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Spatial Closeness of Population and Economic Growth

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We look at the spatial angle of economic growth. Specifically, we assess whether areas where people live closer together experience faster growth. Traditional measures like population density or urbanization are not optimal, as they are affected by large uninhabited areas or capped, respectively. We thus introduce a new measure Spatial Population Concentration (SPC) that captures how many people live on average within a given radius of every person within a geographic area. This measure allows for a more accurate measurement of the population concentration than traditional measures, as it does not share some of their shortcomings. Next, we show for U.S. counties that areas with a high spatial population concentration experience faster growth. We nd that counties with a low value of SPC measure in 1990 experienced substantially lower GDP growth over the next 25 years.

Urbanization is growing at a fast pace across the world. How close people live together is instrumental for the exchange of ideas and hence innovation and economic growth. There have been already extensive studies showing that cities where people live close together can act as a growth engine of the economy (Chen et al., 2014; Gollin et al., 2016; Jedwab and Vollrath, 2015; Jedwab et al., 2017). In response, various concepts have been proposed as to how cities should be designed and how close people should live together. One open policy question is how large this distance should be to maximize economic activity. For instance, should we aim for concepts such as the fifteen-minute city (Moreno et al, 2021) where every person should be able to work, shop, enjoy leisure, etc. within fifteen minutes of their home, or should we rather aim for a smaller or larger radius?

In order to address this question, we first introduce a new measure of how close together people live. **There exist some measures for how close people live together like population density or urbanization rates. While these measures can distinguish densely populated areas, they have their short comings. Particularly, population density ignores uninhabited areas and does not distinguish how close people live within urban or rural areas. In addition, these measures cannot easily be used to assess whether living closer together or further is better for economic growth.**

We introduce a new measure for how close people live together and call this spatial population concentration (SPC). This measure intuitively captures how many people live, on average, within a given radius of every person in a specific area. More formally, it takes a radius 'd' around a location 'i' and measures the number of people within that radius (n_{di}). For a given area (e.g., a state or country), this number 'n_{di}' is averaged across all locations 'i', weighted by the number of people at each location 'x_i':

$$SPC_d = \frac{\sum_{i=1}^{N} x_i * n_{di}}{\sum_{i=1}^{N} x_i} - 1$$

This measure requires more data than population density, but it reflects more accurately how close people live together. In addition, it can be easily aggregated as the aggregate measure of two areas is simply the weighted average of the population.

Visual Representation of SPC

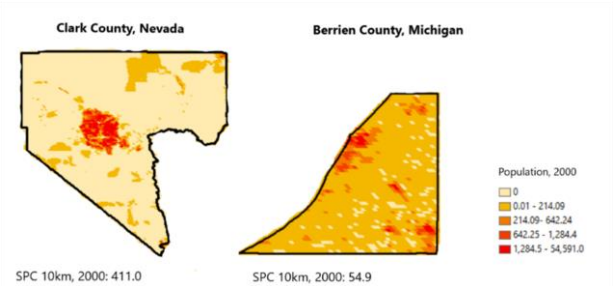

Figure 1: Comparison of Spatial Population Concentration and Population Density – within the United States

Figure 1 shows two U.S. counties with similar population densities. Clark County, NV (Las Vegas) has a substantial desert area around the city which reduces the population density. This causes it to have a similar density to Berrien County, MI, which does not have a major city. Due to

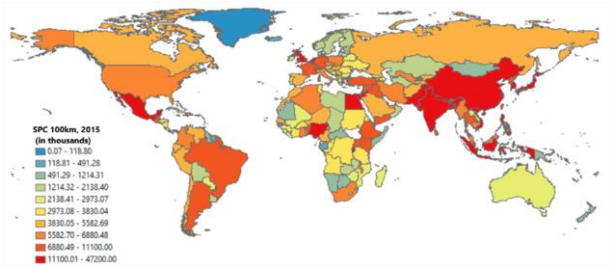

Figure 2: Distribution of SPC measure for 100km distance in 2015

not having a major city however, Berrien County exhibits a much lower SPC value than Clark County.

Figure 2 presents the SPC measure for 100 km distance in 2015 for the world based for quantiles. The counties (countries) shown in blue color are where people are more spread out compared to the counties (countries) shown in red where people concentrate.

How Close Should People Live Together?

Dependent variable:	log change in income per capita (1990 - 2015)						
SPC Distance (d):	(15 km)	(20 km)	(25 km)	(50 km)	(75 km)	(100 km)	(200 km)
log SPC 1990	24.35**	36.30***	50.06***	28.77***	13.17***	4.68	-9.12*
	(10.10)	(10.43)	(7.56)	(5.20)	(4.63)	(4.43)	(5.39)

Table 1: Impact of SPC on Income per Capita

In order to assess, how close people should live together to maximize GDP growth, we regress the logarithm of our SPC measure for 1990 on the change in income per capita between 1990 and 2015 at the U.S. county level for various distances. As Table 1 shows, how close people live together is positively related with income per capita growth for most distances. The largest coefficient (and impact) is for a radius of 25km. This suggests that 25km is the relevant distance for policy purposes and policy makers that want to increase GDP might want to focus on creating densely populated areas with that radius rather than very larger cities or smaller cities. Indeed, this finding suggests that the 15min cities concept does not maximize GDP and a larger radius might be more advisable from that perspective. Bürgi and Gorgulu (2021) show that this result still holds after a number of robustness checks.

Additional policy relevant findings in Bürgi and Gorgulu (2021) include that the interaction between SPC and infrastructure measures reach a maximum impact on growth between 25km and 50km, suggesting that infrastructure within these distances of the city center should be prioritized.

Potential Additional Applications of SPC

The SPC measure can be applied to many contexts where the distribution of population is relevant. Here we present a few applications for which the SPC measure has potential applications:

- **SPC and energy infrastructure:** What are the implications of population density for siting of energy production facilities, infrastructure development, demand patterns, and public acceptance of new projects and technologies?
- **SPC, environment and climate change:** Are more densely populated areas causing more pollution? Will the most densely populated areas also be the most affected by climate change?
- **SPC and the spread of diseases:** To what extent does living closely together increase the spread of diseases? Are areas where people live closely together more affected by infectious diseases (e.g., see Bürgi and Gorgulu, 2020)?
- **SPC and other critical infrastructure:** Is the contribution of infrastructure linked to how close people live together? Where should infrastructure projects be developed to benefit the largest population?

References

Bürgi, C., and Gorgulu, N. (2020). Social Distancing and the Economic Impact of Covid-19 in the United States. CESifo Working Paper Series 8577, CESifo.

Bürgi, C., and Gorgulu, N. (2021). The Impact of the Spatial Population Distribution on Economic Growth. Copenhagen Business School [wp]. Working Paper / Department of Economics. Copenhagen Business School No. 17-2021CSEI Working Paper No. 2021-07

Chen, M., Zhang, H., Liu, W., and Zhang, W. (2014). The global pattern of urbanization and economic growth: evidence from the last three decades. PloS one, 9(8):e103799

Gollin, D., Jedwab, R., and Vollrath, D. (2016). Urbanization with and without industrialization. Journal of Economic Growth, 21(1):35–70.

Jedwab, R., Christiaensen, L., and Gindelsky, M. (2017). Demography, urbanization and development: Rural push, urban pull and... urban push? Journal of Urban Economics, 100(98):6–16.

DOI 10.22439/csei.pb.014

Jedwab, R. and Vollrath, D. (2015). Urbanization without growth in historical perspective. Explorations in Economic History, 58:1–21.

Moreno, C., Allam, Z., Chabaud, D., Gall, C., and Pratlong, F. (2021). Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities. Smart Cities, 4(1), 93–111.