Tracking Migration in Real Time With "Big Data"

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Introduction

Migration was a key differentiator in the U.S. housing market performance last year both across and within markets. As the pandemic spread, people moved from more densely populated and more expensive gateway metro areas to more affordable ones as well as from cities to suburbs. Residential demand responded quickly to the changing patterns and the year ended with an unusually wide variation in rent growth and home price appreciation around the country. As the public health situation started to improve in early 2021 and the economy re-opened, did migration flows change too? Are migration patterns responding to the recent increases in the Delta variant infections?

Our analysis based on mobile phone data sheds light on these questions and provides early evidence that for the most part population losses or gains (depending on location) directly triggered by the pandemic are likely temporary. We also find that mobile phone data can be a good predictor of near-term domestic net migration in general and therefore a key alternative source relative to the official estimates that are provided by the Census Bureau, which has at least a one-year lag. Not only does this new data allow us to track domestic migration flows in real time but it also offers a few important additional advantages including the ability to conduct analysis at the most granular levels of geography as well as by various demographic characteristics such as household income or age.

Data Validation

Using mobile phone data to track migration is still an emerging area of research. There is no shortage of firms that now offer a wide range of products and services based on such data to helps their customers answer all kinds of questions that have to do with locational attributes. Not surprisingly, it is a particularly hot topic in prop-tech that is transforming real estate, including how firms search for and analyze potential opportunities for investment and development. Promises of any innovation must be proven out; however, and big data is no exception. While it makes sense that technology would make it possible to track people's daily mobility through their mobile phone usage, we could not find any published studies or articles on how accurately this can be done–at least relative to publicly verifiable U.S. sources. This prompted us to do our own analysis and the results turned out to be quite encouraging.

One of the first steps in the analysis was to compare our implied domestic migration estimates based on mobile phone data to the actual domestic migration estimates provided by the Bureau of the Census across states, metro areas, counties, and cities.[2] Once we confirmed that the two sets of estimates are highly correlated across various geographies, the next step was to determine whether our estimates of domestic migration in the current

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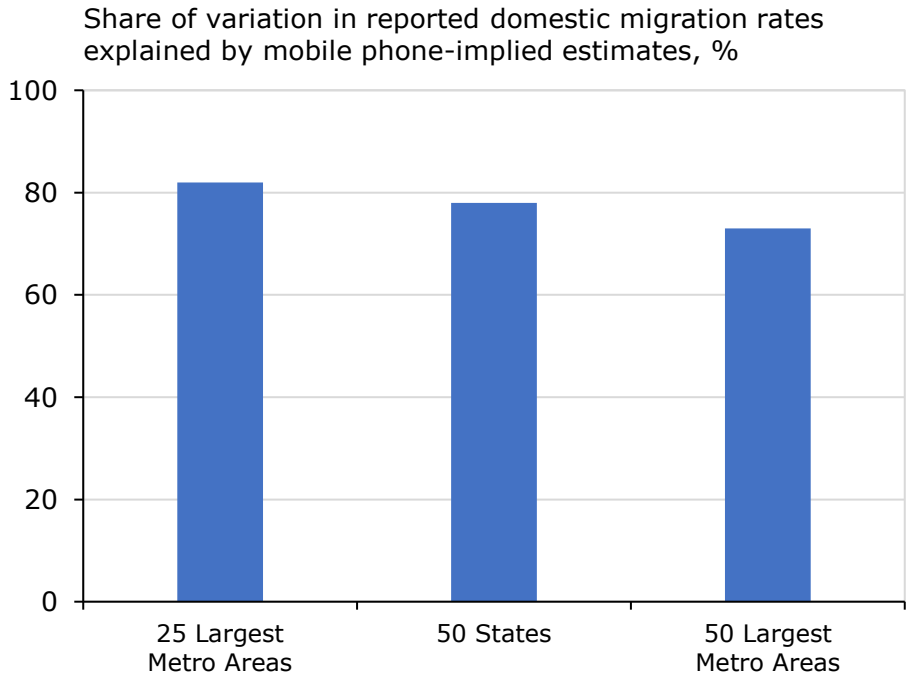
[1] Authors would like to thank Danny Kaminsky of StratoDem Analytics for his data support.
[2] StratoDem Analytics integrates raw mobile phone data provided by Unacast with StratoDem economic and demographic nowcasting and forecasting to measure aggregate migration rates at the neighborhood level by household characteristics.

year could also be reliably used as a predictor of the official domestic migration figures reported by the Census in the *following* year. We found that they could, especially in more populous parts of the country where large mobile phone data sets provide more representative samples as shown in the chart below. Of course, it helps that domestic migration patterns change gradually from year to year, but it was important to prove that the new alternative source of high-frequency (monthly) data can be used as an accurate leading indicator for the main driver of population growth across markets.



1) Sources: Bureau of the Census, StratoDem Analytics – An Altus Group Company, Berkshire Research.

Domestic Migration During the Pandemic

Once the data was validated, we were much more confident answering two key questions that arose last year as the pandemic started regarding major impacts on domestic migration trends:

1) Are people moving out of the more expensive and more densely populated metro areas (especially coastal and gateway markets) and, if so, are they moving out at greater rates than in the prior year?

2) Are people moving out of major cities into suburbs more than they did in the prior year or are they leaving for other metro areas?

Our initial findings, which are now also supported by the recently released Census estimates, have suggested that *across* markets the pandemic did exacerbate domestic migration trends that were in place for some time. As the table below shows, domestic migration has indeed improved or kept pace in most metro areas or divisions where it was already strong before the pandemic but has worsened on the opposite side of the spectrum.

Top and Bottom Metro Areas for Domestic Migration in 2020

	Rate, %	
Top 10	**2019**	**2020**
Austin	1.9	2.1
Phoenix	1.5	1.6
Jacksonville	1.3	1.3
Raleigh	1.3	1.3
Tampa	1.1	1.3
Las Vegas	1.4	1.2
Charlotte	1.0	1.1
San Antonio	0.8	1.0
Nashville	0.8	0.9
Dallas	0.7	0.8
Average	**1.2**	**1.3**

	Rate, %	
Bottom 10	**2019**	**2020**
Philadelphia	-0.6	-0.7
Newark	-0.6	-0.7
Oakland	-0.5	-0.8
Detroit	-0.7	-0.8
Chicago	-0.9	-1.0
Los Angeles	-1.0	-1.1
Miami	-1.7	-1.5
San Jose	-1.4	-1.5
New York	-1.4	-1.6
San Francisco	-0.9	-1.6
Average	**-1.0**	**-1.1**

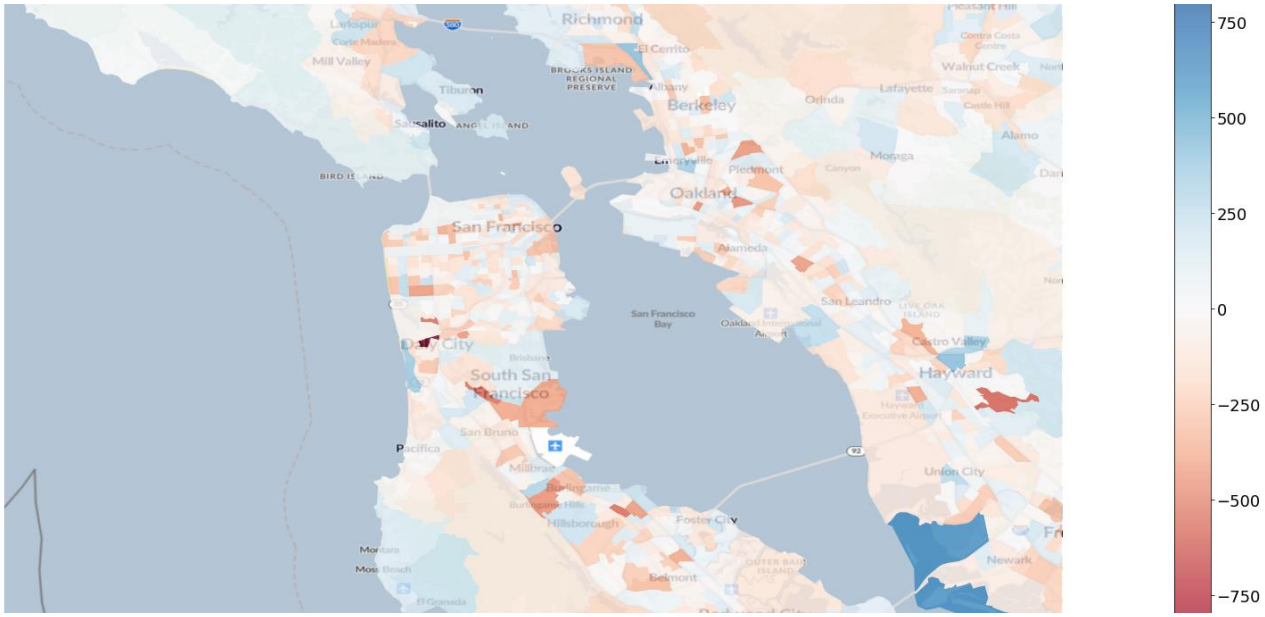
Sources: Bureau of the Census, StratoDem Analytics – An Altus Group Company, Berkshire Research.

In the case of the domestic trends *within* markets, the picture remained more nuanced. The data shows, for example, that for many major cities the pandemic did not materially affect domestic migration trends. In fact, urban population flows have even improved relative to the prior year in places such as Austin, Denver, Houston, Phoenix, Raleigh, San Antonio, Seattle, and Tampa. At the same time, the pandemic has reinforced migration out of the large and densely populated major cities in gateway markets including New York, Los Angeles, Chicago, Boston, and San Francisco. Our preliminary analysis suggests that most of the people who left those cities last year did move into neighboring suburbs. Despite the influx of new dwellers, suburbs still have experienced net out-migration at about the same rates as before the pandemic. In other words, *both* cities and suburbs experienced net population move-outs into other markets–usually in other states. Texas, Florida, Tennessee, Arizona, and Nevada were among the major beneficiaries of these trends.

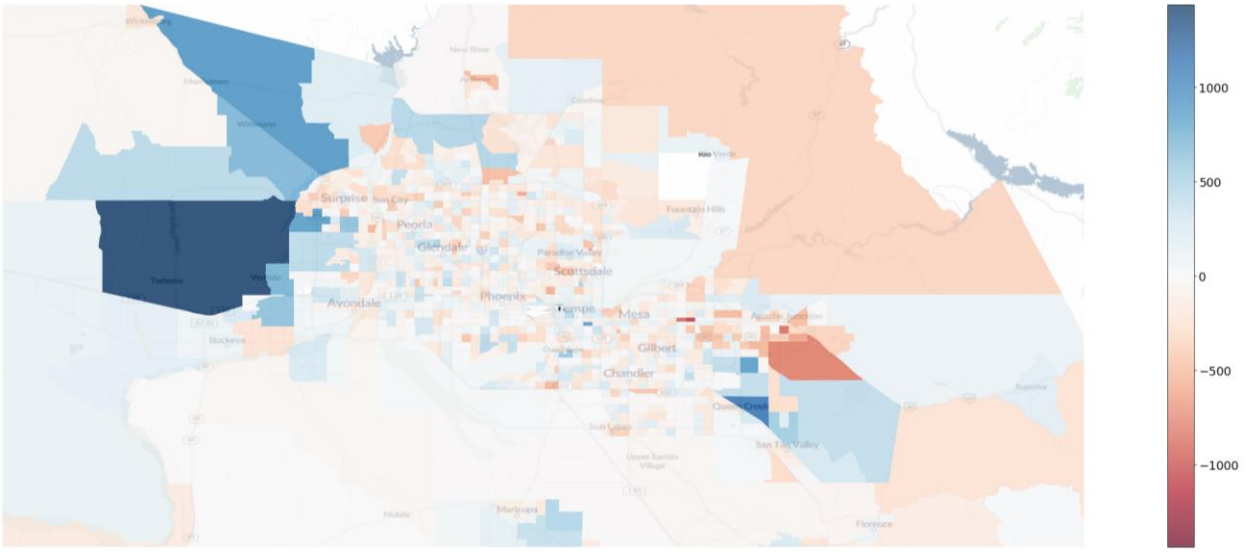
The new data allows us to look at the population flows even more closely and to have a fuller picture of how migration trends varied *within* cites or suburbs as well as in terms of demographic profile of the movers. For example, the map below shows that while the San Francisco metro area as a whole lost population last year, some neighborhoods have added hundreds of new residents. Meanwhile, some of highest migration flows into Phoenix took place in large, rapidly expanding master-planned communities west of the city such as Tartesso and Verrado. It was also instructive to find out that a typical migrant from San Francisco to Phoenix was 39 years old with a household income of approximately $150,000, while those moving from Phoenix to San Francisco were 37 years old with a much lower household income of $88,000.

Estimated net migration from March 2020 to April 2021

San Francisco, CA



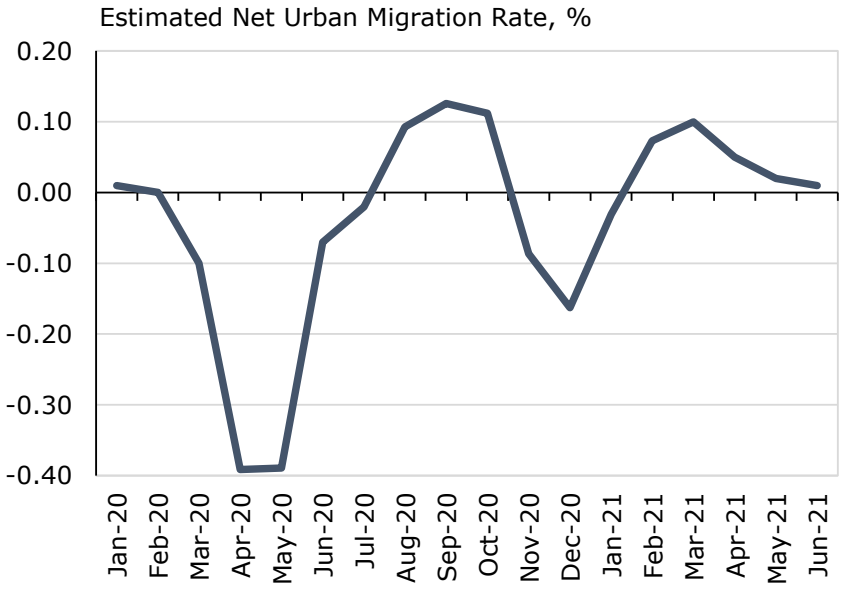
Phoenix, AZ



Sources: Unacast, StratoDem Analytics – An Altus Group Company, Berkshire Research

Looking Ahead

Our analysis suggests that as the public health situation improves, most of the population losses or gains (depending on location) directly linked to the pandemic are likely to be temporary. The chart below shows estimated implied rates of migration into/out of urban neighborhoods in gateway markets that experienced tangible negative migration flows last year measured using monthly mobile phone data.



Sources: Bureau of the Census, StratoDem Analytics – An Altus Group Company, Berkshire Research.

In all of these cities, population flows were closely tied to the two waves of new infections in the spring and winter. As the waves of infections subsided, migration flows quickly turned positive suggesting that the pandemic related move-outs would partially reverse as the economy re-opens, depending on how flexible businesses would be regarding work from home arrangements with their employees. At the same time, the data also shows that urban migration is now also slowing and in some cities turning negative again as the Delta variant infections are on the rise.

The pandemic is still only part of the story; however, as all of these cities (and in most cases also their suburbs) were already experiencing negative domestic migration before last year and it will take time for those trends to stabilize or turn around. It is certainly encouraging to see that people are now coming back into urban areas, but the real recovery will only start when domestic migration exceeds pre-pandemic rates, which has yet to take place.

Conclusion

Mobile phone data is a powerful alternative source for evaluating domestic migration across and within markets. It allows us to track it with high frequency and granularity, including stratification by age and income, and can also be used to predict near-term population flows and potentially other demographic trends. As with any new data source, further research will be needed to better understand the full range of its potential applications, but it is already proving to be quite effective in explaining variations in regional growth patterns as well as factors that might be driving them.