The Postpandemic U.S. Immigration Surge: New Facts and Inflationary Implications*

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ABSTRACT

The U.S. experienced an extraordinary surge in immigration from 2021 to 2024, which triggered widespread discussions about its macroeconomic impact, particularly on inflation. To determine the impact of the immigration surge, we first document the salient features of these new immigrants: they are primarily low-skilled relative to the existing workforce and more likely to be hand-to-mouth consumers. We then incorporate these features into a heterogeneous agent model with capital-skill complementarity. We find that the supply- and demand-side effects of the immigration surge roughly cancel out, causing a negligible response of inflation.

Keywords: Immigration, population growth, inflation, skill complementarity, hand-to-mouth
JEL Classifications: E21, E22, E31, F22, J11, J15

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1 INTRODUCTION

Prior to 2020, immigration to the U.S. was relatively stable, with about one million net immigrants added to the population annually from 2000 to 2019, according to Congressional Budget Office (CBO) estimates. Starting in 2021, the U.S. experienced an unprecedented surge in immigration. The CBO estimated in September 2025 that total net immigration reached 10.5 million from 2021 to 2024, causing annual population growth to increase from about 0.6% before 2020 to 1.1% at its peak in 2023.[1] This extraordinary shock triggered widespread discussions about its macroeconomic impact, particularly on inflation. Motivated by the policy relevance and historic nature of the shock, this paper examines the inflationary implications of the 2021–2024 immigration surge.

The inflationary effect of a surge in immigration is theoretically ambiguous due to the tension between supply and demand. This core dilemma was articulated by Wicksell, who noted that when

> *"the growth of population is accompanied by an increased demand for all kinds of products, on the one hand, and by an increased supply of labor available in the future, on the other, then a capital accumulation...will only just suffice to maintain capital at about the same relative level, for which reason it will continue to possess a high marginal productivity and to yield a high rate of interest."* —*Wicksell (1934, p. 213)*

An immigration surge, which temporarily boosts population growth, therefore generates two competing effects: It increases the labor supply, which eases cost pressures and pushes down inflation, but it also increases consumption demand and spurs investment as firms race to equip new workers.

Although previous studies have explored the macroeconomic effects of immigration from various angles, theoretical models often abstract from inflation dynamics, empirical macro models such as VARs tend to face data limitations, and empirical micro studies typically focus on local labor market effects. These challenges require understanding the characteristics of the 2021–2024 immigration surge and developing a macroeconomic model consistent with these characteristics.

[1] See *An Update to the Demographic Outlook, 2025 to 2055*, www.cbo.gov/publication/61390.

In the first part of our paper, we set up a stylized New Keynesian model that permits an analytical solution to illustrate the competing supply and demand effects of an immigration shock. We fix investment growth and use a representative agent, so there is no household heterogeneity. In this case, the supply-side effects dominate and inflation falls in response to the immigration shock. However, we show that when a fraction of households are hand-to-mouth consumers or investment is endogenously determined, the demand-side effects dominate, leading to a positive inflation response. This exercise highlights the importance of using data to discipline the key features of a quantitative model that examines the inflationary effect of the 2021–2024 U.S. immigration surge.

The second part of our paper provides empirical evidence on the features of the 2021–2024 immigration surge. Using administrative data from government agencies and immigration courts, we document the unprecedented size of this shock, and more importantly, the unusual composition of this immigration surge. Unlike in the past, this surge was driven by unauthorized immigrants from a few Central and South American countries, rather than legal and skilled immigrants worldwide.[2]

Since administrative data do not include information on the economic characteristics of immigrants, we combine several large-scale household survey datasets to understand the labor-market and consumption-savings patterns of recent unauthorized immigrants. The challenge is that survey data do not indicate whether an immigrant is unauthorized or legal. To address this issue, we use as a proxy respondents who arrived in the U.S. recently and who were born in countries where the majority of unauthorized immigrants originated. This approach is motivated by a large literature on immigration enclaves, which finds that immigrants from the same countries share similar socioeconomic characteristics (Bartel, 1989; Borjas, 1987, 1994; Caiumi and Peri, 2024; Card, 2001, 2009; Munshi, 2003). We provide evidence consistent with this view and show that further restricting our sample to immigrants who are most likely to be unauthorized has little effect on our estimates.

Our empirical analysis establishes three stylized facts. First, unauthorized immigrants who ar-

[2]We use unauthorized immigrants to refer to people who entered the U.S. illegally, people who overstay their legal temporary status, and people who were temporarily permitted to enter the U.S. through the use of parole and may be awaiting proceedings in immigration court (referred to as "other foreign nationals" by the CBO). Some of these individuals may have received a temporary status that allows them to live and work in the U.S. However, they are not provided with an immigration status nor are they formally "admitted" into the country for purposes of immigration law.

rived in the U.S. after 2020 have lower skills and earn much lower income than the native-born population. Second, these immigrants spend a much higher fraction of their income, have substantially lower wealth and liquid savings, and are more likely to be viewed as "hand-to-mouth" consumers (Kaplan and Violante, 2014). Third, the characteristics of unauthorized immigrants are persistent.

In the third part of our paper, we build the empirical characteristics of 2021–2024 immigration surge into a heterogeneous agent New Keynesian model with population growth. There are high-skilled and low-skilled workers (consistent with fact 1), a fraction of the low-skilled workers are hand-to-mouth consumers (consistent with fact 2), and household characteristics are persistent (consistent with fact 3). In addition, there is a higher degree of complementarity between high-skilled labor and capital than between low-skilled labor and capital, consistent with empirical evidence in Krusell et al. (2000) and Ohanian et al. (2023).[3] The model is calibrated to match micro evidence in the literature and population and income shares in the data, providing a credible laboratory for us to examine the responses of inflation and real activity to the immigration surge.

Our quantitative results suggest that the inflationary demand-side pressures and disinflationary supply-side effects of the immigration surge roughly canceled out. The large increase in low-skilled labor reduced the low-skilled wage rate, increasing aggregate supply and putting downward pressure on inflation. There are two potential offsetting demand-side responses: investment and consumption. The low-skilled nature of the influx tempered the investment response. However, the large increase in the low-skilled population boosted aggregate consumption, even though the decline in the low-skilled wage rate lowered consumption per capita. We find a robust result that the net effect on aggregate inflation from these two competing channels was positive but negligible.

Although the model suggests that the immigration surge had little impact on inflation, there were larger effects on economic activity. The influx of workers causes a persistent increase in output, which leads to a temporary increase in the growth rate that could be interpreted as an overheating economy. However, our model predicts that there is a roughly one-for-one increase in potential output, so there is little change in the output gap. The muted responses of inflation and the output

[3]Since Krusell et al. (2000), capital skill complementarity has been a common feature in macroeconomic models. See, for example, Lindquist (2004), Ben-Gad (2008), He and Liu (2008), Dolado et al. (2021), and Bilbiie et al. (2023).

gap suggest that policymakers should be careful not to overreact to low-skilled immigration shocks.

As a final exercise, we consider a counterfactual scenario in which the immigration surge was concentrated among high-skilled workers, given that these individuals made up the bulk of the immigration before the pandemic. In this scenario, firms respond by significantly increasing investment, which generates stronger demand-side effects and a larger increase in aggregate inflation.

Related literature Our paper builds on a small but important literature that employs general equilibrium models to explore the implications of immigration. For example, Canova and Ravn (2000) consider an influx of low-skilled workers as a consequence of the reunification of Germany. Storesletten (2000) utilizes an overlapping generations model to examine the fiscal repercussions of immigration. Ben-Gad (2004, 2008) uses a similar model with overlapping dynasties to investigate the effects of immigration on investment. Our model shares some features of these models, but also builds in nominal rigidities, allowing us to assess the impact of immigration on inflation dynamics.

Several studies have also used macro models to study migration in other countries and contexts. Burriel et al. (2010), for example, estimate a New Keynesian model for the Spanish economy, and Bentolila et al. (2008) show that immigration moderates the slope of the Phillips curve in Spain. Similar models with net migration are analyzed for New Zealand (Smith and Thoenissen, 2019), Germany (Braun and Weber, 2021), and the U.S. (Hauser and Seneca, 2022). A few papers examine the cross-country effects of immigration (Burstein et al., 2020; Mandelman and Zlate, 2012). Relative to these papers, we account for the unique characteristics of the U.S. immigration surge.

There is a related empirical literature that uses VAR models to estimate the impact of immigration shocks in different countries. Kiguchi and Mountford (2019) estimate a VAR model with sign restrictions on U.S. data, observing muted impacts of immigration on real wages. Furlanetto and Robstad (2019) apply a similar approach to Norwegian data, concluding that immigration shocks affect unemployment fluctuations but have negligible effects on inflation. Smith and Thoenissen (2019) analyze New Zealand data, finding that migration shocks contribute to per capita GDP growth with the size dependent on the relative human capital of immigrants and natives. Weiske (2019) estimates a VAR model with long-run restrictions for the U.S., finding that immigration

temporarily decreases the real wage, stimulates investment, and has modest effects on per capita output, consumption, and hours. These models are intended to capture the impact of legal and skilled immigration. A recent exception is Orrenius et al. (2025), who use U.S. data on unauthorized immigration to quantify the effects on inflation. They find a muted inflationary response and higher real activity in response to an unauthorized immigration shock, consistent with our model.

Finally, our paper is related to a large empirical micro literature that examines the impact of immigration on specific markets. Studies that focus on the labor market have long debated the effects of immigration on native wages and employment (Borjas, 2003; Caiumi and Peri, 2024; Card, 2005, 2009; East et al., 2023; Ottaviano and Peri, 2012), while others have documented important price effects on non-tradable services (Cortes, 2008; Frattini, 2014), consumer goods (Lach, 2007), and housing (Saiz, 2003, 2007). A key insight from this literature is the crucial role of capital in mediating these impacts (Clemens et al., 2018; Peri, 2012). Our model with heterogeneous labor, hand-to-mouth consumers, and capital accumulation provides a macroeconomic framework that combines these micro channels and can assess the effects of immigration on aggregate inflation.

Outline The paper proceeds as follows. Section 2 highlights the tension between the supply- and demand-side effects of immigration. Section 3 presents our empirical analysis based on administrative and survey data. Section 4 describes our model motivated by the empirical analysis. Section 5 quantifies the inflationary effects of the U.S. immigration surge using impulse responses that are calibrated to match the 2025 CBO projections for population growth. Section 6 discusses the policy implications and shows the importance of the skill level of recent immigrants. Section 7 concludes.

2 COMPETING FORCES OF IMMIGRATION

To highlight the competing forces of a population growth change articulated by Wicksell, we consider a stylized representative agent New Keynesian model. To allow for balanced growth while maintaining analytical tractability, we initially assume that aggregate investment growth is fixed.

As shown in Appendix C, a log-linear approximation of the detrended model around the deter-

ministic steady state simplifies to the usual investment-saving (IS) relation and Phillips curve (PC):

$$\widehat{gap}_t = \mathbb{E}_t \widehat{gap}_{t+1} - C(\hat{R}_t - \mathbb{E}_t \hat{\Pi}_{t+1} - \hat{r}_t^*), \tag{IS}$$

$$\hat{\Pi}_t = \kappa \widehat{gap}_t + \beta \Gamma_N \mathbb{E}_t \hat{\Pi}_{t+1}, \tag{PC}$$

where $\widehat{gap}_t$ is the output gap, $\hat{R}_t$ is the nominal interest rate set by the central bank, $\hat{\Pi}_t$ is the inflation rate, C is the steady-state consumption share of aggregate expenditure that governs the interest rate semi-elasticity of the output gap, κ is the slope of the Phillips curve, β is the subjective discount factor, and Γ_N is the trend population growth rate. The natural interest rate $\hat{r}_t^*$ is given by

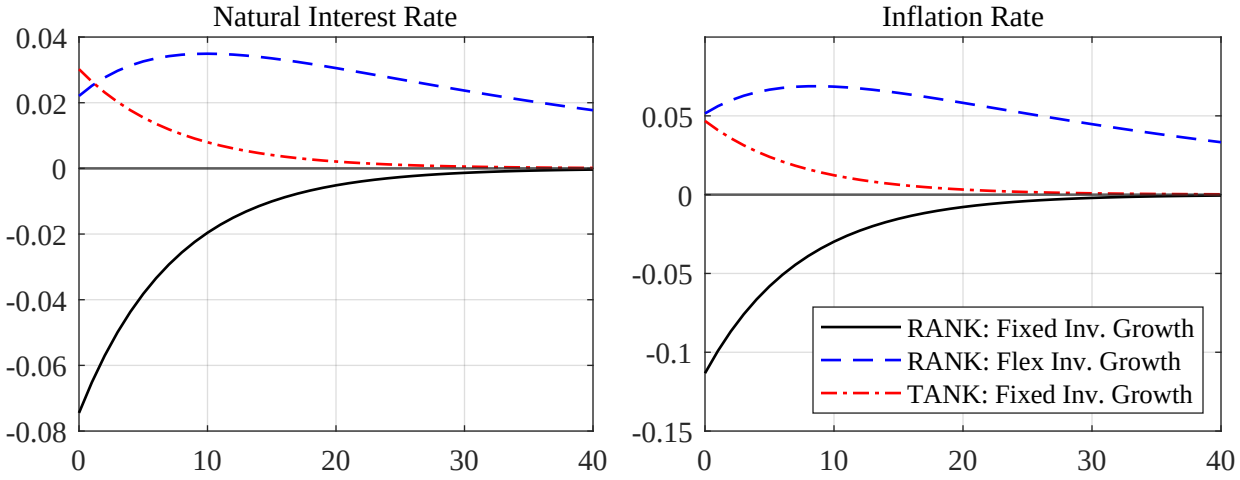
$$\hat{r}_t^* = \frac{1+\eta}{(1-C)(1-\alpha)+C(1+\eta)} \mathbb{E}_t \Delta \hat{a}_{t+1} - \frac{(1-C)(\alpha+\eta)}{(1-C)(1-\alpha)+C(1+\eta)} \mathbb{E}_t \Delta \hat{\imath}_{t+1},$$

where α is the capital share of income, η is the inverse Frisch elasticity, Δ is a first-difference operator, $\hat{\imath}_t$ is per capita investment, and $\hat{a}_t$ is a measure of productivity that depends on the initial capital stock and population growth. Given a change in the natural rate, the model dynamics are standard: An increase in the natural rate increases the output gap and inflation. The Phillips curve governs the relationship between current inflation and the expected future output gap. The IS curve implies that the output gap is a function of expected future real rate deviations from the natural rate.

What is new relative to the dynamics in the textbook New Keynesian model is that population growth shocks shift the natural interest rate through a supply-side effect arising from changes in productivity growth (first term) and a demand-side effect due to changes in per capita investment growth (second term). These supply- and demand-side channels have competing effects on inflation. To resolve this tension and determine the response of inflation to an increase in population growth, we must sign the natural interest rate, which requires closed-form solutions for productivity growth and per capita investment growth. Since aggregate investment growth is fixed, $\mathbb{E}_t \Delta \hat{a}_{t+1}$ and $\mathbb{E}_t \Delta \hat{\imath}_{t+1}$ only depend on current population growth. We assume that population growth follows a first-order autoregressive process with persistence ρ_N, so the natural interest rate collapses to

$$\hat{r}_t^* = -\rho_N \frac{C\alpha - \eta(1-\alpha-C)}{(1-C)(1-\alpha)+C(1+\eta)} \hat{\Gamma}_{N,t}.$$

Figure 1: Impulse responses to an immigration shock in alternative settings



Notes: The responses are in annualized percentage point deviations from steady state. The solid and dashed lines are based on a representative agent New Keynesian (RANK) model with fixed investment growth and flexible investment growth, respectively. The dashed-dotted line is based on a two-agent New Keynesian (TANK) model with fixed investment growth, where a fraction of households are hand-to-mouth consumers.

An increase in population growth reduces the natural rate under weak conditions.[4] In this case, the supply-side effects of the shock dominates, causing the output gap and inflation to fall on impact.

As an illustration, Figure 1 plots the responses of the natural rate and inflation to an increase in population growth under standard parameter values. Consistent with our analytical results, both variables decline on impact (solid lines). This shows that when we use a representative agent model that does not account for any household heterogeneity and shut down the firm's investment decision by fixing investment growth, the supply-side effects of the population growth shock dominate. However, the demand-side effects dominate when relaxing either of these two restrictions.

To demonstrate the sensitivity of the responses, we consider the same-sized population growth shock in two alternative models: a representative agent New Keynesian (RANK) model with endogenous investment growth and a two-agent New Keynesian (TANK) model where investment growth remains fixed but a fraction of households are hand-to-mouth consumers. In the first model, the larger workforce from higher population growth endogenously increases the return to capital, boosting investment demand (dashed line). In the second model, the larger population coupled

[4] It requires that $\frac{1}{\eta} > \frac{1-\alpha-C}{C\alpha}$, which is a weak restriction since $\alpha + C$ tends to exceed unity.

with the fact that a fraction of the households consume all of their income each period boosts aggregate consumption (dashed-dotted lines).[5] In either case, the demand-side effects become strong enough to dominate the supply-side effects of the population growth shock, causing the natural rate and inflation responses to flip signs. This sensitivity highlights the importance of accounting for the unique features of the 2021–2024 immigration surge when assessing its inflationary effects.

3 EMPIRICAL EVIDENCE

In this section, we first discuss the nature of the 2021–2024 surge, drawing on a wide range of administrative data. These data show that unauthorized immigrants, rather than legal immigrants, constituted the bulk of this influx, which is in sharp contrast to U.S. immigration before 2020. We then use household survey data to learn about the labor-market and consumption-savings patterns of likely unauthorized immigrants. Our analysis shows that these immigrants tend to be low-skilled workers and hand-to-mouth consumers, and that they share similar characteristics with earlier immigrants from the same country.

3.1 THE 2021–2024 IMMIGRATION SURGE

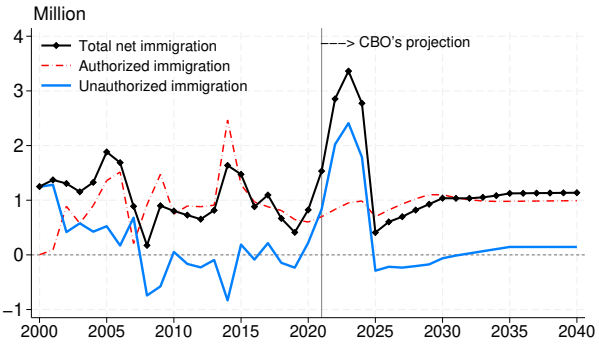
Prior to 2020, immigration to the U.S. was relatively stable (Figure 2a). The CBO estimates that about one million immigrants were added to the U.S. population each year during 2000–2019. Authorized immigrants, which include lawful permanent residents, individuals who are eligible to apply for lawful permanent residency, and nonimmigrants admitted under the Immigration and Nationality Act (e.g., students and temporary workers), accounted for the majority of net immigration. Unauthorized immigrants were not an important contributor to net immigration during this period.

Starting in 2021, border protection officers working between or at ports of entry encountered an increasing number of foreign nationals who attempted to enter the U.S. without legal immigration status (Figure 2b). Moreover, a higher fraction of these individuals than in the past was released into the country through the use of parole or with a "notice to appear", which permits the individual

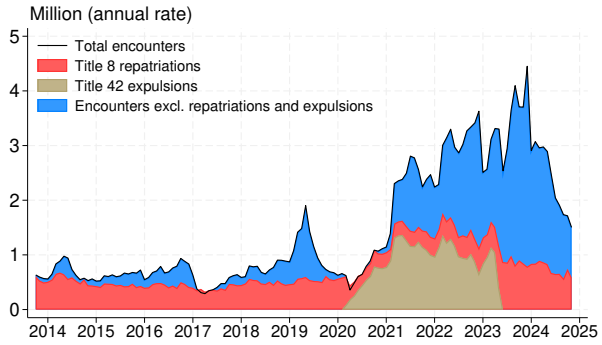
[5] Appendix C derives the stationary equilibrium and provides the parameter values for all three models.

Figure 2: The 2021–2024 immigration surge

(a) Immigration by type



(b) Border encounters



Notes: Encounters are the sum of apprehensions (arrests of potentially removable noncitizens by the U.S. Border Patrol under Title 8 authority), inadmissibles (determined by the Office of Field Operations at ports of entry under Title 8 authority), and expulsions under Title 42 public health authority.

Sources: Congressional Budget Office; U.S. Department of Homeland Security.

to wait in the U.S. while petitioning an immigration court for asylum.[6] While in the U.S., these individuals can apply for work authorization, typically after 0-6 months for parolees (depending on the country of origin) and 150 days for asylum seekers (Edelberg and Watson, 2024).

Using Department of Homeland Security data on border encounters and removals (the sum of repatriations and expulsions), we estimate that net unauthorized immigration surged from 17,000 in 2020 to 2.2 million in 2023, before falling to 1.6 million in 2024, as the Biden administration restricted the ability to apply for asylum at the southern border (Figure 3a, solid line). This boom coincided with a sharp rise in new deportation cases filed in U.S. immigration courts (Figure 3a, dashed line). In contrast, authorized immigration has been stable since 2022 and only slightly above its pre-2020 level, based on visa-issuance data from the Department of State (Figure 3b).[7]

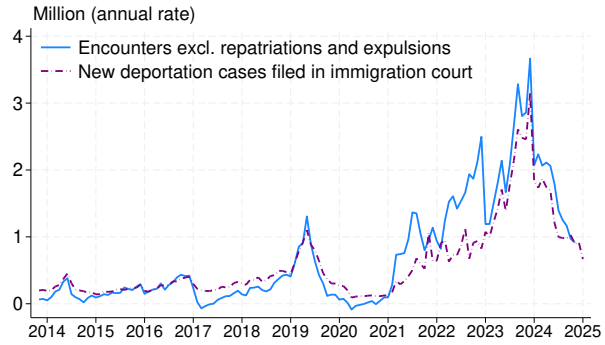
The surge of unauthorized immigration raises the question of whether this is a national shock or a regional shock that mainly impacts border states. Figure 4 shows that, although most of these

[6] It often takes several years to process immigration court cases, especially when the court faces a large influx of new cases. Immigration court data from TRAC, a research center at Syracuse University, show that the average time between the court filing and the final decision is 1,027 days for cases that were completed in fiscal years 2021–2023.

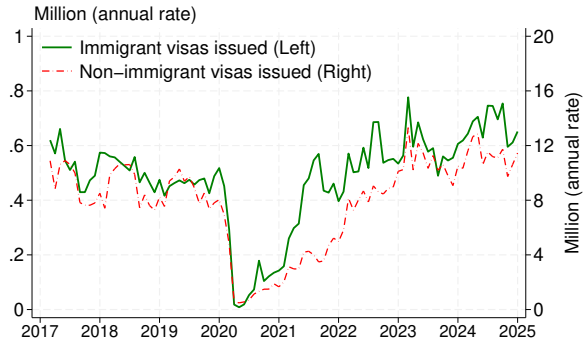
[7] In 2020, authorized immigration inflows dropped sharply due to global travel restrictions and a slowdown in the processing of applications. In addition, the Center for Disease Control issued a public health order under a provision of a 1944 public health law (Section 265 of Title 42), which allowed for the rapid expulsion of unauthorized border crossers and asylum seekers, citing COVID-19 concerns. The order was lifted on May 11, 2023.

Figure 3: Measures of immigration inflows

(a) Unauthorized immigration



(b) Authorized immigration



Sources: U.S. Department of Homeland Security; TRAC, Syracuse University; U.S. Department of State.

immigrants attempted to enter through the southern border, immigration court records, which track the mailing addresses of individuals who received a notice to appear, suggest that the geographical footprint of unauthorized immigrants has been widespread. In 39 states, new deportation cases filed after 2021 exceeded 0.5% of the state population. The spatial distribution of these immigrants supports the view that the 2021–2024 immigration surge was a national shock.

3.2 MICRO DATA AND EMPIRICAL APPROACH

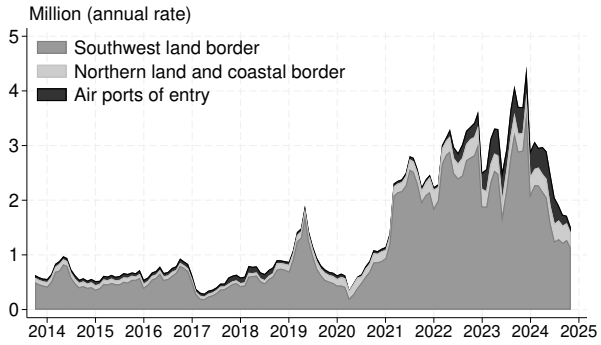
To examine the labor-market and consumption-savings patterns of immigrants who arrived in the U.S. after 2020, we turn to household survey data. We use two nationally representative household surveys that have information on respondents' immigration status based on citizenship or country of birth: (i) the monthly IPUMS CPS microdata and its Annual Social and Economic (ASEC) supplement, and (ii) the PSID. The former provides an up-to-date picture of labor market conditions, while the latter offers a comprehensive view of households' consumption, income, and wealth. Appendix A provides an overview of these surveys, detailing the questions we use to identify immigrants and their composition.[8]

Although these survey data allow us to identify immigrants, they do not indicate whether an

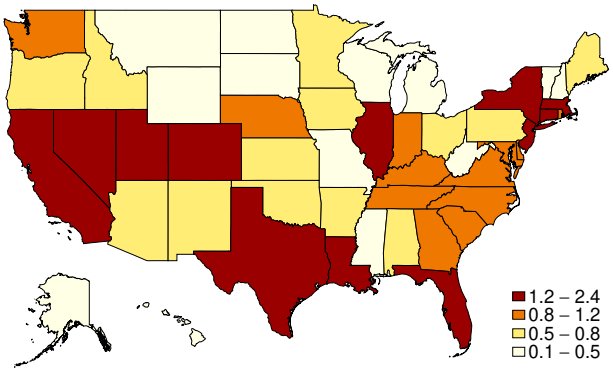
[8]We obtain very similar results to the CPS-based analysis when using the American Community Survey (ACS). However, the latest version of the ACS reflects only the population through July 2023. As to consumption and wealth information, the PSID is the only household survey that contains this information and allows us to identify immigrants. The Consumer Expenditure Survey and the Survey of Consumer Finances, for example, do not provide enough information to determine immigration status or the country of origin.

Figure 4: Geographic distribution of encounters and immigration court cases

(a) Encounters by border region



(b) New deportation cases by state



Notes: The left panel shows encounters in each border region. The right panel shows new deportation cases filed in immigration courts from 2022–2024 as a percent of the state's population in 2021.

Sources: U.S. Department of Homeland Security; TRAC, Syracuse University.

immigrant is unauthorized. To address this issue, we utilize the rich information and large sample size of the CPS (about 110,000 individuals each month), restricting the sample to individuals that reasonably well approximate unauthorized immigrants in the 2021–2024 surge. Specifically, we apply three sample selection criteria: (i) the respondent is an immigrant, (ii) the respondent arrived in the U.S. after 2020, and (iii) the respondent was born in one of the countries where the majority of the unauthorized immigrants came from, as suggested by administrative encounters data.[9] This approach, especially the last criterion, is motivated by a large literature in economics and sociology on immigration enclaves.[10] This literature finds that new immigrants tend to live in neighborhoods with a high concentration of immigrants coming from the same country of origin ("enclaves"), and that new immigrants share similar socioeconomic status with their predecessors. Indeed, we will show that immigrants arriving in the U.S. after 2020 have similar skills, labor-market outcomes, and consumption-savings behavior as the earlier immigrants coming from the same country.

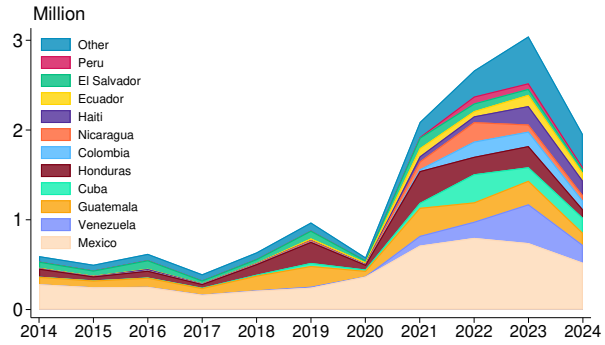
Figure 5 shows the nationality of unauthorized immigrants from the administrative data on

[9] Although the legal status of an immigrant is unknown, large-scale U.S. household surveys, such as the CPS and ACS, capture unauthorized immigrants. In fact, the Department of Homeland Security publishes annual estimates of the total number of undocumented immigrants based on the information from household survey data and legal immigration records (Borjas, 2017).

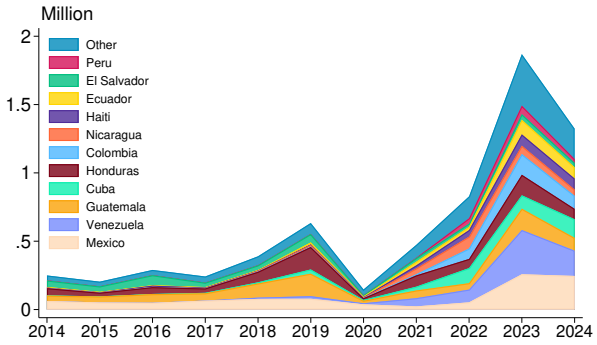
[10] See, e.g., Borjas (1987), Bartel (1989), Borjas (1994), Card (2001), Munshi (2003), Card (2009) and Caiumi and Peri (2024) in the economics literature and Wilson and Portes (1980) and Logan et al. (2002) in the sociology literature.

Figure 5: Nationality of unauthorized immigrants

(a) Encounters by country of origin



(b) New deportation cases by country of origin



Notes: Encounters data underlying the left panel are the sum of the U.S. Border Patrol encounters, the Office of Field Operations enforcement encounters, and confirmed CHNV paroles. The 2024 encounters data cover from January to November due to the suspension of the data after November 2024.

Sources: U.S. Department of Homeland Security; TRAC, Syracuse University.

border encounters and new deportation cases filed in immigration courts. A small number of countries in Central and South America have been associated with 80%–90% of these entries. These countries include Mexico, Guatemala, Honduras, and El Salvador—the main contributors before 2021—and some new contributors after 2021 (Venezuela, Colombia, Cuba, Ecuador, Nicaragua, Haiti, and Peru). We refer to these eleven countries as high-encounter (HE) countries and immigrants from these countries as HE immigrants. Our analysis below contrasts HE immigrants with immigrants born in other countries (non-HE immigrants), as well as with native-born individuals.

One may be concerned that the characteristics of legal and unauthorized immigrants may still be different even conditional on the country of origin. While we cannot completely address this concern, given that such information is not asked in any large-scale U.S. household survey, we explore further sample selections to identify the most likely unauthorized immigrants. The previous literature has often used "low-educated foreign-born" to proxy for undocumented immigrants (Albert, 2021; Borjas and Cassidy, 2019; East et al., 2023; East and Velasquez, 2024). We find that our most restrictive sample—new immigrants arriving after 2020 from HE countries who are non-U.S. citizens, have a high-school degree or less, and are male aged between 20-50—shares similar labor market characteristics with those in our baseline sample. This alleviates the concern

arising from the missing legal status in the survey data.

Applying these additional sample restrictions to PSID data is challenging because of the small sample size (about 6,000 households) and low frequency (biennial) of the survey. Our baseline PSID sample of unauthorized immigrants includes those born in HE countries and arriving in the U.S. after 2015. As we will show, further restricting the sample to immigrants who are more likely to be unauthorized such as renters and young households, at the cost of an even smaller sample size, makes little difference to our main conclusion.

It is important to note that differentiating immigrants based on their country of origin is essential for understanding the U.S. immigration surge. Some studies have used the average immigrant in the CPS who arrived in the U.S. after 2020 to characterize the population underlying this immigration surge.[11] A closer look at the composition of survey immigrants (Appendix A) suggests that this approach paints a biased picture of these recent immigrants, because those born in HE countries accounted for less than half of the new immigrants in the survey. The rest are high-skilled, likely legal immigrants from other countries. This happens because household surveys tend to undercount unauthorized immigrants due to their residency conditions and lower response rates (Brown et al., 2023). In other words, ignoring the information on the country of origin leads to bias in characterizing the immigration surge, a pitfall we avoid using our empirical approach.

3.3 STYLIZED FACTS ABOUT RECENT IMMIGRANTS

Drawing on a comprehensive set of micro data, we next compare unauthorized immigrants who arrived in the U.S. after 2020 with new immigrants from other countries and native-born individuals. We also show how the characteristics of unauthorized immigrants evolved over time in terms of their expected labor market outcomes and consumption-savings behavior. This analysis establishes three new stylized facts.

Fact 1. *Newly arrived unauthorized immigrants have low skills and earn low income.*

We use monthly CPS data from January 2022 to June 2025 and its ASEC supplement to ex-

[11] See, e.g., *Rising Immigration Has Helped Cool an Overheated Labor Market*, Federal Reserve Bank of Kansas City Economic Bulletin, May 22, 2024; *Who's Coming to America?*, Goldman Sachs U.S. Daily, April 4, 2024.

Table 1: Labor market characteristics

	Native-born	New immigrants from		Difference
		HE countries	Non-HE countries	
% of working age (16–65)	61.6	78.6***	77.5***	1.1***
% of working-age male	49.6	55.1***	48.7***	6.4***
Labor force participation rate, %				
Cond. on working age	73.8	73.3*	64.0***	9.3***
Cond. on working-age male	77.4	85.3***	75.0***	10.3***
Employment rate, % (cond. on participation)	96.1	93.3***	92.3***	1.0***
Education (cond. on participation)				
% of high school or below	31.9	64.4***	27.2***	37.2***
% of master degree and above	14.4	5.8***	28.3***	-22.5***
Wage and salary, thous. 2019 $ (cond. on employment)	53.9	24.6***	45.2*	-20.6***

Notes: *, ** and *** in columns 2 and 3 denote significance at the 10%, 5% and 1% level, respectively, for testing the equality of the means between immigrants in a specific country group (HE or non-HE) and native-born individuals. The last column shows the difference between columns 2 and 3, with stars indicating the significance level for testing whether the difference is zero. All tests control for the month fixed effect. New immigrants refer to immigrants who arrived in the U.S. after 2020.

Source: Monthly Current Population Survey (CPS) from January 2022 to June 2025 and the Annual Social and Economic (ASEC) supplement from 2022-2024.

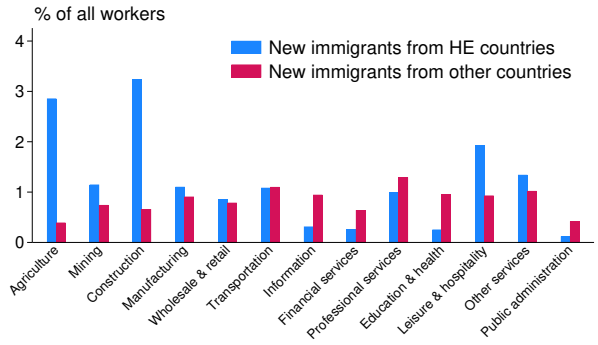
amine labor market characteristics of individuals born in different country groups.[12] The first two rows of Table 1 show basic demographic features of new immigrants. They tend to be younger and are more likely to be of working age. In addition, immigrants from HE countries are more likely to be male. The next two rows show that the labor force participation rate (LFPR) is similar for native-born individuals and HE immigrants, but conditional on being male, the latter group has the higher participation rate. The employment rate does not differ much across groups.

We present three pieces of evidence that support the differences in skills between HE immigrants and other workers. First, the bottom three rows of Table 1 show that the educational attain-

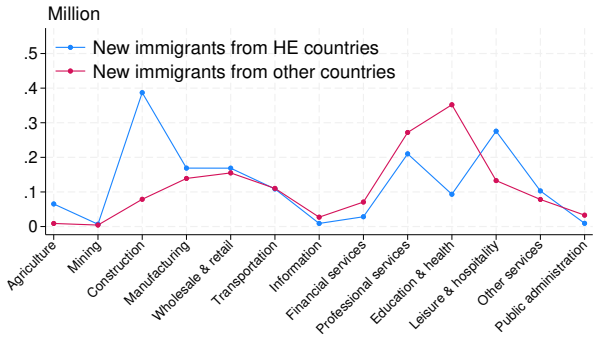
[12]Our sample begins in January 2022 rather than January 2021, because the 2021 surveys contain few immigrants arriving in 2020-2021. In addition, the CPS reports the year of arrival in bins, which typically cover 2-3 years. Thus, we are unable to distinguish between immigrants arriving in 2020-2021 from those arriving in 2018-2019 in the 2021 surveys. Using January 2022 and later surveys, we can clearly isolate immigrants who arrived in and after 2020.

Figure 6: The presence of immigrants by industry

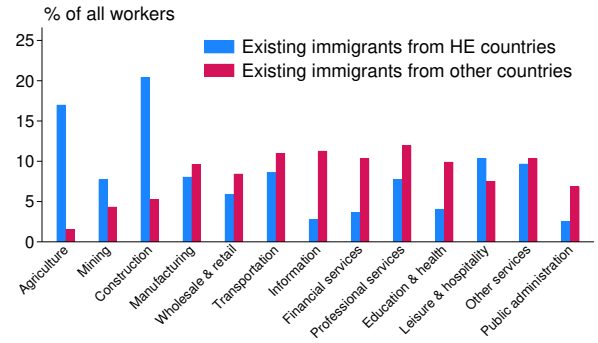
(a) Employment share of new immigrants



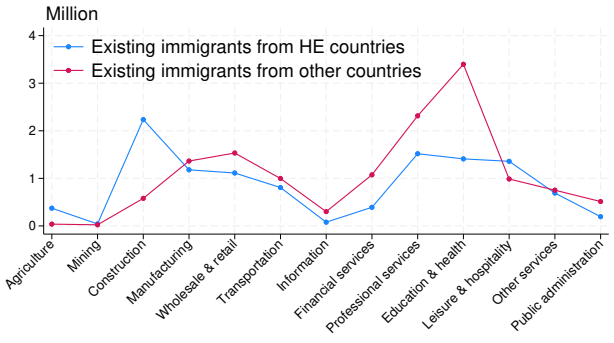
(b) Number of new immigrants



(c) Employment share of existing immigrants



(d) Number of existing immigrants



Notes: Industry classification based on the NAICS 2-digit code. New immigrants refer to immigrants arriving in the U.S. after 2020. Existing immigrants refer to those who arrived before 2020.
Source: Monthly Current Population Survey from January 2022 to June 2025.

ment of HE immigrants is much lower than for other workers: 64% of them have a high-school degree or lower, compared to about 30% for the other two groups. Non-HE immigrants, in contrast, are more concentrated at the upper end of educational attainment: 28% of them hold at least a master's degree, compared to 14% for native-born individuals and only 6% for HE immigrants. The difference in education is reflected in their wages and salaries. HE immigrants earn about half of what native-born workers earn, whereas the earnings of non-HE immigrants are comparable to the earnings of native-born workers.

Second, immigrants from HE countries are more likely to work in industries with lower skill requirements (measured by workers' average educational attainment) and lower salary, such as agriculture, construction, and leisure and hospitality (Figure 6, panels a and b). In contrast, non-

HE immigrants are more concentrated in private sector jobs that require higher skills, such as information, financial services, and education.

Third, within an industry, immigrants from HE countries tend to work in occupations that require lower skills and pay less. Appendix Table B.1 shows ten industries that have the highest employment shares of new HE immigrants. Within each industry, we classify various occupations into three broad categories: management occupations ("Manager"), computer and IT related occupations ("IT"), and all other occupations ("Other"). We find without exception that new HE immigrants are highly concentrated in non-management, non-IT occupations. In the data, these occupations tend to require lower skills and pay less than management and IT related jobs.

Is the missing legal status a concern? Recall that the legal status of an immigrant is not asked in U.S. household surveys. To address the concern that unauthorized immigrants may have different labor market characteristics from legal immigrants of the same country of origin, we perform several additional sample restrictions to identify the most likely unauthorized immigrants.

In Table 2, we impose an increasing number of restrictions on our baseline new-HE-immigrant sample. The literature has used low-educated noncitizens to capture the undocumented population (Albert, 2021; Borjas and Cassidy, 2019; East et al., 2023; East and Velasquez, 2024). In columns (2) and (3) we apply these two restrictions and find similar patterns to the baseline sample. In columns (4) and (5), we further impose age and gender restrictions, given that unauthorized immigrants tend to be younger and are more likely to be male. Even under the most restrictive set in column 5, immigrants have a similar LFPR, employment rate, industry and occupation specialization, and earnings as those in the baseline sample. This suggests that the concern of missing legal status is not likely to be quantitatively important for characterizing the 2021–2024 immigration surge, given the information on the country of origin.

Fact 2. *Newly arrived unauthorized immigrants have similar characteristics as their predecessors.*

Our analysis so far has focused on new immigrants who arrived in the U.S. after 2020. There are two related questions. First, do unauthorized immigrants arriving after 2020 share similar characteristics with their predecessors (i.e., immigrants from the same country of origin who arrived

Table 2: Further restrictions imposed to identify the most likely unauthorized immigrants

	(1) Baseline	(2) Noncitizens	(3) HS or less	(4) Age 20-50	(5) Male
% of working age	78.6	78.8	72.0	100	100
% of working-age male	55.1	55.6	59.0	59.6	100
Labor force participation rate, % (cond. on working-age male)	85.3	85.2	86.2	90.3	90.4
Employment rate, % (cond. on participation)	93.3	93.0	92.8	93.1	94.9
% of high school or below (cond. on participation)	64.4	64.7	100	100	100
% in construction sector	23.7	24.6	31.5	32.4	42.2
% in low-skilled occupations	96.0	96.5	98.3	98.4	98.3
Wage and salary, thous. 2019 $	24.6	23.6	21.5	22.1	21.9
# of immigrants in CPS	30,010	28,077	20,300	11,643	6,977

Notes: Column (1) uses the sample of HE immigrants arriving in the U.S. after 2020. Columns (2)-(4) impose an additional restriction to the previous column. Low-skilled occupations refer to non-management and non-IT related occupations in an industry.

Source: Monthly Current Population Survey (CPS) from January 2022 to June 2025 and the Annual Social and Economic (ASEC) supplement from 2022–2024.

in the U.S. earlier)? Second, do unauthorized immigrants' labor market outcomes change much after arriving in the U.S.? A positive answer to the first question would support using a structural model that fits U.S. data prior to 2020 for studying the macroeconomic effects of the 2021–2024 immigration surge. After all, in this case it would be the size of the unauthorized immigration shock that is unprecedented, not the characteristics of these immigrants. A positive answer to the second question would require a model that captures the evolution of recent immigrants' labor market characteristics.

To answer the first question, we compare HE immigrants who arrived during 2020-2024 with those arriving from 2015-2019. Panel A of Table 3 shows that the two cohorts are very similar.

When considering the second question, we present three key pieces of evidence. First, Panel B of Table 3 shows that new HE immigrants share similar characteristics with existing HE immi-

Table 3: Labor market characteristics by arrival status

	A. New HE immigrants		B. Existing HE immigrants	
	2020-2024	2015-2019	2020-2024	2015-2019
Labor force participation rate, % (cond. on working age male)	85.3	83.0	88.9	89.3
Employment rate, % (cond. on participation)	93.3	94.0	96.2	95.9
% of high school or below (cond. on participation)	64.4	64.3	67.7	71.0
% employed in construction sector	23.6	21.5	20.0	17.8
% employed in low-skilled occupations	96.0	94.7	92.3	93.3
Wage and salary, thous. 2019 $	24.6	28.7	34.8	34.2
# of immigrants in CPS	30,101	29,142	192,845	318,639

Notes: New HE immigrants refer to immigrants who were born in high-encounter countries and arrived in the U.S. during the period indicated. Existing HE immigrants refer to those who were born in high-encounter countries and arrived before the beginning of the period. Low-skilled occupations refer to non-management and non-IT related occupations in an industry.

Source: Monthly Current Population Survey (CPS) from January 2022 to June 2025 and the Annual Social and Economic (ASEC) supplement from 2022–2024.

grants, except that the latter have a modestly higher LFPR and higher wages. Second, Figure 6 and Appendix Table B.1 show a striking similarity between new and existing HE immigrants' concentration across industries and occupations. This evidence suggests that labor-market profiles of HE immigrants do not change much over time. Third, we formally evaluate the variation in immigrants' labor market characteristics by estimating the following event-study type of regression:

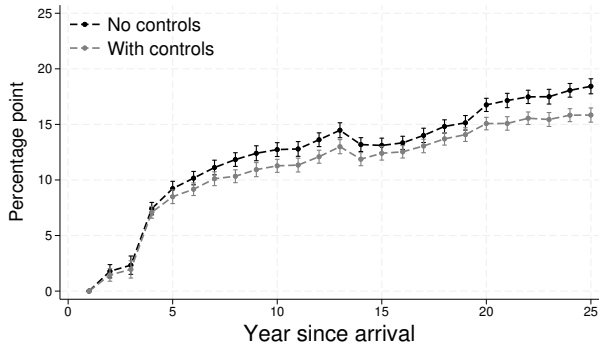
$$y_{it} = \delta_t + \sum_{n=1}^{N} \alpha_n \mathbb{I}(t - E_i \in n) + \beta \mathbf{x}_{it} + \varepsilon_{it}, \tag{1}$$

where y_{it} is an outcome variable. $\mathbb{I}(t - E_i \in n)$ is an indicator that equals 1 if immigrant i has been in the U.S. for n years since his or her arrival in year E_i. δ_t is the survey month fixed effect and $\mathbf{x}_{it}$ is a vector of controls including educational attainment, age dummies and gender.

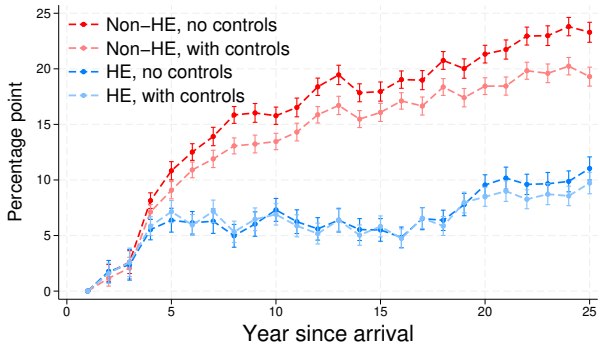
It is widely believed that the LFPR of immigrants increases steeply over time, by about 10-20 percentage points in the first several years of arrival (Edelberg and Watson, 2024). This view,

Figure 7: The evolution of the labor force participation rate

(a) All immigrants



(b) HE vs non-HE immigrants



Notes: The point estimates and 95% confidence intervals are obtained by estimating Equation 1 using the monthly Current Population Survey from January 2015 to June 2025. All regressions include month fixed effects. Control variables include dummies of educational attainment, age and gender.

however, does not distinguish between immigrants' county of origin. Figure 7a confirms the view that the LFPR increases notably over time for the average immigrant, by about 15pp over a 15-year horizon. Focusing on HE immigrants in Figure 7b, however, we find that their profile is not as steep, increasing by only 5pp. Including control variables does not change the results.

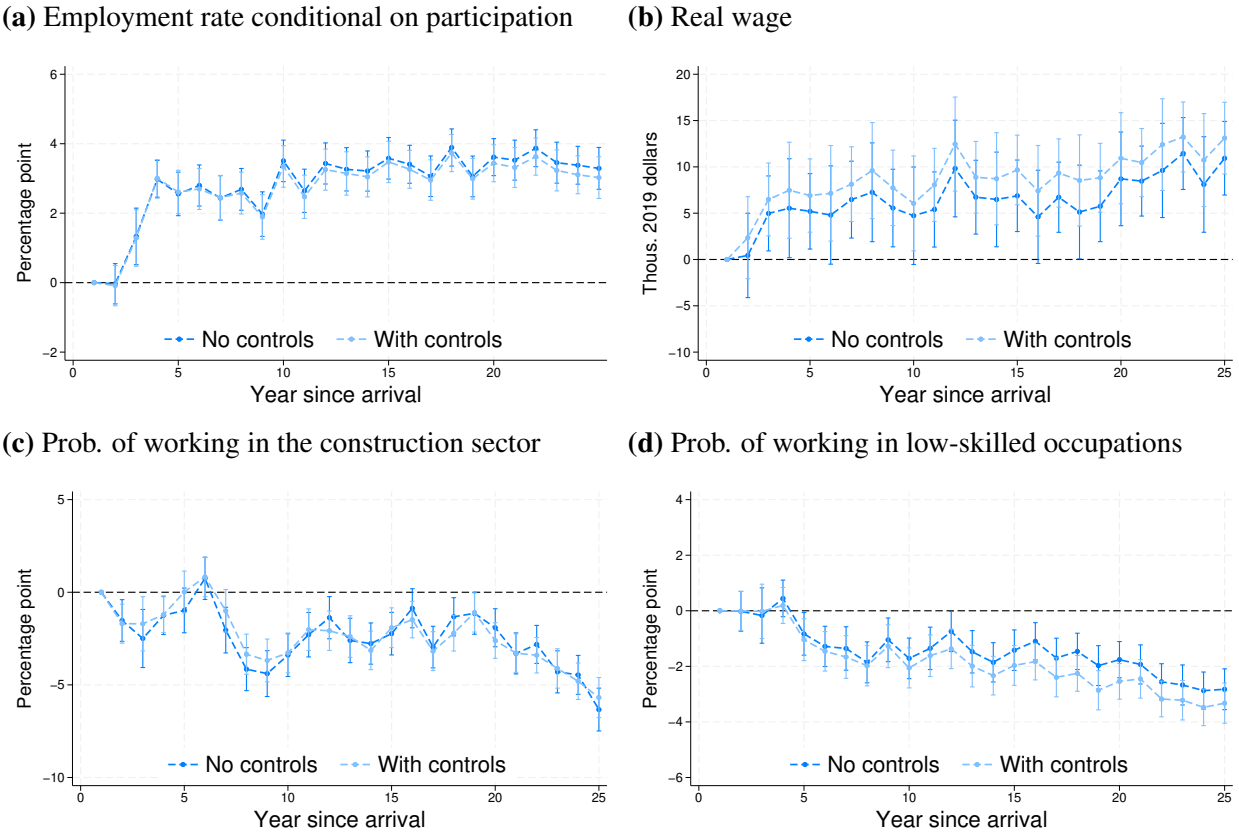
Consistent with this pattern, Figure 8 shows the evolution of a broader set of labor-market outcomes for HE immigrants. Although the employment rate increase is statistically significant (panel a), the magnitude is small and the path is essentially flat after the first three years of arrival. Real wages (panel b) and the likelihoods of working in the construction sector (panel c) and low-skilled occupations (panel d) do not change much over time.

Together, this evidence suggests that immigrants arriving in the U.S. after 2020 do not differ from those who arrived before 2020. Furthermore, the labor market outcomes of HE immigrants do not appear to change much over time, suggesting that their economic status is persistent. Our evidence is also consistent with the aforementioned literature on immigration enclaves.

Fact 3. *Unauthorized immigrants behave like "hand-to-mouth" consumers.*

Turning to the consumption-savings behavior of immigrants, we first use PSID data from 2015–2023 to document key features of new immigrants (HE vs non-HE) and contrast them with native-

Figure 8: Labor market profiles of HE immigrants over time



Notes: The point estimates and 95% confidence intervals are obtained by estimating Equation 1 using the monthly Current Population Survey from January 2015 to June 2025. All regressions include month fixed effects. Control variables include dummies of educational attainment, age and gender.

born households. We then restrict the sample to identify the respondents that are most likely to be unauthorized immigrants. Finally, we compare new HE immigrants with existing HE immigrants and estimate how the probability of HE immigrants being hand-to-mouth changes over time.

We measure the prevalence of hand-to-mouth consumers in several ways. The first row of Table 4 shows the total consumption-to-income ratio, a commonly used indicator for savings behavior.[13] This ratio is significantly higher for newly arrived HE immigrants (about 83%) than native-born households (66%). This difference is explained by the fact that HE immigrants have much lower income and that most of their income is spent—a necessary condition for being "hand-to-mouth" (Kaplan et al., 2014). One caveat with this measure is that the consumption basket may

[13] We measure consumption, wealth, and income in the PSID as in Zhou (2022). See Appendix A for more details.

Table 4: Prevalence of hand-to-mouth consumers

	Native-born	New immigrants from	
		HE countries	Non-HE countries
Consumption-income ratio, %			
Total consumption	65.5	82.9	79.3
Basic consumption	51.1	70.6	65.9
Wealth, thous. 2019 $			
Total wealth	280.8	23.7	53.9
Liquid wealth	24.3	1.6	12.6
Months of consumption using liquid wealth	6.9	0.6	6.3
KV hand-to-mouth prob, %	37.8	62.8	40.0

Notes: New immigrants refer to PSID households whose head was born in a foreign country and arrived in the U.S. after 2015. Basic consumption refers to spending on food, housing, utilities and gasoline. See text for the measurement of total consumption, wealth and the KV hand-to-mouth probability.

Source: Panel Study of Income Dynamics from 2015-2023.

differ substantially across households due to preferences or shocks unrelated to income. To address this issue, we conduct a more direct comparison by isolating spending on necessities, which includes food, housing, utilities, and gasoline (Table 4, row 2). These expenditures take up 71% of HE immigrants' income, the highest among all households, confirming the prevalence of the hand-to-mouth feature of this group.[14]

The next three rows of Table 4 focus on household wealth. Newly arrived HE immigrants have the lowest wealth, with $24K compared to $281K for native-born and $54K for non-HE families. Their liquid savings are particularly low, in that these households are unable to support even a full month of their consumption. In contrast, liquid savings of native-born and non-HE immigrants can support their respective consumption for about 6-7 months.

In the last row of Table 4, we use a conservative approach to measure the prevalence of hand-to-mouth consumers. Following Kaplan and Violante (2014), we define hand-to-mouth households

[14]Kaplan et al. (2014) and Kaplan and Violante (2014) distinguish between two types of hand-to-mouth households: the poor hand-to-mouth, who hold little or no wealth, and the wealthy hand-to-mouth, who hold a significant amount of illiquid wealth but have little or no liquid wealth. The balance sheets of HE immigrants, as shown in Table 4 and Table 5, suggest that they are closer to poor hand-to-mouth consumers.

Table 5: Robustness of the hand-to-mouth feature of HE immigrants

	Immigrants from HE countries who are			
	New Baseline	New Renters	New Renters & Young	Existing Renters & Young
Consumption-income ratio, %				
Total consumption	82.9	85.1	86.0	88.2
Basic consumption	70.6	75.2	78.2	73.6
Wealth, thous. 2019 $				
Total wealth	23.7	10.0	11.0	16.5
Liquid wealth	1.6	0.8	0.9	3.1
Months of consumption using liquid wealth	0.6	0.3	0.4	0.8
KV hand-to-mouth prob, %	62.8	66.7	64.5	60.7

Notes: See Table 4. Existing immigrants refer to those who arrived before 2015. Young households refer to those whose head is between the ages of 20 and 50.

Source: Panel Study of Income Dynamics from 2015-2023.

as those whose liquid savings are less than half their per-pay-period earnings.[15] In our data, the probability of being hand-to-mouth is 38% for native-born households, in line with the estimate by Kaplan and Violante (2014), while it is 63% for newly arrived HE immigrants. This corroborates the earlier evidence that HE immigrants behave like hand-to-mouth consumers.[16]

Due to the small sample size and low frequency of the PSID survey, further restricting the sample of new HE immigrants to those arriving only after 2020 would substantially increase the uncertainty of our estimates. Instead, we show in Table 5 that restricting the sample to renters and young households (the middle two columns)—two features that likely characterize the 2021–2024 unauthorized immigrants—does not change our conclusion that hand-to-mouth is a prevalent trait among these immigrants. Furthermore, the last column of Table 5 shows that existing HE immigrants with these two features behave very similarly to new HE immigrants.

[15] Since the PSID does not have information on paycheck frequency, we use the weighted mean frequency from Kaplan and Violante (2014) to compute the per-pay-period income for every household.

[16] A fraction of immigrants' unspent income is likely to be remitted to their home country. Previous studies based on surveys of Mexican immigrants suggest that a quarter of their monthly income is remitted (see Amuedo-Dorantes et al., 2005). Using more recent data on Mexican workers' remittances published by the Bank of Mexico for 2022–2024 and the average income of Mexican immigrants in the CPS, we estimate that about 13% of immigrants' income is remitted. These estimates are small and unlikely to weaken the aggregate demand effects of the 2021–2024 immigration surge.

Finally, in Appendix Figure B.1 we show that, while the hand-to-mouth probability decreases over time for the average immigrant, there is no significant change in this probability for HE immigrants. This supports the persistence of the hand-to-mouth feature of unauthorized immigrants.

4 MODEL OF THE 2021–2024 IMMIGRATION SURGE

Having established the labor-market and consumption-savings characteristics of post-pandemic immigrants, in this section we present a heterogeneous agent New Keynesian model with capital, population growth, and features consistent with the empirical facts documented in Section 3. There are N_t households, of which $N_{h,t}$ are high skilled. The remaining $N_{\ell,t}$ households are low skilled of two types: $N_{\ell n,t}$ that are hand-to-mouth as in Galí et al. (2004) and Bilbiie (2008) and $N_{\ell s,t}$ that can save each period. The production process includes capital-skill complementarity as in Krusell et al. (2000), so that high-skilled labor is more complementary to capital than low-skilled labor.

High-skilled population growth is fixed at Γ_N, while low-skilled population growth follows

$$\ln \Gamma_{\ell,t} = (1-\rho_N)\ln \Gamma_N + \rho_N \ln \Gamma_{\ell,t-1} + \sigma_\ell \epsilon_{\ell,t}, \quad \epsilon_{\ell,t} \sim N(0,1). \tag{2}$$

Consistent with the empirical evidence in Section 3, immigrants in the model are low-skilled, and the 2021–2024 immigration surge is modeled as an exogenous shock to their growth rate ($\Gamma_{\ell,t}$).

Define ν_t as the high-skilled population share $N_{h,t}/N_t$. This share can be written recursively as

$$\nu_t = (\Gamma_N/\Gamma_{N,t})\nu_{t-1}, \tag{3}$$

where the gross population growth rate is given by

$$\Gamma_{N,t} = \Gamma_N \nu_{t-1} + \Gamma_{\ell,t}(1-\nu_{t-1}). \tag{4}$$

The share of the low-skilled population that is hand-to-mouth $N_{\ell n,t}/N_{\ell,t}$ is fixed at ϑ, so $\Gamma_{\ell n,t} = \Gamma_{\ell,t}$.

4.1 HOUSEHOLDS

Given that households of the same type are identical, we focus on the representative household of each type. Household preferences are consistent with balanced growth as in

King et al. (1988) and Jaimovich and Rebelo (2009). Households of type $i \in \{h, \ell s, \ell n\}$ consume $c_{i,t}$, supply labor $l_{i,t}$ to firms, and receive real wage $w_{i,t}$ per hour worked. Those of type $i \in \{h, \ell s\}$ are also able to save via a risk-free nominal bond $b^n_{i,t}$, which returns gross nominal interest rate R_t. The high-skilled households own all firms in the economy and receive per capita real dividends d_t.

High-Skilled The high-skilled household's optimization problem is given by

$$\max_{c_{h,t}, l_{h,t}, b_{h,t}} \quad \mathbb{E}_0 \sum_{j=0}^{\infty} \beta^j N_{h,j} \frac{\left(c_{h,j}(1 - \psi l_{h,j}^{1+\theta})\right)^{1-\sigma}}{1-\sigma}$$

$$\text{s.t.} \quad c_{h,t} + b_{h,t} = w_{h,t} l_{h,t} + \frac{R_{t-1}}{\Gamma_{h,t}\Pi_t} b_{h,t-1} + d_t,$$

where $b_{h,t} = {}^{b^n_{h,t}}/_{P_t}$ is real bond holdings, P_t is the price of the consumption good, $\Pi_t = {}^{P_t}/_{P_{t-1}}$ is the inflation rate, β is the discount factor, σ is the elasticity of intertemporal substitution, θ controls the Frisch elasticity, and ψ controls the steady-state labor supply. The optimality conditions imply

$$l_{h,t} = (1+\theta) \frac{\psi l_{h,t}^{1+\theta}}{1 - \psi l_{h,t}^{1+\theta}} \frac{c_{h,t}}{w_{h,t}}, \tag{5}$$

$$1 = \mathbb{E}_t \left[\Lambda_{h,t+1} \frac{R_t}{\Pi_{t+1}} \right], \tag{6}$$

where

$$\Lambda_{h,t} = \beta \left(\frac{1 - \psi l_{h,t}^{1+\theta}}{1 - \psi l_{h,t-1}^{1+\theta}} \right)^{1-\sigma} \left(\frac{c_{h,t-1}}{c_{h,t}} \right)^{\sigma}. \tag{7}$$

Low-Skilled Savers The low-skilled saver's optimization problem is given by

$$\max_{c_{\ell s,t}, l_{\ell s,t}, b_{\ell s,t}} \quad \mathbb{E}_0 \sum_{j=0}^{\infty} \beta^j N_{\ell s,t} \frac{\left(c_{\ell s,j}(1 - \psi l_{\ell s,j}^{1+\theta})\right)^{1-\sigma}}{1-\sigma}$$

$$\text{s.t.} \quad c_{\ell s,t} + b_{\ell s,t} = w_{\ell,t} l_{\ell s,t} + \frac{R_{t-1}}{\Gamma_{\ell s,t}\Pi_t} b_{\ell s,t-1}$$

The optimality conditions imply

$$l_{\ell s,t} = (1+\theta) \frac{\psi l_{\ell s,t}^{1+\theta}}{1 - \psi l_{\ell s,t}^{1+\theta}} \frac{c_{\ell s,t}}{w_{\ell,t}}, \tag{8}$$

$$1 = \mathbb{E}_t \left[\Lambda_{\ell s,t+1} \frac{R_t}{\Pi_{t+1}} \right], \tag{9}$$

where

$$\Lambda_{\ell s,t} = \beta \left(\frac{1 - \psi l_{\ell s,t}^{1+\theta}}{1 - \psi l_{\ell s,t-1}^{1+\theta}} \right)^{1-\sigma} \left(\frac{c_{\ell s,t-1}}{c_{\ell s,t}} \right)^{\sigma}. \tag{10}$$

Low-Skilled Non-Savers The low-skilled non-saver's optimization problem is given by

$$\begin{aligned} \max_{c_{\ell n,t}, l_{\ell n,t}} \quad & N_{\ell n,t} \frac{\left(c_{\ell n,t} \left(1 - \psi l_{\ell n,t}^{1+\theta} \right) \right)^{1-\sigma}}{1-\sigma} \\ \text{s.t.} \quad & c_{\ell n,t} = w_{\ell,t} l_{\ell n,t}. \end{aligned} \tag{11}$$

The optimality conditions imply

$$1 = (1+\theta) \frac{\psi l_{\ell n,t}^{1+\theta}}{1 - \psi l_{\ell n,t}^{1+\theta}}. \tag{12}$$

4.2 PRODUCTION SECTOR The production sector is separated into three levels. The wholesaler produces a good for sale to a continuum of monopolistically competitive retailers. Retailers differentiate the wholesale good for sale to a final good bundler and exercise market power in pricing. The bundler operates in a perfectly competitive market, selling the final good to the households.

We describe the production sector from the top down. The final good producer purchases $Y_t(f)$ units of each retail good $f \in [0,1]$ and then bundles them to produce a finished good $Y_t = \left(\int_0^1 Y_t(f)^{(\varepsilon-1)/\varepsilon} df \right)^{\varepsilon/(\varepsilon-1)}$ that is sold to households, where ε is the elasticity of substitution across retail goods. The bundler chooses retail good purchases to maximize profits $P_t Y_t - \int_0^1 P_t(f) Y_t(f) df$. Optimality implies $Y_t(f) = \left(P_t(f)/P_t \right)^{-\varepsilon} Y_t$, where $P_t = \left(\int_0^1 P_t(f)^{1-\varepsilon} df \right)^{1/(1-\varepsilon)}$.

Monopolistically competitive retailers purchase $Y_{w,t}(f)$ units of the wholesale good at the relative price $p_{w,t}$. Each retailer maximizes profits subject to final good firm demand, differentiating wholesale goods for sale as retail goods, $Y_t(f) = Y_{w,t}(f)$, and optimally resetting its price each period with probability $1 - \zeta$. A retailer that can reset its price at t chooses P_t^* to maximize $E_t \sum_{k=t}^{\infty} \zeta^{k-t} \Lambda_{h,t,k} D_k^*$, where $\Lambda_{h,t,t} \equiv 1$, $\Lambda_{h,t,k} \equiv \prod_{j=t+1}^{k>t} \Lambda_{h,j}$, and $D_k^* = \left(\frac{P_t^*}{P_k} - p_{w,k} \right) \left(\frac{P_t^*}{P_k} \right)^{-\varepsilon} Y_k$.

Letting $p_t^* \equiv P_t^*/P_t$, the optimality condition implies

$$p_t^* = \frac{\varepsilon}{\varepsilon - 1} \frac{X_{1,t}}{X_{2,t}}, \tag{13}$$

where

$$X_{1,t} = p_{w,t}Y_t + \zeta \mathbb{E}_t[\Lambda_{h,t+1}\Pi_{t+1}^{\varepsilon}X_{1,t+1}], \tag{14}$$

$$X_{2,t} = Y_t + \zeta \mathbb{E}_t[\Lambda_{h,t+1}\Pi_{t+1}^{\varepsilon-1}X_{2,t+1}]. \tag{15}$$

The aggregate price index implies that inflation evolves according to

$$1 = (1-\zeta)(p_t^*)^{1-\varepsilon} + \zeta\Pi_t^{\varepsilon-1}. \tag{16}$$

The wholesaler produces a wholesale good using a nested CES production technology given by

$$Y_{w,t} = \left((1-\mu)L_{\ell,t}^{\eta} + \mu\left((1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}\right)^{\frac{\eta}{\xi}}\right)^{\frac{1}{\eta}}, \tag{17}$$

where $\eta, \xi < 1$ govern the elasticities of substitution. The elasticity of substitution between capital (or high-skilled labor) and low-skilled labor is $1/(1-\eta)$. The elasticity of substitution between capital and high-skilled labor is $1/(1-\xi)$. Thus, capital-skill complementarity requires that $\eta > \xi$.

The wholesaler maximizes the expected present discounted value of real profits,

$$\max_{L_{\ell,t},L_{h,t},K_t,I_t} \mathbb{E}_t \sum_{k=t}^{\infty} \Lambda_{h,t,k}(p_{w,k}Y_{w,k} - w_{\ell,k}L_{\ell,k} - w_{h,k}L_{h,k} - I_k),$$

subject to the production function and the law of motion for capital,

$$K_t = I_t + (1-\delta)K_{t-1}, \tag{18}$$

where δ is the depreciation rate. Defining R^k as the rental rate, the optimality conditions imply

$$w_{\ell,t} = p_{w,t}\frac{Y_{w,t}}{L_{\ell,t}}\frac{(1-\mu)L_{\ell,t}^{\eta}}{(1-\mu)L_{\ell,t}^{\eta} + \mu\big((1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}\big)^{\eta/\xi}}, \tag{19}$$

$$w_{h,t} = p_{w,t}\frac{Y_{w,t}}{L_{h,t}}\frac{\mu\big((1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}\big)^{\eta/\xi}}{(1-\mu)L_{\ell,t}^{\eta} + \mu\big((1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}\big)^{\eta/\xi}}\frac{(1-\chi)L_{h,t}^{\xi}}{(1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}}, \tag{20}$$

$$R_t^k = p_{w,t}\frac{Y_{w,t}}{K_{t-1}}\frac{\mu\big((1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}\big)^{\eta/\xi}}{(1-\mu)L_{\ell,t}^{\eta} + \mu\big((1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}\big)^{\eta/\xi}}\frac{\chi K_{t-1}^{\xi}}{(1-\chi)L_{h,t}^{\xi} + \chi K_{t-1}^{\xi}}, \tag{21}$$

$$1 = \mathbb{E}_t\left[\Lambda_{h,t,t+1}(R_{t+1}^k + 1 - \delta)\right]. \tag{22}$$

4.3 MONETARY POLICY The central bank sets the gross nominal interest rate according to

$$R_t = R(\Pi_t/\Pi)^{\upsilon_\pi}, \tag{23}$$

where υ_π controls the response to the inflation gap, but our results are robust to alternative rules.

4.4 COMPETITIVE EQUILIBRIUM Aggregate supply is defined by

$$Y_{w,t} = \int_0^1 Y_t(j)dj = \Delta_t Y_t, \tag{24}$$

where price dispersion is defined as

$$\Delta_t \equiv \int_0^1 \left(\frac{P_t(f)}{P_t}\right)^{-\varepsilon} df = (1-\zeta)(p_t^*)^{-\varepsilon} + \zeta \Pi_t^{\varepsilon} \Delta_{t-1}. \tag{25}$$

Aggregate bond holdings are in zero net supply. Aggregate labor of each skill type is given by

$$L_{\ell,t} = N_{\ell s,t} l_{\ell s,t} + N_{\ell n,t} l_{\ell n,t}, \tag{26}$$

$$L_{h,t} = N_{h,t} l_{h,t}. \tag{27}$$

The goods market clearing condition implies

$$N_{h,t} c_{h,t} + N_{\ell s,t} c_{\ell s,t} + N_{\ell n,t} c_{\ell n,t} + I_t = Y_t. \tag{28}$$

A competitive equilibrium is defined by sequences of quantities, $\{l_{h,t}, c_{h,t}, l_{\ell s,t}, c_{\ell s,t}, l_{\ell n,t}, c_{\ell n,t}, L_{h,t}, L_{\ell,t}, N_t, N_{h,t}, N_{\ell,t}, N_{\ell s,t}, N_{\ell n,t}, K_t, I_t, Y_t, Y_{w,t}\, \nu_t\}$, prices, $\{\Lambda_{h,t}, \Lambda_{\ell s,t}, R_t, \Pi_t, p_t^*, X_{1,t}, X_{2,t}, \Delta_t, w_{h,t}, w_{\ell,t}, R_t^k, p_{w,t}\}$, and growth rates, $\{\Gamma_{\ell,t}, \Gamma_{N,t}\}$, such that (2)–(28) are satisfied, given the low-skilled non-saver population $N_{\ell n,t} = \vartheta N_{\ell,t}$, the total low-skilled population, $N_{\ell,t} = N_{\ell s,t} + N_{\ell n,t}$, the aggregate population, $N_t = N_{h,t} + N_{\ell,t}$, low-skilled population growth $\Gamma_{\ell,t} = {}^{N_{\ell,t}}/_{N_{\ell,t-1}}$, and aggregate population growth $\Gamma_{N,t} = {}^{N_t}/_{N_{t-1}}$. The model is detrended by redefining trending variables in per capita terms. Appendix D provides the detrended equilibrium system. We solve the log-linearized model around the detrended steady state using Sims (2002) `gensys` algorithm.

4.5 QUARTERLY CALIBRATION The parameters in Table 6 are informed by moments in our microdata and the related literature. The moments are computed using data averages over 2015-2019.

The weight on high-skilled labor in the production function (μ) is set to achieve a steady-state wage-skill premium, $w_h/w_\ell - 1$, of 0.86, where high-skilled workers in the data are defined as those in the CPS with greater than a high school degree. The weight on capital in the production function (χ) is set to target a steady-state capital income share, $R^k k/(p_w y_w \Gamma_N)$, of 0.38, consistent with updated estimates of the income share based on the methodology in Fernald (2014). The parameters governing the elasticities of substitution between capital and low-skilled labor (η) and between capital and high-skilled labor (ξ) are set to the estimates in Krusell et al. (2000).[17] In line with the New Keynesian literature (see, e.g., Galí, 2015), the elasticity of substitution between retail goods (ε) implies a steady-state price markup of 20%, while the degree of price stickiness (ζ) implies that retailers reset prices every 3 quarters on average. The capital depreciation rate (δ) is set to match the 10% annual depreciation rate on fixed assets and durable goods in the data.

The discount factor (β) implies a steady-state annual real interest rate of 1%. The elasticity of intertemporal substitution (σ) is set to 1, consistent with Jaimovich and Rebelo (2009). The labor preference weight (ψ) implies that steady-state hours worked, l, are one-third of total hours. The labor preference elasticity (θ) is set to achieve an aggregate Frisch elasticity of 0.5, consistent with the estimates in Chetty et al. (2012). The steady-state high-skilled population share (ν) is set to 0.655 to match the share of individuals in the CPS with greater than a high school degree. The low-skilled non-saver population share (ϑ) is set to 0.54 to match the share of households in the PSID with a high school degree or less whose liquid savings are less than half of their income per pay period. These shares imply that 19% of households in the model are non-savers, consistent with the share of poor hand-to-mouth consumers in the Survey of Consumer Finances (see Kaplan et al., 2014). To help pin down the division between agents, the steady-state share of wage income earned by low-skilled workers, $\varphi \equiv \frac{(1-\nu)w_\ell l_\ell}{(1-\nu)w_\ell l_\ell + \nu w_h l_h}$, is set to 0.221, which matches the analogous

[17] The estimated parameters in Krusell et al. (2000), which are commonly used in the literature, are based on data from 1963-1992. Ohanian et al. (2023) updated the sample to include data through 2019 and found little change in the original estimates. Using a slightly shorter sample, Castex et al. (2022) and Maliar et al. (2022) obtain similar results.

Table 6: Model calibration

Parameter	Description	Value	Target
Production			
μ	High-skilled Labor Production Weight	0.564	Wage Skill-Premium
χ	Capital Production Weight	0.893	Capital Income Share
η	Capital, Low-Skilled Labor Elasticity	0.4	Krusell et al. (2000)
ξ	Capital, High-Skilled Labor Elasticity	-0.5	Krusell et al. (2000)
ε	Goods Elasticity of Substitution	6	20% Markup, Galí (2015)
ζ	Probability of Changing Prices	0.667	3Q Duration, Galí (2015)
δ	Capital Depreciation Rate	$1.1^{1/4} - 1$	Depreciation, Fixed Assets
Households			
β	Subjective discount factor	$1.01^{-1/4}$	1% Annual Real Rate
σ	Intertemporal Substitution Elasticity	1	Jaimovich-Rebelo (2009)
ψ	Labor Preference Weight	2.953	Work $1/3$ of Total Hours
θ	Labor Preference Elasticity	1.253	Frisch Elasticity of 0.5
ν	High-Skilled Population Share	0.655	Pop. Share, More than HS
ϑ	Low-Skilled Non-Saver Pop. Share	0.54	HTM Share, HS or Less
φ	Low-Skilled Wage Income Share	0.221	Wage Share, HS or Less
Monetary Policy			
υ_Π	Monetary Response to Inflation	1.5	Galí (2015); Taylor (1993)
Π	Inflation Target	$1.02^{1/4}$	2% Annual Inflation Rate
Demographics			
Γ_N	Steady-State Population Growth	$1.0065^{1/4}$	CBO Demographic Outlook
ρ_N	Immigration Shock Persistence	0.875	CBO Demographic Outlook

share in the CPS, where low-skilled workers are defined as those with a high school degree or less.

The monetary response to inflation (υ_Π) is set to 1.5, as is common in the literature (see, e.g., Galí, 2015; Taylor, 1993). The steady-state inflation rate (Π) is consistent with an annual inflation target of 2%. The demographic parameters are based on data from the CBO's September 2025 update to the demographic outlook. The steady-state population growth rate (Γ_N) is set to the average growth rate over 2015-2019. The persistence of the immigration shock (ρ_N) is set to 0.875 so the average duration of the shock is 2 years, consistent with the CBO data. When computing impulse responses, the size of the immigration shock is set so that the increase in annual population growth matches the increase from its 2015-2019 average (0.65%) to its peak in 2023 (1.12%).

It is possible to design a model that distinguishes between low-skilled native workers and low-skilled immigrant workers, further interacted with their liquidity status. However, this distinction

Table 7: Untargeted Moments

	High Skilled		Low-Skilled Savers		Low-Skilled Nonsavers	
	Model	Data	Model	Data	Model	Data
Consumption Share	77.6%	72.7%	12.7%	15.7%	9.7%	11.7%
Hours Worked Share	65.5%	68.6%	14.1%	14.9%	20.5%	16.6%

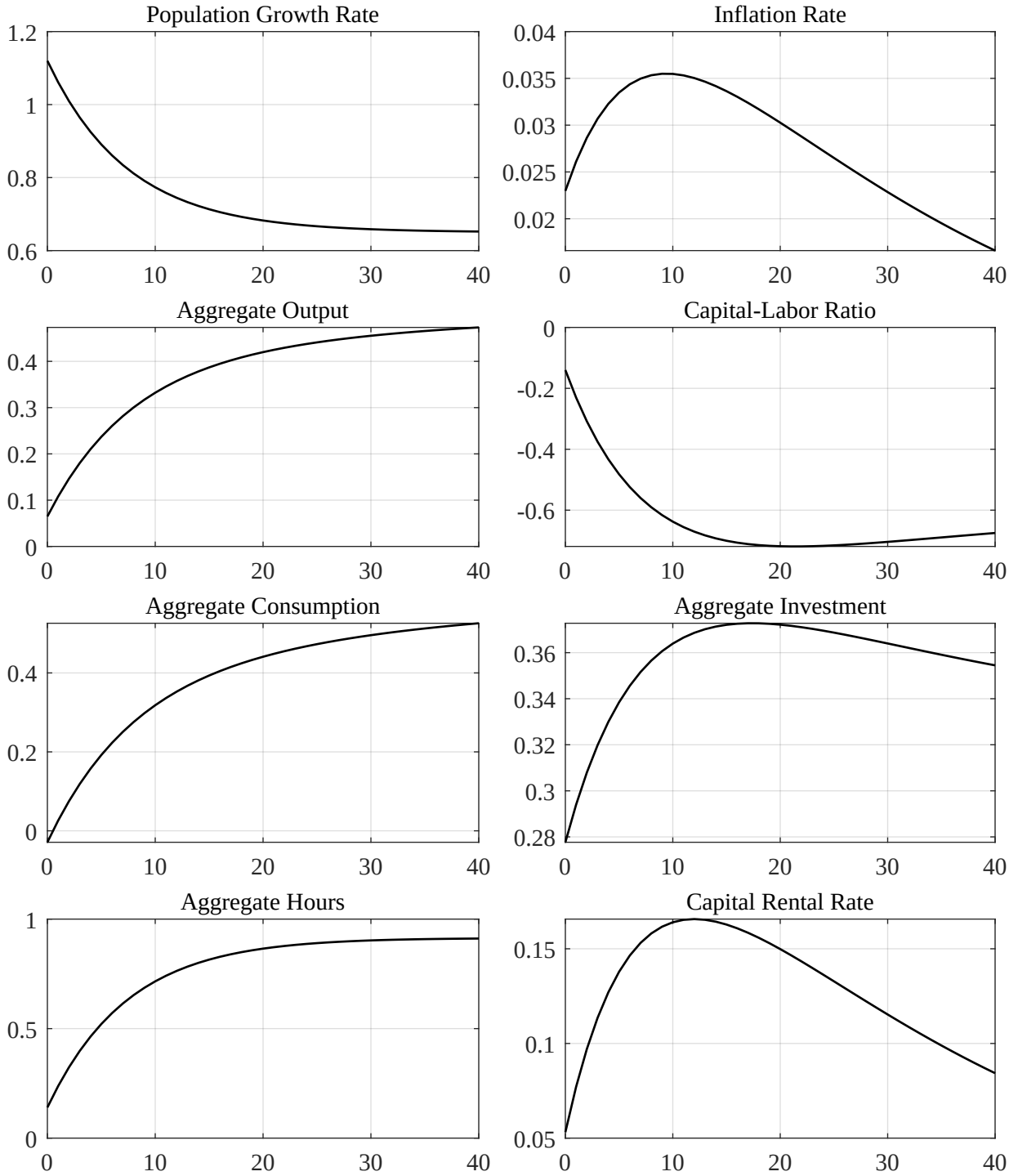
would substantially increase the model complexity, not only because it would require two additional household types, but because we have limited extraneous evidence to inform how different worker types interact in the production process. For this reason, we assume that domestic and foreign low-skilled workers are perfectly substitutable. Our calibration strategy captures low-skilled workers in the data that include both domestic and immigrant workers. The calibration of the low-skilled population shock reflects the 2021–2024 surge of low-skilled immigrants, adjusted for their share in the low-skilled population to be consistent with the CBO projection for population growth.

Untargeted Moments Table 7 compares untargeted moments from the model with the data. In the model, high-skilled individuals make up 78% of total consumption, while the low-skilled consumption share is split roughly evenly between savers and nonsavers. All three shares closely match their counterparts in the PSID. We obtain similar results for the hours shares. In particular, high-skilled individuals make up the bulk of totals hours, while low-skilled nonsavers work more hours than low-skilled savers in the model and the data. These results help validate the model.

5 INFLATIONARY IMPLICATIONS OF THE 2021–2024 IMMIGRATION SURGE

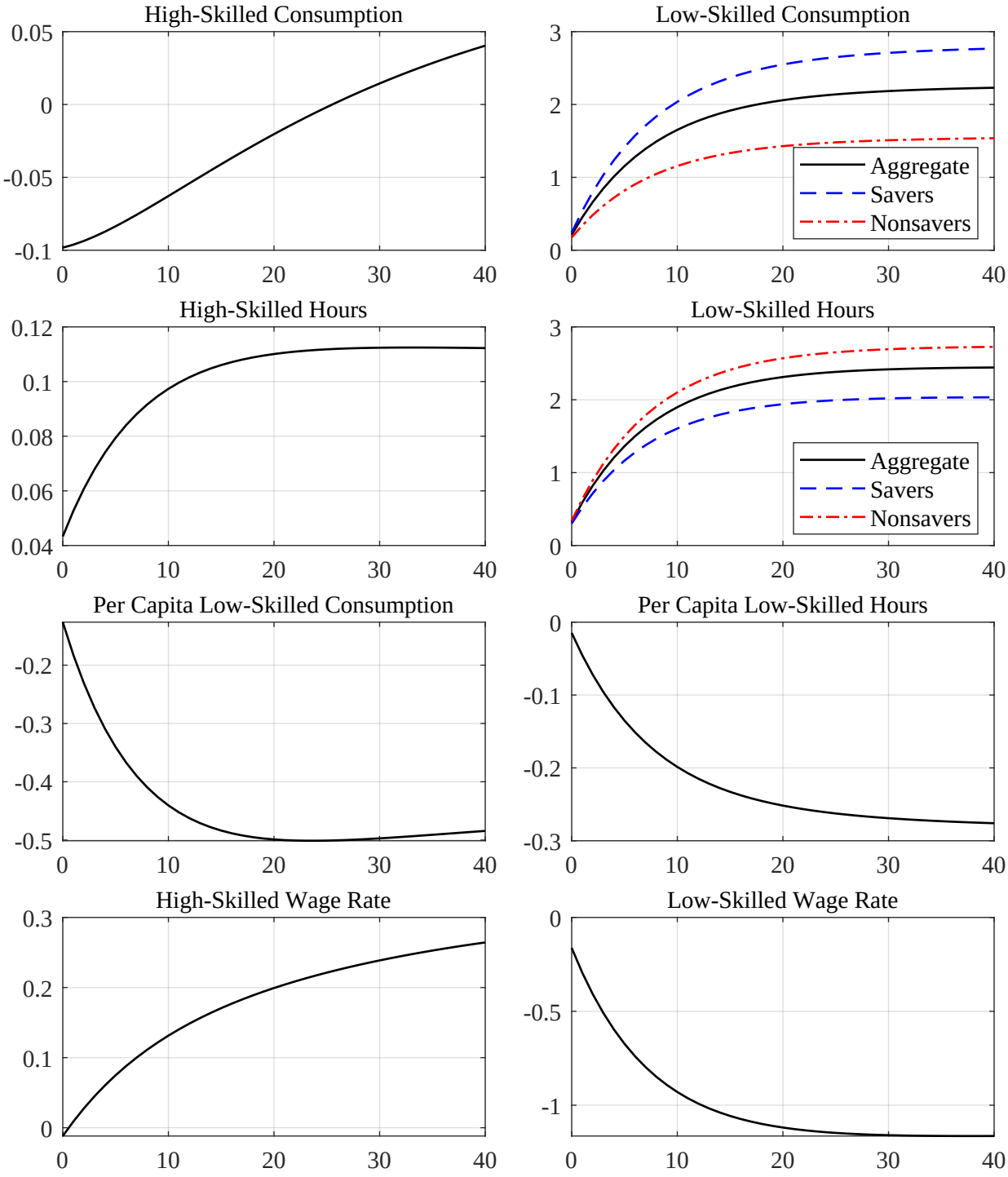
We use our calibrated model to examine the inflationary effects of the 2021–2024 immigration surge. An immigration shock in our model is defined as an increase in the low-skilled population, consistent with the empirical facts documented in Section 3. Figure 9 presents the impulse responses of key aggregate variables. The immigration shock temporarily boosts aggregate population growth, which generates a persistent increase in hours worked and output. This expansion in labor supply represents the primary disinflationary force of immigration. With a more abundant

Figure 9: Responses of aggregate variables to the 2021–2024 immigration surge



Notes: The population growth response is the net annualized aggregate population growth rate. The inflation rate responses are annualized percentage point deviations from steady state. The capital-labor ratio and capital rental rate responses are percent deviations from the detrended steady state. The remaining impulse responses are percent deviations from the pre-shock trend.

Figure 10: Responses of skill-specific variables to the 2021–2024 immigration surge



Notes: The wage rate and per capita responses are in percent deviations from the detrended steady state. The remaining impulse responses are percent deviations from the pre-shock trend.

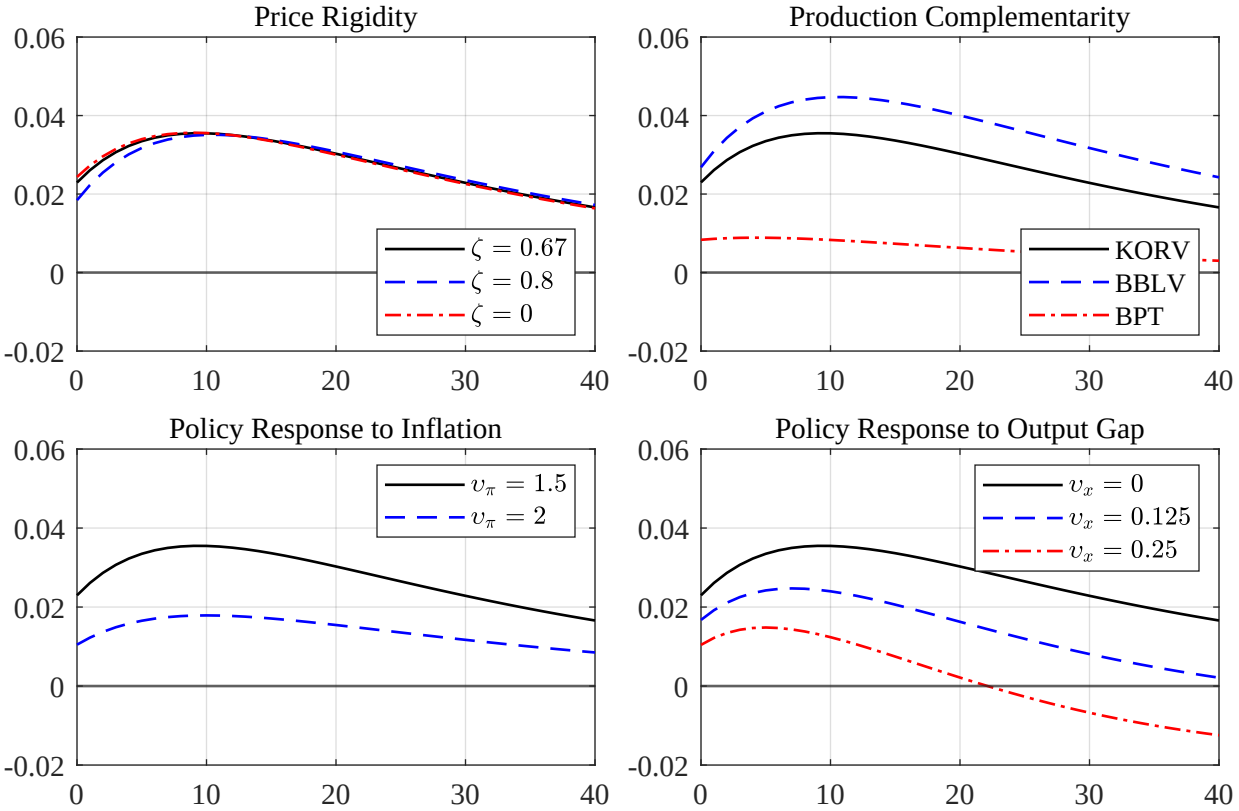
labor supply, the aggregate capital-labor ratio falls sharply. This raises the rental rate of capital and aggregate investment as firms equip the larger workforce. However, these responses are relatively weak since the new labor is low-skilled and less complementary to capital than high-skilled labor.

Although the demand-side effects of investment are small, there is a larger increase in aggregate consumption. At first, this result may seem surprising because the influx of low-skilled workers reduces their real wage and both per capita hours and per capita consumption, as shown in Figure 10. However, with a much larger population of low-skilled workers, aggregate low-skilled hours and consumption increase for both savers and nonsavers. The increase in aggregate low-skilled consumption is partially offset by high-skilled households who temporarily reduce their consumption to finance investment, but this response is small due to the weak investment demand and slight increase in high-skilled hours. Therefore, the immigration surge generates a persistent increase in aggregate consumption, providing a strong demand-side effect. In general equilibrium, the demand-side effects of the immigration surge roughly cancel out the disinflationary supply-side effects from the increased labor supply, generating a small but positive aggregate effect on inflation.

Robustness We first consider whether the response of inflation is robust to alternative calibrations of our model. The results are shown in Figure 11. In the upper left panel, we consider higher and lower degrees of price stickiness (ζ) to allow for different slopes of the Philips curve. In the upper right panel, we consider alternative elasticities in the production function. Our baseline calibration is based on the empirical estimates in Krusell et al. (2000). Recently, Berlingieri et al. (2024) refined their methodology to account for trends in skill-augmenting productivity, finding a smaller degree of capital-skill complementarity. In contrast, Bilbiie et al. (2023) estimate a New Keynesian model with Bayesian methods and obtain a much stronger degree of capital-skill complementarity. We assess the sensitivity of our results to these estimates. In the bottom panel, we consider alternative monetary policy rules. Specifically, we generalize the rule to $R_t = R(\Pi_t/\Pi)^{\upsilon_\pi}(y_t^{gap}/y^{gap})^{\upsilon_x}$ and consider alternative responses to the inflation gap (υ_π) and the output gap (υ_x), where the output gap is defined as the deviation of output from its flexible price analogue (Woodford, 2003).

Despite the wide range of parameterizations we consider, there is very little effect on the infla-

Figure 11: Inflation responses to the 2021–2024 immigration shock under alternative calibrations



Notes: The responses are annualized percentage point deviations from steady state. ζ is the degree of price stickiness, and υ_π and υ_π are the monetary responses to the inflation and output gaps. KORV, BBLV, and BPT correspond to the capital-skill complementarity estimates in Krusell et al. (2000, $\eta = 0.4, \xi = -0.5$), Berlingieri et al. (2024, $\eta = 0.17, \xi = 0.08$), and Bilbiie et al. (2023, $\eta = 0.89, \xi = -1.63$), respectively.

tion response to the immigration surge. Inflation increases on impact under every parameterization and the annualized increase never exceeds 0.1%.[18] This highlights the robustness of our key result.

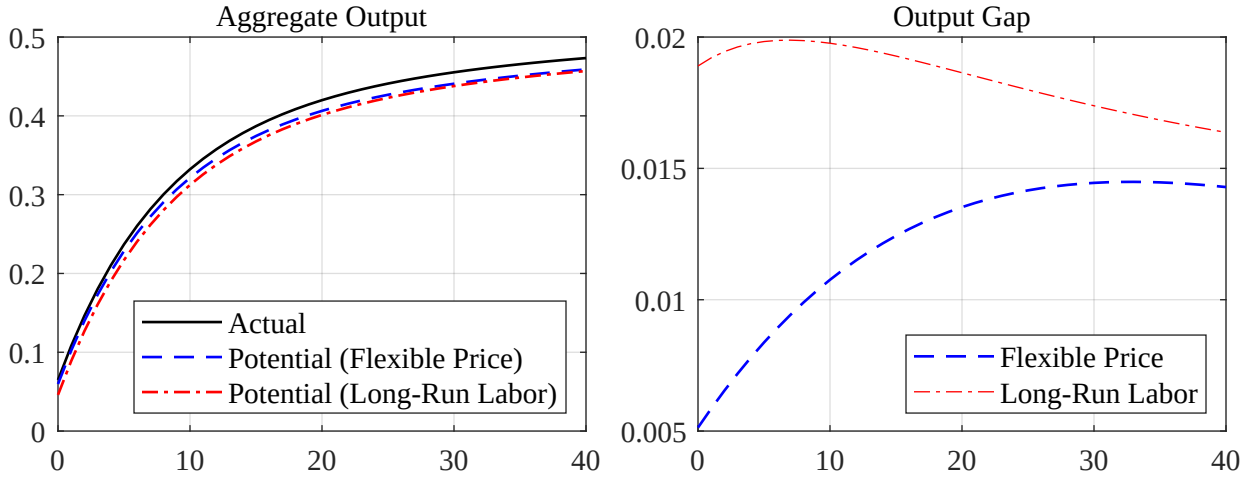
6 POLICY IMPLICATIONS AND EXTENSIONS

In this section, we first examine the monetary policy implications of the 2021–2024 immigration surge. We then show a counterfactual scenario where there is a surge in high-skilled immigration.

Monetary Policy Implications Although the model suggests that the immigration surge has little impact on inflation, it has larger effects on economic activity. The influx of workers causes a per-

[18] Our results are also robust to using a higher Frisch elasticity, as is sometimes used in the macro literature.

Figure 12: Policy implications of the 2021–2024 immigration shock



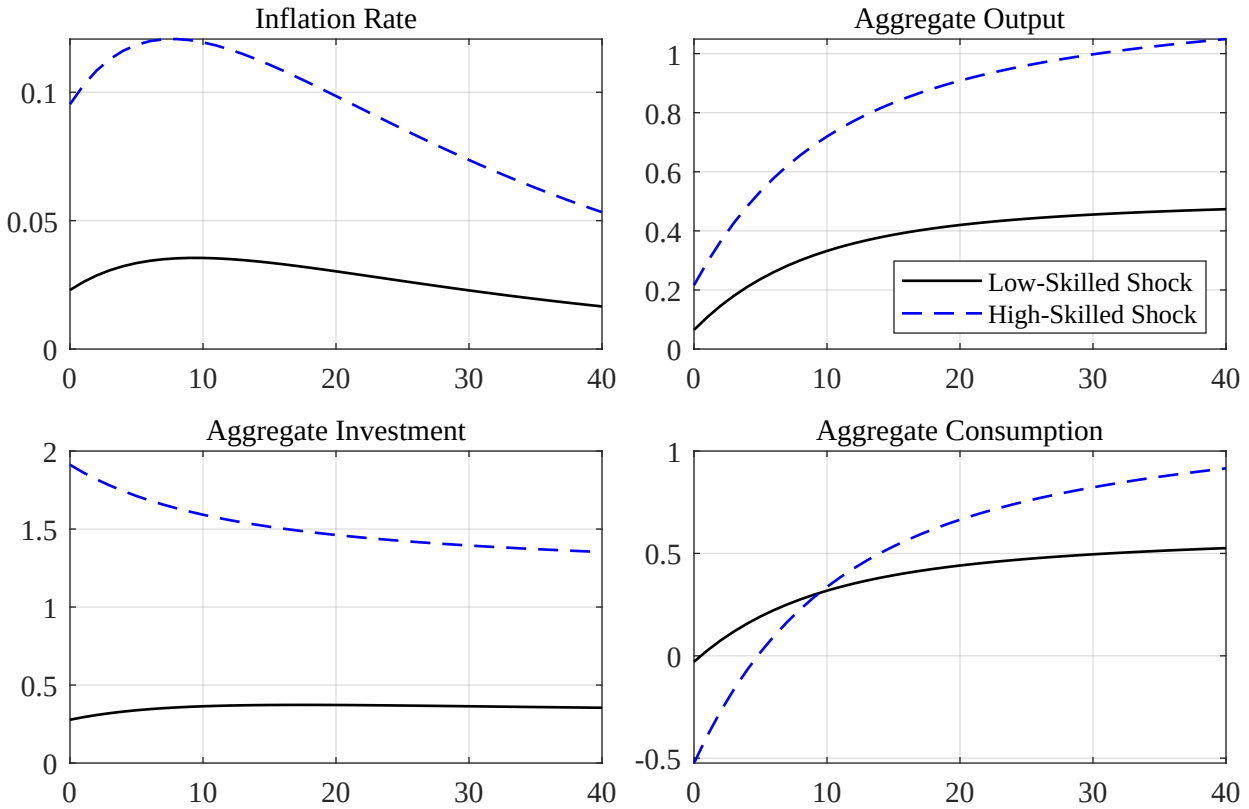
Notes: The output and potential output responses are percent deviations from the pre-shock trend The output gap response is the percent deviation of output from potential output, where potential output is the level of output under flexible prices or the level that would occur if labor inputs were equal to their long-run values.

sistent increase in output, which leads to a temporary increase in the growth rate that could be interpreted as an overheating economy (Figure 12, left panel). However, our model predicts that there is a roughly one-for-one increase in potential output, so there is little change in the output gap (Figure 12, right panel). This result holds regardless of whether potential output is defined as the level of output that would occur under flexible prices, as is common in the literature, or the level of output that would occur if labor inputs were equal to their long-run values (Kiley, 2013), which is more in line with the definition used by policymakers. The muted responses of inflation and the output gap suggest that policymakers should be careful not to overreact to low-skilled immigration shocks.

Surge in high-skilled immigration Our analysis thus far has focused on the influx of low-skilled workers driven by the 2021–2024 immigration surge. A related question is how high-skilled immigration impacts the economy, given that U.S. immigration inflows had been concentrated among highly educated individuals in the two decades prior to 2021 (Caiumi and Peri, 2024), and that the U.S. public generally supports high-skilled immigration.[19] The literature on this question has mostly focused on the labor market effects, with little evidence on the inflationary effects. We use

[19]See, for example, the results of a Pew Research survey from 2018 (www.pewresearch.org/global/2019/01/22/majority-of-u-s-public-supports-high-skilled-immigration).

Figure 13: Impulse responses to a high-skilled and low-skilled immigration shock



Notes: The inflation rate responses are annualized percentage point deviations from steady state. The remaining impulse responses are percent deviations from the pre-shock trend.

our baseline model to shed light on this issue by introducing shocks to the high-skilled population. Analogous to low-skilled population growth, high-skilled population growth evolves according to

$$\ln \Gamma_{h,t} = (1 - \rho_N) \ln \Gamma_N + \rho_N \ln \Gamma_{h,t-1} + \sigma_h \epsilon_{h,t}, \quad \epsilon_{h,t} \sim N(0, 1),$$

where the standard deviation is scaled by the relative population share (i.e., $\sigma_h = (1 - \nu)\sigma_\ell / \nu$).

Figure 13 compares the responses to a high-skilled and low-skilled immigration shock. The high-skilled shock generates a much larger increase in aggregate investment than the low-skilled shock without a compensating decline in aggregate consumption. This strengthens the demand-side effects of the shock and generates a much larger increase in inflation. Our empirical evidence in Section 3 shows that immigrants arriving in 2021–2024 were primarily low-skilled and more likely to work in industries and occupations that require lower skills. These results indicate that if

the immigration surge was instead driven by high-skilled workers, the effect on output would have been larger and stronger demand-side effects would have generated a larger increase in inflation.

7 CONCLUSION

The 2021–2024 U.S. immigration surge triggered widespread discussion about its macroeconomic impact, particularly on inflation. Despite this attention, the inflationary implications of the immigration surge remain uncertain due to the tension between its disinflationary supply-side forces and its inflationary demand-side pressures. To determine the net effect on inflation, we first combine administrative records with household survey data to provide a complete picture of unauthorized immigrants arriving in the U.S from 2021 to 2024: They tend to be hand-to-mouth consumers and low-skilled workers that complement the existing workforce. In addition, they do not differ from previous immigrants from the same countries. We then build these characteristics into a heterogeneous agent New Keynesian model with and capital-skill complementarity to quantify the aggregate effects of the immigration surge. We find that the supply and demand channels of the 2021–2024 immigration surge roughly cancel out, leading to a small but positive effect on inflation.

REFERENCES

ALBERT, C. (2021): "The Labor Market Impact of Immigration: Job Creation versus Job Competition," *American Economic Journal: Macroeconomics*, 13, 35–78.

AMUEDO-DORANTES, C., C. BANSAK, AND S. POZO (2005): "On the Remitting Patterns of Immigrants: Evidence from Mexican Survey Data," Federal Reserve Bank of Atlanta *Economic Review*, 90, 37–58.

BARTEL, A. P. (1989): "Where Do the New U.S. Immigrants Live?" *Journal of Labor Economics*, 7, 371–391.

BEN-GAD, M. (2004): "The Economic Effects of Immigration–A Dynamic Analysis," *Journal of Economic Dynamics and Control*, 28, 1825–1845.

——— (2008): "Capital-Skill Complementarity and the Immigration Surplus," *Review of Economic Dynamics*, 11, 335–365.

BENTOLILA, S., J. J. DOLADO, AND J. F. JIMENO (2008): "Does Immigration Affect the Phillips curve? Some evidence for Spain," *European Economic Review*, 52, 1398–1423.

BERLINGIERI, G., F. BOERI, D. LASHKARI, AND J. VOGEL (2024): "Capital-Skill Complementarity in Firms and in the Aggregate Economy," NBER Working Paper 33000.

BILBIIE, F. O. (2008): "Limited Asset Markets Participation, Monetary Policy and (Inverted) Aggregate Demand Logic," *Journal of Economic Theory*, 140, 162–196.

BILBIIE, F. O., G. PRIMICERI, AND A. TAMBALOTTI (2023): "Inequality and Business Cycles," NBER Working Paper 31729.

BORJAS, G. J. (1987): "Self-Selection and the Earnings of Immigrants," *American Economic Review*, 77, 531–553.

——— (1994): "The Economics of Immigration," *Journal of Economic Literature*, XXXII, 1667–1717.

——— (2003): "The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market," *Quarterly Journal of Economics*, 118, 1335–1374.

——— (2017): "The Labor Supply of Undocumented Immigrants," *Labour Economics*, 46, 1–13.

BORJAS, G. J. AND H. CASSIDY (2019): "The Wage Penalty to Undocumented Immigration," *Labour Economics*, 61: 101757.

BRAUN, S. T. AND H. WEBER (2021): "How Do Regional Labor Markets Adjust to Immigration? A Dynamic Analysis for Post-War Germany," *Journal of International Economics*, 129, 103416.

BROWN, J. D., M. L. HEGGENESS, AND M. MURRAY-CLOSE (2023): "Noncitizen Coverage and Its Effects on U.S. Population Statistics," *Center for Economic Studies Working Paper CES-23-42*.

BURRIEL, P., J. FERNÁNDEZ-VILLAVERDE, AND J. RUBIO-RAMÍREZ (2010): "MEDEA: A DSGE Model for the Spanish Economy," *SERIEs: Journal of the Spanish Economic Association*, 1, 175–243.

BURSTEIN, A., G. HANSON, L. TIAN, AND J. VOGEL (2020): "Tradability and the Labor-Market Impact of Immigration: Theory and Evidence From the United States," *Econometrica*, 88, 1071–1112.

CAIUMI, A. AND G. PERI (2024): "Immigration's Effect on US Wages and Employment Redux," NBER Working Paper 32389.

CANOVA, F. AND M. RAVN (2000): "The Macroeconomic Effects of German Unification: Real Adjustments and the Welfare State," *Review of Economic Dynamics*, 3, 423–460.

CARD, D. (2001): "Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration," *Journal of Labor Economics*, 19, 22–64.

——— (2005): "Is the New Immigration Really so Bad?" *Economic Journal*, 115, 300–323.

——— (2009): "Immigration and Inequality," *American Economic Review*, 99, 1–21.

CASTEX, G., S.-W. (STANLEY) CHO, AND E. DECHTER (2022): "The Decline in Capital-Skill Complementarity," *Journal of Economic Dynamics and Control*, 138.

CHETTY, R., A. GUREN, D. MANOLI, AND A. WEBER (2012): "Does Indivisible Labor Explain the Difference between Micro and Macro Elasticities? A Meta-Analysis of Extensive Margin Elasticities," in *NBER Macroeconomics Annual 2012, Volume 27*, ed. by D. Acemoglu, J. Parker, and M. Woodford, MIT Press, Cambridge, 1–56.

CLEMENS, M. A., E. G. LEWIS, AND H. M. POSTEL (2018): "Immigration Restrictions as Active Labor Market Policy: Evidence from the Mexican Bracero Exclusion," *American Economic Review*, 108, 1468–1487.

CORTES, P. (2008): "The Effect of Low-Skilled Immigration on U.S. Prices: Evidence from CPI Data," *Journal of Political Economy*, 116, 381–422.

DOLADO, J. J., G. MOTYOVSZKI, AND E. PAPPA (2021): "Monetary Policy and Inequality under Labor Market Frictions and Capital-Skill Complementarity," *American Economic Journal: Macroeconomics*, 13, 292–332.

EAST, C. N., A. L. HINES, P. LUCK, H. MANSOUR, AND A. VELASQUEZ (2023): "The Labor Market Effects of Immigration Enforcement," *Journal of Labor Economics*, 41, 957–996.

EAST, C. N. AND A. VELASQUEZ (2024): "Unintended Consequences of Immigration Enforcement: Household Services and High-Educated Mothers' Work," *Journal of Human Resources*, 59, 1458–1502.

EDELBERG, W. AND T. WATSON (2024): "New Immigration Estimates Help Make Sense of the Pace of Employment," The Hamilton Project, Brookings Institution.

FERNALD, J. G. (2014): "A Quarterly, Utilization-Adjusted Series on Total Factor Productivity," Federal Reserve Bank of San Francisco Working Paper 2012-19.

FLOOD, S., M. KING, R. RODGERS, S. RUGGLES, J. R. WARREN, D. BACKMAN, A. CHEN, G. COOPER, S. RICHARDS, M. SCHOUWEILER, , AND M. WESTBERRY (2024): "IPUMS CPS: Version 12.0 [dataset]." Minneapolis, MN: IPUMS.

FRATTINI, T. (2014): "Impact of Migration on UK Consumer Prices," Independent Report, Migration Advisory Committee.

FURLANETTO, F. AND O. ROBSTAD (2019): "Immigration and the Macroeconomy: Some New Empirical Evidence," *Review of Economic Dynamics*, 34, 1–19.

GALÍ, J. (2015): *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework and its Applications*, Princeton University Press.

GALÍ, J., J. D. LÓPEZ-SALIDO, AND J. VALLÉS (2004): "Rule-of-Thumb Consumers and the Design of Interest Rate Rules," *Journal of Money, Credit & Banking*, 36, 739–764.

HAUSER, D. AND M. SENECA (2022): "Labor Mobility in a Monetary Union," *Journal of International Economics*, 137, 103600.

HE, H. AND Z. LIU (2008): "Investment-Specific Technological Change, Skill Accumulation, and Wage Inequality," *Review of Economic Dynamics*, 11, 314–334.

JAIMOVICH, N. AND S. REBELO (2009): "Can News about the Future Drive the Business Cycle?" *American Economic Review*, 99, 1097–1118.

KAPLAN, G. AND G. L. VIOLANTE (2014): "A Model of the Consumption Response to Fiscal Stimulus Payments," *Econometrica*, 82, 1199–1239.

KAPLAN, G., G. L. VIOLANTE, AND J. WEIDNER (2014): "The Wealthy Hand-to-Mouth," *Brookings Papers on Economic Activity*, 45, 77–153.

KIGUCHI, T. AND A. MOUNTFORD (2019): "Immigration And Unemployment: A Macroeconomic Approach," *Macroeconomic Dynamics*, 23, 1313–1339.

KILEY, M. T. (2013): "Output gaps," *Journal of Macroeconomics*, 37, 1–18.

KING, R. G., C. I. PLOSSER, AND S. T. REBELO (1988): "Production, Growth and Business Cycles: I. The Basic Neoclassical Model," *Journal of Monetary Economics*, 21, 195–232.

KRUSELL, P., L. E. OHANIAN, J.-V. RÌOS-RULL, AND G. L. VIOLANTE (2000): "Capital-Skill Complementarity and Inequality: A Macroeconomic Analysis," *Econometrica*, 68, 1029–1054.

LACH, S. (2007): "Immigration and Prices," *Journal of Political Economy*, 115, 548–587.

LINDQUIST, M. J. (2004): "Capital-Skill Complementarity and Inequality Over the Business Cycle," *Review of Economic Dynamics*, 7, 519–540.

LOGAN, J. R., W. ZHANG, AND R. D. ALBA (2002): "Immigrant Enclaves and Ethnic Communities in New York and Los Angeles," *American Sociological Review*, 67, 299–322.

MALIAR, L., S. MALIAR, AND I. TSENER (2022): "Capital-Skill Complementarity and Inequality: Twenty Years After," *Economics Letters*, 220, 110844.

MANDELMAN, F. S. AND A. ZLATE (2012): "Immigration, Remittances and Business Cycles," *Journal of Monetary Economics*, 59, 196–213.

MUNSHI, K. (2003): "Networks in the Modern Economy: Mexican Migrants in the U. S. Labor Market," *Quarterly Journal of Economics*, 118, 549–599.

OHANIAN, L., M. ORAK, AND S. SHEN (2023): "Revisiting Capital-Skill Complementarity, Inequality, and Labor Share," *Review of Economic Dynamics*, 51, 479–505.

ORRENIUS, P., G. OZOR, M. ZAVODNY, AND X. ZHOU (2025): "Declining Immigration Weighs on GDP Growth, with Little Impact on Inflation," *Dallas Fed Economics*, Federal Reserve Bank of Dallas, July 8, 2025.

OTTAVIANO, G. I. P. AND G. PERI (2012): "Rethinking the Effect Of Immigration On Wages," *Journal of the European Economic Association*, 10, 152–197.

PERI, G. (2012): "The Effect Of Immigration On Productivity: Evidence From U.S. States," *Review of Economics and Statistics*, 94, 348–358.

SAIZ, A. (2003): "Room in the Kitchen for the Melting Pot: Immigration and Rental Prices," *The Review of Economics and Statistics*, 85, 502–521.

——— (2007): "Immigration and Housing Rents in American Cities," *Journal of Urban Economics*, 61, 345–371.

SIMS, C. A. (2002): "Solving Linear Rational Expectations Models," *Computational Economics*, 20, 1–20.

SMITH, C. AND C. THOENISSEN (2019): "Skilled Migration and Business Cycle Dynamics," *Journal of Economic Dynamics and Control*, 109.

STORESLETTEN, K. (2000): "Sustaining Fiscal Policy through Immigration," *Journal of Political Economy*, 108, 300–323.

TAYLOR, J. B. (1993): "Discretion Versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, 39, 195–214.

WEISKE, S. (2019): "On the Macroeconomic Effects of Immigration: A VAR Analysis for the US," German Council of Economic Experts Working Paper 02/2019.

WICKSELL, K. (1934): *Lectures on Political Economy, Volume I: General Theory*, London: George Routledge & Sons, first ed.

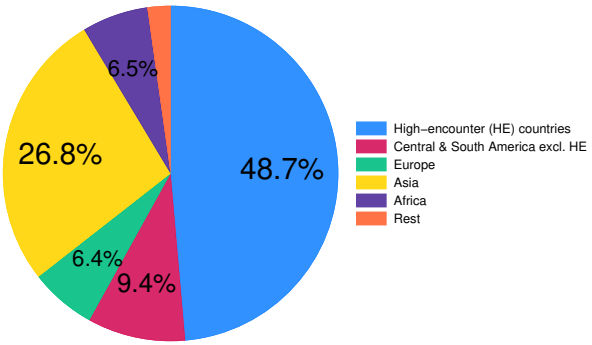
WILSON, K. L. AND A. PORTES (1980): "Immigrant Enclaves: An Analysis of the Labor Market Experiences of Cubans in Miami," *American Journal of Sociology*, 86.

WOODFORD, M. (2003): *Interest and Prices: Foundations of a Theory of Monetary Policy*, Princeton University Press.

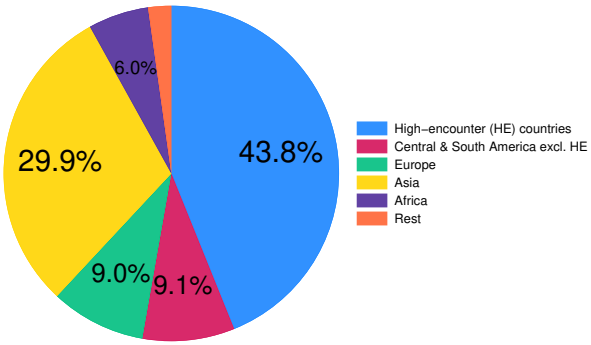
ZHOU, X. (2022): "Mortgage Borrowing and the Boom-Bust cycle in Consumption and Residential Investment," *Review of Economic Dynamics*, 44, 244–268.

Figure A.1: Composition of the origin of CPS immigrants

(a) Immigrants arriving after 2020



(b) Immigrants arriving before 2020



Notes: High-encounter (HE) countries refer to the eleven countries listed by name in Figure 5.
Sources: U.S. Department of Homeland Security; Current Population Survey, January 2022-June 2025.

A HOUSEHOLD SURVEY DATA AND IMMIGRANT COMPOSITION

The Current Population Survey (CPS) is a monthly household survey conducted by the U.S. Census Bureau and the Bureau of Labor Statistics. It is the primary source of labor force statistics in the U.S. and provides current estimates and trends in employment, unemployment, hours, earnings, and other characteristics of the labor force. The Annual Social and Economic Supplement (CPS-ASEC) is conducted annually and contains detailed information on all potential income sources. We use IPUMS CPS microdata developed by Flood et al. (2024) for our empirical analysis.

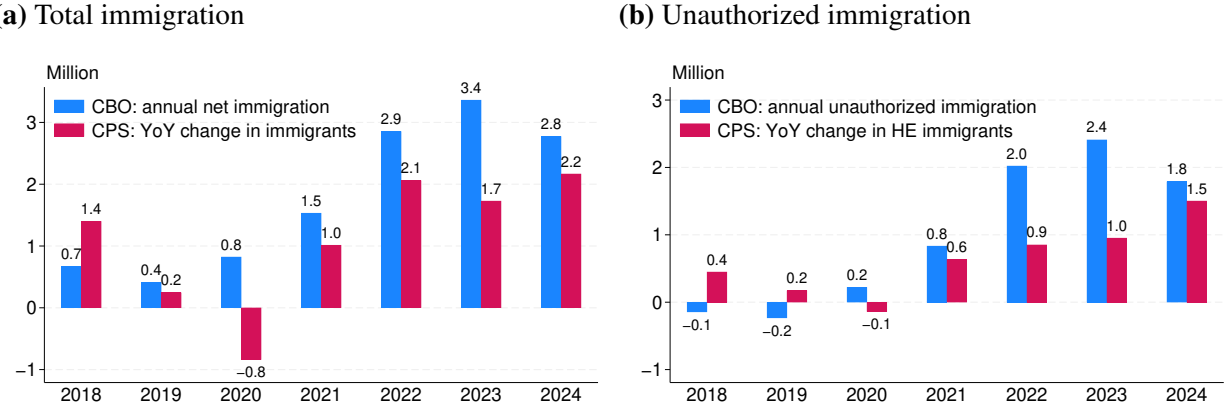
Two survey questions are used to determine immigrants and their country of origin. First, the CPS asks respondents about their citizenship status: born in the U.S., born in the U.S. outlying, born abroad of American parents, naturalized citizen, or not a citizen. We identify immigrants as those reporting themselves as a naturalized citizen or not a citizen. Second, we identify immigrants' country of origin based on their reported country of birth.

Figure A.1a shows that immigrants from HE countries account for 46% of all new immigrants arriving after 2020, not much different from the composition of existing immigrants (Figure A.1b). This suggests that the CPS likely undercounts unauthorized immigrants, as administrative data on border encounters, visa issuance, and immigration court cases suggest that the 2021–2024 immigration surge was mainly driven by unauthorized immigrants born in HE countries.[20]

This undercounting problem can also be seen by comparing the CBO's estimates of net immi-

[20] A back-of-the-envelope calculation suggests that the share of HE immigrants is at least 63% of all newly arrived immigrants from 2021–2024. This is because (i) unauthorized immigrants account for 70% of U.S. immigration during 2021–2024, according to the CBO, (ii) HE immigrants account for 90% of unauthorized immigration from 2021–2024, according to the DHS and immigration court data, and (iii) the CPS does not distinguish between legal and unauthorized immigrants, so the share of HE legal and unauthorized immigrants would be even higher than 63%.

Figure A.2: Immigration estimates using CBO and CPS data



Sources: Congressional Budget Office; Current Population Survey.

gration and unauthorized immigration to those implied by the CPS (Figure A.2). For example, the CPS implies 1.6 million (or 48%) fewer immigrants and 1.4 million (or 58%) fewer unauthorized immigrants in 2023 than estimated by the CBO. Since the labor market characteristics of HE immigrants differ substantially from non-HE immigrants as shown in Section 3.3, focusing on the average new immigrant in the CPS provides a biased picture of unauthorized immigrants.

The Panel Study of Income Dynamics (PSID) is a biennial household survey conducted by the University of Michigan. It contains information on household wealth, income, and expenditures. We use two questions to determine immigrants and their country of origin. First, the survey asks whether or not the respondent (head of the household) was born in a U.S. state. We identify those reporting "no" as immigrants. Second, the survey asks what country or part of the world the respondent's ancestors came from. We use immigrants' answers to this question to determine their country of origin. Similar to the pattern in the CPS, the share of immigrants born in HE countries is 50% among new immigrants and 46% among existing immigrants in the 2015-2023 survey waves.

We measure consumption, wealth, and income in the PSID as in Zhou (2022). Total expenditures consist of (i) nondurable goods, which include food, gasoline, and clothing, (ii) durable goods, which include furniture, auto consumption, and recreation, and (iii) services, which include housing, utility, telephone and internet, education, health, childcare, transportation, and home repairs. We do not include investment expenditures such as vehicle and home purchases or home improvements in the consumption measurement. Household wealth includes: (i) net liquid assets, which are the sum of liquid savings (cash, checking and savings accounts, money market funds, CDs, Treasury bills, and government bonds) and risky assets, net of non-mortgage debt, and (ii) net illiquid assets, which include home equity, IRAs and private annuities, and net values of real estate, farms, business, and other assets. Income refers to total annual family income.

Data sources The data is available from the following sources:

1. Congressional Budget Office population projection,
   https://www.cbo.gov/publication/59697#data
2. Current Population Survey microdata,
   https://cps.ipums.org/cps
3. Panel Study of Income Dynamics,
   https://simba.isr.umich.edu/data/data.aspx
4. Immigration enforcement and legal processes monthly tables,
   https://ohss.dhs.gov/topics/immigration/immigration-enforcement/immigration-enforcement-and-legal-processes-monthly
5. New proceedings filed in immigration court,
   https://trac.syr.edu/phptools/immigration/ntanew
6. Monthly immigrant and nonimmigrant visa issuances,
   https://travel.state.gov/content/travel/en/legal/visa-law0/visa-statistics.html

B ADDITIONAL EMPIRICAL RESULTS

Table B.1: The employment share of HE immigrants at the industry-occupation level

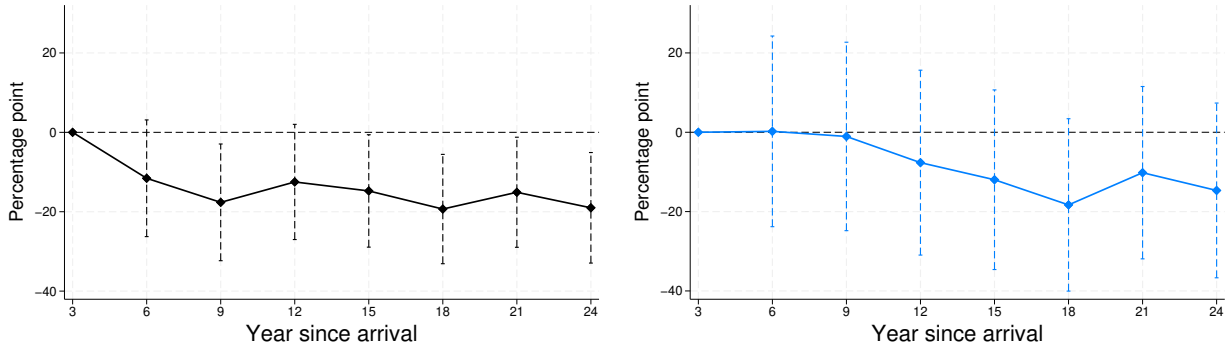
		New HE immigrants			Existing HE immigrants		
Code	Industry Description	Manager	IT	Other	Manager	IT	Other
5617	Building and landscaping services	0.3	0.0	4.5	10.2	2.7	30.3
814	Private households	0.0	0.0	4.0	3.7	0.0	28.9
721	Accommodation	0.4	0.0	3.9	3.3	1.5	19.1
23	Construction	0.5	0.0	3.9	9.0	2.0	23.2
11	Agriculture	0.4	0.0	4.6	4.0	0.0	26.0
311	Food manufacturing	0.9	0.8	2.8	5.8	3.1	17.9
315	Apparel, knitting and fabric	0.0	0.0	3.1	7.4	0.0	18.2
493	Warehousing and storage	0.6	4.1	2.6	4.3	8.0	15.9
722	Food and drinking places	0.4	0.0	2.7	8.0	3.6	12.7
492	Couriers and delivery services	0.0	0.0	2.3	3.4	0.0	7.1

Notes: Industry classification based on NAICS codes; occupation classification based on SOC codes for major groups. New HE immigrants refer to immigrants who were born in high-encounter countries and arrived in the U.S. after 2020. Existing HE immigrants refer to those who were born in high-encounter countries and arrived in the U.S. before 2020.

Source: Monthly Current Population Survey (CPS) from January 2022 to June 2025.

Figure B.1: Immigrant hand-to-mouth probability over time

(a) All immigrants **(b)** HE Immigrants



Notes: The point estimates and 95% confidence intervals are obtained by estimating Equation 1 using the Panel Study of Income Dynamics from 2015-2023. All regressions include year fixed effects and control for the household size, age and educational attainment of the household head, and housing-tenure status.

C MODELS AND DERIVATIONS FOR SECTION 2

C.1 REPRESENTATIVE AGENT MODEL WITH FIXED INVESTMENT GROWTH

We begin by considering a representative agent New Keynesian model that facilitates an analytical solution.

Capital follows a standard law of motion,

$$K_t = I_t + (1-\delta)K_{t-1}. \tag{C.1}$$

but investment growth is fixed,

$$I_t = \Gamma_N I_{t-1}. \tag{C.2}$$

Gross population growth, $\Gamma_{N,t} = N_t/N_{t-1}$, evolves according to

$$\ln \Gamma_{N,t} = (1-\rho_N)\ln \Gamma_N + \rho_N \ln \Gamma_{N,t-1} + \sigma_N \epsilon_t, \quad \epsilon_t \sim N(0,1), \tag{C.3}$$

where ϵ_t can be interpreted as a population growth shock due to an increase in immigration.

Households The representative household's optimization problem is given by

$$\begin{aligned} \max_{c_t, l_t, b_t} \quad & \mathbb{E}_0 \sum_{j=0}^{\infty} \beta^j N_t \ln\left(c_j\left(1-\psi l_j^{1+\theta}\right)\right) \\ \text{s.t.} \quad & c_t + b_t = w_t l_t + \tfrac{R_{t-1}}{\Gamma_{N,t}\Pi_t} b_{t-1} + d_t. \end{aligned}$$

The optimality conditions imply

$$l_t = (1+\theta)\frac{\psi l_t^{1+\theta}}{1-\psi l_t^{1+\theta}}\frac{c_t}{w_t}, \tag{C.4}$$

$$1 = \mathbb{E}_t\left[\Lambda_{t+1}\tfrac{R_t}{\Pi_{t+1}}\right], \tag{C.5}$$

where the stochastic discount factor is given by

$$\Lambda_{t-1,t} = \beta(c_{t-1}/c_t). \tag{C.6}$$

Production Sector Consistent with the baseline model, the production sector has three levels. The bundler's and retailers' problems are unchanged from Section 4. The equilibrium conditions, reproduced here for convenience, are given by

$$p_t^* = \frac{\varepsilon}{\varepsilon-1}\frac{X_{1,t}}{X_{2,t}}, \tag{C.7}$$

$$X_{1,t} = p_{w,t}Y_t + \zeta\mathbb{E}_t[\Lambda_{t+1}\Pi_{t+1}^{\varepsilon}X_{1,t+1}], \tag{C.8}$$

$$X_{2,t} = Y_t + \zeta\mathbb{E}_t[\Lambda_{t+1}\Pi_{t+1}^{\varepsilon-1}X_{2,t+1}], \tag{C.9}$$

$$1 = (1-\zeta)(p_t^*)^{1-\varepsilon} + \zeta\Pi_t^{\varepsilon-1}. \tag{C.10}$$

The wholesaler produces the wholesale good using a Cobb-Douglas production technology,

$$Y_{w,t} = K_{t-1}^{\alpha}L_t^{1-\alpha}, \tag{C.11}$$

and maximizes the expected present discounted value of real profits,

$$\max_{L_t}\ \mathbb{E}_t\sum_{k=t}^{\infty}\Lambda_{t,k}(p_{w,k}Y_{w,k} - w_kL_k - I_k),$$

subject to the production function. The optimality condition implies

$$w_t = p_{w,t}(1-\alpha)\tfrac{Y_{w,t}}{L_t}. \tag{C.12}$$

Monetary policy The central bank sets the gross nominal interest rate according to

$$R_t = R\left(\Pi_t/\Pi\right)^{\upsilon_\pi}. \tag{C.13}$$

Competitive Equilibrium Aggregate supply is given by

$$Y_{w,t} = \Delta_t Y_t, \tag{C.14}$$

where

$$\Delta_t = (1-\zeta)(p_t^*)^{-\varepsilon} + \zeta \Pi_t^{\varepsilon} \Delta_{t-1}. \tag{C.15}$$

Aggregate labor is given by

$$L_t = N_t l_t \tag{C.16}$$

and goods market clearing implies

$$N_t c_t + I_t = Y_t. \tag{C.17}$$

A competitive equilibrium is defined by sequences of quantities $\{c_t, l_t, L_t, N_t, K_t, I_t, Y_t, Y_{w,t}\}$, prices $\{\Lambda_t, R_t, \Pi_t, p_t^*, X_{1,t}, X_{2,t}, \Delta_t, w_t, p_{w,t}\}$, and exogenous population growth $\Gamma_{N,t}$, such that (C.1)–(C.17) hold, given gross population growth, $\Gamma_{N,t} = {}^{N_t}/_{N_{t-1}}$.

Stationary equilibrium Let lowercase quantities denote per capita variables. The detrended equilibrium system is given by

$$\begin{aligned}
\Gamma_{N,t} i_t &= \Gamma_N i_{t-1} \\
k_t &= i_t + (1-\delta)\, k_{t-1}/\Gamma_{N,t} \\
l_t &= (1+\theta)\frac{\psi l_t^{1+\theta}}{1-\psi l_t^{1+\theta}}\frac{c_t}{w_t}, \\
1 &= \mathbb{E}_t\left[\Lambda_{t+1}\tfrac{R_t}{\Pi_{t+1}}\right] \\
\Lambda_t &= \beta\frac{c_{t-1}}{c_t} \\
p_t^* &= \frac{\varepsilon}{\varepsilon-1}\frac{x_{1,t}}{x_{2,t}} \\
x_{1,t} &= p_{w,t} y_t + \zeta \mathbb{E}_t[\Lambda_{t+1}\Gamma_{N,t+1}\Pi_{t+1}^{\varepsilon} x_{1,t+1}] \\
x_{2,t} &= y_t + \zeta \mathbb{E}_t[\Lambda_{t+1}\Gamma_{N,t+1}\Pi_{t+1}^{\varepsilon-1} x_{2,t+1}] \\
1 &= (1-\zeta)(p_t^*)^{1-\varepsilon} + \zeta \Pi_t^{\varepsilon-1} \\
w_t &= p_{w,t}(1-\alpha)\tfrac{\Delta_t y_t}{l_t} \\
R_t &= R\left(\Pi_t/\Pi\right)^{\upsilon_\pi} \\
\Delta_t y_t &= \left(k_{t-1}/\Gamma_{N,t}\right)^{\alpha} l_t^{1-\alpha} \\
\Delta_t &= (1-\zeta)(p_t^*)^{-\varepsilon} + \zeta \Pi_t^{\varepsilon}\Delta_{t-1} \\
c_t + i_t &= y_t \\
\ln \Gamma_{N,t} &= (1-\rho_N)\ln\Gamma_N + \rho_N \ln \Gamma_{N,t-1} + \sigma_N \epsilon_t
\end{aligned}$$

Log-Linear Equilibrium A log-linear approximation of the stationary equilibrium where $\hat{x}_t = \ln x_t - \ln x$ and $C = c/y$ is given by:

$$\hat{\imath}_t = \hat{\imath}_{t-1} - \hat{\Gamma}_{N,t}$$
$$\hat{k}_t = \tfrac{\Gamma_N-(1-\delta)}{\Gamma_N}\hat{\imath}_t + \tfrac{1-\delta}{\Gamma_N}(\hat{k}_{t-1} - \hat{\Gamma}_{N,t})$$
$$\hat{w}_t - \hat{c}_t = \left[\tfrac{1+\theta}{1-\psi l^{1+\theta}} - 1\right]\hat{l}_t,$$
$$\mathbb{E}_t\hat{\Lambda}_{t+1} + \hat{R}_t - \mathbb{E}_t\hat{\Pi}_{t+1} = 0$$
$$\hat{\Lambda}_t = \hat{c}_{t-1} - \hat{c}_t$$
$$\hat{p}^*_t = \hat{x}_{1,t} - \hat{x}_{2,t}$$
$$\hat{x}_{1,t} = (1-\zeta\beta\Gamma_N)\left(\hat{p}_{w,t} + \hat{y}_t\right) + \zeta\beta\Gamma_N\left(\mathbb{E}_t\hat{\Lambda}_{t+1} + \mathbb{E}_t\hat{\Gamma}_{N,t+1} + \varepsilon\mathbb{E}_t\hat{\Pi}_{t+1} + \mathbb{E}_t\hat{x}_{1,t+1}\right)$$
$$\hat{x}_{2,t} = (1-\zeta\beta\Gamma_N)\hat{y}_t + \zeta\beta\Gamma_N\left(\mathbb{E}_t\hat{\Lambda}_{t+1} + \mathbb{E}_t\hat{\Gamma}_{N,t+1} + (\varepsilon-1)\mathbb{E}_t\hat{\Pi}_{t+1} + \mathbb{E}_t\hat{x}_{2,t+1}\right)$$
$$0 = (1-\zeta)\hat{p}^*_t - \zeta\hat{\Pi}_t$$
$$\hat{w}_t = \hat{p}_{w,t} + \hat{\Delta}_t + \hat{y}_t - \hat{l}_t$$
$$\hat{R}_t = \upsilon_\pi\hat{\Pi}_t$$
$$\hat{\Delta}_t + \hat{y}_t = \alpha(\hat{k}_{t-1} - \hat{\Gamma}_{N,t}) + (1-\alpha)\hat{l}_t$$
$$\hat{\Delta}_t = -\varepsilon(1-\zeta)\hat{p}^*_t + \zeta(\varepsilon\hat{\Pi}_t + \hat{\Delta}_{t-1})$$
$$C\hat{c}_t + (1-C)\hat{\imath}_t = \hat{y}_t$$
$$\hat{\Gamma}_{N,t} = \rho_N\hat{\Gamma}_{N,t-1} + \sigma_N\epsilon_t$$

Derivation of the IS and Phillips Curves First simplify the log-linear equilibrium system by substituting out $\hat{w}_t$, $\hat{\Lambda}_t$, $\hat{p}^*_t$, $\hat{x}_{1,t}$, $\hat{x}_{2,t}$, and $\hat{\Delta}_t$:

$$\hat{\imath}_t = \hat{\imath}_{t-1} - \hat{\Gamma}_{N,t} \tag{C.18}$$
$$\hat{k}_t = \tfrac{\Gamma_N-(1-\delta)}{\Gamma_N}\hat{\imath}_t + \tfrac{1-\delta}{\Gamma_N}(\hat{k}_{t-1} - \hat{\Gamma}_{N,t}) \tag{C.19}$$
$$\hat{p}_{w,t} + \hat{y}_t - \hat{c}_t = \tfrac{1+\theta}{1-\psi l^{1+\theta}}\hat{l}_t, \tag{C.20}$$
$$\hat{c}_t = \mathbb{E}_t\hat{c}_{t+1} - (\hat{R}_t - \mathbb{E}_t\hat{\Pi}_{t+1}) \tag{C.21}$$
$$\zeta\hat{\Pi}_t = (1-\zeta)(1-\zeta\beta\Gamma_N)\hat{p}_{w,t} + \zeta\beta\Gamma_N\mathbb{E}_t\hat{\Pi}_{t+1} \tag{C.22}$$
$$\hat{R}_t = \upsilon_\pi\hat{\Pi}_t \tag{C.23}$$
$$\hat{y}_t = \alpha(\hat{k}_{t-1} - \hat{\Gamma}_{N,t}) + (1-\alpha)\hat{l}_t \tag{C.24}$$
$$C\hat{c}_t + (1-C)\hat{\imath}_t = \hat{y}_t \tag{C.25}$$
$$\hat{\Gamma}_{N,t} = \rho_N\hat{\Gamma}_{N,t-1} + \sigma_N\epsilon_t \tag{C.26}$$

Next, use (C.25) to substitute out consumption from (C.20) and (C.21) to obtain

$$\hat{p}_{w,t} = (1+\eta)\hat{l}_t + \tfrac{1-C}{C}(\hat{y}_t - \hat{\imath}_t), \tag{C.27}$$

$$\hat{y}_t = \mathbb{E}_t\hat{y}_{t+1} - (1-C)\mathbb{E}_t\Delta\hat{\imath}_{t+1} - C(\hat{R}_t - \mathbb{E}_t\hat{\Pi}_{t+1}), \tag{C.28}$$

where $\eta = {}^{(1+\theta)}/_{(1-\psi l^{1+\theta})} - 1$ is the inverse Frisch elasticity and Δ is a first-difference operator. Finally, rewrite (C.24) as $\hat{y}_t = \hat{a}_t + (1-\alpha)\hat{l}_t$, where $a_t \equiv \alpha(\hat{k}_{t-1} - \hat{\Gamma}_{N,t})$ captures productivity, and substitute out $\hat{l}_t$ from (C.27) to obtain

$$\hat{p}_{w,t} = \frac{1+\eta}{1-\alpha}\left(\hat{y}_t - \hat{a}_t\right) + \frac{1-C}{C}\left(\hat{y}_t - \hat{\imath}_t\right). \tag{C.29}$$

From (C.22), the markup is fixed when prices are flexible ($\zeta = 0$). Let asterisks denote the flexible price economy. The flexible price level of output is given by

$$\hat{y}^*_t = \frac{C(1+\eta)}{(1-C)(1-\alpha) + C(1+\eta)}\hat{a}_t + \frac{(1-C)(1-\alpha)}{(1-C)(1-\alpha) + C(1+\eta)}\hat{\imath}_t,$$

where $\hat{\imath}_t = \hat{\imath}^*_t$ since investment only depends on current and past population growth. Therefore,

$$\hat{p}_{w,t} = \frac{(1-C)(1-\alpha) + C(1+\eta)}{C(1-\alpha)}\widehat{gap}_t,$$

where $\widehat{gap}_t = \hat{y}_t - \hat{y}^*_t$ is the output gap.

We can now write the Phillips curve as

$$\hat{\Pi}_t = \kappa\widehat{gap}_t + \beta\Gamma_N\mathbb{E}_t\hat{\Pi}_{t+1}, \tag{PC}$$

where $\kappa = \frac{(1-\zeta)(1-\zeta\beta\Gamma_N)}{\zeta}\frac{(1-C)(1-\alpha)+(1+\eta)C}{C(1-\alpha)}$. Higher trend population growth flattens the Phillips curve but increases the sensitivity to expected inflation. For $C = \Gamma_N = 1$ and $\alpha = 0$, the Phillips curve reduces to the textbook equation in Galí (2015).

To derive the investment-saving curve, first note that the natural rate is given by

$$\hat{r}^*_t = \frac{1+\eta}{(1-C)(1-\alpha) + C(1+\eta)}\mathbb{E}_t\Delta\hat{a}_{t+1} - \frac{(1-C)(\alpha+\eta)}{(1-C)(1-\alpha) + C(1+\eta)}\mathbb{E}_t\Delta\hat{\imath}_{t+1}.$$

Therefore, writing (C.28) in terms of the output gap implies

$$\widehat{gap}_t = \mathbb{E}_t\widehat{gap}_{t+1} - C(\hat{R}_t - \mathbb{E}_t\hat{\Pi}_{t+1} - \hat{r}^*_t). \tag{IS}$$

A population growth shock acts as a natural rate shock with accompanying supply-side, $\hat{a}_t$, and demand-side, $\hat{\imath}_t$, effects. To determine the macroeconomic response to a population growth shock, we must sign the natural rate response, which requires solutions for productivity growth and in-

vestment growth. Investment at time t and $t+1$ is easy to define

$$\hat{\imath}_t = -\hat{\Gamma}_{N,t}, \quad \mathbb{E}_t\hat{\imath}_{t+1} = -(1+\rho_N)\hat{\Gamma}_{N,t} \quad \Rightarrow \quad \mathbb{E}_t\Delta\hat{\imath}_{t+1} = -\rho_N\hat{\Gamma}_{N,t}.$$

To define productivity, we must first define the per capita level of capital in the current period,

$$\hat{k}_t = \frac{\Gamma_N - (1-\delta)}{\Gamma_N}\hat{\imath}_t - \frac{1-\delta}{\Gamma_N}\hat{\Gamma}_{N,t} = -\frac{\Gamma_N - (1-\delta)}{\Gamma_N}\hat{\Gamma}_{N,t} - \frac{1-\delta}{\Gamma_N}\hat{\Gamma}_{N,t} = -\hat{\Gamma}_{N,t},$$

which implies that

$$\hat{a}_t = -\alpha\hat{\Gamma}_{N,t}, \quad \mathbb{E}_t\hat{a}_{t+1} = -\alpha\left(1+\rho_N\right)\hat{\Gamma}_{N,t} \quad \Rightarrow \quad \mathbb{E}_t\Delta\hat{a}_{t+1} = -\alpha\rho_N\hat{\Gamma}_{N,t}.$$

Therefore, the natural rate is given by

$$\hat{r}_t^* = -\rho_N\frac{C\alpha - \eta(1-\alpha-C)}{(1-C)(1-\alpha)+C(1+\eta)}\hat{\Gamma}_{N,t}.$$

An increase in population growth reduces the natural rate as long as $\rho_N > 0$ and $\frac{1}{\eta} > \frac{1-\alpha-C}{C\alpha}$.

C.2 REPRESENTATIVE AGENT MODEL WITH VARIABLE INVESTMENT GROWTH Remove (C.2). The wholesale firm chooses K_t, to obtain

$$1 = \mathbb{E}_t[\Lambda_{t,t+1}(R^k_{t+1} + 1 - \delta)]$$

where

$$R^k_t = \alpha p_{w,t}\left(\frac{K_{t-1}}{L_t}\right)^{\alpha-1} = \alpha p_{w,t}\left(\frac{k_{t-1}}{l_t\Gamma_{N,t}}\right)^{\alpha-1}.$$

The rest of the model remains unchanged.

C.3 TWO-AGENT MODEL WITH FIXED INVESTMENT GROWTH There are N_t households, where $N_{ns,t}$ are non-savers and $N_{s,t}$ are savers. Saver population growth is fixed at Γ_N, while

$$\ln\Gamma_{ns,t} = (1-\rho_N)\ln\Gamma_N + \rho_N\ln\Gamma_{ns,t-1} + \sigma_n\epsilon_{ns,t}, \quad \epsilon_{ns,t} \sim N(0,1). \tag{C.30}$$

Define $\nu_t = N_{s,t}/N_t$ as the saver population share. This share can be written recursively as

$$\nu_t = (\Gamma_N/\Gamma_{N,t})\nu_{t-1}, \tag{C.31}$$

where

$$\Gamma_{N,t} = \Gamma_N\nu_{t-1} + \Gamma_{ns,t}(1-\nu_{t-1}). \tag{C.32}$$

Savers The representative saver's optimization problem is given by

$$\begin{aligned} \max_{c_{s,t}, l_{s,t}, b_{s,t}} \quad & \mathbb{E}_0 \sum_{j=0}^{\infty} \beta^j \ln\left(c_{s,j}\left(1-\psi l_{s,j}^{1+\theta}\right)\right) \\ \text{s.t.} \quad & c_{s,t} + b_t = w_t l_{s,t} + \tfrac{R_{t-1}}{\Gamma_N \Pi_t} b_{t-1} + d_t, \end{aligned}$$

The optimality conditions imply

$$l_{s,t} = (1+\theta)\frac{\psi l_{s,t}^{1+\theta}}{1-\psi l_{s,t}^{1+\theta}}\frac{c_{s,t}}{w_t}, \tag{C.33}$$

$$1 = \mathbb{E}_t\left[\Lambda_{t+1}\tfrac{R_t}{\Pi_{t+1}}\right], \tag{C.34}$$

where

$$\Lambda_t = \beta(c_{s,t-1}/c_{s,t}) \tag{C.35}$$

Non-savers The representative non-saver's optimization problem is given by

$$\begin{aligned} \max_{c_{ns,t}, l_{ns,t}} \quad & \mathbb{E}_0 \sum_{j=0}^{\infty} \beta^j \ln\left(c_{ns,j}\left(1-\psi l_{ns,j}^{1+\theta}\right)\right) \\ \text{s.t.} \quad & c_{ns,t} = w_t l_{ns,t}. \end{aligned} \tag{C.36}$$

The optimality conditions imply

$$1 = (1+\theta)\frac{\psi l_{ns,t}^{1+\theta}}{1-\psi l_{ns,t}^{1+\theta}}. \tag{C.37}$$

Competitive Equilibrium Aggregate labor is given by

$$L_t = N_{ns,t} l_{ns,t} + N_{s,t} l_{s,t} \tag{C.38}$$

and goods market clearing implies

$$N_{ns,t} c_{ns,t} + N_{s,t} c_{s,t} + I_t = Y_t. \tag{C.39}$$

A competitive equilibrium is defined by sequences of quantities, $\{l_{ns,t},\, c_{ns,t},\, l_{s,t},\, c_{s,t},\, L_t,\, N_t,\, N_{ns,t},\, N_{s,t},\, K_t,\, I_t,\, Y_t,\, Y_{w,t},\, \nu_t\}$, prices, $\{\Lambda_t,\, R_t,\, \Pi_t,\, p_t^*,\, X_{1,t},\, X_{2,t},\, \Delta_t,\, w_t,\, p_{w,t}\}$, and growth rates, $\{\Gamma_{ns,t}, \Gamma_{N,t}\}$, such that (C.1), (C.2), (C.7)-(C.15), and (C.30)-(C.39) are satisfied, given the aggregate population, $N_t = N_{ns,t} + N_{s,t}$, non-saver population growth, $\Gamma_{ns,t} = N_{ns,t}/N_{ns,t-1}$, and aggregate population growth, $\Gamma_{N,t} = N_t/N_{t-1}$.

Stationary equilibrium Let lowercase quantities denote per capita variables. The detrended equilibrium system is given by

$$\ln \Gamma_{ns,t} = (1-\rho_N)\ln \bar{\Gamma}_N + \rho_N \ln \Gamma_{ns,t-1} + \sigma_{ns}\epsilon_{ns,t} \tag{C.40}$$

$$\nu_t = (\bar{\Gamma}_N/\Gamma_{N,t})\nu_{t-1} \tag{C.41}$$

$$\Gamma_{N,t} = \bar{\Gamma}_N \nu_{t-1} + \Gamma_{\ell,t}(1-\nu_{t-1}) \tag{C.42}$$

$$\Gamma_{N,t} i_t = \Gamma_N i_{t-1} \tag{C.43}$$

$$l_{s,t} = (1+\theta)\frac{\psi l_{s,t}^{1+\theta}}{1-\psi l_{s,t}^{1+\theta}}\frac{c_{s,t}}{w_t} \tag{C.44}$$

$$1 = \mathbb{E}_t\left[\Lambda_{t+1}\frac{R_t}{\Pi_{t+1}}\right] \tag{C.45}$$

$$\Lambda_t = \beta \frac{c_{s,t-1}}{c_{s,t}} \tag{C.46}$$

$$c_{ns,t} = w_t l_{ns,t} \tag{C.47}$$

$$1 = (1+\theta)\frac{\psi l_{ns,t}^{1+\theta}}{1-\psi l_{ns,t}^{1+\theta}} \tag{C.48}$$

$$p_t^* = \frac{\varepsilon}{\varepsilon-1}\frac{x_{1,t}}{x_{2,t}} \tag{C.49}$$

$$x_{1,t} = p_{w,t} y_t + \zeta \mathbb{E}_t[\Lambda_{t,t+1}\Gamma_{N,t+1}\Pi_{t+1}^{\varepsilon} x_{1,t+1}] \tag{C.50}$$

$$x_{2,t} = y_t + \zeta \mathbb{E}_t[\Lambda_{t,t+1}\Gamma_{N,t+1}\Pi_{t+1}^{\varepsilon-1} x_{2,t+1}] \tag{C.51}$$

$$1 = (1-\zeta)(p_t^*)^{1-\varepsilon} + \zeta \Pi_t^{\varepsilon-1} \tag{C.52}$$

$$k_t = i_t + (1-\delta)k_{t-1}/\Gamma_{N,t} \tag{C.53}$$

$$w_t = (1-\alpha)p_{w,t}\left(\frac{k_{t-1}}{l_t \Gamma_{N,t}}\right)^{\alpha} \tag{C.54}$$

$$R_t = \bar{R}(\Pi_t/\bar{\Pi})^{\upsilon_\pi} \tag{C.55}$$

$$\Delta_t y_t = (k_{t-1}/\Gamma_{N,t})^{\alpha} l_t^{1-\alpha} \tag{C.56}$$

$$\Delta_t = (1-\zeta)(p_t^*)^{-\varepsilon} + \zeta \Pi_t^{\varepsilon}\Delta_{t-1} \tag{C.57}$$

$$c_t = \nu_t c_{s,t} + (1-\nu_t)c_{ns,t} \tag{C.58}$$

$$l_t = \nu_t l_{s,t} + (1-\nu_t)l_{ns,t} \tag{C.59}$$

$$c_t + i_t = y_t \tag{C.60}$$

Table C.1: Parameter values for the representative agent and two-agent models

Parameter	Description	Value	Source
Production			
α	Capital income share	0.38	Updated Fernald (2014) Data
ε	Goods Elasticity of Substitution	6	20% Markup, Galí (2015)
ζ	Probability of Changing Prices	0.667	3Q Duration, Galí (2015)
δ	Capital Depreciation Rate	$1.1^{1/4} - 1$	Depreciation, Fixed Assets
Households			
β	Subjective discount factor	$1.01^{-1/4}$	1% Annual Real Rate
ψ	Labor Preference Weight	2.95	Work $1/3$ of Total Hours
θ	Labor Preference Elasticity	1.25	Frisch Elasticity of 0.5
ν*	High-Skilled Population Share	0.81	Baseline Model Targets
Monetary Policy			
υ_Π	Monetary Response to Inflation	1.5	Galí (2015); Taylor (1993)
Π	Inflation Target	1	2% Annual Inflation Rate
Demographics			
Γ_N	Steady-State Population Growth	$1.0065^{1/4}$	CBO Demographic Outlook
ρ_N	Immigration Shock Persistence	0.875	CBO Demographic Outlook

*Parameter only applies to the two-agent model.

C.4 MODEL PARAMETERS Table C.1 describes the model parameters used to generate Figure 1. The values are identical to those used in the baseline model, except there is no trend inflation ($\Pi = 1$) and α is directly set rather than an implied target. For the two-agent model, $\nu = \nu^b + (1 - \vartheta^b)(1 - \nu^b)$, where a b superscript denotes the corresponding value from the baseline model. The utility preference parameters, θ and ψ, are set to target an aggregate Frisch elasticity of labor supply of 0.5 and a steady-state aggregate hours share of $1/3$, consistent with the baseline model.

D BASELINE MODEL STATIONARY EQUILIBRIUM

Let lowercase quantities denote per capita variables. A stationary competitive equilibrium is defined by sequences of quantities $\{l_{h,t},\, c_{h,t},\, l_{\ell s,t},\, c_{\ell s,t},\, l_{\ell n,t},\, c_{\ell n,t},\, l_{\ell,t},\, c_{\ell,t},\, c_t,\, k_t,\, i_t,\, y_t,\, \nu_t\}$, prices $\{\Lambda_{h,t},\, \Lambda_{\ell s,t},\, R_t,\, \Pi_t,\, p_t^*,\, \Delta_t,\, w_{h,t},\, w_{\ell,t},\, R_t^k,\, p_{w,t},\, x_{1,t},\, x_{2,t}\}$, and growth rates $\{\Gamma_{\ell,t},\, \Gamma_{N,t}\}$, such that

$$\ln \Gamma_{\ell,t} = (1-\rho_N)\ln \Gamma_N + \rho_N \ln \Gamma_{\ell,t-1} + \sigma_{\ell N}\epsilon_{\ell,t} \tag{D.1}$$

$$\nu_t = \tfrac{\Gamma_N}{\Gamma_{N,t}}\nu_{t-1} \tag{D.2}$$

$$\Gamma_{N,t} = \Gamma_N \nu_{t-1} + \Gamma_{\ell,t}(1-\nu_{t-1}) \tag{D.3}$$

$$c_{\ell,t} = (1-\vartheta)c_{\ell s,t} + \vartheta c_{\ell n,t} \tag{D.4}$$

$$l_{\ell,t} = (1-\vartheta)l_{\ell s,t} + \vartheta l_{\ell n,t} \tag{D.5}$$

$$l_{h,t} = (1+\theta)\tfrac{\psi l_{h,t}^{1+\theta}}{1-\psi l_{h,t}^{1+\theta}}\tfrac{c_{h,t}}{w_{h,t}} \tag{D.6}$$

$$1 = \mathbb{E}_t\left[\Lambda_{h,t+1}\tfrac{R_t}{\Pi_{t+1}}\right] \tag{D.7}$$

$$\Lambda_{h,t} = \beta\left(\tfrac{1-\psi l_{h,t}^{1+\theta}}{1-\psi l_{h,t-1}^{1+\theta}}\right)^{1-\sigma}\left(\tfrac{c_{h,t-1}}{c_{h,t}}\right)^{\sigma} \tag{D.8}$$

$$l_{\ell s,t} = (1+\theta)\tfrac{\psi l_{\ell s,t}^{1+\theta}}{1-\psi l_{\ell s,t}^{1+\theta}}\tfrac{c_{\ell s,t}}{w_{\ell,t}} \tag{D.9}$$

$$1 = \mathbb{E}_t\left[\Lambda_{\ell s,t+1}\tfrac{R_t}{\Pi_{t+1}}\right] \tag{D.10}$$

$$\Lambda_{\ell s,t} = \beta\left(\tfrac{1-\psi l_{\ell s,t}^{1+\theta}}{1-\psi l_{\ell s,t-1}^{1+\theta}}\right)^{1-\sigma}\left(\tfrac{c_{\ell s,t-1}}{c_{\ell s,t}}\right)^{\sigma} \tag{D.11}$$

$$c_{\ell n,t} = w_{\ell,t} l_{\ell n,t} \tag{D.12}$$

$$1 = (1+\theta)\frac{\psi l_{\ell n,t}^{1+\theta}}{1-\psi l_{\ell n,t}^{1+\theta}} \tag{D.13}$$

$$p_t^* = \tfrac{\varepsilon}{\varepsilon-1}\tfrac{x_{1,t}}{x_{2,t}} \tag{D.14}$$

$$x_{1,t} = p_{w,t}y_t + \zeta\mathbb{E}_t[\Lambda_{h,t+1}\Gamma_{N,t+1}\Pi_{t+1}^{\varepsilon}x_{1,t+1}] \tag{D.15}$$

$$x_{2,t} = y_t + \zeta\mathbb{E}_t[\Lambda_{h,t+1}\Gamma_{N,t+1}\Pi_{t+1}^{\varepsilon-1}x_{2,t+1}] \tag{D.16}$$

$$1 = (1-\zeta)(p_t^*)^{1-\varepsilon} + \zeta\Pi_t^{\varepsilon-1} \tag{D.17}$$

$$k_t = i_t + (1-\delta)k_{t-1}/\Gamma_{N,t} \tag{D.18}$$

$$w_{\ell,t} = p_{w,t}\tfrac{\Delta_t y_t}{(1-\nu_t)l_{\ell,t}}\tfrac{(1-\mu)((1-\nu_t)l_{\ell,t})^{\eta}}{(1-\mu)((1-\nu_t)l_{\ell,t})^{\eta}+\mu((1-\chi)(\nu_t l_{h,t})^{\xi}+\chi(k_{t-1}/\Gamma_{N,t})^{\xi})^{\eta/\xi}} \tag{D.19}$$

$$w_{h,t} = p_{w,t}\tfrac{\Delta_t y_t}{\nu_t l_{h,t}}\tfrac{\mu((1-\chi)(\nu_t l_{h,t})^{\xi}+\chi(k_{t-1}/\Gamma_{N,t})^{\xi})^{\eta/\xi}}{(1-\mu)((1-\nu_t)l_{\ell,t})^{\eta}+\mu((1-\chi)(\nu_t l_{h,t})^{\xi}+\chi(k_{t-1}/\Gamma_{N,t})^{\xi})^{\eta/\xi}}\tfrac{(1-\chi)(\nu_t l_{h,t})^{\xi}}{(1-\chi)(\nu_t l_{h,t})^{\xi}+\chi(k_{t-1}/\Gamma_{N,t})^{\xi}} \tag{D.20}$$

$$R_t^k = p_{w,t}\tfrac{\Delta_t y_t}{k_{t-1}/\Gamma_{N,t}}\tfrac{\mu((1-\chi)(\nu_t l_{h,t})^{\xi}+\chi(k_{t-1}/\Gamma_{N,t})^{\xi})^{\eta/\xi}}{(1-\mu)((1-\nu_t)l_{\ell,t})^{\eta}+\mu((1-\chi)(\nu_t l_{h,t})^{\xi}+\chi(k_{t-1}/\Gamma_{N,t})^{\xi})^{\eta/\xi}}\tfrac{\chi(k_{t-1}/\Gamma_{N,t})^{\xi}}{(1-\chi)(\nu_t l_{h,t})^{\xi}+\chi(k_{t-1}/\Gamma_{N,t})^{\xi}} \tag{D.21}$$

$$1 = \mathbb{E}_t[\Lambda_{h,t+1}(R_{t+1}^k + 1 - \delta)] \tag{D.22}$$

$$R_t = R(\Pi_t/\Pi)^{\upsilon_\pi} \tag{D.23}$$

$$(\Delta_t y_t)^{\eta} = (1-\mu)((1-\nu_t)l_{\ell,t})^{\eta} + \mu\Big((1-\chi)(\nu_t l_{h,t})^{\xi} + \chi(k_{t-1}/\Gamma_{N,t})^{\xi}\Big)^{\eta/\xi} \tag{D.24}$$

$$\Delta_t = (1-\zeta)(p_t^*)^{-\varepsilon} + \zeta\Pi_t^{\varepsilon}\Delta_{t-1} \tag{D.25}$$

$$c_t = \nu_t c_{h,t} + (1-\nu_t)c_{\ell,t} \tag{D.26}$$

$$c_t + i_t = y_t \tag{D.27}$$

Frisch Elasticity Type-i households receive utility flows from consumption, $c_{i,t}$, and disutility from labor, $l_{i,t}$, with nonseparable preferences,

$$u\left(c_{i,t}, l_{i,t}\right) = \frac{\left(c_{i,t}\left(1-\psi l_{i,t}^{1+\theta}\right)\right)^{1-\sigma}}{1-\sigma},$$

where hours worked provide total labor income $w_{i,t}l_{i,t}$. Equating the marginal cost and benefit of working yields the type-i household's labor supply curve,

$$w_{i,t}\lambda_{i,t} = c_{i,t}^{1-\sigma}\left(1-\psi l_{i,t}^{1+\theta}\right)^{-\sigma}(1+\theta)\psi l_{i,t}^{\theta},$$

where $\lambda_{i,t}$ is the household's marginal utility of wealth,

$$\lambda_{i,t} = c_{i,t}^{-\sigma}\left(1-\psi l_{i,t}^{1+\theta}\right)^{1-\sigma}.$$

To derive the Frisch elasticity, log-linearize the labor supply curve and marginal utility of wealth,

$$\hat{w}_{i,t} + \hat{\lambda}_{i,t} - (1-\sigma)\hat{c}_{i,t} = \left[\theta + \sigma(1+\theta)\frac{\psi l_i^{1+\theta}}{1-\psi l_i^{1+\theta}}\right]\hat{l}_{i,t},$$
$$\hat{\lambda}_{i,t} = -\sigma\hat{c}_{i,t} - (1-\sigma)(1+\theta)\frac{\psi l_i^{1+\theta}}{1-\psi l_i^{1+\theta}}\hat{l}_{i,t}.$$

The Frisch elasticity is the wage elasticity of labor supply conditional on the marginal utility of wealth being held fixed. Setting $\hat{\lambda}_{i,t} = 0$ and combining the two log-linear equations implies

$$\sigma\hat{w}_{i,t} = \left[\sigma\theta + (2\sigma-1)(1+\theta)\frac{\psi l_i^{1+\theta}}{1-\psi l_i^{1+\theta}}\right]\hat{l}_{i,t},$$

so the steady-state Frisch elasticity is given by

$$\phi_i = \frac{\sigma}{\sigma\theta + (2\sigma-1)(1+\theta)\psi l_i^{1+\theta}/(1-\psi l_i^{1+\theta})} = \frac{\sigma}{\sigma\theta + (2\sigma-1)w_i l_i/c_i}.$$

The aggregate Frisch elasticity, which is used to calibrate the model, is given by

$$\phi = \nu\phi_h + (1-\nu)((1-\vartheta)\phi_{\ell s} + \vartheta\phi_{\ell n}).$$