# Worker Shortages and Local Immigration Support[*]

Daniel Auer[1,2], Gloria Gennaro[3], and Tiziano Rotesi[4]

[1]*Collegio Carlo Alberto, Italy,* [2]*University of Mannheim, Germany,* [3]*University College London, United Kingdom,* [4]*Brown University, United States*

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## Abstract

Swiss agricultural production relies heavily on foreign labor. However, the pandemic lockdown induced a shortage of foreign seasonal workers in the spring of 2020. How peoples' perceptions towards immigration change when exposed to dramatic declines in the availability of immigrant labor? We combine fine-grained voting results from referendums on immigration-related policy decisions with variation in seasonal worker needs. We establish that municipalities growing spring crops, and therefore rely on seasonal workers in this season, voted significantly more in favor of immigration in September 2020 compared to otherwise similar rural regions. Using text from open-ended questions from survey data, we document how this shock popularized a narrative highlighting the role of foreign workers as complements to the local population rather than substitutes. We conclude that economic shocks have the potential to confirm and enhance economic narratives and, ultimately, change attitudes toward immigration.

# 1.  Introduction

Immigration is considered one of the top priorities by voters in most Western democracies. For example, in 2024, 35% of US voters considered immigration as the first priority for the next president (Jackson et al., 2024). Similarly, 24% of European voters considered immigration one of the top priorities of the newly elected European Parliament (Abnett, 2024). The widespread public concern about immigration has translated into concrete policy proposals, which are predominantly focused on reducing immigration or facilitating the deportation of immigrants to their countries of origin. However, as employers in many industries heavily rely on immigrant labor to fill vacant positions, these policies have the potential of creating worker shortages in various sectors of the economy (Garsd, 2024; Feng and Acevedo, 2024). The tension between public demands for immigration restrictions and the economy's reliance on foreign workers makes it crucial to study how labor market conditions, particularly worker shortages, shape public attitudes toward immigration.

Despite the importance of understanding how worker shortages affect attitudes toward immigration, this question remains understudied in the existing literature. Research in this area has primarily focused on how immigrant inflows influence support for right-wing parties (Halla et al., 2017; Dustmann et al., 2019; Alrababah et al., Forthcoming) and increase anti-immigrant legislation (Tabellini, 2020). Within economics, studies examining reductions in immigrant labor have concentrated on labor market outcomes, such as changes in native workers' wages and firms' adoption of mechanization and automation technologies (Lafortune et al., 2015; Clemens et al., 2018; Lew and Cater, 2018; Abramitzky et al., 2023; Clemens and Lewis, 2024).

Worker shortages provide a unique opportunity to study how voters interpret information about immigration and its economic effects. While numerous studies have found that providing factual information about immigration has limited effects on policy preferences (Sides and Citrin, 2007; Hopkins et al., 2019; Barrera et al., 2020; Grigorieff et al., 2020; Alesina et al., 2023), public discourse around immigration is fundamentally shaped by competing narratives, that is, causal models that explain how immigration affects voters' lives (Shiller, 2017; Shiller, 2020; Eliaz and Spiegler, 2020). When it comes to economic narratives, two opposing models dominate. On the one hand, we see narratives based on competition over limited resources (Chinoy et al., 2023). Immigrants compete with the local population for goods and jobs, thereby increasing prices and unemployment. On the other hand, we see models that highlight the role that immigrants play in the local economy, increasing economic activity and filling positions — often less desired by native workers — that might otherwise remain vacant (Haaland and Roth, 2020).

This article studies how exogenous and sudden shortages of foreign workers impacted attitudes toward immigration in Switzerland in 2020. As an advanced economy that has experienced substantial immigration flows, the country has grappled with tensions related

to immigration since the early 2000s. In our analysis, we leverage the sudden closure of international borders due to the pandemic in March 2020. This border closure created an unexpected and significant disruption to the supply of foreign labor, particularly affecting sectors heavily reliant on seasonal migrant workers, such as agriculture. Swiss media at the national level and in all regions extensively covered the labor shortages that ensued, highlighting the economic challenges faced by industries dependent on migrant labor (e.g., Baumer, 2020; Prantner, 2020; Sikora, 2020; Thoele, 2020). We explore whether this temporary yet highly visible shock to the labor market influenced Swiss citizens' preferences toward immigration.

Switzerland has one of the largest foreign populations in Europe, with foreigners constituting about one-third of its workforce (32.2% in 2020 FSO, 2024). A key element of Swiss immigration policy is the 1999 Agreement on the Free Movement of People with the European Union (EU), which governs European workers' access to the Swiss labor market. This agreement allows EU citizens to easily access the Swiss job market (Beerli et al., 2021). However, immigration has always been a contested topic, with important political actors frequently seeking to capitalize on anti-immigration sentiment. In line with the country's tradition of deciding specific policies through public referendums, Swiss voters participated in two particularly significant immigration referendums in 2014 and 2020. The 2014 referendum "against mass immigration," strongly supported by the Swiss People's Party (SPP), aimed to impose quotas on immigration and ultimately renegotiate or even abandon the Free Movement of People agreement with the European Union. The referendum passed narrowly, signaling considerable public concern over immigration levels. However, when significant policy changes failed to materialize, the SPP launched another initiative in 2020. This second referendum, termed "for moderate immigration," contained the same policy demands as the 2014 referendum but ultimately failed to pass.

We leverage three specific aspects of this context. First, the two referendums provide us with granular data on attitudes regarding specific immigration policies at different points in time, allowing us to analyze *changes* in voting. Second, we exploit the unanticipated timing of the border closure in relation to agricultural growing seasons. Since these restrictions coincided with spring harvesting, they created variation in labor demand shocks across municipalities, with areas dependent on spring crop cultivation being disproportionately affected. This comparison is at the core of our identification strategy. Third, we leverage survey data collected in the immediate aftermath of both referendums, providing insights into voters' decision-making processes. These data contain free-text answers to open-ended questions, which we use to identify the presence of narratives —if any —behind people's voting decisions.

Our empirical analysis revolves around measuring labor shortages in agriculture. We construct this measure by comparing the observed number of seasonal workers in 2020 with predictions based on historical data from 2012-2019. The key identification challenge relates to using predicted rather than actual counterfactual employment levels, which

could introduce non-classical measurement error. This could arise if local factors simultaneously influenced both hiring decisions and referendum voting patterns. Specifically, if a municipality shifted toward more conservative positions in 2020, local farmers might have reduced their hiring of foreign seasonal workers. We would interpret this reduction as a higher labor shortage, when in fact it reflected a change in hiring preferences. This would bias our estimates upward if the same conservative shift also led the municipality to vote more strongly against immigration.

To identify the causal effect of shortages on voting in the referendum, we exploit both the unexpected timing and duration of border closures relative to agricultural growing seasons. We use detailed data on crop types at the municipality level, which creates variation in exposure to the labor supply shock. Some municipalities, particularly those cultivating labor-intensive spring crops like asparagus and strawberries, rely heavily on foreign labor during the spring season — precisely when the border closures were imposed and maintained. In particular, we instrument the shortages using the predicted hiring needs. These are obtained using data from 2012-2019 to train a prediction model that estimates labor demand based solely on agricultural inputs, including hectares of crops (across 32 categories) and livestock at the municipality level. We then use this predicted labor demand as an instrument for actual shortages. Our identification strategy rests on two key assumptions. First, the predicted number of seasonal workers—based on pre-existing agricultural patterns—should not directly influence referendum voting except through its effect on actual labor shortages. Second, the crop composition should be predetermined with respect to both the shortage and the political debate. The unexpected nature of the border closures and the long-term planning required in agriculture support the plausibility of this assumption.

In the first part of the analysis, we document a severe shortage of temporary foreign workers during spring crop cultivation in 2020, while demand for agricultural products remained stable. Our baseline results reveal that municipalities experiencing more severe labor shortages were significantly less likely to support the referendum to curb immigration. The effect is economically meaningful: a one standard deviation increase in labor shortage is associated with a 0.91 percentage point decrease in support for the referendum, equivalent to approximately one-tenth of the standard deviation in voting outcomes. Importantly, the magnitude of this effect suggests broader voter responses beyond the agricultural sector, as farmers represent only 1.6% of the Swiss population. These findings indicate that voters responded to the concrete economic consequences of labor shortages, leading to a significant shift in attitudes toward immigration.

In the second part of the paper, we use survey data to shed light on the likely mechanism driving the change in attitudes. Our analysis draws on the *VOTO* surveys conducted at the time of a given referendum, which contain responses from representative samples of the Swiss population. We initially collect text responses from approximately 3,100 respondents who explained their voting motivations in the 2014 and 2020 immigration

referendums in up to two open-ended text responses (Ferrario and Stantcheva, 2022; Haaland et al., 2024). To characterize these explanations, we use BERTopic (Grootendorst, 2022), which detects the most relevant themes through topic modeling. Competing economic explanations emerge as two of the largest clusters, together with concerns about overpopulation and European integration. We document strong correlations between explanations and voting behavior, with themes like wage dumping correlating with support for immigration restrictions. Using GPT4 to refine the BERTopic clusters, we can identify specific narratives from the explanations: (i) a "complements" narrative, suggesting foreign workers have a positive causal impact on economic variables or are complements to native workers; and (ii) a "substitutes" narrative, where respondents mention, directly or indirectly, labor market competition between foreign and Swiss workers. We also consider a third narrative focused on overcrowding and overpopulation, which was particularly promoted by the SPP (Alrababah et al., Forthcoming). We find that respondents from municipalities more affected by labor shortages are more likely to justify their voting decision with their perception of immigrant workers as "complements". Specifically, a one standard deviation increase in the shortage of workers in their municipality increases the probability of mentioning the "complements" narrative by 2%, which is a sizable effect compared to the average probability of 9%. We also observe a 3% reduction in the probability of supporting immigration restrictions. Given that 95% of respondents who mention complements vote against restrictions, we estimate that changes in narratives account for approximately two-thirds of the overall effect on voting behavior. Interestingly, we do not observe any effect on the "substitutes" narrative or on overpopulation.

Our study makes several contributions to different strands of literature. First, we contribute to research on economic versus non-economic determinants of immigration attitudes (Alesina and Tabellini, 2024; Weber et al., 2024) by leveraging unexpected border closures as a natural experiment. While previous work has studied how immigration shocks affect attitudes (Halla et al., 2017; Dustmann et al., 2019; Alrababah et al., Forthcoming), we examine a unique setting with two distinguishing features. For one, we consider a transitory shock that highlights the positive economic contribution of immigrants, making our results less likely to capture cultural concerns. For another, we study voting on a specific policy rather than support for right-wing parties. This outcome variable has the advantage of capturing attitudes toward immigration more directly, as opposed to examining a bundle of themes that may constitute a party's political platform.

Our work shares the same setting as Alrababah et al. (Forthcoming), who document increasing support for anti-immigrant parties in Switzerland and link this to overpopulation narratives. We complement their findings by using quasi-experimental data to demonstrate how exogenous local economic shocks that highlight immigrants' contribution to the economy can counteract these trends and popularize different narratives.

We also relate to studies using survey experiments to investigate how economic beliefs shape immigration attitudes (Hopkins et al., 2019; Grigorieff et al., 2020; Alesina et al.,

2023). While these studies typically use information treatments to correct misperceptions about immigrant characteristics or population size, we rely on a natural experiment. Our analysis of referendum survey data shows that changes in narratives about immigration's economic impact account for approximately two-thirds of the effect on voting behavior. This finding suggests that attitudes might be shaped more by the economic models people use to think about immigration than by specific beliefs. This could help explain why information treatments correcting misperceptions often yield weak effects.

Furthermore, we contribute to the growing literature on the determinants and consequences of narratives in general (Andre et al., 2023; Djourelova et al., 2023). While previous work has focused on macroeconomic phenomena like inflation or on climate change, we extend these insights to immigration policy. This setting is particularly suitable for studying narratives given the complexity of immigration's economic effects and the role of competing models in shaping public attitudes.

Finally, we expand research on labor shortages of workers. Existing studies typically focus either on labor market outcomes such as employment and wages, or on firms' responses through mechanization and automation (Clemens et al., 2018; Abramitzky et al., 2023). We examine how labor shortages affect public attitudes. By analyzing the impact of border-closure-induced shortages on referendum voting, we show that labor market disruptions can shape not only economic outcomes but also political preferences.

## 2. Background and Data

Our aim is to identify the effect of shortages of foreign labor on attitudes towards immigration. Therefore, we leverage quasi-exogenous variation in the local influx of foreign short-term workers caused by the sudden closure of national borders in March 2020. We compile a rich dataset containing information on municipality-level soil use for crops, labor shortages, and voting outcomes. The paragraphs below provide details on the data, contextualize the institutional setting, and highlight the salience of the topic.

### 2.1. Voting on Immigration Policy

We retrieve municipality-level results from the Federal Statistical Office (2024d) for two almost identical public referendums in Switzerland (see Figure 1), the initiative *Against Mass Immigration* (2014) and the referendum for *Moderate Immigration* (2020).

Figure 1: MIGRATION-SPECIFIC NATIONAL REFERENDUMS



(a) AGAINST MASS IMMIGRATION – 2014



(b) FOR MODERATE IMMIGRATION – 2020

**Note:** The Figures show the main campaign slogans for the two referendums. Content-wise, they were almost identical.

Initially, the federal initiative (read: referendum) Against Mass Immigration called for more sovereignty to manage immigration into Switzerland, to enact annual quotas, and to tie immigration to the explicit needs of Swiss employers only in case they were unable to fill their vacancies from the native labor force (Federal Chancellery, 2014). Although the referendum was passed with a marginal majority of 50.3% on February 9, 2014, lawmakers were reluctant to ratify it because it violated established agreements with the European Union (EU). The overarching framework to govern many aspects of Swiss immigration policy is the 1999 Agreement on the Free Movement of People with the EU. This agreement allows EU citizens to easily access the Swiss labor market (e.g., Beerli et al., 2021).

According to supporters of a tougher stance on immigration around the Swiss People's Party (SPP), the parliament disobeyed the people's will to curb immigration. It enacted a preference mechanism for native workers to fill vacancies primarily on the domestic labor market but refrained from implementing immigration quotas. Therefore, the party issued the referendum For Moderate Immigration in 2020, which contained the same demands as the initiative against mass immigration (Federal Chancellery, 2020).[1] These two public referendums with the same content, specifically focused on labor migration, allow us to observe the change in public opinion in response to local labor shortages. At the same time, potential biases from unobserved factors are minimized.[2]

We provide additional evidence on the likely mechanism of changing narratives using detailed post-vote survey data from the *VOX/VOTO*-project (GFS, 2024). These standardized surveys are conducted after every federal vote through a collaboration between Swiss federal authorities and a private research company. The surveys collect responses from a representative sample of voters, gathering information on demographics, socioeconomic

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[1]On September 27, 2020, voters rejected the referendum with 61.7%.

[2]We argue that results from general elections are less suited to measure changes in political attitudes in response to labor shocks, as their analysis may be biased due to unobserved factors. For instance, it could have been that during the onset of the pandemic public opinion shifted in favor of or against populist parties (e.g., Bayerlein et al., 2021). If such shifts were locally clustered, the effect of spatially confined labor shortages on electoral outcomes might be biased by simultaneous political developments.

characteristics, voting behavior, and importantly, voters' motivations for their decisions. A key feature of these surveys is that respondents provide free-text explanations of their voting decisions in response to open-ended questions about their motivations.[3] Our final sample comprises 3,115 explanations from both referendums. The 2014 survey yielded 1,584 responses from 994 respondents, while the 2020 survey provided 1,531 responses from 1,123 respondents.

## 2.2. Labor Market and Short-term Workers

To assess the magnitude of potential labor shortages, we rely on monthly matched employer-employee registry data comprising every Swiss resident's employment situation (i.e., labor-market status and income subject to social security contributions, typically income from work, self-employment, pensions, or other subsidies). Matching the employee registry with the employer registry allows us to identify the economic sector of the company.[4] Both registries—employer (STATENT) and employee (ZAS)—are maintained and provided by the Swiss Federal Statistical Office (2024; 2024).

Using the social security identifier, we link this data covering the labor-market situation of all workers in Switzerland with the migrant registry maintained by the State Secretariat for Migration (2024). This registry records all residents in the country who are not Swiss citizens. Notably, the data comprises the person's residence permit, including the so-called "L-permit" for short-term work. These permits are valid for the duration of a working contract, from three months up to one year.

In terms of demand for foreign short-term labor, agriculture is by far the sector with the strongest dependency with more than 5% of the labor force being seasonal or short-term workers.[5] Moreover, focusing on the agricultural sector allows us to leverage variation in the coinciding harvest of spring crops in some municipalities and the sudden border closures in spring 2020 that is not endogenous to contemporaneous changes in political or economic factors in response to border closures.

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[3]In 2014, respondents were first asked "How did you vote on the popular initiative 'Against Mass Immigration'?", followed by "What were the main reasons why you accepted/rejected the popular initiative 'Against Mass Immigration'?" and "What else?" (Longchamp et al., 2014). In 2020, the sequence was "How did you vote on the initiative 'for moderate migration'?", followed by "What is the main reason that led you to accept/reject this proposal?" and "What other reasons did you have?" (Tresch et al., 2016–2020).

[4]We apply the first layer of the established General Classification of Economic Activities classification (Federal Statistical Office, 2024c) with 10 categories: (1) Agriculture, forestry, and fishing; (2) Manufacturing, mining and quarrying, and other industry; (3) Construction; (4) Wholesale and retail trade, transportation and storage, accommodation and food service activities; (5) Information and communication; (6) Financial and insurance activities; (7) Real estate activities; (8) Professional, scientific, technical, administration, and support service activities; (9) Public administration, defense, education, human health, and social work activities; (10) Other services.

[5]In Appendix Figure A1a, we report the average number of short-term workers in the Swiss economy by economic sector (2000–2019). In absolute numbers, trade and freelance services are the sectors employing the most short-term workers. Figure A1b in the Appendix shows the share of short-term workers among all workers in a given sector.

To study the importance of agriculture at the local level and the distribution of crops across municipalities, we utilize two datasets from the Federal Statistical Office (2024b), "Environment, Sustainable Development, Territory" and "Economic Structure and Analyses". The first dataset provides information at the year (2006 to 2022) and municipality level, including the number of farms, workers, total cultivated hectares, and animals raised (Federal Statistical Office, 2024b). We complement this information with a second dataset that details the number of hectares allocated to each crop type (32 categories), also recorded by municipality and year (from 2010 to 2021).

### 2.3. Border Closures

The COVID-19 pandemic had a profound impact on Switzerland, particularly through the implementation of strict border closures in March 2020 (see Figure 2). As the virus spread across Europe, Switzerland closed its borders with neighboring countries (Germany, France, Italy, and Austria) to contain the outbreak. Despite being temporary until mid-June 2020, these border closures severely affected the Swiss economy, especially in sectors dependent on cross-border workers such as agriculture, construction, and healthcare (Sager and Mavrot, 2020). The country is firmly integrated into the European market, and cross-border economic activity has been largely without regulatory constraints since Switzerland adopted the Agreement on the Free Movement of People with the EU in 1999 (e.g., Beerli et al., 2021). The mobility-restricting measures to contain the spread of the COVID-19 virus, thus, caused severe friction.

Figure 2: Timeline of the events
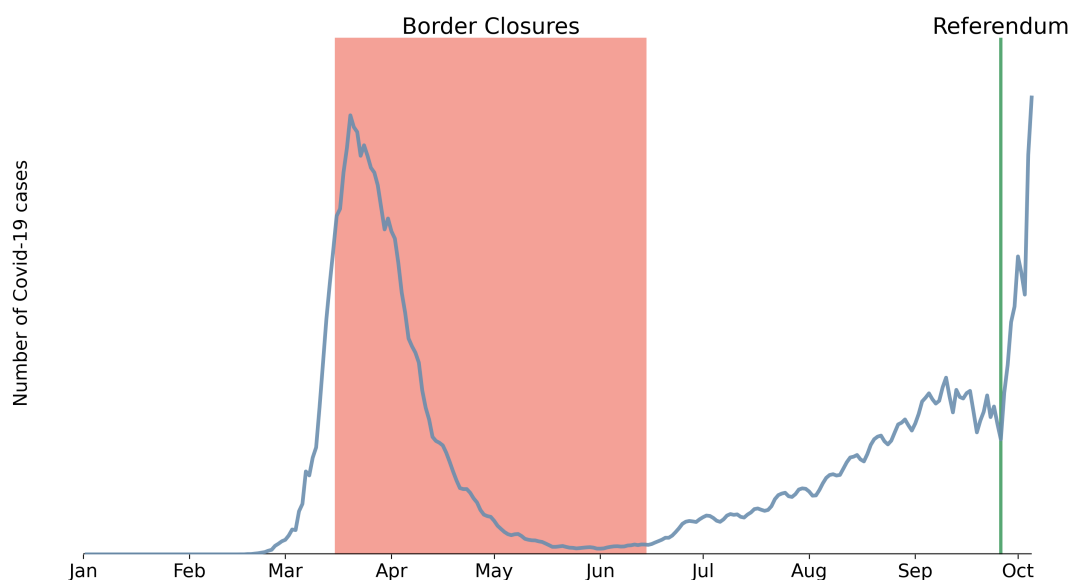


**Note:** The Figure shows the development of COVID-19 infections in Switzerland and the consequential closure of national borders between March 16 and June 15, 2020. The referendum "for moderate immigration" was held on September 27.

## 2.4. Salience

To demonstrate how seasonality in agriculture influences the attention given to specific crops and how the COVID-19 crisis impacted the salience of specific professions within the industry, we use web search data. Figure 3 plots the weekly Google Search intensities for related keywords between January 2019 and December 2021. We observe a seasonal increase in searches for asparagus and—to a lower extent—for strawberries, both of which are harvested in spring. Importantly, search numbers have been significantly higher in April 2020 compared to other years. The roughly 25% increase might be explained by the additional salience due to difficulties in harvesting asparagus during the pandemic. This is further supported by the exceptional peak of searches for harvesting helpers around March 2020.

Figure 3: SALIENCE OF LABOR SHORTAGE IN AGRICULTURE
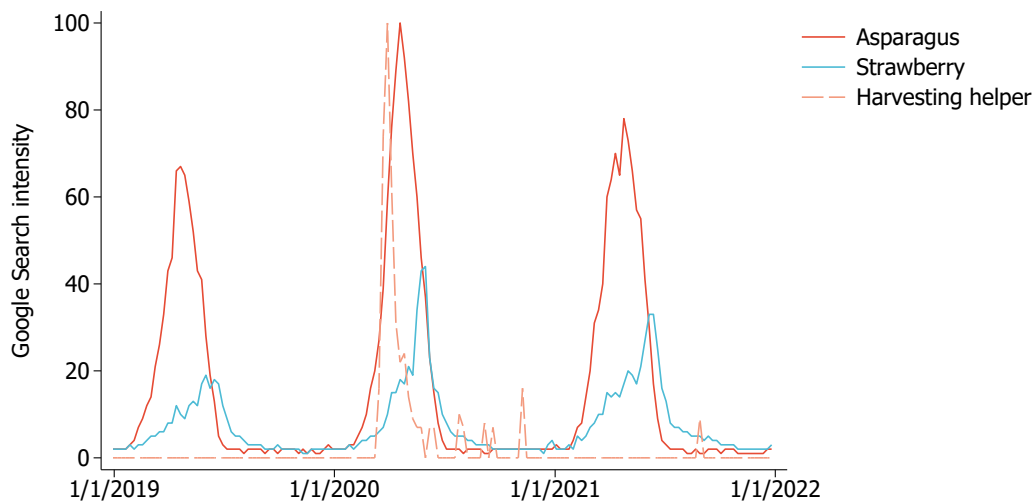


**Note:** Google Search intensities for "asparagus", "strawberry", and "harvesting helper" between January 01, 2019 and December 31, 2021. Intensities for asparagus and strawberry are relative to the peak intensity for asparagus (April 2020). Harvester searches are documented separately due to the lower overall search level.

Table 1: SUMMARY STATISTICS

|  | Mean | SD | Median | Min | Max |
|---|---|---|---|---|---|
| Share Foreign Population | 17.38 | 9.54 | 15.61 | 0.00 | 54.81 |
| Population Density | 509.25 | 795.02 | 250.45 | 6.29 | 12810.99 |
| Population | 4464.30 | 14470.06 | 1764.00 | 32.00 | 420217.00 |
| Share Age 20-64 | 60.41 | 2.89 | 60.43 | 47.62 | 75.00 |
| Share Age 65 plus | 18.58 | 3.80 | 18.40 | 6.46 | 37.87 |
| Share of land used for housing and infrastructure | 17.25 | 14.55 | 12.19 | 0.56 | 94.24 |
| Share of land used for agriculture | 50.00 | 17.77 | 51.86 | 0.61 | 91.51 |
| Share of land covered by forests | 30.94 | 15.39 | 29.42 | 0.00 | 88.04 |
| Share of workers in the primary sector | 15.32 | 16.35 | 9.23 | 0.00 | 100.00 |
| Share of workers in the secondary sector | 26.35 | 15.65 | 24.50 | 0.00 | 95.47 |
| Total establishments in the primary sector | 70.79 | 41.27 | 68.00 | 1.00 | 458.00 |
| New Dwellings | 27.89 | 103.63 | 7.04 | 0.00 | 3450.12 |
| Share Yes 2014 | 54.82 | 11.11 | 56.03 | 19.05 | 92.00 |
| Yes/Eligible 2014 | 31.39 | 6.55 | 31.39 | 11.94 | 64.13 |
| Share Yes 2020 | 43.41 | 10.31 | 43.64 | 15.98 | 82.67 |
| Yes/Eligible 2020 | 26.30 | 6.51 | 25.93 | 10.38 | 55.19 |

Note: This table presents summary statistics for municipality characteristics and referendum outcomes. The sample only includes 1684 municipalities that are suitable for crop production according to terrain and climate conditions. For each variable, we report the mean, standard deviation, minimum, and maximum values. Municipality controls are measured in 2020.

## 3. Crops Seasonality and Labor Shortages

We start by documenting that border closures generated shortages of short-term foreign workers across sectors. Specifically, we show that there is a significant gap in the number of registered temporary workers in the spring months in 2020, compared to previous years. Focusing on agriculture, we then develop a measure of labor shortages of seasonal workers, which we will use in the rest of the analysis. In the second part of the section, we develop our instrument, which is based on how the specific type of crops cultivated locally are driving the demand of seasonal workers. We first show this idea for asparagus and then move to train a machine learning model which takes into account the full set of crops cultivated in Switzerland, as well as the the presence of livestock.

### 3.1. Border Closures and the Share of Foreign Workers

To capture the effect of border closures, we calculate the month-by-month difference between the share of registered short-term foreign workers in 2020 compared to previous years. Specifically, we estimate the following fixed-effect regressions using foreign worker registry data between 2012 and 2020:

$$L_{i,m,y} = \sum_m \beta_m \mathtt{I}(\text{month} = m) \times \mathtt{I}(\text{year} = 2020) + \gamma_m + \delta_i + \epsilon_{i,m,y}, \qquad (1)$$

Figure 4: IMPACT OF BORDER CLOSURE ON SHORT-TERM LABOR IN SPRING
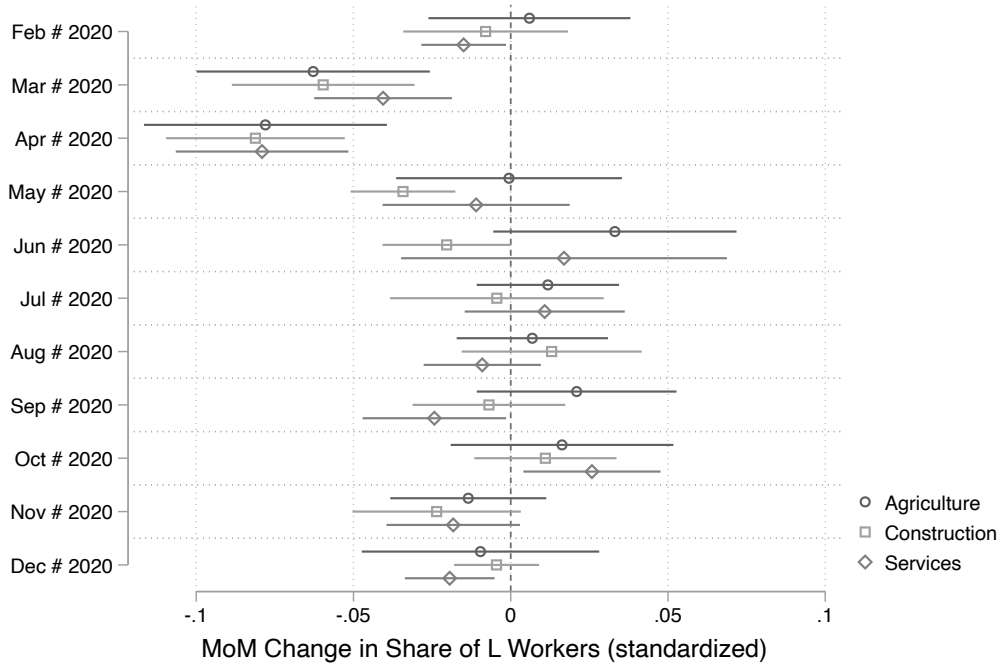


**Note**: Each point estimate is the coefficient of different months, interacted with the 2020-year dummy, as estimated in equation 2. January serves as the reference point. Bars indicate 95% CI. The complete regression results are reported in Appendix Table C.7.

where $L_{i,m,y}$ measures the ratio of short-term workers on all workers in a given sector, in municipality $i$, month $m$ and year $y$; $\mathrm{I}(\text{month} = m)$ are month dummies; $\mathrm{I}(\text{year} = 2020)$ indicates the pandemic year 2020. The regression includes fixed effects for month ($\gamma_m$) and municipalities ($\delta_i$). Standard errors are clustered at the municipality level.

In Specification (1), the $\beta_m$ coefficients capture the month-specific difference in the share of agricultural workers registered in 2020, compared to previous years. This difference is net of fixed municipality characteristics (e.g. geography, historical sector specialization, or cultural predispositions), and general (monthly) seasonality in short-term employment.

Figure 4 reports the main results for the three sectors that rely the most on short-term foreign workers (Appendix Figure A1): agriculture (circles), construction (squares), and services (diamonds). Across all three sectors of activity, the share of short-term workers registered in March and April 2020 is significantly lower than the share registered in previous years. This confirms that border closures in late March effectively reduced the influx of short-term foreign workers in the subsequent months. Moreover, we find no signs of a compensation for lost labor in the months after border restrictions were lifted and registrations returned to normal levels. Overall, the results strongly support the hypothesis that border closures affected labor markets precisely in the spring months following their introduction.

Figure 5: Monthly shortages in short-term foreign labor in 2020
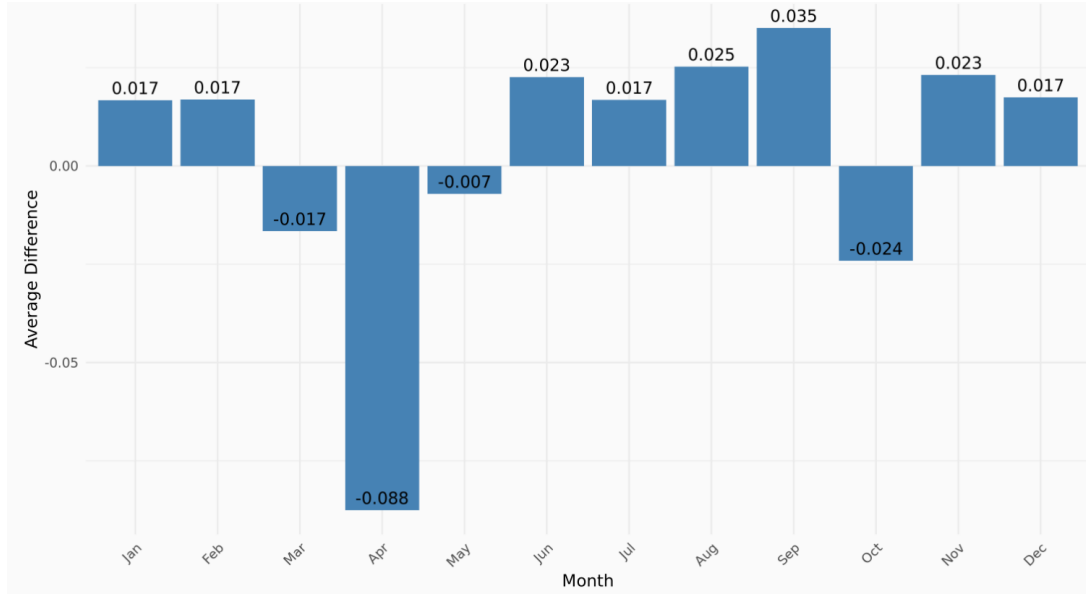


**Note:** Each bar represents the average residual for 2020, standardized. Negative residuals indicate that the total wage bill for short-term foreign workers is lower than expected, which is interpreted as evidence of labor shortages.

## 3.2. Measuring labor shortages

Building on this analysis, we conceptualize shortages as deviations from what would have been the number of short-term foreign worker registration in any given month, absent the pandemic. Specifically, we take the difference between the realized number of short-term foreign workers that were registered in a given month, and the number predicted based on seasonal variation.

In particular, we estimate the following regression:

$$L_{i,m,y} = \gamma_m + \delta_i + L_{i,m,y-1} + y + \epsilon_{i,m,y} \tag{2}$$

where $L_{i,m,y}$ measures the standardized number of short-term workers in agriculture in municipality $i$ in month $m$ and year $y$. Additionally, $\gamma_m$ represents month fixed-effects, $\delta_i$ represents municipality fixed-effects, and $y$ represents a linear yearly trend. This model is estimated using the data from 2012 to 2019 to avoid capturing the effect of the border closure. Next, we use the estimated parameters to predict the value for 2020 and take the difference with respect to the observed numbers. The averages at the monthly level are plotted in Figure 5 below. The results show that the difference between the observed and the predicted number is close to 0 in all months expect April, i.e. the month immediately following the border closure decision. In the rest of the paper we will therefore use the difference observed in April as our measure of shortage.

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### 3.3. Asparagus and Seasonal Foreign Labor

We illustrate how seasonality in the reliance on foreign workers depends on the crops grown in the municipality, we begin by estimating the following fixed-effect regression model on monthly employment data between 2012 and 2019:

$$L_{i,m,y} = \sum_m \beta_m \mathtt{I}(\text{month} = m) \times \mathtt{I}(\text{Asparagus}_{i,y} > 0) + \gamma_m + \delta_i + \theta_y + \epsilon_{i,m,y}, \quad (3)$$

where $L_{i,m,y}$ measures the standardized share of short-term workers over total workers in the sector in municipality $i$, month $m$ and year $y$; $\mathtt{I}(\text{month} = m)$ are month dummies; $\mathtt{I}(\text{Asparagus}_{i,y} > 0)$ indicates the presence of asparagus in municipality $i$ in year $y$. Here, we adopt a conservative approach to the definition of spring crops, only including asparagus. We measure the presence of asparagus as any strictly positive number of hectares dedicated to asparagus cultivation. The regression includes fixed effects for month ($\gamma_m$), municipalities ($\delta_i$), and year ($\theta_m$). Standard errors are clustered at the municipality and year level.

In this specification, the $\beta_m$ coefficients capture the month-specific difference in the share of agricultural workers registered in municipalities with asparagus compared to those registered in municipalities without spring crops. This difference is net of fixed municipality characteristics (e.g., geography, historical sector specialization, or cultural predispositions), temporal fluctuations that affect all municipalities (e.g., business cycles and macroeconomic shocks), and general seasonality in short-term employment.

Figure 6 reports the main results for the agricultural sector (circles) and compares those with similarly estimated monthly coefficients for alternative sectors as placebo specifications (construction - squares - and services - diamond). The positive and statistically significant coefficients corresponding to the months of February to May—peaking in March and April—provide strong evidence in support of the hypothesis that, in the absence of border closures, municipalities growing asparagus have significant labor demand (and corresponding supply) precisely spring months.

This does not translate into higher demand for short-term labor in general. Indeed, services and construction, respectively, which also heavily rely on foreign short-term workers (see Appendix Figure A1), do not show those seasonal differences in demand across municipalities with or without spring crops. This result suggests that the specification does not capture general differences across those municipalities, while short-term labor demand closely matches their agricultural specialization.

Figure 6: SEASONALITY OF SHORT TERM LABOR IN SPRING CROP MUNICIPALITIES
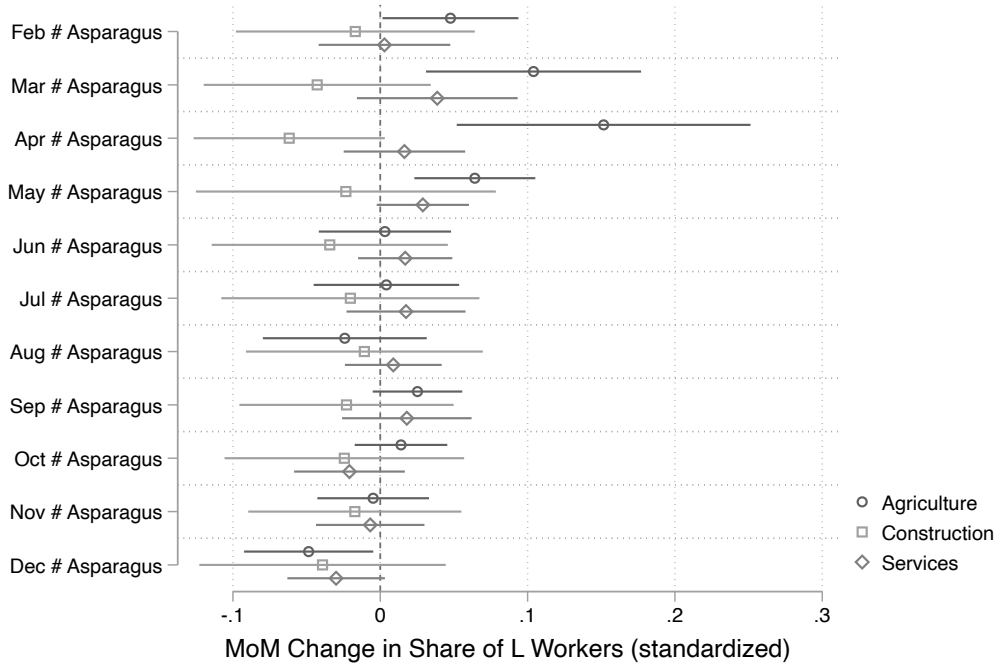


**Note:** Each point estimate is the coefficient of different months, interacted with the dummy indicating the presence of asparagus, as estimated in equation 3. Bars indicate 95% CI.

# 4. Empirical Strategy

To identify the causal effect of labor shortages on referendum voting, we estimate:

$$Y_{ij}^{2020} = \beta_0 + \beta_1 \text{Shortage}_i + Y_{ij}^{2014} + \mathbf{X}_i'\boldsymbol{\gamma} + \gamma_j + \epsilon_{ij} \tag{4}$$

where $Y_{ij}^{2020}$ is the share of votes cast to restrict immigration over total cast votes, or over total eligible population; $\text{Shortage}_i$ is the shortage measured according to the procedure described in Section 3.2. The regression further includes controls for the municipality-level outcome of the 2014 referendum ($Y_{ij}^{2014}$) and canton FE ($\gamma_j$). $\mathbf{X}_i$ is a vector of municipality level controls.

## 4.1. Using Agricultural Inputs to Instrument for Shortages

The main empirical challenge when estimating Equation 4 stems from potential non-classical measurement error in our shortage measure. Since we cannot directly observe labor demand in the counterfactual scenario without border closures, our estimates may suffer from endogeneity bias through several channels.

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A key concern is that the shortage measure captures local variation potentially correlated with political factors. For instance, the political discourse surrounding the referendum may have influenced farmers' hiring intentions. Areas with stronger immigration presence in the years preceding 2020 might have experienced shifts in right-wing political attitudes, leading to two concurrent effects: (i) a reduced willingness to hire foreign workers relative to predicted levels, resulting in measured shortages exceeding actual shortages perceived by farmers, and (ii) higher vote shares against immigration in the referendum. This mechanism would generate an upward bias in our OLS estimates.

To address these endogeneity concerns, we construct an instrumental variable that exploits two sources of plausibly exogenous variation: the seasonality of crop production and the complementarities between agricultural inputs in the production function – specifically, the relationship between workers, cultivated land by crop type, and livestock holdings. We use these structural features of agricultural production to predict the counterfactual number of workers that would have been employed in April 2020, which serves as our instrument.

Our approach proceeds in two steps. First, we train a machine learning model to predict the number of seasonal agricultural workers at the municipality-month level using data from January 2012 to December 2019. Specifically, we implement an XGBoost algorithm that uses month indicators along with detailed municipality-year level agricultural characteristics as predictors. These characteristics comprise the hectares allocated to each of 32 crop categories, livestock counts, and a set of interactions between month indicators and hectares for seasonal crops. Importantly, we exclude municipality identifiers from the prediction model, ensuring that our estimates rely solely on the relationship between agricultural inputs and seasonal labor demand. We evaluate the model's performance using a randomly selected 20% hold-out sample and notice that it replicates the seasonal pattern (Appendix C.2). In the second step, we apply the trained model to agricultural inputs observed in 2020 to predict counterfactual worker counts for April 2020.

## 4.2. Indentifying assumptions and robustness checks

The validity of our instrumental variable strategy rests on two key identifying assumptions. First, local agricultural inputs that predict April labor demand affect referendum voting only through their impact on labor shortages during the border closure. The plausibility of this exclusion restriction is supported by balance tests showing that our instrument is uncorrelated with various pre-determined characteristics, including – importantly – vote shares in the 2014 referendum (see Table 2). Importantly, our instrument uses only predicted rather than observed worker counts, as the latter might be problematic if municipality-level labor market conditions in April 2020 were correlated with referendum outcomes through channels unrelated to labor shortages. Second, crop selection decisions were predetermined relative to both the border closure and any changes

in political attitudes. This identifying assumption is supported by two features of our setting: the substantial planning horizon required for agricultural production decisions and the unexpected implementation of border closures in response to the pandemic.

Table 2: BALANCE TABLE: PREDICTED HIRING USING AGRICULTURAL INPUTS

|  | Predicted Hiring (inputs based) | |
|  | Coefficient | Standard Error |
| --- | --- | --- |
| Share Foreign Population | 0.74 | (0.47) |
| Population Density | -22.72 | (27.02) |
| Population | 1048.48 | (712.45) |
| Share Age 20-64 | 0.14 | (0.11) |
| Share Age 65 plus | -0.16 | (0.11) |
| Share of land used for housing and infrastructure | -0.45 | (0.48) |
| Share of land used for agriculture | 1.20* | (0.63) |
| Share of land covered by forests | -0.78 | (0.58) |
| Share of workers in the primary sector | 0.84 | (0.74) |
| Share of workers in the secondary sector | 0.04 | (0.40) |
| Total establishments in the primary sector | 1.00 | (2.20) |
| New Dwellings | 0.35 | (1.63) |
| Share Yes 2014 | -0.16 | (0.33) |
| Observations | 1680 | |

**Note:** Each row refers to a different regression where the control variables is regressed on the value of *Predicted Hiring*. The sample only includes municipalities that are suitable for crop production according to terrain and climate conditions. All models include canton-fixed effects. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

To further validate our identification strategy, we conduct two robustness checks that address potential concerns about our instrumental variable approach. First, we run the same analysis on the full sample, to exclude that the pattern is driven by sample selection. Second, we develop two simplified versions of our instrument that focus exclusively on the presence of spring crops at the local level: (i) the total hectares devoted to spring crops in each municipality, and (ii) the share of spring crops relative to total cultivated land. These alternative specifications help validate that our main results are not driven by the particular functional form of our baseline instrument, but rather by the fundamental variation in spring crop intensity that drives seasonal labor demand.

### 4.3. First Stage

Table 3 reports estimates from regressions of shortages as measured in Section 3.2 on the input-based instrument. Column (1) presents the baseline specification without fixed effects, showing a positive and significant relationship between predicted and actual shortages. The relationship remains robust when we progressively add canton fixed effects

(Column 2), municipality-level controls (Column 3), and the 2014 referendum vote share (Column 4) to account for pre-existing political preferences.

Table 3: First Stage Regressions

|  | Dep. Variable: Shortage (standardized) | | | |
|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) |
| Predicted hiring (inputs based) | 0.43*** | 0.38*** | 0.35*** | 0.35*** |
|  | (0.09) | (0.09) | (0.08) | (0.08) |
| F-Stat | 22.79 | 19.65 | 19.33 | 19.43 |
| Observations | 1,680 | 1,680 | 1,680 | 1,680 |
| Municipality Controls | No | No | Yes | Yes |
| Share Yes 2014 | No | No | No | Yes |
| Canton Fixed Effects | No | Yes | Yes | Yes |

**Note:** Each row refers to a different regression where *Shortage (standardized)* is regressed on the standardized value of *Predicted hiring (inputs based)*, which is calculated based on the agricultural inputs. The sample only includes municipalities that are suitable for crop production according to terrain and climate conditions. F-stat refers to the Kleinbergen-Paap F-stat for weak instrument. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

We find a stable coefficient of approximately 0.35, indicating that while our instrument strongly predicts actual labor shortages, the relationship is not one-to-one. This suggests that additional local factors beyond agricultural production patterns contributed to labor shortages. Notably, even though our instrument relies only on predicted rather than observed worker counts, the F-statistics from our first-stage regressions remain well above conventional thresholds, supporting the relevance of our instrumental variable approach. In Appendix C.3 and C.4, we demonstrate the robustness of these first-stage results across several dimensions. First, we show that similar relationships hold in the full sample of municipalities, not just those suitable for crop production. Additionally, we document strong first-stage relationships for our alternative instruments, including total hectares of spring crops, and the share of spring crops in total agricultural land.

## 5. Shortages and Voting in the Referendum

In this section, we examine how shortages of foreign workers shaped local attitudes toward immigration by analyzing voting patterns in referendums on European labor migration. Our analysis focuses on two key votes with factually identical content: the 2020 referendum *For Moderate Immigration* and the 2014 referendum *Against Mass Immigration*. This setting allows us to study whether municipalities that experienced more

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severe worker shortages during the pandemic showed different voting patterns compared to those less affected.

Building on the instrumental variable approach described in Section 4, we exploit differences in agricultural production patterns across municipalities to identify the causal effect of labor shortages on referendum outcomes. Specifically, we estimate the following two-stage model:

$$\text{Shortage}_i = \alpha_0 + \alpha_1 \text{Predicted Hiring}_i + Y_{ij}^{2014} + \mathbf{X}_i' \boldsymbol{\delta} + \gamma_j + \nu_{ij}$$

$$Y_{ij}^{2020} = \beta_0 + \beta_1 \widehat{\text{Shortage}}_i + Y_{ij}^{2014} + \mathbf{X}_i' \boldsymbol{\gamma} + \gamma_j + \epsilon_{ij}$$

where $Y_{ij}^{2020}$ represents the share of votes in favor of immigration restrictions, measured either as a fraction of total votes cast or of the eligible population. Our specification includes the 2014 referendum outcome ($Y_{ij}^{2014}$) to control for pre-existing differences in political preferences, canton fixed effects ($\gamma_j$) to capture only variation within administrative units that share similar geographical, linguistic, and institutional features. Finally, the specification includes a vector of municipality-level controls ($X_{i,j}$) as detailed in Table 2.

The coefficient of interest, $\beta_1$, captures how labor shortages affected support for immigration restrictions, comparing municipalities within the same canton that experienced different degrees of worker scarcity. The validity of our research design rests on the assumption that, conditional on our controls, municipalities with different agricultural profiles would have exhibited similar voting patterns in the absence of the border closure-induced labor shortages.

## 5.1. Referendum Results

Table C.14 presents our main results on the relationship between labor shortages and support for immigration restrictions. Panel A reports estimates using the share of 'yes' votes among total votes cast as the dependent variable, while Panel B uses the share of 'yes' votes over the total eligible voting population. For each outcome, we present specifications without municipality controls (Columns 1-3) and with municipality controls (Columns 4-6). Within each set, we report OLS estimates (Columns 1 and 4), reduced form results (Columns 2 and 5), and instrumental variable estimates (Columns 3 and 6).

Our preferred specification in Column 6 indicates that municipalities more affected by labor shortages showed significantly lower support for immigration restrictions. Specifically, a one standard deviation increase in labor shortages led to a 0.91 percentage point decrease in support for restricting immigration. This effect is economically meaningful, representing approximately 9 percent of the standard deviation in referendum support across municipalities. The results remain consistent when examining the share of support

among eligible voters (Panel B).

Comparing the OLS and IV estimates provides support for our identification strategy discussed in Section 4. The OLS coefficients exhibit an upward bias relative to the IV estimates, consistent with our hypothesis that unobserved factors simultaneously affect both the likelihood of experiencing labor shortages and attitudes toward immigration restrictions.

These findings suggest that direct exposure to labor market disruptions significantly influenced municipalities' views on immigration policy. Specifically, municipalities that experienced more severe shortages of foreign workers during the spring months showed systematically lower support for additional immigration restrictions. We interpret these results as evidence that the concrete experience of labor shortages led municipalities to more fully appreciate the economic costs associated with restricting access to foreign workers.

Table 4: Effect of shortages on referendum outcomes

| | (1) OLS | (2) RF | (3) IV | (4) OLS | (5) RF | (6) IV |
|---|---|---|---|---|---|---|
| **Panel A** - Share Yes | | | | | | |
| Shortage | -0.19*** | | -0.54*** | -0.26*** | | -0.91*** |
| | (0.07) | | (0.21) | (0.07) | | (0.25) |
| Predicted hiring (inputs based) | | -0.11** | | | -0.17*** | |
| | | (0.05) | | | (0.04) | |
| Share Yes 2014 | 0.90*** | 0.90*** | 0.89*** | 0.80*** | 0.80*** | 0.79*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Dep. Var. Mean | 43.41 | 43.41 | 43.41 | 43.41 | 43.41 | 43.41 |
| Dep. Var. Std. Dev. | 10 | 10 | 10 | 10 | 10 | 10 |
| **Panel B** - Yes / Eligible | | | | | | |
| Shortage | -0.17*** | | -0.45** | -0.21*** | | -0.63*** |
| | (0.06) | | (0.19) | (0.06) | | (0.25) |
| Predicted hiring (Inputs Based) | | -0.09*** | | | -0.12*** | |
| | | (0.04) | | | (0.04) | |
| Yes/Eligible 2014 | 0.87*** | 0.87*** | 0.87*** | 0.68*** | 0.68*** | 0.67*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Dep. Var. Mean | 26.30 | 26.30 | 26.30 | 26.30 | 26.30 | 26.30 |
| Dep. Var. Std. Dev. | 7 | 7 | 7 | 7 | 7 | 7 |
| 1st Stage F-Stat | - | - | 19.78 | - | - | 19.43 |
| Municipality Controls | No | No | No | Yes | Yes | Yes |
| Fixed Effects | Canton | Canton | Canton | Canton | Canton | Canton |
| Observations | 1,680 | 1,680 | 1,680 | 1,680 | 1,680 | 1,680 |

**Note:** Columns 1-6 report estimates of the effect of labor shortages on referendum outcomes in 2020 in municipality $i$. Both shortage and predicted hiring variables are standardized. Panel A uses the share of 'yes' votes over total votes cast as the dependent variable, while Panel B uses the share of 'yes' votes over total eligible voters. For each panel, Columns 1-3 present specifications without municipality controls, while Columns 4-6 include them. Within each set, we report OLS estimates (Columns 1 and 4), reduced form results (Columns 2 and 5), and instrumental variable estimates (Columns 3 and 6). All specifications include canton fixed effects and controls for the 2014 referendum outcome. Municipality controls include number of inhabitants, share of foreigners, share of population 65 or older, population density, share of land occupied by housing and infrastructure, share of agricultural land, share of employed population, share of workers in the primary sector, and share of workers in the secondary sector. The sample only includes only municipalities that are suitable for crop production according to terrain and climate conditions. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

## 5.2.  Robustness Checks

We conduct several robustness checks to verify the stability of our main results (Appendix C.5). First, we extend our analysis to the full sample of municipalities, including mountain regions, rather than restricting it to areas suitable for crop production. Second, we consider alternative instruments based on agricultural characteristics: the total hectares dedicated to spring crops and the share of spring crops relative to total agricultural land.

Finally, we examine the sensitivity of our results by using as outcome variable the first difference in vote shares relative to 2014. Our main findings remain stable across these alternative specifications, supporting the robustness of our results.

# 6.    Shortages and Narratives from Survey Data

In this section, we use survey data to shed more light on the drivers of the change in attitudes documented in the previous section. Our primary goal is to understand whether labor shortages influenced how voters think about immigration, particularly whether voters in municipalities experiencing greater worker shortages were more likely to view immigrants as beneficial to the local economy. To investigate this relationship, we draw on the *VOTO* studies, which contain detailed survey responses from representative samples of Swiss voters collected immediately after the 2014 and 2020 immigration referendums. Our main variables of interest are the respondents' votes (whether they supported or opposed immigration restrictions) and their open-ended explanations for their voting decisions. The surveys also provide a rich set of individual-level characteristics, including respondents' age, education, income, employment status, and political preferences, allowing us to account for potential confounding factors in our analysis.

## 6.1.    Explanations

We begin our analysis by collecting voters' explanations from the 2014 and 2020 surveys. In both surveys, respondents were asked about their main reason for accepting or rejecting the proposal ("What is the main reason that led you to accept/reject this proposal?"), followed by a question about any additional reasons ("What other reasons did you have?").Our sample consists of 3,115 explanations in total. Since the surveys were conducted in German, French, and Italian, we first translated all responses into English to ensure consistency in our analysis. For this translation task, we employed GPT-4, with the exact prompt detailed in Appendix X. To identify the most relevant themes in these explanations, we employ topic modeling using BERTopic (Grootendorst, 2022).[6]

BERTopic is particularly well-suited for our analysis due to the specific characteristics of our data. The explanations in our sample are typically short, consisting of one or two sentences, and each response tends to express a single main point. These features align well with BERTopic's operational framework, which models the task as a clustering problem and assigns each document to a single topic. Unlike traditional topic modeling techniques, BERTopic leverages sentence embeddings, capturing more nuanced semantic meaning in short texts. The model also identifies keywords that characterize each topic,

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[6]Our implementation uses the all-mpnet-base-v2 embeddings from the Sentence Transformers library for the initial document representations.

allowing us to validate the coherence of the identified themes and ensure they capture meaningful patterns in the responses.

Figure 7 presents the distribution of topics identified in our analysis, displaying the average topic probabilities estimated by the model. The horizontal axis represents the mean probability assigned to each topic, with individual documents receiving probability scores between 0 and 1 for every possible topic. To characterize these topics, we employ KeyBERT to identify the most representative keywords for each cluster. Additionally, we color-code the topics based on the share of pro-immigration restriction votes among respondents whose explanations are assigned to each respective topic, allowing us to measure how different explanations relate to voting outcomes.

Figure 7: Topics from Voter's Explanations



**Mean Topic Probabilities**
Across all years
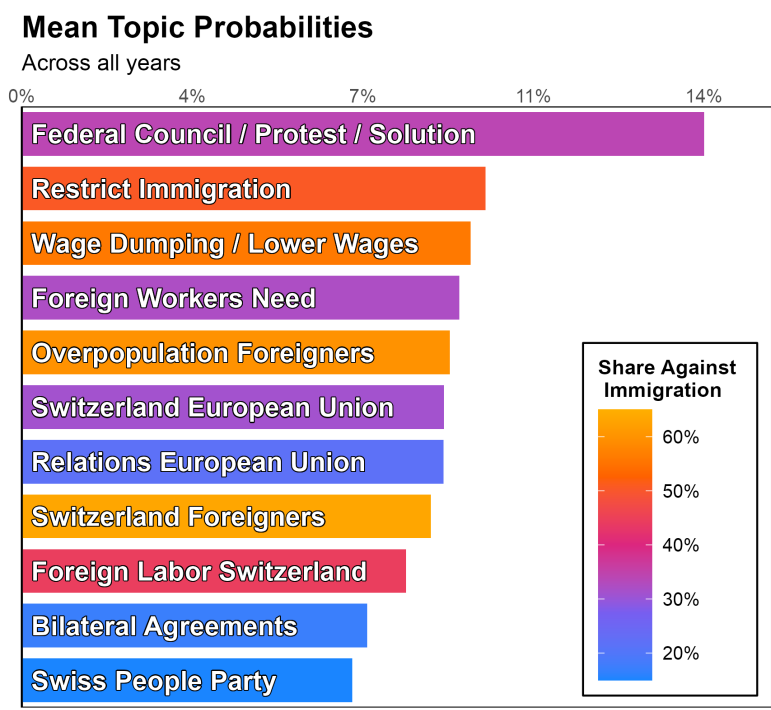
**Note:** This figure shows the topic distribution from our BERTopic analysis of voter explanations (N=3,115). Documents receive probability scores between 0 and 1 for each topic, with the sum of probabilities across all topics equal to 1 for each document. For each topic, we report the average topic probability across all documents on the horizontal axis. The keywords listed for each topic are those receiving the highest scores from KeyBERT. Topics are color-coded based on the share of Yes votes (supporting immigration restrictions) among respondents whose explanations were assigned to that topic.

Several notable patterns emerge from this analysis. First, competing economic narratives surface as two of the largest clusters, alongside concerns about overpopulation and

European integration.[7] Looking at how topics correlate with voting decisions, we find that while references to wage dumping are strongly associated with support for immigration restrictions, discussions of labor market needs and foreign worker contributions are more prevalent among those who opposed such restrictions. However, not all explanations center on economic or policy-based reasoning. Some topics reflect more political considerations, such as explicit reactions to the Swiss People's Party, with some voters indicating their opposition to the party's stance. We also observe a subset of explanations that lack sufficient specificity to conclusively determine the underlying motivations for the vote.

## 6.2.    From Explanations to Narratives

While the topics identified by our model effectively capture broad themes in voters' responses, they do not always clearly delineate the underlying economic reasoning. Consider, for instance, the topic labeled "Foreign workers need." This cluster contains explanations such as "As a manager, I see the importance of using individuals from abroad and not just people with degrees," which clearly aligns with a complementarity narrative between foreign and native workers. However, it also includes vague statements like "Workers from abroad are not necessarily needed," which offer little insight into the respondent's economic reasoning. Similarly, the "Wage dumping / Lower wages" topic encompasses explanations like "There are problems of wage dumping as well as unemployment exacerbated by foreign labor," which explicitly articulates a substitution effect between foreign and native workers, alongside generic observations such as "Young people no longer find work," which are too vague to infer whether the respondent is basing their decision on any specific economic model. Given this heterogeneity within topics, it is important to refine our categorization to better identify specific economic narratives in the explanations.

To refine this categorization, we employ GPT-4 to identify three specific economic narratives in the explanations. While the complete classification protocol and detailed prompts are provided in the Appendix, we briefly outline here the key criteria used to instruct the model. For the "complements" narrative, the text should suggest foreign workers have a positive causal impact on economic variables or are complements to native workers, including direct statements about foreign workers boosting economic indicators, references to them filling crucial roles, or implications that they create opportunities for natives. For the "substitutes" narrative, the text should explicitly mention or implicitly suggest competition between Swiss and foreign workers, including references to wage pressure, job scarcity, or calls for protecting Swiss workers. Finally, for the "density stress" narrative, the text should explicitly mention concerns related to overpopulation or infrastructure

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[7]The topics we identify broadly align with those found by Gehring et al., 2022 in their analysis of German newspapers, though our respondents place greater emphasis on European Union-related themes and less on religious considerations, reflecting the specific context of these referendums.

strain due to immigration, such as overcrowding in cities, pressure on housing availability, or perceived decrease in quality of life due to population increase.

These three narratives are present in a substantial portion of our sample, with approximately 25% of respondents mentioning at least one of them in their explanations. Figure 8 compares the prevalence of these narratives between 2014 and 2020, showing that the complements narrative became more frequent in 2020, while mentions of substitutes and density stress narratives declined. The expression of these narratives strongly predicts referendum voting: 95% of respondents expressing the "complements" narrative voted against immigration restrictions, while 85% and 95% of those mentioning "substitutes" and "density stress" narratives, respectively, voted in favor.

Figure 8: SHARE OF USERS MENTIONING IMMIGRATION NARRATIVES
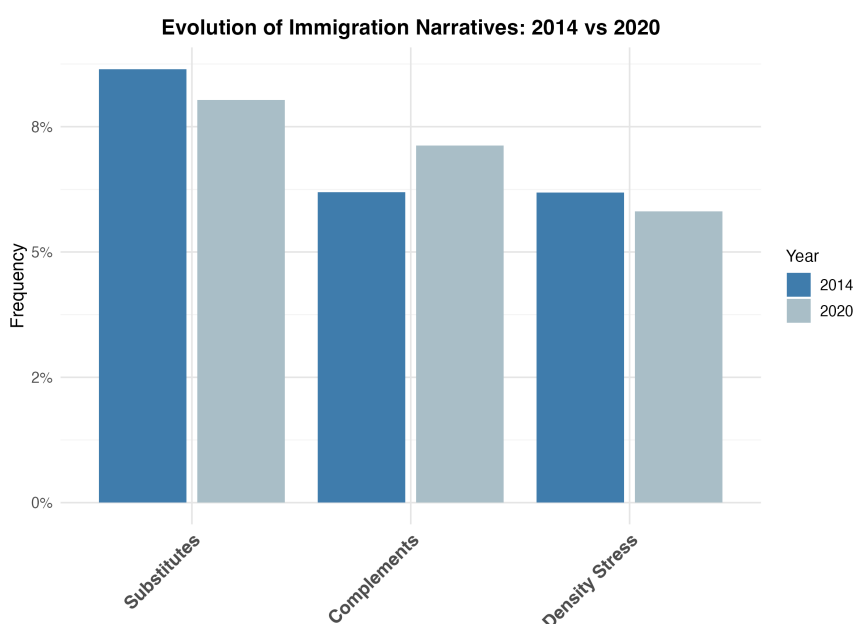


**Note:** This figure shows the share of respondents expressing each of the three economic narratives (complements, substitutes, and density stress) in their explanations of voting choices for the 2014 and 2020 referendums. A response is classified as expressing a narrative if GPT-4 detects the presence of that narrative based on the criteria detailed in the Appendix.

Table 5 shows how the likelihood of mentioning one of the three narratives correlates with observable socioeconomic characteristics. We show the results of logit regressions where we use as explanatory variable one characteristics. We focus on job position, income, education level and left-right ideology. Complements and Substitutes narratives tend to be associated with the job position, in particular respondents working in managerial position tend to mention more the complements narratives and less the substitutes narrative. Regarding income, we can notice that higher level of income correlated with lower tendency to mention substitutes and density stress. These two narratives are also associated with the education level: higher education correlated with lower likelihood of mentioning

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one of these two. Finally, political ideology is related to substitutes and density stress, with right leaning more likely to mention these narratives. It is worth underlying the different pattern that arises when comparing these coefficients. Complements is driven by job position, while the other two are more linked to political factors.

Table 5 examines how socioeconomic characteristics correlate with the likelihood of expressing specific immigration narratives through a series of logit regressions. The results reveal distinct patterns in how occupational position, household income, educational attainment, and political ideology associate with different narratives. Occupational position emerges as a significant predictor of both complement and substitute narratives. Notably, respondents in managerial positions show a higher propensity to articulate the complementarity narrative while being less likely to express the substitution narrative. Income and education levels demonstrate particularly strong associations with substitution and density stress narratives, with higher levels in both characteristics correlating negatively with these narratives. Political ideology exhibits a clear relationship with both substitution and density stress narratives, with right-leaning respondents more likely to express these concerns. This alignment with political ideology is consistent with the broader political discourse, where in particular density stress concerns have been emphasized by the SPP party. A particularly noteworthy pattern emerges when comparing across narratives: while the complementarity narrative appears primarily driven by professional experience, both substitution and density stress narratives show stronger associations with political ideology and socioeconomic status. This distinction suggests that different mechanisms may underlie the formation and expression of these various immigration narratives.

Table 5: SOCIOECONOMIC PREDICTORS OF IMMIGRATION NARRATIVES

| | Narrative | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| | Complements | Substitutes | Density Stress |
| | **Panel A** - Current or Former Job Position | | |
| Self-employed with employees | 0.61 | -1.16* | -0.40 |
| | (0.40) | (0.61) | (0.54) |
| Self-employed without employees | 0.39 | -0.51 | 0.52 |
| | (0.41) | (0.45) | (0.38) |
| Director or management position | 1.12*** | -0.94* | -1.20 |
| | (0.34) | (0.53) | (0.74) |
| Employee with supervision/training function | 0.34 | -0.04 | 0.07 |
| | (0.28) | (0.24) | (0.28) |
| *Reference: Employee without supervision function* | | | |
| | **Panel B** - Income | | |
| Income | 0.02 | -0.10*** | -0.16*** |
| | (0.03) | (0.03) | (0.04) |
| | **Panel C** - Education | | |
| Secondary | 0.53 | 0.09 | -0.66* |
| | (0.61) | (0.40) | (0.36) |
| Tertiary | 0.98 | -0.80* | -1.53*** |
| | (0.61) | (0.43) | (0.40) |
| *Reference: Primary or less* | | | |
| | **Panel D** - Political left-right placement | | |
| Left - right | -0.04 | 0.27*** | 0.48*** |
| | (0.04) | (0.05) | (0.06) |

**Note:** Coefficients from logit regressions where the dependent variable is an indicator for each narrative. Column (1) refers to the complements narrative (equals 1 if respondent mentions the complement narrative), column (2) refers to the substitutes narrative, and column (3) refers to the density stress narrative. Data source: Voto Survey, observations refer to year 2020. Panel A shows estimates for a categorical variable on current or former job position. Panel B uses gross monthly household income (15 categories, from 1: "less than 2,000 CHF" to 15: "more than 15,000 CHF"). Panel C shows estimates for a categorical variable on educational attainment. Panel D uses a left-right scale ranging from 0 (extreme left) to 10 (extreme right). Robust standard errors in parentheses.*,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

## 6.3.   Did Shortages change Narratives?

We now examine whether labor shortages affected respondents' narratives about immigration as captured in the survey data. For the 2020 referendum, we can link respondents to their municipality of residence, allowing us to conduct an analysis similar to our previous specifications. Given the smaller number of municipalities in our survey sample, we cannot implement the same instrumental variable strategy used earlier. However,

to maintain consistency with our previous approach of using predicted hiring, we calculate shortages by comparing observed 2020 values with predictions based on agricultural inputs. Specifically, we estimate:

$$Y_{ijk} = \beta_0 + \beta_1 \text{Shortage}_j + \mathbf{X}_i' \boldsymbol{\gamma} + \mathbf{Z}_j' \boldsymbol{\delta} + \gamma_k + \epsilon_{ijk}$$

where $i$ indexes respondents, $j$ municipalities, and $k$ cantons. The vector $\mathbf{X}_i$ includes respondent-level controls, while $\mathbf{Z}_j$ captures municipality-level characteristics. We examine four outcome variables ($Y_{ijk}$): indicators for each of the three narratives and a binary variable for voting in favor of immigration restrictions. All specifications include canton fixed effects ($\gamma_k$), and standard errors are clustered at the municipality level.

Table 6 presents our findings. Panel A reports estimates for the complements narrative (columns 1-3) and the probability of voting in favor of restrictions (columns 4-6). For both panels, we progressively add controls: columns 1 and 4 present baseline specifications without controls, columns 2 and 5 include demographic characteristics from the survey data, and columns 3 and 6 add both socioeconomic controls from the survey and municipality-level characteristics. Respondents from municipalities experiencing labor shortages are significantly more likely to mention the complements narrative. The linear specification with full controls indicates a 2 percentage point increase in the probability of mentioning complements for a one standard deviation increase in shortages—a substantial effect relative to the 9 percent baseline probability. Moreover, we find a 3 percentage point decrease in the probability of voting in favor of additional restrictions. Panel B examines effects on alternative narratives, reporting results for the substitutes narrative (columns 1-3) and density stress (columns 4-6). We find no significant effect of labor shortages on either of these narratives, suggesting that the increased salience of the complements narrative does not come at the expense of other explanations. To contextualize the magnitude of these effects, we can leverage the strong correlation between narratives and voting preferences in our data: 95% of respondents who mention the complements narrative vote against immigration restrictions. Using the coefficients from columns 3 and 6 of Panel A, this correlation implies that approximately two-thirds of the observed effect on voting behavior operates through changes in narrative adoption, underscoring the crucial role of economic narratives in shaping immigration policy preferences.

Table 6: Effect of shortages on referendum outcomes - Survey

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **Panel A** | | | | | |
| | Narrative - Complements | | | Vote Yes | | |
| Shortage (Inputs Based) | 0.01** | 0.01** | 0.02** | -0.03** | -0.03** | -0.03*** |
| | (0.01) | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) |
| Dep. Var. Mean | 0.09 | 0.09 | 0.09 | 0.32 | 0.32 | 0.32 |
| Observations | 1,093 | 1,093 | 1,093 | 1,132 | 1,132 | 1,132 |
| | **Panel B** | | | | | |
| | Narrative - Substitutes | | | Narrative - Density Stress | | |
| Shortage (Inputs Based) | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Dep. Var. Mean | 0.10 | 0.10 | 0.10 | 0.08 | 0.08 | 0.08 |
| Observations | 1,093 | 1,093 | 1,093 | 1,093 | 1,093 | 1,093 |
| Demographic Controls | No | Yes | Yes | No | Yes | Yes |
| Socioeconomic Controls | No | No | Yes | No | No | Yes |
| Municipality Controls | No | No | Yes | No | No | Yes |
| Fixed Effects | Canton | Canton | Canton | Canton | Canton | Canton |

**Note:** The table presents OLS estimates of the impact of labor shortages on voting narratives and behavior. Labor shortage is calculated as the difference between observed employment in 2020 and predicted employment based on agricultural inputs. Panel A reports results for the complements narrative (columns 1-3) and an indicator for voting in favor of immigration restrictions (columns 4-6). Panel B reports results for the substitutes narrative (columns 1-3) and the density stress narrative (columns 4-6). Demographic controls include the respondent's education, nationality at birth (Swiss or non-Swiss), sex, and age. Socioeconomic controls include type of work activity, income level, housing tenure (own/rent), and main sources of information. Municipality controls include number of inhabitants, share of foreigners, share of population 65 or older, population density, share of land occupied by housing and infrastructure, share of agricultural land, share of employed population, share of workers in the primary sector, and share of workers in the secondary sector. Standard errors are clustered at the municipality level and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

# 7. Conclusion

Whether perceptions about immigrants can sway behavior has occupied researchers in different fields for a long time. Contrary to most studies that focus on immigrant threat and whether natives perceive their jobs threatened, we approach this important question using a unique episode in which a lack of foreign labor had adverse economic effects. Put differently, we show how constituents react when reminded of the immigrants' contributions to the economy.

In doing so, our study provides valuable insights into the relationship between labor market disruptions and public attitudes toward immigration, using the COVID-19 pandemic as a natural experiment. The unexpected border closures in Switzerland in March 2020,

which led to significant labor shortages in key sectors, especially in agriculture, offered a unique opportunity to examine how temporary economic shocks influence immigration preferences. Our findings indicate that municipalities most affected by these labor shortages exhibited a marked shift toward greater support for immigration in the subsequent referendum. This suggests that when citizens directly experience the economic costs of reduced immigration—such as unmet labor demands—they may reevaluate their stance on immigration, recognizing the essential role that migrant workers play in their local economies.

Survey evidence from the 2020 referendum further supports this interpretation. Using text analysis of open-ended responses about voting motivations, we find that respondents from municipalities experiencing greater labor shortages were more likely to emphasize the complementarity between foreign and native workers. The magnitude of this effect suggests that changes in narratives about immigrant workers being complements rather than substitutes account for approximately two-thirds of the overall effect on voting behavior. Importantly, we find no evidence that labor shortages affected other prominent narratives, such as concerns about labor market competition or overpopulation, suggesting a specific channel through which economic conditions shaped attitudes.

Our study contributes to the broader literature on the economic versus non-economic determinants of attitudes toward immigration by demonstrating that short-term economic disruptions can significantly influence public opinion. While previous research has primarily focused on long-term immigration trends or individual-level factors shaping immigration attitudes, our study highlights the importance of sudden, transitory shocks. By measuring attitudes through a referendum and analyzing detailed survey responses, we bridge the gap between labor market outcomes and political behavior, offering direct evidence on how economic conditions shape both voting patterns and the narratives citizens use to justify their political choices. Additionally, our analysis adds to the literature on the impact of immigration restrictions by showing that firms, constrained by the short-term nature of the shock, did not have time to adapt, thus amplifying the perceived need for migrant labor.

# References

Abnett, Kate (2024). *Economy, migration, war top voters' concerns in EU election - survey*. Accessed: October 27, 2024. URL: https://www.reuters.com/world/europe/economy-migration-war-top-voters-concerns-eu-election-survey-2024-06-10/.

Abramitzky, Ran, Philipp Ager, Leah Boustan, Elior Cohen, and Casper W Hansen (2023). "The effect of immigration restrictions on local labor markets: Lessons from the

1920s border closure". *American Economic Journal: Applied Economics* 15.1, pp. 164–191.

Alesina, Alberto, Armando Miano, and Stefanie Stantcheva (2023). "Immigration and redistribution". *The Review of Economic Studies* 90.1, pp. 1–39.

Alesina, Alberto and Marco Tabellini (2024). "The political effects of immigration: Culture or economics?" *Journal of Economic Literature* 62.1, pp. 5–46.

Alrababah, Ala, Andreas Beerli, Dominik Hangartner, and Dalston Ward (Forthcoming). "The Free Movement of People and the Success of Far-Right Parties: Evidence from Switzerland's Border Liberalization". *American Political Science Review*.

Andre, Peter, Ingar Haaland, Christopher Roth, and Johannes Wohlfart (2023). "Narratives about the Macroeconomy".

Barrera, Oscar, Sergei Guriev, Emeric Henry, and Ekaterina Zhuravskaya (2020). "Facts, alternative facts, and fact checking in times of post-truth politics". *Journal of public economics* 182, p. 104123.

Baumer, Matthias (2020). *Bei den Gemüsebauern gibt es mehr als genug Arbeit*. URL: https://www.srf.ch/news/schweiz/erntehelfer-dringend-gesucht-bei-den-gemuesebauern-gibt-es-mehr-als-genug-arbeit.

Bayerlein, Michael, Vanessa A Boese, Scott Gates, Katrin Kamin, and Syed Mansoob Murshed (2021). "Populism and COVID-19: How populist governments (mis) handle the pandemic". *Journal of Political Institutions and Political Economy* 2.3, pp. 389–428.

Beerli, Andreas, Jan Ruffner, Michael Siegenthaler, and Giovanni Peri (2021). "The abolition of immigration restrictions and the performance of firms and workers: evidence from Switzerland". *American Economic Review* 111.3, pp. 976–1012.

Chinoy, Sahil, Nathan Nunn, Sandra Sequeira, and Stefanie Stantcheva (2023). *Zero-sum thinking and the roots of US political divides*. Tech. rep. National Bureau of Economic Research.

Clemens, Michael A and Ethan G Lewis (2024). "The effect of low-skill immigration restrictions on US firms and workers: Evidence from a randomized lottery". GMU Working Paper in Economics No. 24-16.

Clemens, Michael A, Ethan G Lewis, and Hannah M Postel (2018). "Immigration restrictions as active labor market policy: Evidence from the mexican bracero exclusion". *American Economic Review* 108.6, pp. 1468–1487.

Djourelova, Milena, Ruben Durante, Elliot Motte, and Eleonora Patacchini (2023). "Experience, Narratives, and Climate Change Beliefs". *Available at SSRN 4680430*.

Dustmann, Christian, Kristine Vasiljeva, and Anna Piil Damm (2019). "Refugee migration and electoral outcomes". *The Review of Economic Studies* 86.5, pp. 2035–2091.

Eliaz, Kfir and Ran Spiegler (2020). "A model of competing narratives". *American Economic Review* 110.12, pp. 3786–3816.

FSO, Federal Statistical Office (2024). *Foreign labour force*. URL: https://www.bfs.admin.ch/bfs/en/home/statistics/work-income/employment-working-hours/economically-active-population/foreign-labour-force.html.

Federal Chancellery (2014). *Federal initiative 'Against mass immigration'*. URL: https://www.bk.admin.ch/ch/d/pore/vi/vis413t.html.

— (2020). *Popular initiative 'For moderate immigration'*. URL: https://www.bk.admin.ch/ch/d/pore/vi/vis483t.html.

Federal Statistical Office (2024a). *Central Compensation Office – ZAS*. URL: https://www.zas.admin.ch/zas/de/home/partenaires-et-institutions-/statistique.html.

— (2024b). *Employees, agricultural holdings, utilized agricultural area and livestock at classification level 1 by institutional breakdowns*. URL: https://www.bfs.admin.ch/bfs/en/home/statistics/agriculture-forestry/farming.assetdetail.31846452.html.

— (2024c). *General Classification of Economic Activities – NOGA 2008*. URL: https://www.bfs.admin.ch/bfs/en/home/statistics/industry-services/nomenclatures/noga.assetdetail.344669.html.

— (2024d). *Referendums (results at municipal level since 1960)*. URL: https://www.bfs.admin.ch/bfs/en/home/statistics/politics/popular-votes.assetdetail.30625923.html.

— (2024e). *Statistics of the Company Structure – STATENT*. URL: https://www.bfs.admin.ch/bfs/de/home/statistiken/industrie-dienstleistungen/erhebungen/statent.html.

Feng, Jing and Nicole Acevedo (2024). *Trump vows to deport millions. Builders say it would drain their crews and drive up home costs*. Accessed: October 27, 2024. URL: https://www.nbcnews.com/politics/2024-election/trump-immigration-deportations-home-building-costs-rcna172886.

Ferrario, Beatrice and Stefanie Stantcheva (2022). "Eliciting people's first-order concerns: Text analysis of open-ended survey questions". In: *AEA Papers and Proceedings*. Vol. 112, pp. 163–169.

GFS (2024). *VOX analyses: Voting decisions explained since 1977*. URL: https://vox.gfsbern.ch/de/.

Garsd, Jasmine (2024). *A year later, Florida businesses say the state's immigration law dealt a huge blow*. Accessed: October 27, 2024. URL: https://www.npr.org/2024/04/26/1242236604/florida-economy-immigration-businesses-workers-undocumented.

Gehring, Kai, Joop Age Harm Adema, and Panu Poutvaara (2022). "Immigrant narratives".

Grigorieff, Alexis, Christopher Roth, and Diego Ubfal (2020). "Does information change attitudes toward immigrants?" *Demography* 57, pp. 1117–1143.

Grootendorst, Maarten (2022). "BERTopic: Neural topic modeling with a class-based TF-IDF procedure". *arXiv preprint arXiv:2203.05794*.

Haaland, Ingar K, Christopher Roth, Stefanie Stantcheva, and Johannes Wohlfart (2024). *Measuring what is top of mind*. Tech. rep. National Bureau of Economic Research.

Haaland, Ingar and Christopher Roth (2020). "Labor market concerns and support for immigration". *Journal of Public Economics* 191, p. 104256.

Halla, Martin, Alexander F Wagner, and Josef Zweimüller (2017). "Immigration and voting for the far right". *Journal of the European Economic Association* 15.6, pp. 1341–1385.

Hopkins, Daniel J, John Sides, and Jack Citrin (2019). "The muted consequences of correct information about immigration". *The Journal of Politics* 81.1, pp. 315–320.

Jackson, Chris, Annaleise Azevedo Lohr, Charlie Rollason, Johnny Sawyer, Sarah Feldman, and Bernard Mendez (2024). *Americans are divided on the top priorities for next president*. Accessed: October 27, 2024. URL: https://www.ipsos.com/en-us/americans-are-divided-top-priorities-next-president.

Lafortune, Jeanne, José Tessada, and Carolina González-Velosa (2015). "More hands, more power? Estimating the impact of immigration on output and technology choices using early 20th century US agriculture". *Journal of International Economics* 97.2, pp. 339–358.

Lew, Byron and Bruce Cater (2018). "Farm mechanization on an otherwise 'featureless' plain: tractors on the Northern Great Plains and immigration policy of the 1920s". *Cliometrica* 12.2, pp. 181–218.

Longchamp, Claude, Adrian Vatter, Thomas Widmer, Pascal Sciarini, Martina Imfeld, and Stephan Tschöpe (9, 2014). *VOX analyses of federal ballots: survey of voters after federal votes*. Dataset. Lausanne. URL: https://doi.org/10.23662/FORS-DS-704-1.

Prantner, Christoph (2020). *Corona-Sperre für Erntehelfer: "Ohne Ausländer funktioniert unsere ganze Gesellschaft nicht mehr"', klagt ein Spargelbauer*. URL: https://www.nzz.ch/international/corona-sperre-fuer-erntehelfer-ohne-auslaender-funktioniert-unsere-ganze-gesellschaft-nicht-mehr-klagt-ein-spargelbauer-ld.1549388.

Sager, Fritz and Céline Mavrot (2020). "Switzerland's COVID-19 policy response: Consociational crisis management and neo-corporatist reopening". *European Policy Analysis* 6.2, pp. 293–304.

Shiller, Robert J (2017). "Narrative economics". *American Economic Review* 107.4, pp. 967–1004.

— (2020). *Narrative economics: How stories go viral and drive major economic events*. Princeton University Press.

Sides, John and Jack Citrin (2007). "How large the huddled masses? The causes and consequences of public misperceptions about immigrant populations". In: *annual meeting of the Midwest Political Science Association, Chicago, IL*. Citeseer.

Sikora, Tomasz (2020). *Unerwartete Hilfe aus dem Inland*. URL: https://www.bazonline.ch/unerwartete-hilfe-aus-dem-inland-922964459845.

State Secretariat for Migration (2024). *Central Migration Information System – ZEMIS*. URL: https://www.sem.admin.ch/sem/en/home.html.

Tabellini, Marco (2020). "Gifts of the immigrants, woes of the natives: Lessons from the age of mass migration". *The Review of Economic Studies* 87.1, pp. 454–486.

Thoele, Alexander (2020). *When there's plenty of work in the fields, but few workers*. URL: https://www.swissinfo.ch/eng/business/asparagus-harvest-_when-there-s-plenty-of-work-in-the-fields-but-few-workers/45679386.

Tresch, Anke, Laura Scaperrotta, Lukas Lauener, and Laurent Bernhard (2016–2020). *VOTO Studies: Standardized Post-Vote Surveys, 2016-2020*. Dataset. Lausanne. URL: https://www.swissubase.ch/en/catalogue/studies/13948/16830/datasets/1231/1982/overview.

Weber, Sigrid, Nik Stoop, Peter Van der Windt, and Haoyu Zhai (2024). "A meta-analysis of attitudes towards migrants and displaced persons". IPL Working Paper N0. 24-03.

# Asparagus
# Supporting Information

## A.   Labor Market Data

Figure A1: SECTOR-SPECIFIC IMPORTANCE OF SHORT-TERM LABOR
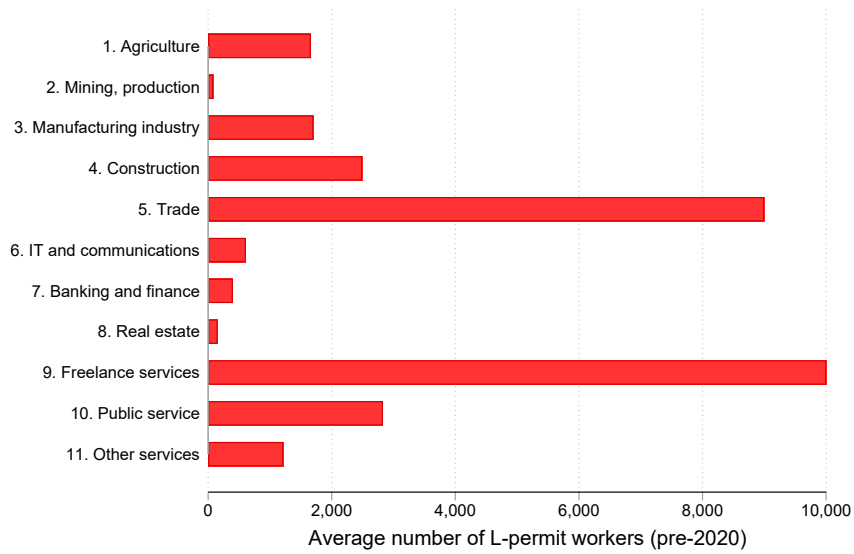


(a) SHORT-TERM WORKERS
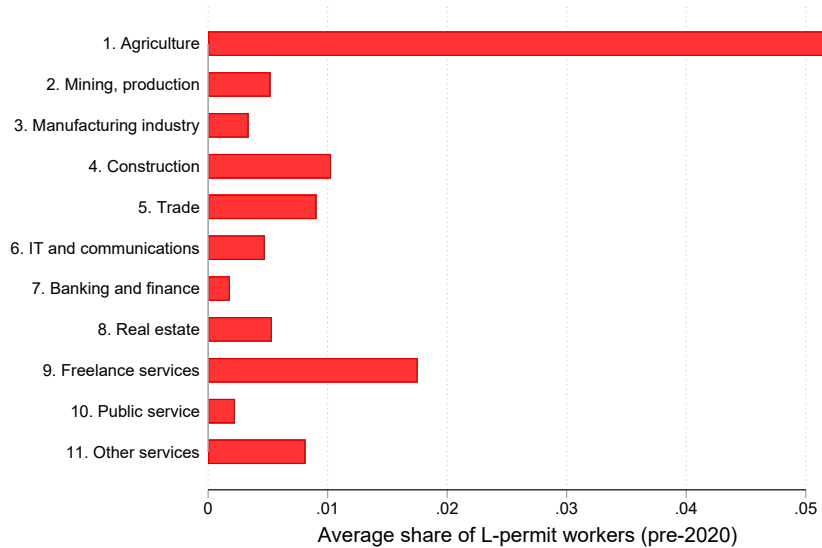


(b) SHARE OF SHORT-TERM WORKERS

**Note:** Importance of short-term foreign labor in the Swiss economy, by sector of activity.

# B. Media Coverage

Figure A2: Examples of media reporting



Coopération entre les entreprises suisses et les associations
agricoles pour assurer la récolte 2020

Mar 24, 2020

(a) Coop article



SWI swissinfo.ch
#NOTHING TO HIDE
**Workplace Switzerland**

Swiss perspectives in 10 languages

When there's plenty of
work in the fields, but
few workers

▲ Workers cultivating asparagus in the eastern canton of St Gallen on April 1, 2020.  Keystone / Gian Ehrenzeller

Swiss farmers are having to improvise to find enough
labourers during the coronavirus pandemic to help with
the harvest, and – as one example illustrates –
are finding creative solutions to get their produce to
market.

April 13, 2020 - 11:00

(b) SwissInfo article

# C. Additional Results

## C.1. Border Closure on Short-Terms Labor

Table C.7: IMPACT OF BORDER CLOSURE ON SHORT-TERM LABOR IN SPRING

|  | (1) Agriculture | (2) Construction | (3) Services |
|---|---|---|---|
| Feb ×2020 | 0.006 | -0.008 | -0.015** |
|  | (0.016) | (0.013) | (0.007) |
| Mar ×2020 | -0.063*** | -0.060*** | -0.041*** |
|  | (0.019) | (0.015) | (0.011) |
| Apr ×2020 | -0.078*** | -0.081*** | -0.079*** |
|  | (0.020) | (0.014) | (0.014) |
| May ×2020 | -0.001 | -0.034*** | -0.011 |
|  | (0.018) | (0.008) | (0.015) |
| Jun ×2020 | 0.033* | -0.020* | 0.017 |
|  | (0.020) | (0.010) | (0.026) |
| Jul ×2020 | 0.012 | -0.004 | 0.011 |
|  | (0.012) | (0.017) | (0.013) |
| Aug ×2020 | 0.007 | 0.013 | -0.009 |
|  | (0.012) | (0.015) | (0.009) |
| Sep ×2020 | 0.021 | -0.007 | -0.024** |
|  | (0.016) | (0.012) | (0.012) |
| Oct ×2020 | 0.016 | 0.011 | 0.026** |
|  | (0.018) | (0.012) | (0.011) |
| Nov ×2020 | -0.013 | -0.024* | -0.018* |
|  | (0.013) | (0.014) | (0.011) |
| Dec ×2020 | -0.010 | -0.005 | -0.019*** |
|  | (0.019) | (0.007) | (0.007) |
| Observations | 204,001 | 194,140 | 192,255 |
| R-squared | 0.032 | 0.030 | 0.031 |

**Note:** Columns 1-3 report the estimated regression coefficients of equation 2. The outcome variable is the standardized monthly change in the share of short-term workers compared to all workers in the sector. Column 1 refers to the agricultural sector, column 2 refers to the construction sector, column 3 refers to the services sector. The sample is composed of all Swiss municipalities for the period 2012-2020. Standard errors are clustered at the municipality level. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

## C.2. XGBoost Model Fit

Figure A3 presents the model validation results using the 20% hold-out sample from the pre-2020 period. The figure compares the observed number of seasonal agricultural workers (in blue) with the model's predictions (in green) for each month. The close alignment between predicted and actual values demonstrates that the XGBoost algorithm successfully captures the seasonal patterns in agricultural employment, relying solely on the relationship between agricultural inputs and labor demand. While the predictions exhibit some smoothing of month-to-month variations, they accurately track the underlying seasonal dynamics. This suggests that our instrument construction approach effectively leverages the features of agricultural production - namely, the seasonality of crop production and input complementarities - to generate counterfactual worker predictions.

Figure A3: MODEL FIT - TEST SET
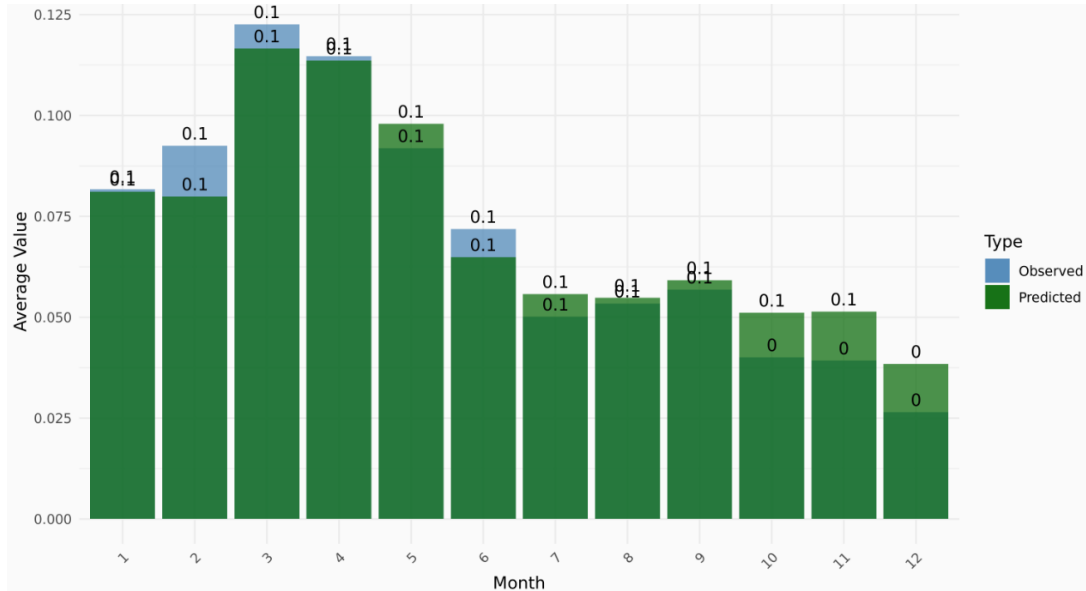


**Note**: The figure compares the observed and predicted number of seasonal agricultural workers by month using the 20% hold-out sample from 2012-2019. Predictions are generated by an XGBoost model trained on municipality-month observations using agricultural inputs (cultivated hectares by crop type and livestock counts) and their interactions with month indicators..

## C.3.  First Stage, full sample

In this section we report results for the first stage based on the full sample of municipalities.

Table C.8: FIRST STAGE REGRESSIONS

| | Dep. Variable: Shortage (standardized) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Predicted hiring (Inputs Based) | 0.45*** | 0.39*** | 0.35*** | 0.35*** |
| | (0.09) | (0.09) | (0.08) | (0.08) |
| F-Stat | 23.31 | 19.95 | 19.76 | 19.84 |
| Observations | 2,099 | 2,099 | 2,099 | 2,099 |
| Municipality Controls | No | No | Yes | Yes |
| Share Yes 2014 | No | No | No | Yes |
| Canton Fixed Effects | No | Yes | Yes | Yes |

 **Note:** Each row refers to a different regression where *Shortage (standardized)* is regressed on the standardized value of *Predicted hiring (inputs based)*, which is calculated based on the agricultural inputs. The sample includes all municipalities that appear both in 2014 and 2020. F-stat refers to the Kleinbergen-Paap F-stat for weak instrument. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

## C.4.  Alternative Instruments

We construct two alternative instruments based on spring crop cultivation patterns. To identify relevant crops, we estimate a series of regressions that predict seasonal worker counts using interactions between crop-specific hectares and monthly indicators. Our analysis reveals five categories with significant positive interactions in April: field vegetable crops, annual aromatic and medicinal plants, asparagus, vegetable crops under cover, and other crops under cover. Using these findings, we develop two instrument variations. The first, *Total Hectares April Crops*, measures the aggregate hectares devoted to these April-intensive crops. The second, *Share April Crops*, captures the ratio of April-intensive crop hectares to total cultivated land. This approach allows us to exploit both absolute and relative measures of spring crop intensity in our instrumental variable strategy.

Table C.9: First Stage Regressions

| | Dep. Variable: Shortage (standardized) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Total Hectares April Crops | 0.01*** | 0.01*** | 0.01*** | 0.01*** |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| F-Stat | 16.89 | 16.05 | 13.86 | 13.70 |
| Observations | 1,672 | 1,672 | 1,672 | 1,672 |
| Municipality Controls | No | No | Yes | Yes |
| Share Yes 2014 | No | No | No | Yes |
| Canton Fixed Effects | No | Yes | Yes | Yes |

**Note:** Each row reports a separate regression of *Shortage (standardized)* on *Total Hectares April Crops*. *Total Hectares April Crops* is defined as the total hectares in the municipality cultivated with field vegetable crops, annual aromatic and medicinal plants, asparagus, vegetable crops under cover, and other crops under cover. The sample is restricted to municipalities suitable for crop production based on terrain and climate conditions. The F-statistic reported is the Kleibergen-Paap F-statistic testing for weak instruments. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table C.10: First Stage Regressions

| | Dep. Variable: Shortage (standardized) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Share April Crops | 3.84*** | 3.97*** | 4.07*** | 4.05*** |
| | (0.78) | (0.79) | (0.77) | (0.78) |
| F-Stat | 24.04 | 25.09 | 27.61 | 27.02 |
| Observations | 1,672 | 1,672 | 1,672 | 1,672 |
| Municipality Controls | No | No | Yes | Yes |
| Share Yes 2014 | No | No | No | Yes |
| Canton Fixed Effects | No | Yes | Yes | Yes |

**Note:** Each row reports a separate regression of *Shortage (standardized)* on the standardized value of *Share April Crops*. *Share April Crops* is defined as the ratio between hectares devoted to April-intensive crops (field vegetable crops, annual aromatic and medicinal plants, asparagus, vegetable crops under cover, and other crops under cover) and total cultivated hectares in the municipality. The sample is restricted to municipalities suitable for crop production based on terrain and climate conditions. The F-statistic reported is the Kleibergen-Paap F-statistic testing for weak instruments. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

## C.5. Shortages and Voting in the Referendum

We conduct several robustness checks to validate our main findings on the relationship between labor shortages and anti-immigration voting patterns. First, we extend our analysis to the full sample of municipalities, confirming that our baseline results are not driven by sample selection. Next, we estimate specifications using the first difference in anti-immigration voting between 2014 and 2020 as the dependent variable, rather than controlling for 2014 voting patterns as in our baseline approach. This specification examines whether changes in voting patterns are directly related to labor market conditions. Finally, we employ our spring crop-based instruments—*Total Hectares April Crops* and *Share April Crops*—as alternative sources of exogenous variation in labor shortages. Across these specifications, our key finding that labor shortages reduce opposition to immigration remains robust, though coefficient magnitudes vary with the chosen specification.

Table C.11: Effect of shortages on referendum outcomes - Full Sample

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | **Panel A** - Share Yes | | | | | |
| Shortage | -0.33*** | | -0.70*** | -0.34*** | | -0.97*** |
|  | (0.07) | | (0.20) | (0.07) | | (0.25) |
| Predicted hiring (Inputs Based) | | -0.15*** | | | -0.18*** | |
|  | | (0.05) | | | (0.04) | |
| Yes/Eligible 2014 | 0.91*** | 0.91*** | 0.91*** | 0.82*** | 0.83*** | 0.82*** |
|  | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| 1st Stage F-Stat | - | - | 20.2 | - | - | 19.84 |
| Dep. Var. Mean | 44.30 | 44.30 | 44.30 | 44.30 | 44.30 | 44.30 |
| Dep. Var. Std. Dev. | 11 | 11 | 11 | 11 | 11 | 11 |
| Observations | 2,099 | 2,099 | 2,099 | 2,099 | 2,099 | 2,099 |
|  | **Panel B** - Yes / Eligible | | | | | |
| Shortage | -0.41*** | | -0.84*** | -0.34*** | | -0.83*** |
|  | (0.06) | | (0.22) | (0.06) | | (0.27) |
| Predicted hiring (Inputs Based) | | -0.18*** | | | -0.16*** | |
|  | | (0.05) | | | (0.05) | |
| YesEligible_Lag | 0.87*** | 0.87*** | 0.87*** | 0.71*** | 0.71*** | 0.71*** |
|  | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| 1st Stage F-Stat | - | - | 20.2 | - | - | 19.86 |
| Dep. Var. Mean | 27.20 | 27.20 | 27.20 | 27.20 | 27.20 | 27.20 |
| Dep. Var. Std. Dev. | 7 | 7 | 7 | 7 | 7 | 7 |
| Observations | 2,099 | 2,099 | 2,099 | 2,099 | 2,099 | 2,099 |
| Municipality Controls | No | No | No | Yes | Yes | Yes |
| Fixed Effects | Canton | Canton | Canton | Canton | Canton | Canton |

**Note:** Columns 1-6 report estimates of the effect of labor shortages on referendum outcomes in 2020 in municipality $i$. Both shortage and predicted hiring variables are standardized. Panel A uses the share of 'yes' votes over total votes cast as the dependent variable, while Panel B uses the share of 'yes' votes over total eligible voters. For each panel, Columns 1-3 present specifications without municipality controls, while Columns 4-6 include them. Within each set, we report OLS estimates (Columns 1 and 4), reduced form results (Columns 2 and 5), and instrumental variable estimates (Columns 3 and 6). All specifications include canton fixed effects and controls for the 2014 referendum outcome. Municipality controls include number of inhabitants, share of foreigners, share of population 65 or older, population density, share of land occupied by housing and infrastructure, share of agricultural land, share of employed population, share of workers in the primary sector, and share of workers in the secondary sector. The sample includes all municipalities that appear both in 2014 and 2020. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table C.12: Effect of shortages on referendum outcomes - First Difference

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **Panel A** - Share Yes | | | | | |
| Shortage | -0.15** | | -0.49** | -0.18** | | -0.72*** |
| | (0.07) | | (0.21) | (0.07) | | (0.27) |
| Predicted hiring (Inputs Based) | | -0.10** | | | -0.14*** | |
| | | (0.04) | | | (0.05) | |
| 1st Stage F-Stat | - | - | 19.65 | - | - | 19.33 |
| Dep. Var. Mean | -11.41 | -11.41 | -11.41 | -11.41 | -11.41 | -11.41 |
| Dep. Var. Std. Dev. | 4 | 4 | 4 | 4 | 4 | 4 |
| Observations | 1,680 | 1,680 | 1,680 | 1,680 | 1,680 | 1,680 |
| | **Panel B** - Yes / Eligible | | | | | |
| Shortage | -0.16*** | | -0.43** | -0.18*** | | -0.60* |
| | (0.06) | | (0.22) | (0.06) | | (0.31) |
| Predicted hiring (Inputs Based) | | -0.09** | | | -0.11** | |
| | | (0.04) | | | (0.05) | |
| 1st Stage F-Stat | - | - | 19.65 | - | - | 19.33 |
| Dep. Var. Mean | -5.09 | -5.09 | -5.09 | -5.09 | -5.09 | -5.09 |
| Dep. Var. Std. Dev. | 3 | 3 | 3 | 3 | 3 | 3 |
| Observations | 1,680 | 1,680 | 1,680 | 1,680 | 1,680 | 1,680 |
| Municipality Controls | No | No | No | Yes | Yes | Yes |
| Fixed Effects | Canton | Canton | Canton | Canton | Canton | Canton |

**Note:** Columns 1-6 report estimates of the effect of labor shortages on referendum outcomes municipality $i$, measured as the first difference between 2014 and 2020. Both shortage and predicted hiring variables are standardized. Panel A uses the share of 'yes' votes over total votes cast as the dependent variable, while Panel B uses the share of 'yes' votes over total eligible voters. For each panel, Columns 1-3 present specifications without municipality controls, while Columns 4-6 include them. Within each set, we report OLS estimates (Columns 1 and 4), reduced form results (Columns 2 and 5), and instrumental variable estimates (Columns 3 and 6). All specifications include canton fixed effects and controls for the 2014 referendum outcome. Municipality controls include number of inhabitants, share of foreigners, share of population 65 or older, population density, share of land occupied by housing and infrastructure, share of agricultural land, share of employed population, share of workers in the primary sector, and share of workers in the secondary sector. The sample includes all municipalities that appear both in 2014 and 2020. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table C.13: ALTERNATIVE INSTRUMENT: TOTAL HECTARES APRIL CROPS

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **Panel A** - Share Yes | | | | | |
| Shortage | -0.19*** | | -0.48* | -0.26*** | | -0.80*** |
| | (0.07) | | (0.26) | (0.07) | | (0.27) |
| Total Hectares April Crops | | -0.11* | | | -0.17** | |
| | | (0.07) | | | (0.07) | |
| Yes/Eligible 2014 | 0.90*** | 0.90*** | 0.90*** | 0.80*** | 0.80*** | 0.79*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| 1st Stage F-Stat | - | - | 15.93 | - | - | 13.7 |
| Dep. Var. Mean | 43.41 | 43.43 | 43.43 | 43.41 | 43.43 | 43.43 |
| Dep. Var. Std. Dev. | 10 | 10 | 10 | 10 | 10 | 10 |
| Observations | 1,680 | 1,672 | 1,672 | 1,680 | 1,672 | 1,672 |
| | **Panel B** - Yes / Eligible | | | | | |
| Shortage | -0.17*** | | -0.42* | -0.21*** | | -0.54** |
| | (0.06) | | (0.22) | (0.06) | | (0.23) |
| Total Hectares April Crops | | -0.10* | | | -0.12** | |
| | | (0.05) | | | (0.06) | |
| YesEligible_Lag | 0.87*** | 0.87*** | 0.87*** | 0.68*** | 0.68*** | 0.67*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| 1st Stage F-Stat | - | - | 15.99 | - | - | 13.84 |
| Dep. Var. Mean | 26.30 | 26.32 | 26.32 | 26.30 | 26.32 | 26.32 |
| Dep. Var. Std. Dev. | 7 | 7 | 7 | 7 | 7 | 7 |
| Observations | 1,680 | 1,672 | 1,672 | 1,680 | 1,672 | 1,672 |
| Municipality Controls | No | No | No | Yes | Yes | Yes |
| Fixed Effects | Canton | Canton | Canton | Canton | Canton | Canton |

**Note:** Columns 1-6 report estimates of the effect of labor shortages on referendum outcomes in 2020 in municipality $i$. Both shortage and predicted hiring variables are standardized. Panel A uses the share of 'yes' votes over total votes cast as the dependent variable, while Panel B uses the share of 'yes' votes over total eligible voters. For each panel, Columns 1-3 present specifications without municipality controls, while Columns 4-6 include them. Within each set, we report OLS estimates (Columns 1 and 4), reduced form results (Columns 2 and 5), and instrumental variable estimates (Columns 3 and 6). All specifications include canton fixed effects and controls for the 2014 referendum outcome. Municipality controls include number of inhabitants, share of foreigners, share of population 65 or older, population density, share of land occupied by housing and infrastructure, share of agricultural land, share of employed population, share of workers in the primary sector, and share of workers in the secondary sector. The sample includes all municipalities that appear both in 2014 and 2020. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table C.14: ALTERNATIVE INSTRUMENT: SHARE APRIL CROPS

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | **Panel A** - Share Yes | | | |
| Shortage | -0.19*** | | -1.11*** | -0.26*** | | -0.95*** |
| | (0.07) | | (0.37) | (0.07) | | (0.33) |
| Share April Crops | | -0.23*** | | | -0.20*** | |
| | | (0.08) | | | (0.07) | |
| Yes/Eligible 2014 | 0.90*** | 0.90*** | 0.89*** | 0.80*** | 0.80*** | 0.79*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| 1st Stage F-Stat | - | - | 24.64 | - | - | 27.02 |
| Dep. Var. Mean | 43.41 | 43.43 | 43.43 | 43.41 | 43.43 | 43.43 |
| Dep. Var. Std. Dev. | 10 | 10 | 10 | 10 | 10 | 10 |
| Observations | 1,680 | 1,672 | 1,672 | 1,680 | 1,672 | 1,672 |
| | | | **Panel B** - Yes / Eligible | | | |
| Shortage | -0.17*** | | -0.93*** | -0.21*** | | -0.67*** |
| | (0.06) | | (0.30) | (0.06) | | (0.26) |
| Share April Crops | | -0.19*** | | | -0.14*** | |
| | | (0.06) | | | (0.05) | |
| YesEligible_Lag | 0.87*** | 0.87*** | 0.86*** | 0.68*** | 0.68*** | 0.67*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| 1st Stage F-Stat | - | - | 24.79 | - | - | 27.31 |
| Dep. Var. Mean | 26.30 | 26.32 | 26.32 | 26.30 | 26.32 | 26.32 |
| Dep. Var. Std. Dev. | 7 | 7 | 7 | 7 | 7 | 7 |
| Observations | 1,680 | 1,672 | 1,672 | 1,680 | 1,672 | 1,672 |
| Municipality Controls | No | No | No | Yes | Yes | Yes |
| Fixed Effects | Canton | Canton | Canton | Canton | Canton | Canton |

**Note:** Columns 1-6 report estimates of the effect of labor shortages on referendum outcomes in 2020 in municipality $i$. Both shortage and predicted hiring variables are standardized. Panel A uses the share of 'yes' votes over total votes cast as the dependent variable, while Panel B uses the share of 'yes' votes over total eligible voters. For each panel, Columns 1-3 present specifications without municipality controls, while Columns 4-6 include them. Within each set, we report OLS estimates (Columns 1 and 4), reduced form results (Columns 2 and 5), and instrumental variable estimates (Columns 3 and 6). All specifications include canton fixed effects and controls for the 2014 referendum outcome. Municipality controls include number of inhabitants, share of foreigners, share of population 65 or older, population density, share of land occupied by housing and infrastructure, share of agricultural land, share of employed population, share of workers in the primary sector, and share of workers in the secondary sector. The sample includes all municipalities that appear both in 2014 and 2020. Standard errors are robust. *,**, *** denote significance at the 10%, 5%, and 1% levels, respectively.

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# D. From Explanations to Narratives

In this section, we detail the prompts used to instruct GPT-4 in classifying economic narratives in voters' explanations. Our prompting strategy incorporates several elements designed to improve classification accuracy. First, we provide context by explaining that the texts come from voter explanations in immigration referendums. Second, we offer detailed criteria and examples of what constitutes each narrative, helping the model distinguish between similar but distinct types of reasoning. Third, we require the model to explain its classification decision, which promotes more careful consideration of the text. Finally, we ask the model to separate its explanation from the category assignment using a specific delimiter ("$$$"), facilitating the ex-post extraction of classifications. The complete prompts are reproduced below.

**Prompt 1: Complements Narrative Classification**

You are an assistant specialized in analyzing voter explanations from referendums on immigration policies. Your task is to categorize these explanations based on whether they suggest that foreign workers have a positive causal impact on economic variables or are complements to native workers.

*Key points to consider:*

1. Mentions of foreign workers contributing positively to economic growth, productivity, or innovation
2. References to foreign workers filling skill gaps or labor shortages that benefit the economy
3. Statements suggesting foreign workers create jobs or opportunities for native workers
4. Implications that foreign workers enhance the competitiveness of certain industries or the overall economy
5. References to foreign workers complementing (rather than substituting) native workers in the labor market
6. Mentions of foreign workers bringing diverse skills or perspectives that benefit native workers or businesses
7. Statements about positive spillover effects from foreign workers to the broader economy
8. Non-economic considerations related to immigration or foreign workers

*Categorization criteria:*

- Category 1: The text suggests foreign workers have a positive causal impact on economic variables or are complements to native workers. This could include:

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- Direct statements about foreign workers boosting economic indicators
- References to foreign workers filling crucial roles that support economic growth
- Implications that foreign workers create opportunities or jobs for natives
- Statements suggesting foreign and native workers have complementary skills or roles
- Mentions of positive economic externalities from foreign worker presence

- Category 0: The text does not suggest positive economic impacts or complementarity of foreign workers. This includes:
  - Neutral statements about foreign workers without economic implications
  - Arguments suggesting foreign workers substitute rather than complement native workers
  - Statements implying negative or no economic impact from foreign workers
  - Explanations focused on non-economic aspects of immigration, such as:
    * Cultural or social impacts of immigration
    * Humanitarian considerations
    * National security or border control issues
    * Demographic changes
    * Political or ideological stances on immigration not related to economics
  - Any other explanations that don't address the economic impact or labor market role of foreign workers

*Provide your analysis in the following format:*

1. A detailed explanation of your reasoning, focusing on how the text addresses (or doesn't address) the positive economic impact or complementarity of foreign workers. If the text focuses on non-economic aspects, explain this as well. Include any relevant context or implications drawn from the text.

2. On a new line, write the "$$$" symbol.

3. After the "$$$" symbol, on a new line, write only the category number (1 or 0).

**Prompt 2: Substitutes Narrative Classification**

You are an assistant specialized in analyzing voter explanations from Swiss referendums on immigration restrictions. Your task is to categorize these explanations based on whether they mention or imply economic competition between foreign workers and Swiss workers.

*Key points to consider:*

1. Direct or indirect mentions of competition in the job market between foreign and Swiss workers

2. Implications of impact on wages for Swiss workers due to foreign labor

3. Suggestions of increased difficulty for Swiss nationals in finding employment

4. Hints at displacement of Swiss workers in certain industries or job sectors

5. References to economic pressures on local workforce that could be attributed to foreign labor

6. Calls for protection of Swiss workers or Swiss jobs, which may imply a perceived threat from foreign workers

7. Mentions of prioritizing Swiss workers or Swiss interests in the job market

*Categorization criteria:*

- Category 1: The text explicitly mentions or implicitly suggests that foreign workers are competing with Swiss workers, potentially leading to negative economic impacts for Swiss residents. This could include:
    - Direct statements about competition between Swiss and foreign workers
    - Implications of wage pressure or job scarcity due to foreign workers
    - Calls for protecting Swiss workers or jobs, which suggest a perceived threat
    - References to prioritizing Swiss workers in the job market
    - Concerns about the Swiss workforce that could be reasonably linked to competition from foreign workers
- Category 0: The text does not mention or imply economic competition between foreign and Swiss workers, nor any resulting negative impacts on the Swiss workforce. The text also doesn't contain any statements that could be reasonably interpreted as concern about job market competition from foreign workers.

*Provide your analysis in the following format:*

1. A detailed explanation of your reasoning, focusing on how the text addresses (or doesn't address) the competition between Swiss and foreign workers. Include any relevant context or implications drawn from the text.

2. On a new line, write the "$$$" symbol.

3. After the "$$$" symbol, on a new line, write only the category number (1 or 0).

## Prompt 3: Density Stress Narrative Classification

You are an assistant specialized in analyzing voter explanations from Swiss referendums on immigration restrictions. Your task is to categorize these explanations based on whether they mention concerns related to overpopulation or density stress due to immigration.

*Key points to consider:*

1. Explicit mentions of overcrowding or overpopulation

2. References to strain on infrastructure, public services, or natural resources

3. Use of terms like "density stress", "overpopulation" or similar concepts

4. Concerns about the impact of population growth on quality of life

*Categorization criteria:*

- Category 1: The text explicitly mentions concerns related to overpopulation or density stress due to immigration. This could include:
    - Overcrowding in cities or public spaces
    - Strain on public transportation, roads, or other infrastructure
    - Pressure on housing availability or affordability
    - Concerns about loss of farmland or natural areas due to urban expansion
    - Perceived decrease in quality of life due to population increase
- Category 0: The text does not explicitly mention concerns related to overpopulation or density stress due to immigration. This includes general statements about immigration that don't specify these issues.

*Provide your analysis in the following format:*

1. A detailed explanation of your reasoning, focusing on how the text addresses (or doesn't address) concerns related to overpopulation or density stress due to immigration.

2. On a new line, write the "$$$" symbol.

3. After the "$$$" symbol, on a new line, write only the category number (1 or 0).