighborhoods can be exacerbated by spatial segregation.

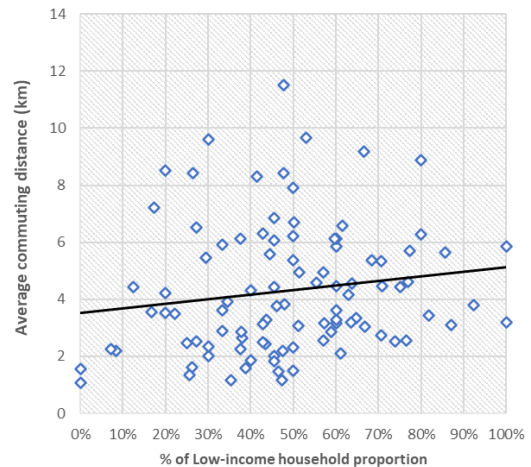
**Figure 7.** Percentage of low-income households and employment rates.



Source: Housing Census 2015 (Department of Statistics, 2015)

31. **The poor's commuting distances are twice as long as residents of affluent neighborhoods.** Using cell phone data, we identified commuting patterns.<sup>63</sup> The average commuting distance in Amman is 2.95 km. However, the average commuting distance from poor neighborhoods (bottom 10 percent of the income distribution) to the workplace is about 4.01 km, while it is only 2.04 km in affluent neighborhoods (top 10 percent). Such difference is consequential as long commuting times are expensive both in terms of commuting costs—especially where private transport is expensive and public transport is scarce<sup>64</sup>, as well in terms of the opportunity cost of time that could have been used for other activities. Longer

**Figure 8.** Commuting distance and neighborhood characteristics.



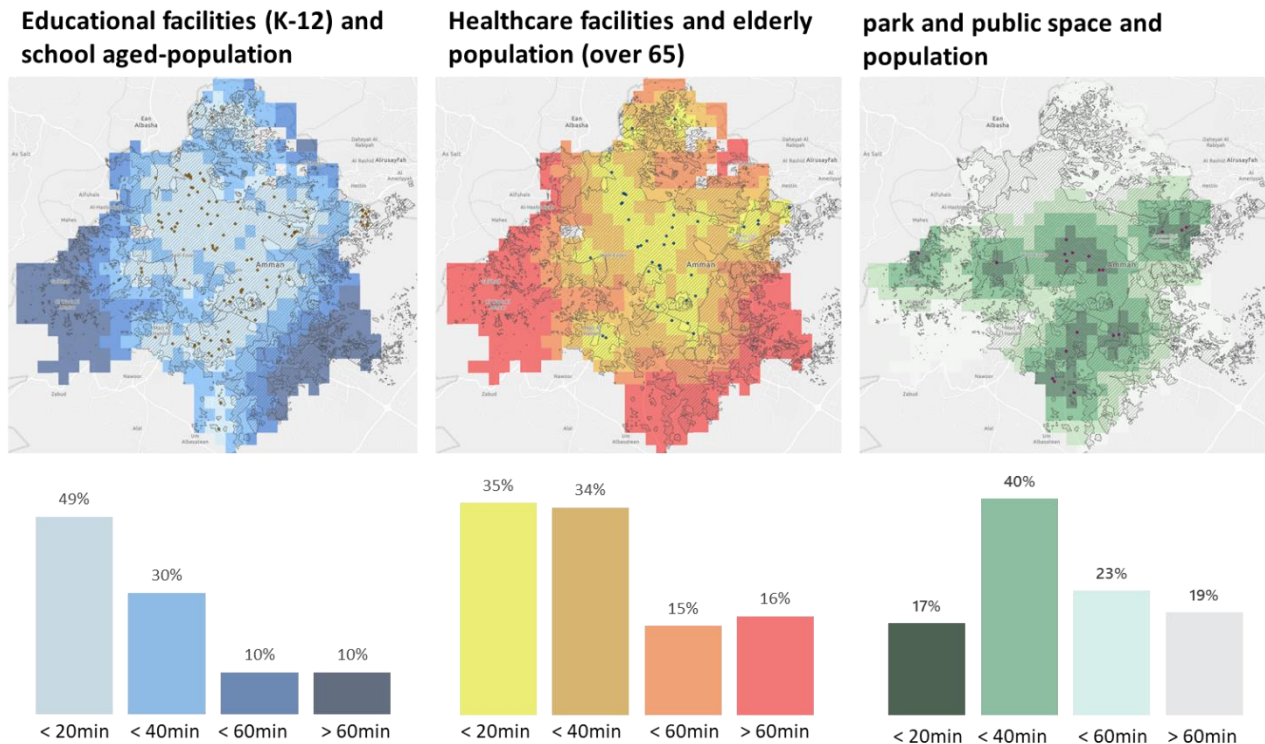
<sup>63</sup> Mobile phones have proven good instruments to measure human behavior (Toole et al., 2012). These patterns can be used to track people's activities. Particularly, by using mobile phone records and their patterns, we identified Home and Work locations and developed Origin-Destination (OD) tables.

<sup>64</sup> Considering the relatively higher price of public transit (0.25-0.65 JD, which is equivalent to 0.35-0.92 USD), this may reduce poor's economic opportunities. It is important to note that USAID (2014) reported that about 23 percent of the youth's salary is allocated to cover transport costs.

commutes may also increase the risk of being the victim of a crime at night.

32. **People in Amman have different levels of access to education facilities, health facilities, and green spaces.** Only 49 percent of students reside within a 20min walkable distance from kindergarten or school. Given relatively expensive transportation costs in Amman, the distance to school certainly plays a critical role in students' school accessibility and availability, which has a long-term effect on the economic consequences of intra-urban inequality. Municipal services and amenities are evenly distributed. More than 10 percent of residents do not have accessible medical services, particularly on the city's outskirts. Moreover, elderly people—economically and socially disadvantaged<sup>65</sup>—reside further away from healthcare facilities than other age groups. Lastly, parks and public spaces have been offered only in selected neighborhoods. As a result, one-fourth of Amman residents reside far away from any public spaces and parks, taking more than an hour to walk there, and the other 11 percent of residents take more than two hours to reach the parks and public spaces.<sup>66</sup> Considering the importance of parks and public space to address emerging climatic events (e.g., heatwaves) and recent pandemics, this unequal access to parks and public spaces contribute to intra-urban inequality as evolving consequence of adverse environmental impact.

**Figure 9.** Accessibility analysis for education facilities, health facilities, and green spaces



<sup>65</sup> Low-income elderly people are, on average, more frequent users of hospital care (Billings et al, 1993; Evashwick et al, 1984). Loo and Lam (2011) reported that about 20 percent of their elderly survey respondents' mode of transportation is walking.

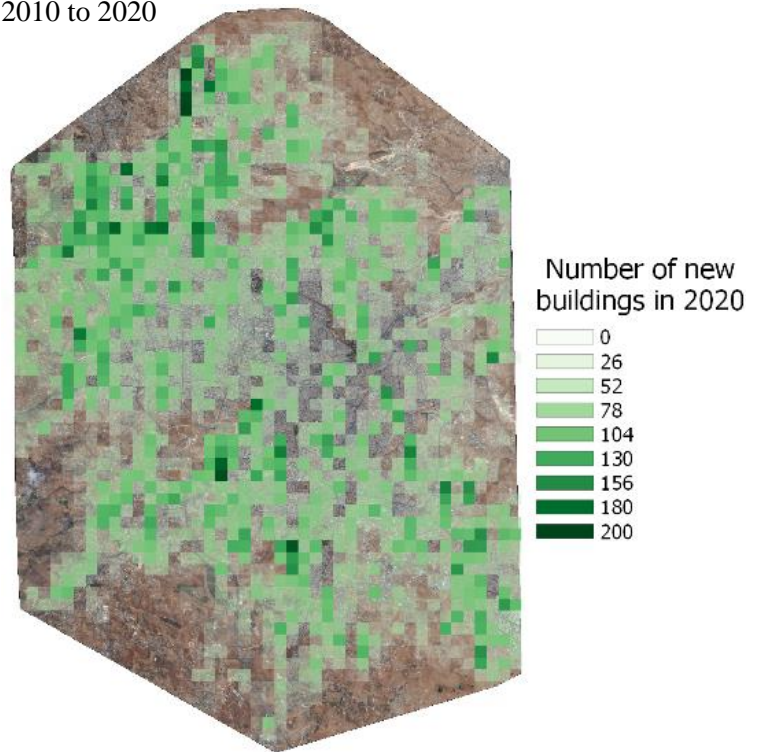
<sup>66</sup> Computed by synthesizing open-sourced Point of Interests data (i.e., Open Street Map), gridded travel time (Weiss et al., 2018), and gridded population (e.g., WorldPoP) in cloud computing (i.e., Google Earth Engine).



33. **The influx of refugees disproportionately affects the spatial organization of Amman. This imposes additional burdens on urban services and amenities.**

Over the past decade, most new buildings were constructed at the fringe or in poor neighborhoods. Given that the vast majority of the refugees live in cities instead of camps, the incoming population has caused severe challenges in maintaining and providing basic infrastructure and public services. However, current limited planning resources and statistics hamper understanding of how Amman has spatially evolved recently. By combining with Machine Learning (ML) technique and Very-High Resolution (VHR) imagery (see detail in Box 2), building footprint layers for the 2010 and 2020 imagery were developed to identify growth at an urban scale. Over the entire study area, we find 138,500 buildings in 2010 and 150,500 buildings in 2020, for an estimated growth of 12,000 buildings.

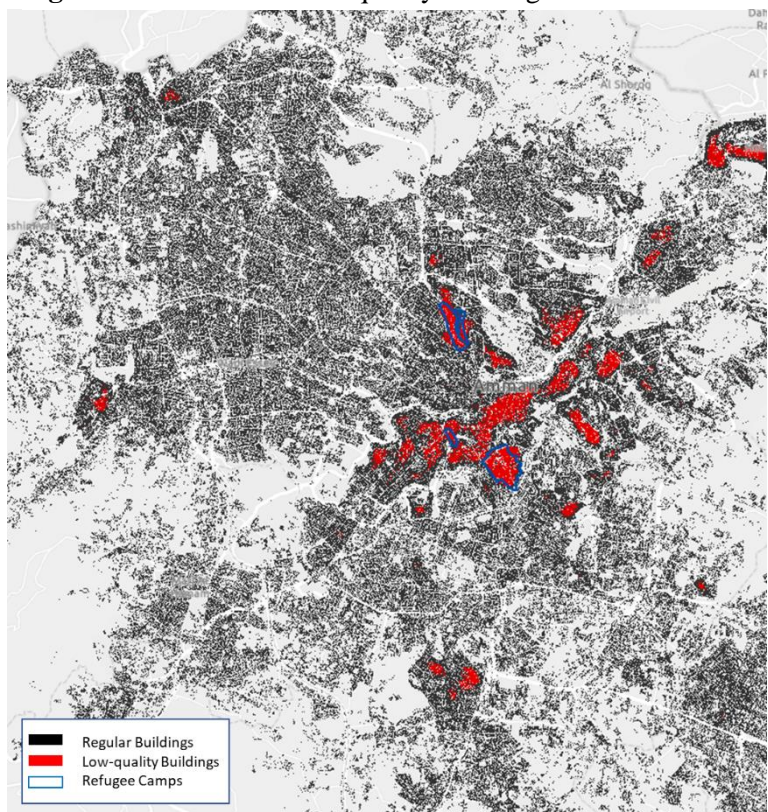
**Figure 10.** Evolution of building footprints in Amman from 2010 to 2020



34. **Out of 150,500 buildings in Amman, 5% percent of them are low-quality buildings.**

Based on building footprints, we further investigated the predicted building footprints to understand the quality of buildings. In the post-conflict and disaster contexts, incoming refugees and migrants are often found living in poor-quality housing that needs immediate assistance. Based on local experts' knowledge, we learned that low-quality buildings are unevenly distributed within a plot, small, irregularly shaped, often built on steep terrain, and are closely packed with surrounding buildings (i.e., narrow gaps between buildings). This analysis enabled us to assess the location of potential low-quality buildings. In addition to low-quality housing in refugee camps, this analysis pointed out the extension and evolution of low-quality housing in the eastern part of Amman.

**Figure 11.** Location of low-quality buildings in Amman

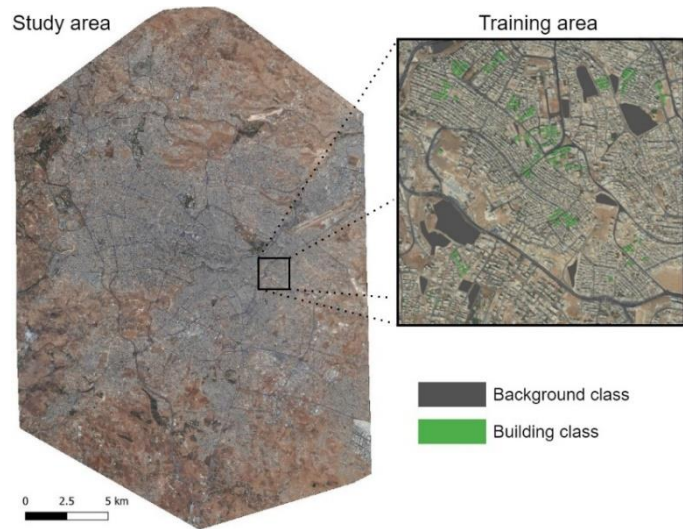




## Box 2. Identifying informal settlement in Amman, Jordan

Building footprints are a crucial piece of data in many applications, for example, disaster response damage assessments, population mapping, and urban planning. High-resolution satellite or aerial imagery can be hand-labeled to create accurate building footprints; however, such an approach quickly becomes prohibitively expensive as the scale of the problem increases. We use a Machine Learning technique with 4 separate high-resolution (0.5m/px) RGB satellite imagery scenes from Maxar's WorldView-2 satellite in this study to expedite the generation of building footprints.

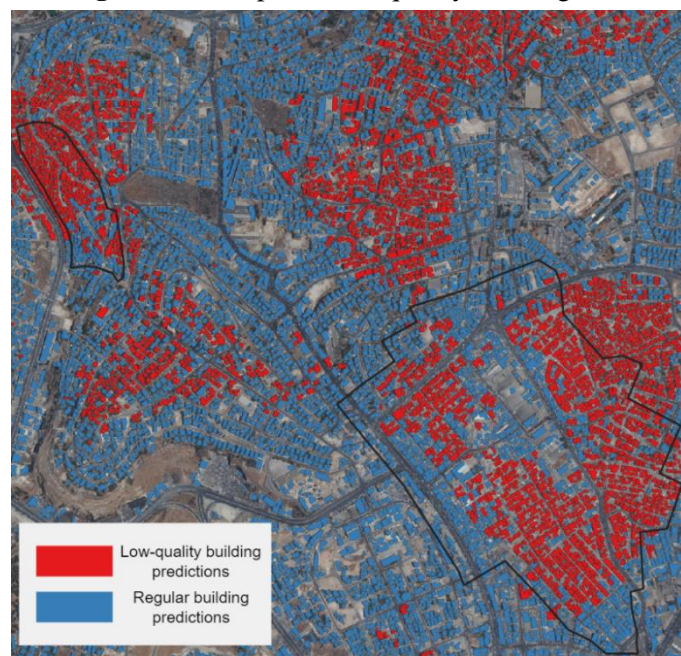
**Box Figure 1.** Overview of the Amman, Jordan study area



By using an open-source web-based tool that allows users to create annotations, we collected a set of ground truths (437 and 311 building footprints in 2010 and 2020, respectively), then trained the building classification model using an unweighted pixel-wise cross-entropy loss that ignores pixels that have not been labeled. By comparing multiple models, including Local random forest, SpaceNet, CrowdAI, and Urban 3D, our approach—Local U-net model—has reliable accuracies both in 2010 and 2020 (Recall: 86.92% and 83.763%,  $R^2$ : 0.93 and 0.84, respectively).

Based on the granular building footprint features and associated characteristics (e.g., size, density, gaps, shape), we further investigated the quality of buildings. We created labels (399 regular and 105 low-quality buildings): 1) through visual inspections of the high-resolution imagery with a series of consultations with local experts, and 2) through a field visit to take geo-coded "ground truth" photos during the field visit, which was held on Feb 3-8, 2022, we took 308 photos near Al Nathif, Al Akhdar, and Al Zohour.

**Box Figure 2.** Example of low-quality buildings



Using the above features and labels, we train a gradient boosting classifier 50 times on random 25%/75% data splits and report the average and standard deviation F1 score per class. Here, we observe F1 scores of  $0.97 \pm 0.01$  and  $0.89 \pm 0.03$  for the regular and low-quality classes, respectively. This set of analyses allows us to break down further the changes in Amman by predicted building quality which is critical for prioritizing planning resources. Ultimately, this analysis can identify socio-economically vulnerable neighborhoods in terms of limited urban services and amenities, which is a critical driver of exacerbating intra-urban spatial inequalities.

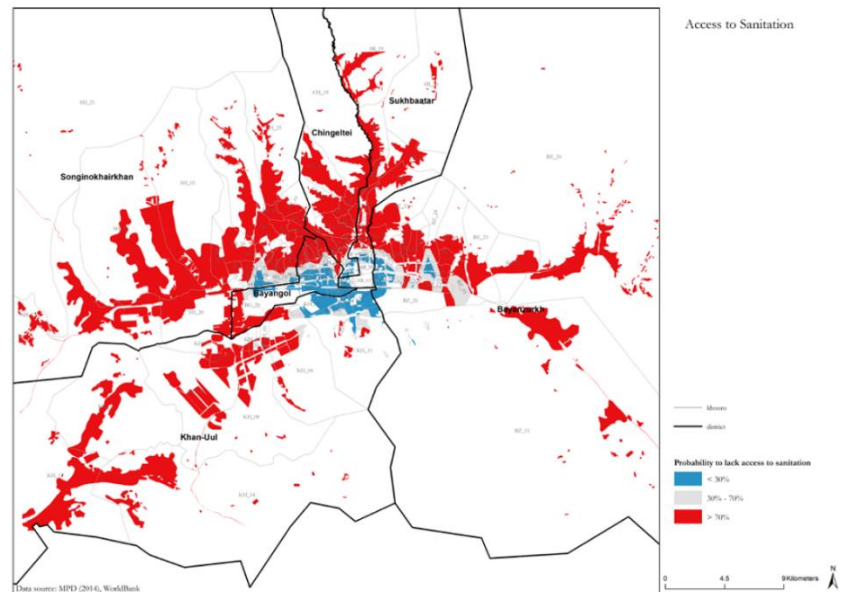


### 3.2. Ulaanbaatar, Mongolia: Sprawled urban development and limited access to jobs<sup>67</sup>

35. **As the capital city of Mongolia, Ulaanbaatar generates 65 percent of the country's GDP, and hosts about half of the country's population.** During the transitional period following the collapse of the Soviet Union, Mongolia experienced accelerated rural-to-urban migration.<sup>68</sup> As a result, Ulaanbaatar has been a major destination for rural migrants.<sup>69</sup> From 1990–2016, 47.7 percent of nationwide in-migration (1,307,000) was headed to Ulaanbaatar, which the population increased from 536,000 to 1,440,000 in 26 years, with four percent annual growth (National Statistical Office of Mongolia, 2016).
36. **While urbanization in Ulaanbaatar has immense potential for fostering wealth and economic possibilities, it is hampered by low-density urbanization with few public services and facilities.** As a result, instead of taking advantage of the benefits of agglomeration and densification, Ulaanbaatar is home to a large number of the poor (23 percent of the total population), and the city has experienced a growing problem of intra-urban inequality due to a lack of essential amenities and unemployment.

37. **This rapid urbanization has resulted in the dramatic increase in the use of portable small felt tents as housing, also known as Ger.<sup>70</sup>** Ger districts, hosting a majority of nomads, have been continuously expanding and now host about 60 percent of the total population of Ulaanbaatar. During the transitional period—after the collapse of Soviet Union, Mongolia has had a unique land distribution system. Both "Law of Mongolia on Land" and the "Law on Allocation of Land to Mongolian Citizens for Ownership" enabled rural-to-urban migrants to privatize land for their residential purpose. While this policy set offers legal ownership of urban land, sprawled

**Figure 12.** Access to sanitation facilities in Ulaanbaatar, Mongolia



Source: Retrieved from Singh (2017)

development of Ger districts brought substantial infrastructure challenges, including sanitation, water, health, and road networks. For example, most of Ger districts are located from the city center through the outskirts of cities where sanitation facilities are not equipped (e.g., red colored-polygons in Fig 8— where more than 70 percent of households do not have access to sanitation facilities).

38. **The shortage of services and amenities in Ger districts is a major constraint on employment.** Due to inefficient and limited public transit, low-income commuters at the urban periphery spend as much as 24 to

<sup>67</sup> Retrieved from Singh, G. (2017). Urban Poverty in Ulaanbaatar: Understanding the Dimensions and Addressing the Challenges. World Bank.

<sup>68</sup> Neupert, R. F. (1999). Population, nomadic pastoralism and the environment in the Mongolian Plateau. *Population and Environment*, 20(5), 413-441.

<sup>69</sup> Park, H., Fan, P., John, R., & Chen, J. (2017). Urbanization on the Mongolian Plateau after economic reform: Changes and causes. *Applied Geography*, 86, 118-127.

<sup>70</sup> A portable small felt tent used by nomads in Mongolia

36 percent of their monthly expenses on bus fares.<sup>71</sup> As such, residents at the periphery have limited access to jobs and other amenities. The lack of affordable childcare options is another constraint for women to work. The majority of kindergartens are located in the city center, where a large portion of higher-income people resides. And again, in Ger districts, there are no kindergartens or far outside of walkable distance.

**39. Ger districts are most damaged by air pollution. At the same time, they act as primary contributors.**

Ulaanbaatar is well known for the worst winter air pollution in the world. Coal-burning stoves used in Ger districts directly contribute as much as 80 percent of this pollution. Since heating services are mostly unavailable in this area, coal-burning stoves are the only option for heating. Air pollution has severe health implications for vulnerable people (i.e., children and the elderly) prone to respiratory disease.<sup>72</sup> Over the past decade, respiratory infection has increased by 2.7 folds. In addition, the children living in Ulaanbaatar have 40 percent lower lung function than children in rural areas.

**3.3. Manila, Philippines: Low education attainment and limited upward mobility<sup>73</sup>**

**40. The Philippines has experienced dramatic urbanization with widespread inequality over the past decades.**

Despite a relatively higher level of economic growth, urban poverty is prevalent. From 2003 to 2009, urban poverty has increased from 11.3 percent to 13.2 percent, respectively. Since then, the urban poverty rate has remained at the same high level. Based on the standard of \$5.5 a day per person, the percentage of poor in Metro Manila can be reached about 30% in 2021. While Metro Manila, as the primary urban agglomeration in the Philippines, has experienced economic growth (i.e., 36 percent of total GDP is generated from Metro Manila), income inequality within the city is increasing (i.e., the GINI coefficient increased from 0.399 in 2006 to 0.403 in 2012).

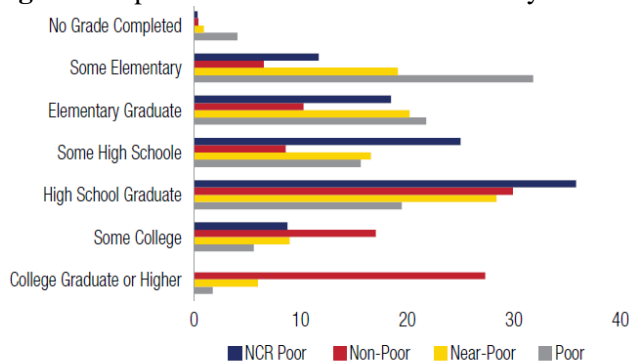
**41. Urban planning has failed to guide urban growth and ended up with sprawling and segregated cities.**

For example, in Metro Manila, the lack of affordable housing has been a critical issue over the past decades, resulting in overcrowded and congested informal settlements with limited access to basic services. National informal settlements upgrading strategy estimated nearly 600,000 households (i.e., approximately three million people) living in Metro Manila under the informal settlements. These informal settlements are vulnerable to natural hazards and have inadequate access to services and amenities.

**42. Informal settlers' experience of informality is not limited to the spaces they inhabit but extends to their education, jobs, and future.**

Lower levels of educational attainment are highly correlated with urban poverty. In the Philippines general, 36 percent of poor households are headed by individuals who have incomplete or no elementary education. This low education attainment led to high underemployment. While Metro Manila has a better education attainment rate, this does not guarantee better economic outcomes. In-work poverty is persistent, and most workers are

**Figure 13.** percent of education attainment by income levels



Source: World Bank (2017)

<sup>71</sup> Baker, J. L., & Gadgil, G. U. (Eds.). (2017). East Asia and Pacific Cities: Expanding opportunities for the urban poor. World Bank.

<sup>72</sup> UNICEF. (2018). Mongolia's Air Pollution Crisis: A call to action to protect children's health.

<sup>73</sup> Retrieved from Singh, G., & Gadgil, G. (2017). Navigating informality: Perils and prospects in Metro Manila's slums. *World Bank: Washington DC*.

trapped in low-skill and low-wage informal employment. World Bank survey (2016) reported that more than half of the 18 years and over had not completed high school level education in Metro Manila's informal settlements. This led them to enter the labor market of informal low-skill, and low-wage jobs (i.e., about 60 percent of respondents are employed in unskilled or semi-skilled positions). This participation in the informal labor market potentially leads to a decrease in wages throughout a worker's life and can reduce the possibility of upward social mobility.

43. **Growing youth population, but limited participation in the labor market.** About 30 million young people between the ages of 10-24 account for 28 percent of the total population. Over the past decades, the youth cohort has increased under the demographic transition. Particularly in the urban areas, twice as many youths have moved from rural areas to cities. However, the large number of migrant youths dreaming of success in the city fall into poverty. For example, in Metro Manila, youth unemployment (28.1 percent) is more than four times the rate for adults. Thus, the proper intervention is required to address these educational challenges and employment gaps for the youth population.

### 3.4. Mexico City: Persistence of intra-urban inequality <sup>74</sup>

44. **As the largest urban agglomerates in Mexico, Mexico City has more than 21 million population, which accounts for almost 16.9 percent of the total population.** Unlike the general trend that labor productivity increases hand-in-hand with a growing population in Mexico, Mexico City is an outlier showing negative labor productivity given the large population. <sup>75</sup> As a result, Mexico City has not maximized the benefits of agglomeration economies.

45. **Mexico City is a highly urbanized area but spatially divided, and intra-urban inequality persists.** Duque et al. (2021) developed a spatial vulnerability index by synthesizing five dimensions, including demographics, housing, labor, education, and health, based on the 2010 and 2020 Mexican population censuses (i.e., INEGI). This indicates that Mexico City shows a clear spatial pattern of spatial inequality. The high vulnerable areas (clusters 4 to 6) are located mainly towards the southwestern part of the city. Less vulnerable areas (most of the 1 to 3 clusters) are located towards the north-eastern part of the city. By comparing different dimensions (i.e., the same level of spatial clustering patterns occurred in housing, labor, education, and health dimension), the researcher claimed that barriers and strong divisions exist in Mexico City.

**Figure 14.** Clusters based on vulnerability index by year 2020



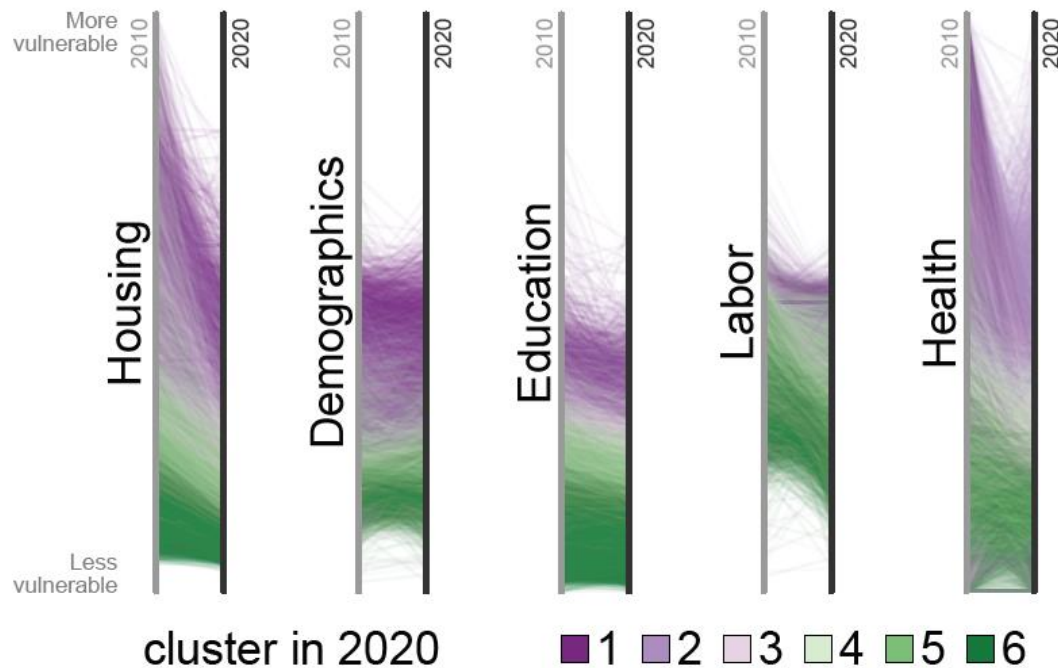
Notes: The high value (green) indicates high vulnerability.

<sup>74</sup> Retrieved from Duque, C., Lozano-Gracia, N. et al (2021) Intraurban inequality in Mexico cities

<sup>75</sup> Kim, Y., & Zangerling, B. (Eds.). (2016). *Mexico urbanization review: Managing spatial growth for productive and livable cities in Mexico*. World Bank Publications.

46. **Overall living standards improved between 2010 and 2020 in most Mexican metropolitan areas (Figure 11), but spatial inequalities persist.** Remarkably, housing and healthcare services are improved over the past decade. National Urban and Housing Programs (SEDATU, 2013) encourage the use of existing urban areas and their consolidation by limiting the spatial expansion of cities as key priorities of the new policy. Under this framework, location-specific housing credits and subsidies were designed to discourage peri-urban expansion. In terms of healthcare, a national program such as *Seguro Popular* improved coverage of healthcare facilities (from 5.3 million people in 2004 to 57.3 million people in 2016) by 2016. However, the trend of urban intra-inequality across the whole country did not change significantly, meaning that unequal cities in 2010 are also unequal by 2020.

**Figure 15.** Vulnerability index across the five dimensions between 2010 (left) and 2020 (right).



Notes: The high value (green) indicates high vulnerability.

47. **Due to the fast-growing population and dramatic urbanization, education and health dimensions present the most significant disparities within cities.** While the overall vulnerability index has improved, some key features have deteriorated (i.e., the travel distances from residential areas to healthcare and education facilities have increased). The intra-urban inequality has been exacerbated by the growing population at the periphery of the city and the limited municipal capacity to provide health and education facilities for these growing areas.
48. **Spatial divisions within cities are kept fixed over time. Therefore, a single intervention cannot alter this situation significantly.** The spatial vulnerability assessment in Mexico City offers an interesting discovery that the spatial clusters regarding housing, education, labor, and health are spatially similar. The intra-urban inequality is a result of the compounding effects of multi-vulnerabilities. The multi-dimensional interventions are required to address those challenges. For example, to reduce the adverse impact of sprawled and fragmented urban development, spatial planning with proper municipal services and amenities would be placed to manage urban growth and achieve sustainable and equitable development outcomes.

#### 4. Conclusion

49. **Intra-urban inequality is large and critical in cities of developing countries.** The gaps in being planned, built, and used make it hard to break a vicious circle of intra-urban inequalities. On a personal level, people from poor neighborhoods are trapped in a vicious cycle of poverty and low-upward mobility due to limited education and employment opportunities. On a city level, due to the low level of human resources and limited labor market, the city itself did not enjoy the benefits of an agglomeration economy; instead, it experienced low productivity owing to the adverse impact of rapid urbanization. Moreover, unplanned and uncoordinated urban plans and policies largely contribute to the misallocation of municipal resources.
50. **Given our empirical finding—small cities' population growth exacerbates intra-urban inequality more than large cities, the cities of developing countries would face rising intra-urban inequality.** Developing countries have driven the growth of the urban population. In 2019, 3.3 billion people resided in developing countries' urban areas, which accounts for 51.1 percent of the total world population. If this urbanization trend in developing countries continues, the projected urban population in 2050 will be 5.5 billion, which accounts for 65.5 percent of the total world population.<sup>76</sup> In developing countries, some town centers and peri-urban areas will be transformed into small cities facing rising intra-urban inequality.
51. **Different underlying mechanisms of spatial inequalities exist across different cities worldwide, but the basic premise is that all urban issues are interlinked.** Cities face a set of challenges, including economic isolation, low-dense, and sprawled development, low-education attainment, and limited services and amenities. It is critical to note that these issues are interlinked together and have long-term impacts on society, as seen in the case of Mexico City.
52. **Intra-urban inequality is a structural problem resulting from a gap between how the city is planned, built, and used.** As seen in the case of Amman, the master plan cannot be implemented in a single step or within a short period of time. Rather, the plan necessitates taking incremental steps over time and coordinating a variety of existing rules and regulations and emerging challenges. In particular, for cities suffering from external shocks such as the influx of refugees, the current planning regulations cannot have the flexibility to accommodate them. The spatial inequality is a product of these gaps. Therefore, the master plan and planning regulation should be used in conjunction with the development of institutional capacity, investment strategy, and incentive schemes.

*1. Institution: Build the capacity and culture within planning institutions to address the complex urban problem and to be prepared for the challenges of tomorrow. It is critical to note that institutions must be prepared to operate flexible planning rules and regulations to suit different needs and challenges. For example, the zoning amendment is not a simple process in the traditional planning system; however, it should be enacted easily and efficiently to achieve planning outcomes and development goals.*

*2. Investment: The infrastructure investment strategy should be tailored to demand. While the investment decisions on infrastructure have been made through a top-down approach, the strategy must be based on meeting the growing needs of the city's population, industrial locations, employment opportunities, and amenities. Infrastructure investment has long been viewed as an important part of guiding urban development; however, more attention*

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<sup>76</sup> UNCTAD (2020) Handbook of Statistics 2020 – [https://unctad.org/system/files/official-document/ser-rp-2020d1\\_en.pdf](https://unctad.org/system/files/official-document/ser-rp-2020d1_en.pdf)



*should be paid to spatial allocation and projections since resource misallocation could lead to significant financial burdens for governments and municipalities*

*3. Incentive: Goodwill is not enough to encourage developers/residents to follow the rules and regulations. Incentives are useful ways to strengthen ties with the planning and development by guiding growth, targeting desirable areas, and encouraging compliance with broader developmental goals without further regulation. Financial savings, relaxed regulations (e.g., increased density and mixed land use), expedited approval, waivers of fees, and taxes are examples of incentives.*

53. **Intra-urban inequality acts as a bottleneck to promoting cities' opportunity, economic vibrancy, and social mobility.** This paper explores intra-urban inequalities through rigorous literature reviews, empirical findings, and case studies. These various approaches resulted in one conclusion that intra-urban inequality in cities of developing countries would continue and persist. Since this urban challenge is often stemmed from outdated rules and regulations which cannot meet the needs of emerging populations and markets, innovative approaches—e.g., particularly focusing on institutional capacity building, market-based investment strategies, and incentive schemes, should be considered.

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