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Immigration and the labor market in the post-pandemic recovery

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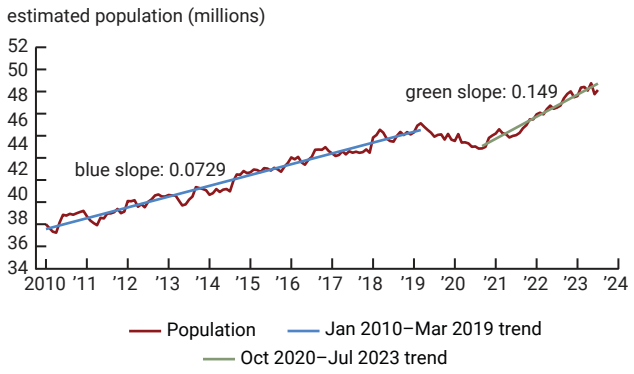
Standard estimates based on the main household survey used to shed light on labor markets—the *Current Population Survey* (CPS)—suggest that after a significant drop during the pandemic, recent rapid growth has brought the foreign-born population in the United States back to, or above, levels predicted by the pre-pandemic trend. However, we document that the weighting factors used to make the CPS nationally representative have recently displayed some unusual movements and conclude that standard estimates of the foreign-born population may currently be too high.

1. CPS estimated foreign-born population, with trends



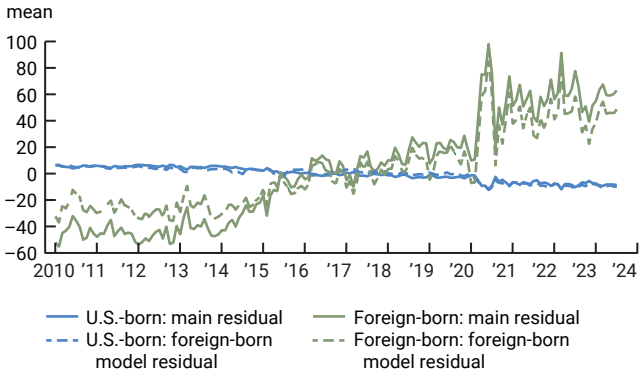
Source: U.S. Bureau of Labor Statistics, *Current Population Survey*, from IPUMS.

The CPS is sponsored jointly by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics (BLS) and is the primary source of labor force statistics for the population of the United States. Between 2010 and 2019, the growth in CPS estimates of the foreign-born population was steady, averaging 0.75 million per year. Estimates of the immigrant population began to decline in 2019, however, and slid further with the pandemic. This led to a shortfall of 2 million people in the working-age foreign-born population relative to its trend by the end of 2021 (Peri and Zaiour, 2022).[1] However, in recent months the CPS[2] has shown a surge in immigration to the U.S. According to the CPS, following the 2019–September 2021 decline, the foreign-born population began growing at 1.5 million per year, twice the pre-2019 trend's rate (see figure 1).[3] This remarkable growth in the foreign-born population in the past two years has been enough to put the aggregate foreign-born population number back where it would have been had the pre-2019 growth trend continued until today.

Sampling and weights in the CPS

Challenges in collecting surveys have increased in recent years (Meyer, Mok, and Sullivan, 2015). They have been exacerbated by the pandemic (*The Economist*, 2023). In their paper "Coronavirus infects surveys, too," Rothbaum and Bee (2021) point out that the CPS suffered from considerably more nonresponse during the pandemic, and that this has important implications for sampling weights.[4] Here we explore the CPS respondent sample and weights with a focus on estimating the foreign-born population.[5]

2. Average residuals from the model for the CPS weights



Source: U.S. Bureau of Labor Statistics, *Current Population Survey*, from IPUMS.

The CPS is a nationally representative monthly survey of the U.S. population based on a rotating panel of approximately 60,000 households (and a response rate of around 85%). Each household spends four months in the sample, eight months out, and four months in again. Under the sampling frame used by the U.S. Census Bureau, every respondent in the survey is assigned a weight, corresponding to the number of U.S. residents the individual represents.[6] The average CPS respondent in July 2019, for example, represented 2,765 people. Summing the weights of all survey respondents, one obtains the Census Bureau's estimate of the U.S. (noninstitutionalized) population.

Designing the weights is complicated and a thorough description is beyond the scope of this publication.[7] Briefly, the CPS creates weights to hit demographic population numbers within states. Importantly, birthplace or citizenship are not among the traits targeted in the design of the weights. Therefore, unexpected changes in the response rate—for example, between the foreign-born and the native-born during the pandemic—have the potential to lead to changes in the population counts of these groups.

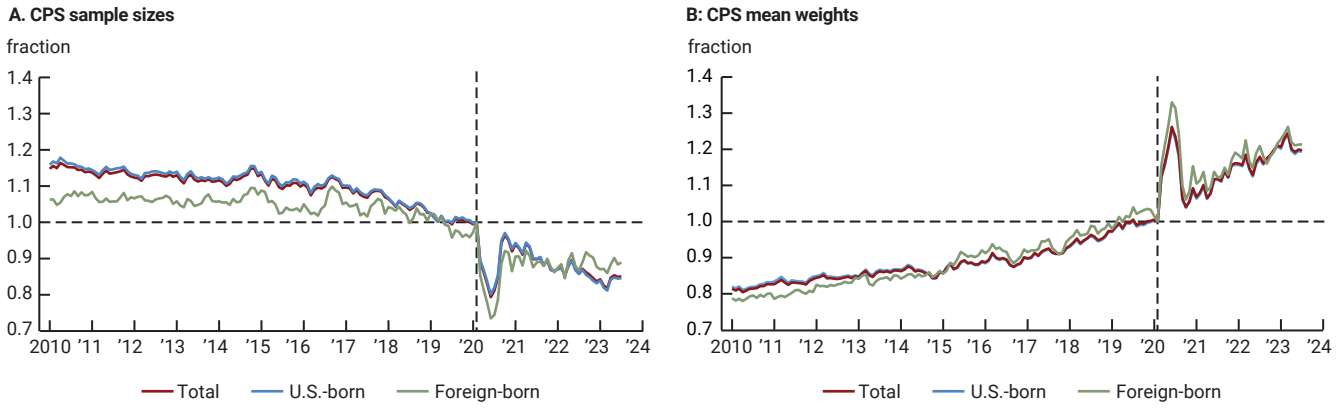
Modeling CPS weights

To explore the role of the weights in estimating the size of the foreign-born population, we estimate a rich linear model of the individual-level weights as a function of age group, sex, and race/Hispanic ethnicity[8] interactions with survey rounds, rotation groups, and states. The data include all respondents between January 2010 and June 2023 (19.8 million observations). The model allows the mean for each age group-sex group-race/Hispanic ethnicity group cell to vary by state (3,570 fixed effects), by survey round (11,270 fixed effects), and by rotation group (560 fixed effects).[9]

Our model explains 78% of the variation in individual sample weights. The remaining 22% reflects additional subtleties in how the BLS computes weights. This is because the probability of being sampled into the CPS is not the same for every household, and because households that are sampled differ in the probability with which they comply with the survey request. In the absence of corrections made by the BLS, these features would make the CPS sample unrepresentative of the U.S. population. More generally, the residuals from our model capture additional information used by the BLS for weight assignment beyond what we can observe in the data. We take a closer look at these residuals, particularly their behavior in relation to foreign-born status, in figure 2.

The solid lines plot the average residual among the foreign-born and the U.S.-born. Two remarkable patterns are apparent: First, a general increase over time in the average residual in the weights among the foreign-born (green line). Prior to 2015, the average foreign-born weight was much lower than our basic model predicts. After 2017, the opposite is true. Remarkably, the positive mean residuals among the foreign-born became much larger after the pandemic shock of early 2020. The sharp jump in the mean residual around February 2020, as we will see, corresponds to the large loss in respondent sample size that the CPS suffered in March 2020, the onset of the Covid-19 pandemic national emergency (see IPUMS). Second, we see a spike in the mean residual for the foreign-born that did not return to its previous level. The pandemic period led to a structural break in the mean weights for the foreign-born.[10] Thus, the CPS is now giving foreign-born individuals with the same demographic characteristics (sex, race, age, location) a much higher weight than it did before March 2020.

3. Average weights and sample sizes in the CPS since 2010, relative to February 2020



Source: U.S. Bureau of Labor Statistics, *Current Population Survey*, from IPUMS.

To try to understand this change better, we estimated a second model that includes a host of additional characteristics as predictors: education level, family size, marital status, industry of employment, occupation, metropolitan area, and county. The dashed line in figure 2 plots the mean residuals of this expanded model. While including these additional variables explains a considerable fraction of the residual variation in foreign-born weights before 2014, they barely change the mean foreign-born residuals in the post-pandemic period.[11] Based on observable characteristics (both those used and not used in the assignment of CPS weights), we cannot account for the larger weights assigned to the foreign-born in the post-pandemic period.

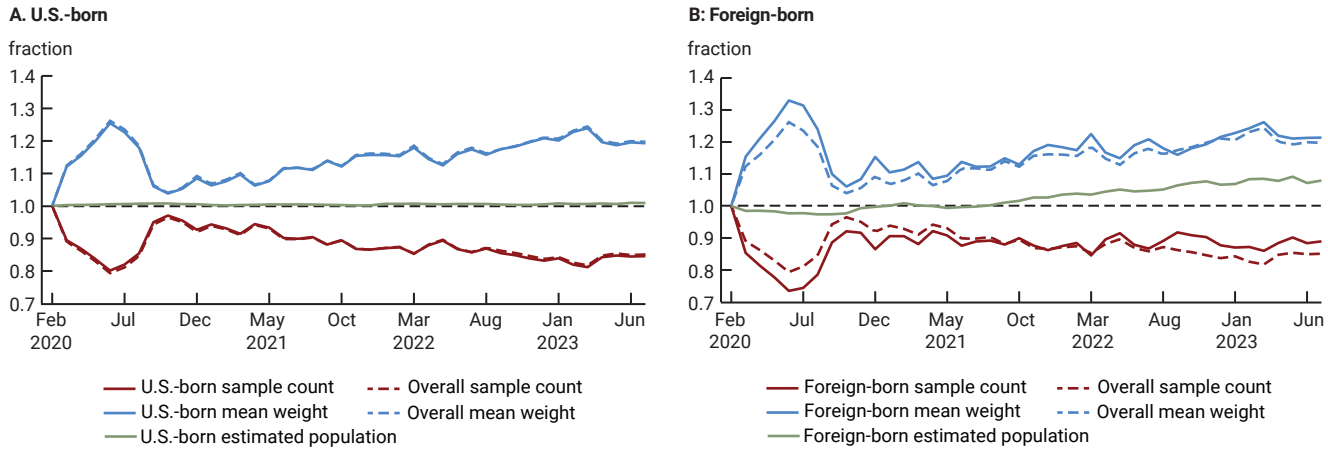
Respondent sample size and weights

Because the CPS is a nationally representative survey, individual-level weights are closely related to the survey's number of respondents. In what follows, we refer to the number of individuals responding to the survey as the sample size. In panel A of figure 3 we show the sample sizes for U.S.-born (blue), foreign-born (green), and for the overall population (red) since 2010, relative to the sample sizes in February 2020. As a result of the increased nonresponse rate, the overall sample size was 15% larger in 2010 than in early 2020. Today, it is 15% smaller than it was in early 2020.

Beyond the general downward trend, the onset of the pandemic period had a major impact on the CPS's number of respondents. In June 2020, the U.S.-born number of respondents was 20% smaller than it had been in the February 2020 round, while for the foreign-born it was 25% smaller. The Census Bureau had to drastically increase the weights to account for this sample loss (see the spike in panel B of figure 3). As a simple adding-up constraint, to make sure the smaller samples still reflect the overall features and size of the U.S. population, the average weight in the sample must be growing over time: With a growing population and a shrinking sample size, each survey respondent represents more U.S. residents. Panel B of figure 3 plots the mean weights for U.S.-born (blue), foreign-born (green), and the overall population (red) since 2010, again relative to February 2020.

The figure reveals a key pattern: Following the reopening of the economy by late 2020, the CPS sample size trends for U.S.-born and foreign-born have behaved very differently. By October 2020, the sample size had rebounded to 95% and 92% of the February 2020 size for the U.S.- and foreign-born, respectively. But since then, the U.S.-born sample size has been falling faster than in the pre-pandemic period; and it is now only 85% of its February 2020 size (blue line in panel A of figure 3). The foreign-born sample, in contrast, has remained relatively steady at around 90% of its February 2020 size (green line in panel A of figure 3). In practice, these two different trends have led to a recomposition of the CPS sample: Prior to the pandemic, the foreign-born represented, on average, 12% of the CPS sample. Today, they represent more than 13%.

4. Average weights and sample sizes in the CPS since 2020, relative to February 2020



Source: U.S. Bureau of Labor Statistics, *Current Population Survey*, from IPUMS.

While the post-pandemic rebounds of the U.S.-born and foreign-born sample sizes have been very different, the evolution of the mean weights for both groups has been very similar, as seen in panel B of figure 3. Because the sample sizes have behaved so differently while the mean weights have behaved so similarly, the implied mean weight changes in response to sample size changes have also been very different.

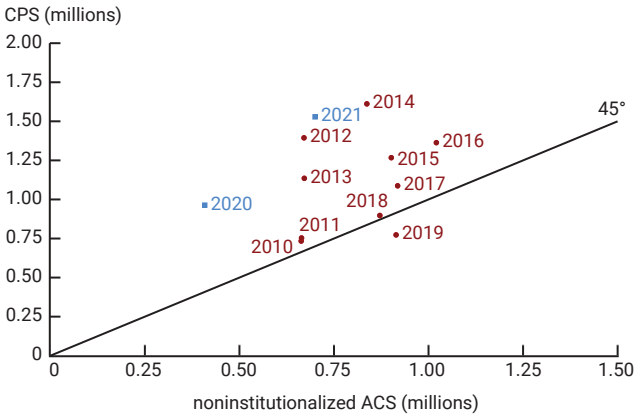
In figure 4 we home in on the joint behavior of sample sizes and mean weights starting in February 2020. Panel A plots the mean weights (blue), sample size (red), and the U.S.-born population (green). Panel B plots the same statistics for the foreign-born population. In both panels the dashed lines plot identical numbers for the overall population for reference. We plot all series relative to their February 2020 levels.

The blue lines in panels A and B of figure 4 show that both the U.S.-born and the foreign-born mean weights behave similarly; they both closely track the variation over time in the overall mean weight. The red lines show, in contrast, the distinct path of the foreign-born sample size. The different path of the foreign-born sample size, together with the relatively similar behavior of the mean weights of both groups over time, implies a steeper path for the foreign-born estimated population (the green line in panel B). From March 2020 to June 2020, the foreign-born sample size fell proportionately more than the U.S.-born sample size while its mean weight did not adjust in the same proportion. Later in 2020, the U.S.-born sample size kept trending down and its mean weight kept growing. The foreign-born mean weight has followed this U.S.-born mean weight trend, although the foreign-born sample has remained steady over this period. This suggests that the CPS foreign-born population estimates may have been too low at the beginning of the pandemic and may be too high today. An estimate of the foreign-born population that was too low early in the pandemic and too high later would imply an increase in the foreign-born population growth that is not warranted.

Taking stock

The discussion above leads us to consider the following thought experiment: What would the implied foreign-born population be, had the average weights for the foreign-born responded to foreign-born sample size changes in the same way that the U.S.-born weights responded to the changes in the U.S.-born sample size? To do this, we compute a "weight elasticity" as the growth rate of the mean weight for a population group divided by the growth rate of the sample size for that group between any survey month and a baseline period (which we choose to be February 2020). When the elasticity for the foreign-born is larger than the elasticity for the U.S.-born, for example, a given percentage decrease in the foreign-born sample size translates into a larger percentage growth in the average weight of the foreign-born, relative to the percentage growth in the

5. CPS versus ACS estimated recent (within the last year) immigrant population



Sources: U.S. Census Bureau, *American Community Survey*, and U.S. Bureau of Labor Statistics, *Community Population Survey*, both from IPUMS.

average weight of the U.S.-born in response to the same percentage decrease in the U.S.-born sample size.[12] We then use these elasticities month to month to compute an alternative foreign-born population series, under a scenario where the foreign-born weights change in the same proportion to changes in the sample size as the U.S.-born weights did.

We find that under this scenario, the estimated early 2020 fall in the foreign-born population would have been slightly smaller and its estimated growth after May 2021 would have been considerably slower. The net effect of a smaller fall in the foreign-born population early in 2020 and smaller growth later on would imply a net growth of the foreign-born population in this period of 1.3 million, in sharp contrast with the CPS's 4 million estimate.

Of course, we are not claiming that the responsiveness of the weights for the foreign-born to sample size changes should have mimicked the one for the U.S.-born.[13] The exercise is not intended to provide a new estimate of the foreign-born population growth. It is only intended to highlight that the sharply distinct behavior of the foreign-born weights in this period plays an important role in the resulting population estimates from the CPS.

We also conducted a bounding exercise using data from the Department of Homeland Security (DHS). We use numbers of new immigrant visa holders, of nonimmigrant visa holders, of apprehensions at the border, and of new asylum and refugee claimants, combined with some assumptions, to estimate the net change in the foreign-born over the past 33 months.[14] Under our preferred assumptions, the DHS numbers suggest about 2.1 million new immigrants since October 2020, while the CPS counts over 4 million. Even under our most generous assumptions, the DHS numbers are 500,000 lower than CPS estimates (more details of this exercise are provided in our recent working paper).

Other sources of information are consistent with the view that the foreign-born population may be overestimated in the CPS. In figure 5, we compare the estimates for the number of recent immigrants (within the past year) in the CPS and in the *American Community Survey* (ACS) over the past 12 years.[15] In most years the estimates are quite similar, but 2020 and 2021 are some of the farthest off from the 45-degree line. For 2021, the ACS estimates 750,000 new immigrants, while the CPS reports 1.5 million.

We also find other evidence consistent with an overcount of the foreign-born population. In our working paper, we show that labor markets have been especially tight in industries that had heavy concentrations of foreign-born workers prior to the pandemic. This was not driven by changes in the foreign-born employment composition across industries, which has remained stable before and after the pandemic. We also show that labor force participation rates for the foreign-born recovered quickly and have remained high post-pandemic and that recent immigration is heavily composed of working-age individuals, suggesting the tightness in these industries is not driven by decline in the labor force participation of the foreign-born.

Discussion

Routine data collection was one of the many activities that faced extreme challenges during the pandemic. It is well documented that the in-person interviews for sample entrants were suspended for months, as it would not have been safe for interviewers or interviewees to conduct them. In-person interviews for new

survey entrants did not resume at the same time in all parts of the country. It seems plausible that differences in data collection methods could lead to differences in response rates, and that this, combined with differences in demographics by geography, could lead to unforeseen sample changes. Without a crystal ball, and with the important goal of getting the overall size of the population right, estimates of some subpopulations may be off. As a proper assessment of the state of the supply chain following the pandemic should include the role of foreign-born labor as a salient component of the labor supply (Powell, 2022), it will be important to compare immigration estimates from the most recent ACS and decennial censuses to better understand how the labor market is evolving in this unprecedented time.

We thank Daniel Aaronson, Lisa Barrow, Jason Faberman, Bart Hobijn, Luojia Hu, Spencer Krane, Jonathan Rothbaum, and Daniel Sullivan for their suggestions.

Notes

[1] Recent analysis and commentary focus on links between immigration and the post-pandemic labor market. For example, Duzhak (2023) investigates the link between the v/u ratio (vacancies relative to unemployment) and net international migration. Goldman Sachs economist Tim Krupa notes that, "The foreign-born labor force has made a disproportionate contribution to reducing the jobs-workers gap" (Salmon, 2023). Krugman (2023) concurs.

[2] We access the CPS at www.ipums.org; see Flood et al. (2022).

[3] We define "foreign-born" based on citizenship status rather than on country of birth. The foreign-born are noncitizens or naturalized citizens and exclude those born abroad to American parents. If we include those born abroad of American parents in the foreign-born group the changes are very similar, but the levels are higher.

[4] Rothbaum and Bee (2021) focus on the CPS's *Annual Social and Economic Supplement* (ASEC) sample and propose alternative weights to account for the special nature of nonresponse during the pandemic. Using these alternative weights, they estimate a smaller 2020 foreign-born population than using the standard CPS weights. Mira and Bollinger (2021) estimate foreign-born population ranges that take into account the added uncertainty from item nonresponse in the CPS.

[5] We accessed the data from www.ipums.org, and the weight referred to is the final basic weight, *wtfinl*.

[6] For more details see U.S. Census Bureau (2019).

[7] The CPS uses a state-by-state two-stage probability sample design. First, the BLS divides the country into primary sampling units (PSUs), each consisting of a metro area or an adjacent group of counties. The BLS then groups these PSUs into strata based on demographic and labor force similarity and picks at random a PSU from each stratum. The BLS uses the number of unemployed men and women, the number of families with a female head, the number of households with three or more people, and additional industry and wage variables for stratification. In a second stage, the BLS picks at random a set of household units (HUs) from the selected PSU for interview. Each HU is assigned to a rotation group, and rotation groups are interviewed in a staggered fashion as follows: four consecutive interview months, eight consecutive noninterview months, and a final four consecutive interview months. The BLS assigns a base weight to each household and to each individual within a household to make each of the rotation groups nationally representative. This base weight is proportional to the household's probability of selection within its state. The base weight is adjusted in a first step to account for nonresponse. The adjustment entails redistributing the weights of the nonrespondents among respondents from PSU clusters with similar demographic characteristics. In a series of additional steps, the CPS adjusts the weights to more accurately reflect features of the joint distribution of race/Hispanic ethnicity, age, and sex at the state, national, and within-rotation group levels.

[8] We assign each respondent to a unique population-group category among the following: non-Hispanic White, non-Hispanic Black, non-Hispanic Asian or Pacific Islander, Hispanic, and other non-Hispanic.

[9] The model takes the form $\omega_{it} = \delta_{race_i,\ age_i,sex_i,state_i} + \gamma_{race_i,age_i,sex_i,rotationgroup_i} + \eta_{race_i,age_i,sex_i}\, t + \epsilon_{it}$, where ω_{it} is the weight of respondent *i* in survey round *t*.

[10] The slight negative trend in the mean residual among the U.S.-born simply reflects an adding-up constraint; our model, by construction, imposes an overall mean residual of zero.

[11] The additional variables appear to start having some explanatory power toward the most recent months.

[12] Consider the sharp fall in the sample size between February and June 2020. As panel A of figure 4 shows, the U.S.-born sample size fell 20 percentage points. In response, the mean weight for this group increased 25 percentage points, for an elasticity of 1.25. Panel B illustrates that in the same period, the foreign-born sample size fell by 25 percentage points. The mean weight for this group increased 32 percentage points, for an elasticity of 1.28. If the responsiveness of the mean foreign-born weight had been the same as the one for the U.S.-born, the mean weight would have increased 31.25 percentage points, close to the 32 percentage points that it actually increased. In contrast, consider the end point of our data series. After the sharp pandemic fall and partial recovery of the CPS's sample, in June 2023 the U.S.-born sample was only 85% its February 2020 size. Correspondingly, the mean weight for this group was 20 percentage points higher than in February 2020 for an elasticity of 1.33. During the same period, the foreign-born sample shrank 12 percentage points. Its mean weight grew 21 percentage points compared to February 2020, for an elasticity of 1.75. If the responsiveness of the mean foreign-born weight had been the same as the one for the U.S.-born, the mean weight would have increased only 16 percentage points rather than 21 percentage points, a substantially lower increase.

[13] This would only be the case if we believed that U.S.-born and foreign-born populations are growing at the same rate.

[14] Some of these assumptions may be heroic, but we can bound these as well. We assume 100% of those obtaining immigrant visas stay. Based on DHS (2021), we assume 1.2% of nonimmigrant visa holders stay. "Inadmissibles" are cases of individuals deemed as qualifying for expulsion under Title 42, so we set 1% as the fraction of those who stay in the U.S. We assume 100% of asylum seekers and refugees stay. We use the overall U.S. death rate of nine individuals per 1,000 to estimate deaths among the foreign-born. We do not have estimates of the emigration of the foreign-born, and this would only serve to increase our estimates of the size of the population. Most people who enter the U.S. unlawfully do so after thwarted attempts by border enforcement (Lopez, Passel, and Cohn, 2021), so we calculate this number as a "stay rate" of those apprehended at the border.

[15] The ACS has a much larger sample size but is released annually. As of this writing, the 2022 data have not been released. In order to define "recent" immigrant across years and data sources as consistently as possible, we consider those who have come within the last year. In the ACS, this can be defined directly since respondents can report that they came within the past year. In the CPS, respondents report in which window of years they arrived. The size of this window is not consistent across years. Therefore, we calculate the number of recent immigrants in a given year as the difference in the number of people who say they arrived in the most recent window between January and December. It is important to keep in mind that the way we measure recent immigrants in the CPS is based on a completed year of responses whereas the ACS is collected over the course of the year. In periods of rapid immigration, one might expect the CPS numbers to be higher than the ACS numbers just for this reason.

APPENDIX: WEIGHT ELASTICITIES AND BENCHMARKING EXERCISE

We define ω_{it} as the CPS weight of individual i in survey round t, $\bar{\omega}_t^j$ as the mean weight of group j in survey round t, and N_t^j as the sample size among group j in survey round t. We also define a time t "weight elasticity" as the growth rate of the mean weight for a group relative to the growth rate of the sample size for that group, between time t and a baseline time period (February 2020):

$$\varepsilon_t^j = \left| \frac{\left(\bar{\omega}_t^j / \bar{\omega}_0^j - 1 \right)}{N_t^j / N_0^j - 1} \right|, \quad j = fb, ub.$$

We then define

$$\rho_t \equiv -\varepsilon_t^{ub} \left(\frac{N_t^{fb}}{N_0^{fb}} - 1 \right)$$

as the adjustment factor, to compute benchmarked foreign-born population estimates under the assumption that the foreign-born weights should have moved in the same proportion to changes in the sample size as the U.S.-born weights did:

$$\hat{Pop}_t^{fb} \Big|_{counter} = \left(1 + \rho_t\right) \bar{\omega}_0^{fb} N_t^{fb}.$$

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