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Drivers of Wage and Employment Growth in Recent Years: A Supply and Demand Decomposition*

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Abstract

Understanding whether labor market developments stem from supply or demand forces has fundamental implications for the conduct of monetary policy. This article develops a structural vector autoregression (VAR) methodology to decompose U.S. employment and wage growth into supply and demand components using sign restrictions. Extending Shapiro (2026), we separately identify trend growth, current shocks, and past shocks across different industries. Results reveal that goods-producing sectors experienced strong demand-driven growth in 2022, which subsequently weakened as Federal Reserve tightening took effect. Service sectors showed robust demand through 2023, but by 2025, supply-side factors—likely due to immigration policy changes—became dominant. We validate our shock identification by linking estimated demand shocks to financial dependence measures during monetary tightening and supply shocks to immigration flows. These findings highlight the asymmetric nature of post-pandemic labor market rebalancing and underscore the importance of distinguishing supply from demand forces for appropriate monetary policy calibration.

Keywords: Wage growth, employment growth, supply and demand shocks, inflation, VAR
JEL Codes: J20, J30

1 Introduction

In early 2020, at the onset of the pandemic, the U.S. economy experienced a sharp downturn in the labor market. Shortly after, the labor market demonstrated remarkable resilience and strength. Important changes in consumers' demand, away from services and toward goods, coupled with high levels of disposable income, led to a period of consumer price inflation, wage growth, important levels of labor market turnover, and labor reallocation across sectors.

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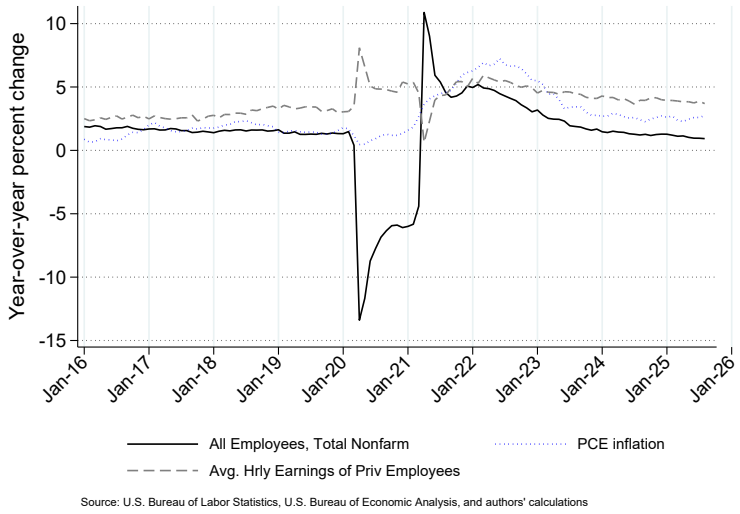
Figure 1: Employment, Wages, and Price Changes in Recent Years



Source: U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis, and authors' calculations

The drivers behind this labor market performance remain a subject of debate among economists and policymakers. Understanding whether wage and employment growth stem from supply-side or demand-side factors has critical implications for policy design and economic forecasting. The 2022-25 period offers a particularly valuable window for this analysis. As Figure 1 illustrates, employment experienced a sharp collapse at the onset of the pandemic followed by substantial recovery. As employment grew through 2022 and 2023, both inflation and wage growth surged to levels not seen in decades before the pandemic. Personal consumption expenditures (PCE) inflation peaked above 7% year-over-year in mid-2022, while average hourly earnings growth approached 5.5% during the same period. Through 2024 and into 2025, all three series—employment growth, wage growth, and inflation—moderated substantially, though they remained above pre-pandemic levels.

Several potential sources of supply and demand shocks shaped this period. On the demand side, monetary policy tightening by the Federal Reserve dramatically altered financial conditions, with the federal funds rate rising from near zero to over 5% between March 2022 and July 2023. All else equal, these tighter financial conditions likely reduced labor demand as firms faced higher borrowing costs. Consumer spending patterns also shifted dramatically during this period, transitioning from goods-heavy pandemic spending back toward services, potentially reshaping labor demand across industries.

On the supply side, immigration policy and changes in the flows of population from abroad experienced significant volatility. Initial restrictions on immigration reduced labor supply during the early years of the pandemic, though immigration flows subsequently recovered and even exceeded pre-pandemic levels by 2023-24. Changes in labor force participation—particularly early retirements during the pandemic—also influenced labor supply. The reallocation of workers across industries and occupations, often termed the "Great Resignation" or "Great Reshuffling," represented another supply-side factor as workers sought better opportunities or different work arrangements. More recently, shifts in tariffs and immigration policy in early 2025 may have affected labor demand and supply in several sectors.

The policy implications of this distinction are substantial. If employment is falling because of negative demand shocks, policymakers might consider accommodative monetary policy to stimulate economic activity. Conversely, if wages are rising and employment growth slows-down because of negative supply shocks—perhaps due to restricted immigration or labor force exits—policymakers might explore broader immigration policies or workforce development initiatives, with a limited role for monetary policy. Furthermore, the inflationary pressures associated with wage growth can vary considerably based on their underlying causes. Wage increases driven by tight labor supply may generate more persistent inflation than those driven by temporary surges in labor demand, fundamentally influencing central bank decision-making.[1]

Then, understanding the main drivers of labor market expansion and contraction is critical. This article aims to provide a comprehensive framework for decomposing employment and wage growth into supply and demand shocks. To disentangle supply and demand contributions to recent labor market dynamics, we follow the structural vector autoregression (VAR) methodology of Shapiro (2026), applying sign restrictions derived from fundamental supply-demand theory to industry-level employment and wage data. Our method extends Shapiro (2026) to separately identify demand and supply shocks (or innovations) from the expected long-run evolution of employment and wages. In addition, we decompose supply and demand contributions into current and past components to understand shock persistence, and we apply the framework for labor market data across multiple industries.

Our approach estimates a 12-lag VAR on monthly growth rates from February 1990 through November 2024 (excluding 2020-21), identifying "net" demand shocks as periods when both employment and wages grow faster than predicted, and "net" supply shocks as periods when employment rises but wages fall relative to predictions. We decompose observed changes into five components: long-run trend growth, current demand shocks, past demand shocks (reflecting persistence), current supply shocks, and past supply shocks. This framework allows us to trace how supply factors—such as immigration flows and labor force participation—and demand factors—such as monetary policy tightening and shifting consumption patterns—have shaped employment and wage trajectories across 10 broad industry categories. While the sign-restriction approach cannot perfectly identify structural shocks (as simultaneous positive demand and negative supply shocks may be misclassified), it provides economically interpretable decompositions that align with basic labor market theory.

Using our method, we analyze the recent evolution of supply and demand forces in the labor market. Our decomposition reveals striking sectoral divergence in the forces driving post-pandemic

[1] Powell (2023) highlights the importance of understanding the sources of wage and employment changes for the adequate calibration of monetary policy. "The rebalancing of the labor market has continued over the past year but remains incomplete. Labor supply has improved, driven by stronger participation among workers aged 25 to 54 and by an increase in immigration back toward pre-pandemic levels. ... Demand for labor has moderated as well. Job openings remain high but are trending lower." In a similar note, Waller (2024) discusses the importance of understanding the sources of labor market conditions. "The imbalance in the labor market was reflected in a surge in job openings, with two vacant jobs for each worker counted as looking for work, nearly double the rate prior to the pandemic. There was also a surge in the number of people quitting their jobs, most of them to take a higher-paying job elsewhere. But now that situation has changed dramatically. Labor supply has improved, with a higher labor force participation rate and much higher rates of immigration. Not long ago, I would have been concerned that the high levels of job creation reported recently were inconsistent with a labor market coming into better balance, but the high pace of immigration in recent quarters helped accommodate the strong demand. And, more recently, as restrictive monetary policy has put downward pressure on aggregate demand, the demand for labor has moderated."

labor market dynamics. In goods-producing sectors, employment growth in early 2022 was propelled primarily by strong current and past demand shocks, reflecting pandemic-era consumption patterns favoring goods over services. However, as Federal Reserve monetary tightening took hold and consumer spending normalized, demand contributions diminished markedly, with goods employment growth decelerating from 5% year-over-year to near-zero by 2024. Wage growth in goods sectors, driven overwhelmingly by demand pressures, peaked at around 5.5% in early 2022 and moderated to close to 4% by 2025 as both supply and demand contributions became more balanced. Service sectors displayed different dynamics: Employment growth remained robust through 2022 supported by persistent positive demand shocks, though this too decelerated toward the long-run trend of 1.8% by 2024. Services wage growth, which began 2022 at elevated levels driven almost entirely by demand shocks, saw demand contributions diminish substantially by 2025 while supply factors—potentially reflecting immigration policy changes—assumed greater importance. The frequency distribution of shocks reinforces this narrative: Positive demand shocks in goods fell from 50% of observations in 2022 to 33% in 2025, while negative supply shocks in services surged from 35% to 46% over the same period, suggesting that by 2025, supply-side constraints had become the dominant driver in service industries.

To provide some empirical support and informally validate that our estimated shocks capture economically meaningful forces, we examine their correlation with observable policy changes and industry characteristics. Industries with higher external financial dependence—measured following Rajan and Zingales (1998)—exhibited more negative demand shocks during the 2024-25 period of restrictive monetary policy, providing some support that our identified demand shocks capture the transmission of interest rate changes through credit-dependent sectors. During 2023-24, when immigration to the United States surged substantially above pre-pandemic levels, industries with higher shares of non-native employment experienced more positive supply shocks, with sectors employing more immigrant workers showing both larger average supply shocks and a greater frequency of positive supply months. Conversely, in early 2025, following the implementation of restrictive immigration policies, these same immigrant-intensive industries experienced larger and more frequent negative supply shocks, with industries having higher immigrant employment shares showing both lower average supply shocks and a greater share of months with negative supply conditions. These systematic relationships between our estimated shocks and independently observable economic events (monetary tightening and immigration policy shifts), although weak, provide some empirical support that the VAR decomposition successfully identifies economically meaningful supply and demand forces rather than statistical artifacts.

The use of VAR models to decompose macroeconomic fluctuations into supply and demand components has a long tradition in economics. Blanchard and Quah (1989) pioneered the structural VAR approach to distinguish between aggregate supply and demand disturbances in explaining unemployment fluctuations. Their methodology imposed long-run restrictions, assuming that demand shocks have only temporary effects on output while supply shocks have permanent effects. This seminal work established the foundation for using dynamic restrictions to recover structural shocks from reduced-form VAR residuals. Uhlig (2005) imposed sign restrictions in a VAR to understand the effects of monetary policy on the economy. Brinca et al. (2021) and more recently Cascaldi-Garcia and Morales-Jiménez (2026) use a Bayesian VAR with sign restrictions to analyze supply and demand shocks in the labor market in the aftermath of the pandemic.

Our approach is closer to Shapiro (2026), who develops a method to decompose the evolution of personal consumption expenditures inflation into supply and demand driven by using sign

restrictions. His approach recognizes that demand shocks should increase both prices and quantities, while supply shocks should move prices and quantities in opposite directions—the basic intuition from elementary economics that we apply to labor markets. The method connects with a large literature of VARs using sign restrictions but relaxes some of the identification assumptions, at the cost of shocks potentially being misidentified. Shapiro (2022) offers additional evidence.

The rest of this article is organized as follows: In Section 2, we outline our econometric methodology and explain how we identify supply and demand shocks from the data. In Section 3, we report our results for both broad sectoral aggregates and the economy as a whole, examining how the relative importance of supply and demand factors evolved from 2022 through 2025. In Section 4, we use some measures of demand conditions linked to monetary policy and supply conditions linked to immigration to offer external validation to our measures. In Section 5, we conclude.

2 Econometric Model

Our goal is to identify how demand and supply forces affect the monthly evolution of employment and wages. For this, we depart from Shapiro (2026)'s approach by using only the innovations to the estimated VAR to identify the supply and demand components. We discuss the details here.

Assume that labor markets are segmented and that equilibrium wages and employment levels are the result of the intersection of the labor demand and supply in each market and each period. One labor market consists of one industry i, such as manufacturing or construction, and we abstract from the simultaneous interaction of other labor markets in determining equilibrium.

We assume the labor demand and supply are log-linear and express them as

$$\begin{aligned} \log(E_{i,t}^D) &= \alpha_{i,t} - \beta_i \log(w_{i,t}), \\ \log(E_{i,t}^S) &= \gamma_{i,t} + \delta_i \log(w_{i,t}), \end{aligned}$$

where the first equation denotes the labor demand in labor market i, and $E_{i,t}^D$ is the level of employment demanded at a given wage. The second equation denotes the labor supply in labor market i, with $E_{i,t}^S$ the level of employment supplied. $\beta_i > 0$ and $\delta_i > 0$ are the elasticities of demand and supply, respectively. The coefficients $\alpha_{i,t}$ and $\gamma_{i,t}$ are the intercepts of the demand and supply functions, which can vary over time and can be interpreted as demand and supply shifters.

Equilibrium in the labor market implies that demand and supply are equal, $E_{i,t}^D = E_{i,t}^S = E_{i,t}$, at the equilibrium level of wages. Rearranging, we can express the equilibrium as

$$\begin{aligned} \log(E_{i,t}) + \beta_i \log(w_{i,t}) &= \alpha_{i,t}, \\ \log(E_{i,t}) - \delta_i \log(w_{i,t}) &= \gamma_{i,t}. \end{aligned}$$

We further assume that supply and demand shifters can be decomposed into a component that can be predicted with information up to period $t-1$ and an innovation in period t that cannot be predicted using information from the past. Therefore, we can write $\alpha_{i,t} = \alpha_{i,t-1} + \sigma_{i,\varepsilon}\varepsilon_{i,t}$ and $\gamma_{i,t} = \gamma_{i,t-1} + \sigma_{i,\eta}\eta_{i,t}$, where $\varepsilon_{i,t}$ and $\eta_{i,t}$ are innovations that we call demand and supply shocks, respectively, as these act as demand and supply shifters. We assume $\varepsilon_{i,t}$ and $\eta_{i,t}$ are random variables with mean zero and unit variance, and parameters $\sigma_{i,\varepsilon}$ and $\sigma_{i,\eta}$ scale the structural shocks

and thus capture their variance. We subtract $\log(E_{i,t-1})$ and $\beta_i \log(w_{i,t-1})$ from both sides of the demand equation, and, similarly, subtract $\log(E_{i,t-1})$ and add $\delta_i \log(i, w_t)$ from both sides of the supply equation. This gives us an expression on the changes in employment and wages at period t:

$$\begin{aligned}
\Delta\log(E_{i,t}) + \beta_i \Delta\log(w_{i,t}) &= \alpha_{i,t-1} - \log(E_{i,t-1}) - \beta_i \log(w_{i,t-1}) + \sigma_{i,\varepsilon}\varepsilon_{i,t}, \\
\Delta\log(E_{i,t}) - \delta_i \Delta\log(w_{i,t}) &= \gamma_{i,t-1} - \log(E_{i,t-1}) + \delta_i \log(w_{i,t-1}) + \sigma_{i,\eta}\eta_{i,t}.
\end{aligned}$$

In addition, we assume that $\alpha_{i,t-1}$ and $\gamma_{i,t-1}$, the components of supply and demand shifters that can be predicted with past information, are linear functions of past employment and wages of market i. To simplify the exposition, we provide here an example with a simple lag structure that aligns conveniently with a VAR(1) in growth rates. Thus,

$$\begin{aligned}
\Delta\log(E_{i,t}) + \beta_i \Delta\log(w_{i,t}) &= [c_{i,1} + \theta_{i,1}\Delta\log(E_{i,t-1}) + \theta_{i,2}\Delta\log(w_{i,t-1})] + \sigma_{i,\varepsilon}\varepsilon_t \\
\Delta\log(E_{i,t}) - \delta_i \Delta\log(w_{i,t}) &= [c_{i,2} + \theta_{i,3}\Delta\log(E_{i,t-1}) + \theta_{i,4}\Delta\log(w_{i,t-1})] + \sigma_{i,\eta}\eta_t
\end{aligned}$$

.

This is a structural VAR(1) in the growth rate of employment and wages. Now, in a more-compact notation, we let the vectors $y_{i,t} = [\Delta\log(E_{i,t}), \Delta\log(w_{i,t})]$ and $\nu_{i,t} = [\varepsilon_{i,t}, \eta_{i,t}]$. Then,

$$A_i y_{i,t} = C_i + B_i y_{t-1} + D_i \nu_{i,t}$$

where

$$A_i = \begin{bmatrix} 1 & \beta_i \\ 1 & -\delta_i \end{bmatrix}, \qquad B_i = \begin{bmatrix} \theta_{i,1} & \theta_{i,2} \\ \theta_{i,3} & \theta_{i,4} \end{bmatrix}, \qquad C_i = \begin{bmatrix} c_{i,1} \\ c_{i,2} \end{bmatrix}, \qquad D_i = \begin{bmatrix} \sigma_{i,\varepsilon} & 0 \\ 0 & \sigma_{i,\eta} \end{bmatrix}.$$

Given the assumptions on elasticities of demand and supply, the inverse of A_i exists and is equal to

$$A_i^{-1} = \begin{bmatrix} \frac{\delta_i}{\beta_i+\delta_i} & \frac{\beta_i}{\beta_i+\delta_i} \\ \frac{1}{\beta_i+\delta_i} & \frac{-1}{\beta_i+\delta_i} \end{bmatrix}.$$

Thus, we can write the VAR in reduced form as

$$y_{i,t} = \hat{C}_i + \hat{B}_i y_{i,t-1} + u_{i,t},$$

where, $\hat{C}_i = A_i^{-1} C_i$, $\hat{B}_i = A_i^{-1} B_i$, and,

$$u_{i,t} = A_i^{-1} D_i \nu_{i,t} = \begin{bmatrix} \frac{\delta_i}{\beta_i+\delta_i}\sigma_{i,\varepsilon}\,\varepsilon_{i,t} + \frac{\beta_i}{\beta_i+\delta_i}\sigma_{i,\eta}\,\eta_{i,t} \\ \frac{1}{\beta_i+\delta_i}\sigma_{i,\varepsilon}\,\varepsilon_{i,t} - \frac{1}{\beta_i+\delta_i}\sigma_{i,\eta}\,\eta_{i,t} \end{bmatrix}.$$

In this way, $u_{i,t}$ represents the vector of reduced-form shocks of the VAR. Note that when there is only a positive demand shock, $\varepsilon_{i,t} > 0$ and $\eta_{i,t} = 0$, it increases the growth rate of employment and the growth rate of wages above predictions made with information up to $t-1$. Alternatively, when there is only a positive supply shock, $\eta_{i,t} > 0$ and $\varepsilon_{i,t} = 0$, it increases the growth rate of employment but decreases the growth rate of wages beyond the predicted component. Clearly, when both shocks occur at the same time, the changes in employment and wages cannot be pinned down exactly.

2.1 Identification of Shocks Using Sign Restrictions

As in Shapiro (2026), we use some basic demand-supply intuitions to identify "net" demand and supply shocks.

We assume that a shock that increases the growth rate of employment and wages in period t, above the prediction, is a *"net" demand shock*. In the reduced-form VAR model, this means $u^E_{i,t} > 0$ and $u^w_{i,t} > 0$, where $u^E_{i,t}$ and $u^w_{i,t}$ are the reduced form residuals from the employment and wage equations, respectively. This restriction implies that $\sigma_{i,\varepsilon}\,\varepsilon_{i,t} > \sigma_{i,\eta}\,\eta_{i,t}$ and $\sigma_{i,\varepsilon}\,\varepsilon_{i,t} > -\frac{\beta_i}{\delta_i}\sigma_{i,\eta}\,\eta_{i,t}$, which says that (1) a positive demand shock has to be larger than the supply shock, such that wages increase, and (2) the shift of the demand curve for a positive demand shock has to be larger than a possible contraction in the supply curve from a negative supply shock, such that employment increases on net. This depends on the elasticities of demand and supply and on the size of the shocks, inclusive of their standard deviations. Clearly, if $\eta_{i,t} = 0$, this restriction identifies the demand shock perfectly.

On the other hand, a shock that increases the growth rate of employment but reduces the growth in wages in period t, above predictions, is a *"net" supply shock*. In the reduced-form VAR model, this means $u^E_{i,t} > 0$ and $u^w_{i,t} < 0$; similar to the previous case, this implies $\sigma_{i,\varepsilon}\,\varepsilon_{i,t} < \sigma_{i,\eta}\,\eta_{i,t}$ and $-\frac{\delta_i}{\beta_i}\sigma_{i,\varepsilon}\,\varepsilon_{i,t} < \sigma_{i,\eta}\,\eta_{i,t}$, which means that (1) a positive demand shock has to be quantitatively smaller than the positive supply shock, such that wages fall, and (2) the shift of the demand and supply curves lead to an increase in employment, which depends on the elasticities of demand and supply as well as the magnitude of the shocks. These conditions guarantee that a positive net supply shock increases employment and decreases wages. Clearly, if $\varepsilon_{i,t} = 0$, this restriction identifies the supply shock perfectly.

We stress that we cannot identify the actual structural demand and supply shocks using these conditions but rather the "net" supply and demand shocks, as discussed before. Thus, the classification of supply and demand shocks should be interpreted with caution. To see why, we study a familiar supply and demand graph.

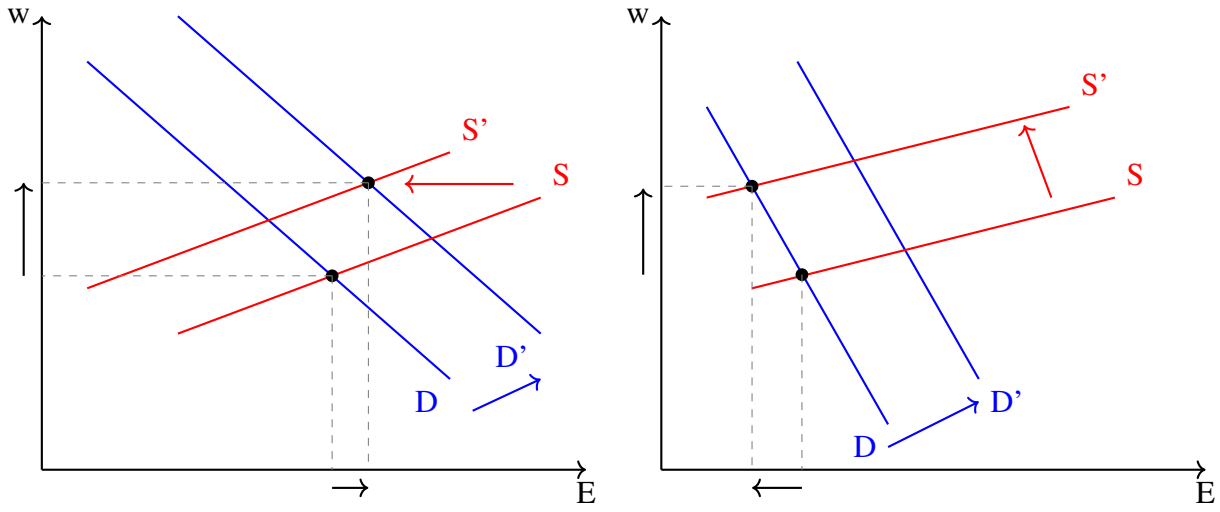
In the left panel of Figure 2, we show the effects of a positive demand and negative supply shock. In this case, both wages and employment increase. Because the positive demand shock expands employment more than the negative supply shock contracts employment, employment on net increases and the method will label this as a net positive demand shock. The right panel of the figure shows the effects of a similar shock—positive demand and negative supply. In this case, however, the effects of the negative supply shock are stronger on employment than the effects of the positive demand shock, leading to a net decline in employment. In our method, we label this a net negative supply shock.

Similar figures can be constructed for other cases. The bottom line is that the categorization process has limitations, and some shocks may be misclassified, obscuring the true nature of structural shocks.

In conclusion, there is a direct link between structural supply and demand shocks and our identification strategy based on sign restrictions. The strategy does not allow us to back out the structural shocks perfectly, but rather as a set. As in Shapiro (2026), we will work with "net" supply and "net" demand shocks as defined here.[2]

[2]However, we stress that with knowledge of the supply and demand elasticities and the scaling parameters, $\sigma_{i,\varepsilon}$ and $\sigma_{i,\eta}$, we would be able to identify the structural demand and supply shocks.

Figure 2: Examples of Shocks and Limitations to Identification



2.2 General VAR Model

We extend the setup of the previous subsection to a VAR with additional lags. The goal in including additional lags of wages and employment in the VAR is to better capture the dynamics of wages and employment that can be predicted with information available up to period $t-1$, thus isolating true shocks or innovations as events that occur at period t. Let $w_{i,t}$ denote log wage and $E_{i,t}$ denote log employment for each industry i in month t. Next, define $y_{i,t} = [\Delta E_{i,t}, \Delta w_{i,t}]$.

We estimate a K-order VAR:

$$y_{i,t} = \hat{C}_i + \sum_{j=1}^{K} \hat{\Phi}_{i,j} y_{i,t-j} + u_{i,t}, \tag{1}$$

where $\hat{C}_i$ and $\hat{\Phi}_{i,j}$ are matrices of parameters of the reduced-form VAR model and $u_{i,t}$ is a vector of reduced-form shocks. The first and second elements of $u_{i,t}$ are denoted $u^W_{i,t}$ and $u^w_{i,t}$, respectively.

2.3 Historical Decomposition

Our goal is to use the VAR model and our identification strategy to understand which forces are driving the observed changes in employment and wages in the data. To recover the net supply and demand shocks for each industry i for all periods in the sample, we propose the following three-step algorithm:

1. Estimate (1) to recover $\hat{u}_{i,t}$, the reduced-form residuals of the estimated VAR model, and the parameters that characterize the dynamics.

2. Classify each $\hat{u}^E_{i,t}$ and $\hat{u}^w_{i,t}$ pair for each industry and time period into one of four types—positive demand, positive supply, negative demand, or negative supply according to

   - Positive Demand ($D^+_{i,t} = 1$) if $\hat{u}^E_{i,t}, \hat{u}^w_{i,t} > 0$,
   - Positive Supply ($S^+_{i,t} = 1$) if $\hat{u}^E_{i,t} > 0, \hat{u}^w_{i,t} < 0$,

- Negative Demand ($D^-_{i,t} = 1$) if $\hat{u}^E_{i,t}, \hat{u}^w_{i,t} < 0$, or
- Negative Supply ($S^-_{i,t} = 1$) if $\hat{u}^E_{i,t} < 0, \hat{u}^w_{i,t} > 0$,

where variable $D^+_{i,t}$ assumes a value of one when the condition is satisfied and is zero otherwise, and similarly for $D^-_{i,t} = 1, S^+_{i,t} = 1$, and $S^-_{i,t} = 1$. Moreover, define $D_{i,t} = D^+_{i,t} + D^-_{i,t}$ as a demand shock and $S_{i,t} = S^+_{i,t} + S^-_{i,t}$ as a supply shock.

3. Write down the following representation, leading to the historical decomposition of the current state of wages and employment changes as a function of all past shocks:

$$y_{i,t} = \underbrace{\hat{\mu}_{i,t}}_{\text{Long-run average}} + \underbrace{S_{i,t}\hat{u}_{i,t}}_{\text{Current Supply}} + \underbrace{D_{i,t}\hat{u}_{i,t}}_{\text{Current Demand}} + \underbrace{\sum_{j=1}^{t} S_{i,t-j}\hat{\Psi}^i_j \hat{u}_{i,t-j}}_{\text{Past Supply}} + \underbrace{\sum_{j=1}^{t} D_{i,t-j}\hat{\Psi}^i_j \hat{u}_{i,t-j}}_{\text{Past Demand}}, \quad (2)$$

where $\hat{\Psi}^i_j$ is a function of the matrices of coefficients $\hat{\Phi}_{i,j}$, and $\hat{\mu}_{i,t}$ is a function of the VAR coefficients and initial conditions. After a sufficiently long time, $\hat{\mu}_{i,t}$ will be a constant that reflects the long-run wages and employment growth in each industry.

2.4 Sample and Data Used

We set $K = 12$ and use monthly growth rates for employment and wages. Note that the results from the decomposition will depend on details of the VAR specification, such as the chosen lag length K, the level of disaggregation of industries, and the sample on which the VAR is estimated. We estimate this VAR for each industry i separately. When we wish to study the effects for the aggregate economy or for a group of industries, such as goods producing or service providing, we perform this aggregation using a weighted sum of the industry-level shocks. The contribution toward overall employment growth of current supply is then

$$\sum_i \omega_{i,t} S_{i,t} \hat{u}_{E,i,t}.$$

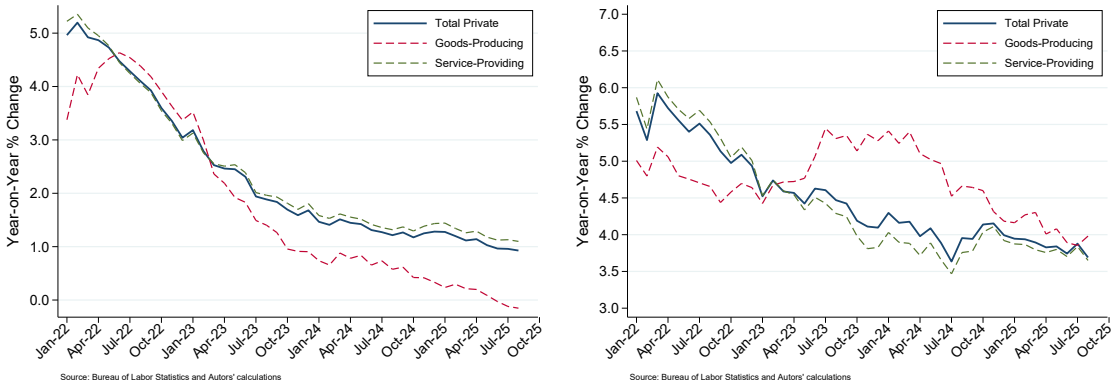
Current demand's contributions to employment and to wages are defined similarly. To calculate aggregate changes over longer horizons, we sum aggregate month-over-month changes for the relevant period.

Our primary data source is the Current Employment Statistics (CES) survey, conducted monthly by the U.S. Bureau of Labor Statistics (BLS). We limit our sample to production and non-supervisory employees from private non-agricultural industries, as data on wages are available for a longer period of time. Non-supervisory employees account for roughly 80% of all private non-agricultural employment.

In our estimation, we use seasonally adjusted data on monthly wage and employment growth for private production and non-supervisory employees from February 1990 through November 2024. To estimate parameters of our econometric model, we exclude the years 2020 and 2021 because of the large labor market swings in the pandemic. In addition, we use 10 broad industry groups, as employment and wage information for more disaggregated sectors is available with a lag and would not allow us to decompose employment and wage changes for the most-recent month with available data.[3]

[3] We use nominal wages rather than real wages, as information about inflation for the United States arrives two to

Figure 3: Recent Evolution of Employment and Wage Growth



(a) Employment: percent change y/y

(b) Wages: percent change y/y

3 Drivers of the Recent Evolution of Employment and Wages

Between January 2022 and August 2025, total nonfarm employment expanded by close to 6%, adding roughly 8.5 million jobs to the country's payrolls. Yet the trajectory has been anything but smooth. The blistering hiring of 2022 and 2023—when employers added an average of 377,000 and 210,000 jobs per month, respectively—has given way to a more subdued expansion. In 2024, monthly gains averaged 122,000, and through the first eight months of 2025, the labor market has shown little change at all, with employment essentially stagnating since April.

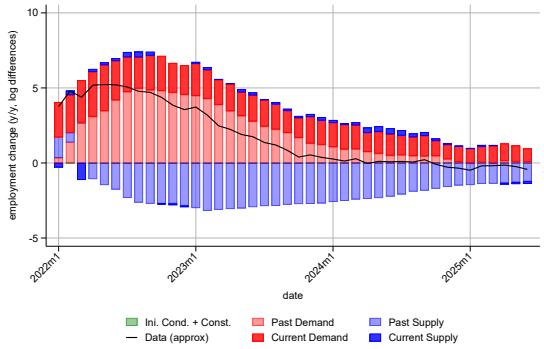
This slowdown reflects a broader normalization after the extraordinary disruptions of the pandemic era. In 2022, when PCE inflation reached a 40-year high of 7.2% in June, employers competed ferociously for workers, pushing average hourly earnings up by as much as 6% year-on-year in early 2022. Nominal wage growth has since decelerated steadily, falling to 4% in August 2025—still above the pre-pandemic norm, but considerably more restrained than the peak years. Figure 3 shows the evolution of employment and wage growth since 2022 for the U.S. economy and further decomposes by broad sectors: goods producing and service providing.

The divergence between goods-producing and service-providing industries tells much of the story. While employment has surged by over 5% in mid-2022 in both sectors, services have expanded at a much faster pace since mid-2023. This reflects both productivity improvements and a gradual shift in consumer spending patterns back toward services after pandemic-era goods binges. This asymmetric pattern suggests that different supply and demand forces may have been at work across these sectors. We apply our framework to better understand these differential dynamics and their implications for aggregate labor market outcomes.

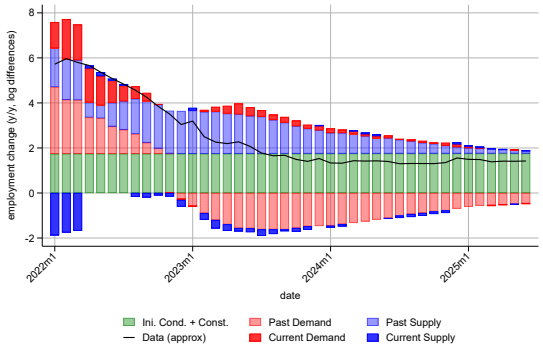
Figure 4 presents the historical decomposition of employment and wage growth for goods-producing and service-providing sectors from January 2022 through mid-2025. These four panels—(a) goods employment, (b) services employment, (c) goods wages, and (d) services wages—illustrate how different supply and demand forces contributed to observed changes over time.

four weeks later, depending on the measure used. While we are aware that it would be more appropriate to use real wages in the analysis, we use nominal wages in an effort to identify the forces driving changes in employment across sectors as soon as the information on employment and wages is available.

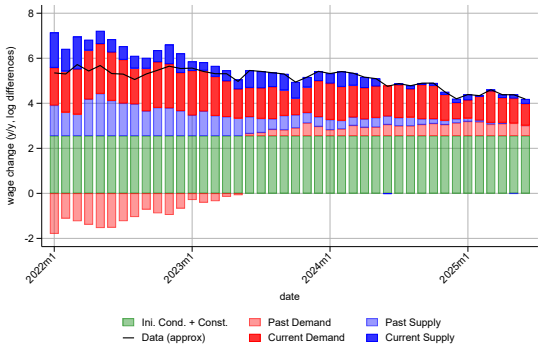
Figure 4: Historical Decomposition of Employment and Wage Growth in Goods and Services



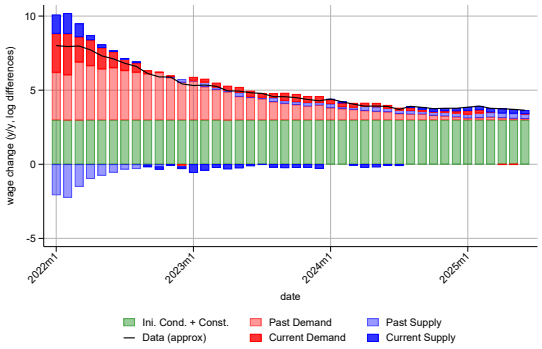
(a) Goods employment: percent change y/y



(b) Services employment: percent change y/y



(c) Goods wages: percent change y/y



(d) Services wages: percent change y/y

Each graph uses a stacked area format where the black line represents the actual data (measured as year-over-year log differences), while colored areas show the contributions of different factors. The green area at the bottom represents the combination of initial conditions and the constant term, which, given the negligible importance of initial conditions of our sample by 2022, captures the long-run average growth. The red areas represent demand shocks—darker red for current demand and lighter red for past demand. The blue areas represent supply shocks—darker blue for current supply and lighter blue for past supply. The height of the stacked areas at any point sums approximately to the actual data line.

In early 2022, goods employment growth, shown in Panel (a), was running at approximately 5% year-over-year. The decomposition reveals that this growth was driven primarily by strong past demand (light red) and current demand (dark red), while supply contributions were relatively modest or even negative in some months. This pattern suggests that goods-producing industries were experiencing robust demand for their products during the pandemic years, leading firms to increase hiring despite some supply-side headwinds. As 2022 progressed into 2023, employment growth in goods-producing sectors decelerated, falling to around 1% year-over-year by mid-2023, and with little to no growth afterward. The decomposition shows that this slowdown coincided with diminishing demand contributions, particularly past demand. Current supply shocks (dark blue) became more prominent during this period, sometimes contributing negatively to employment growth. Consumption patterns in the post-pandemic years normalized away from goods, partly explaining this evolution. In addition, in early 2022, the Federal Reserve started to tighten monetary policy. By 2024 and into 2025, goods employment growth continued its downward trajectory, approaching zero or slightly negative growth. The decomposition indicates that both supply and demand contributions moderated during this period. The persistent weakness in demand contributions aligns with the Federal Reserve's efforts to cool the economy through higher interest rates, which particularly affected interest-sensitive sectors such as manufacturing and construction that comprise the bulk of goods production.

Wage growth in goods-producing sectors, Panel (c), began 2022 at approximately 5.5% year-over-year. The decomposition shows that current demand (dark red) was the primary driver of this rapid wage growth, with substantial contributions also from past demand (light red). Supply shocks contributed positively to wage growth. As 2022 transitioned into 2023, goods wage growth remained elevated at 5% year-over-year before beginning to moderate. By 2024 and into 2025, goods wage growth decelerated to approximately 4% year-over-year. The decomposition shows that both supply and demand contributions moderated, with neither dominating. The more-balanced contributions suggest that the labor market in goods-producing sectors was moving toward normalization.

Services employment growth, Panel (b), presents a notably different picture. In early 2022, year-over-year employment growth in service-providing sectors was running at approximately 6%, stronger than the growth in goods. The decomposition reveals that this robust growth was supported by large positive contributions from both current demand (dark red) and past demand (light red), with supply factors playing a more mixed role. Throughout 2023, services employment growth moderated. The decomposition shows persistent positive demand contributions, though these gradually diminished over time. Current supply shocks (dark blue) showed more variability in services than in goods, sometimes contributing positively and other times negatively, suggesting ongoing adjustments in labor supply. By 2024 and into 2025, services employment growth decelerated to less than 2% year-over-year, close to the long-run growth. This suggests that the labor markets in services were roughly back to normal by late 2024/early 2025.

Services wage growth began 2022 at elevated levels. The decomposition reveals that demand shocks were the overwhelming driver during this period, with important contributions from both current demand (dark red) and past demand (light red). Throughout 2023 and 2024, services wage growth moderated, but demand contributions remained dominant. By late 2024 and into 2025, demand contributions diminished substantially while supply contributions became relatively more important. This evolution suggests that the extreme demand pressures of 2022-23 had eased by late 2024 and that changes in labor supply—possibly through changes in immigration or labor force participation—were playing a larger role in wage determination.

The next two tables provide complementary perspectives on the supply and demand forces shaping recent labor market dynamics.

	goods				services			
	2022	2023	2024	2025	2022	2023	2024	2025
Positive Supply	0.17	0.22	0.19	0.21	0.30	0.20	0.26	0.14
Positive Demand	0.50	0.47	0.39	0.33	0.19	0.33	0.25	0.16
Negative Supply	0.25	0.19	0.22	0.29	0.35	0.26	0.27	0.46
Negative Demand	0.08	0.11	0.19	0.17	0.17	0.20	0.21	0.23

Table 1: Share of demand and supply shocks across industries and years

Table 1 presents the frequency distribution of different shock types across goods-producing and service-providing sectors from 2022 through 2025. That is, the table shows how prevalent some shocks were in different periods but abstracts from their magnitude. The table reveals a striking evolution in labor market conditions. In goods-producing sectors, positive demand shocks dominated in 2022 (50% of observations) but steadily declined through 2025 (to 33%), reflecting the cooling effects of monetary tightening and the normalization of consumption patterns away from pandemic-era goods purchases. Conversely, negative supply shocks increased from 25% in 2022 to 29% in 2025, potentially reflecting immigration restrictions and other supply-side constraints. The service sector shows a different pattern: In 2022, negative supply shocks were most prevalent (35%), likely reflecting pandemic-related labor supply disruptions and worker reallocation. However, by 2025, negative supply shocks surged to 46% of observations, coinciding with recent restrictive immigration policies. Positive demand shocks in services fell from 33% in 2023 to just 16% in 2025, consistent with the Federal Reserve's efforts to moderate aggregate demand.

Table 2 provides a detailed decomposition of employment and wage growth as of August 2025, showing both annualized monthly changes and year-over-year changes across industries. The aggregate picture shows goods-producing sectors experiencing employment contraction (–1.33% annualized monthly, –0.69% year-over-year) while service sectors maintained modest growth (1.03% and 1.29%, respectively). The long-run average growth rates differ substantially across sectors, consistent with the historical decomposition figures analyzed previously. Manufacturing employment has been contracting over time, while professional business services and education and health have been expanding. Long-run trends capture these differences, and the method allows us to explain the deviations of the data from these trends. Since the observed value for August is below the long-run trend, the contribution of shocks is, on average, negative. Current demand contributions were negative for goods and services (–0.12% and –0.18% monthly), while supply

shocks varied considerably across specific industries. Mining and logging experienced particularly severe contractions (–13.26% annualized monthly change), driven by large negative current demand (–4.00%) and past supply (–6.28%) shocks. Within services, information services showed the strongest decline (–6.18% annualized monthly change), driven primarily by negative current and past supply shocks. The wage decomposition shows that while overall wage growth averaged around 3-6% across most sectors, the contributions from supply and demand shocks differed markedly, with information services showing the highest wage growth (9.7% annualized monthly change) driven substantially by current supply conditions.

Table 2: Decomposition of employment and wages growth rates, August 2025

	Annualized monthly change in Employment						Annualized monthly change in Hourly Wages						
	Total	Long Term Average	Current Demand	Past Demand	Current Supply	Past Supply	Total	Long Term Average	Current Demand	Past Demand	Current Supply	Past Supply	Emp. Share
Goods	**-1.33**	**0.03**	**-0.12**	**0.04**	**0.15**	**-1.43**	**2.85**	**2.56**	**-0.18**	**1.30**	**-1.16**	**0.34**	**17.3**
Mining and Logging	-13.26	-0.49	-4.00	-2.48	0.00	-6.28	-0.96	2.76	-6.14	-0.89	0.00	3.31	0.6
Construction	-1.99	1.59	0.00	0.95	-1.92	-2.62	6.10	2.66	0.00	1.08	1.45	0.91	5.4
Manufacturing	-0.27	-1.01	0.00	-0.45	1.57	-0.38	0.83	2.47	0.00	1.55	-3.00	-0.20	11.4
Services	**1.03**	**1.76**	**-0.18**	**-0.28**	**-0.20**	**-0.08**	**4.87**	**2.99**	**-0.16**	**-0.22**	**1.74**	**0.52**	**82.7**
Financial Activities	-0.34	1.19	0.00	-0.60	-0.58	-0.35	7.34	3.49	0.00	1.04	4.06	-1.25	6.6
Information	-6.18	0.78	0.00	0.18	-4.28	-2.86	9.70	3.20	0.00	-3.50	10.44	-0.45	2.4
Leisure and Hospitality	1.94	2.03	0.00	0.13	-0.03	-0.19	5.33	3.14	0.00	-0.88	2.46	0.61	12.4
Professional Services	-0.61	2.31	0.00	-1.15	-0.01	-1.76	6.12	3.24	0.00	1.54	1.20	0.14	15.2
Education and Health	2.70	2.54	-0.71	0.51	0.00	0.36	2.56	3.01	-0.64	-0.07	0.00	0.27	17.6
Trade and Utilities	0.53	0.83	0.00	-0.76	-0.76	1.22	5.34	2.53	0.00	-1.39	2.53	1.67	23.7
Other Services	3.91	1.11	0.00	0.42	2.96	-0.58	2.10	2.97	0.00	0.45	-1.42	0.10	4.8
	Year-over-Year change in Employment						Year-over-Year change in Hourly Wages						
	Total	Long Term Average	Current Demand	Past Demand	Current Supply	Past Supply	Total	Long Term Average	Current Demand	Past Demand	Current Supply	Past Supply	Emp. Share
Goods	**-0.69**	**0.02**	**0.80**	**-0.10**	**-0.14**	**-1.27**	**4.07**	**2.56**	**0.90**	**0.55**	**0.09**	**-0.03**	**17.3**
Mining and Logging	-6.45	-0.49	-0.25	-0.46	-2.01	-3.25	3.01	2.76	0.36	0.11	0.37	-0.59	0.6
Construction	0.28	1.59	0.98	0.53	-0.31	-2.51	4.25	2.66	0.91	0.31	0.55	-0.18	5.4
Manufacturing	-1.04	-1.01	0.73	-0.51	0.07	-0.33	4.01	2.47	0.93	0.74	-0.24	0.10	11.4
Services	**1.29**	**1.76**	**-0.02**	**-0.41**	**-0.03**	**-0.00**	**3.79**	**2.99**	**-0.00**	**0.02**	**0.41**	**0.38**	**82.7**
Financial Activities	1.25	1.19	0.02	0.14	-0.12	0.03	4.72	3.49	0.45	0.37	0.60	-0.18	6.6
Information	-0.94	0.78	0.25	-0.85	-0.76	-0.37	6.46	3.20	2.40	-0.70	1.59	-0.03	2.4
Leisure and Hospitality	1.12	2.03	0.08	-1.17	-0.07	0.25	3.46	3.14	0.48	-1.40	-0.26	1.49	12.4
Professional Services	-0.63	2.31	-0.07	-1.18	-0.02	-1.67	4.16	3.24	-0.75	0.05	0.67	0.95	15.2
Education and Health	3.56	2.54	0.00	0.70	0.01	0.30	3.53	3.01	-0.47	0.56	0.22	0.22	17.6
Trade and Utilities	0.80	0.83	-0.11	-0.65	-0.09	0.82	3.58	2.53	0.28	0.25	0.86	-0.34	23.7
Other Services	1.41	1.11	-0.03	-0.06	0.59	-0.20	3.09	2.97	0.23	0.28	-0.75	0.36	4.8

Note: Aggregate wage changes may differ slightly from official figures due to non-linear structure in weights.

4 Linking the Estimated Demand and Supply Shocks to Specific Events

While the method offers a useful way to uncover the supply and demand forces driving changes in employment and wages, it imposes minimal assumptions and it may not always be evident that the shocks are related to a specific economic phenomenon. To help contextualize these shocks in the real world, in this section we relate the estimated shocks with characteristics of industries and specific changes that we conjecture are related to supply or demand forces shaping labor market outcomes.

4.1 External financial dependence and restrictive monetary policy

The period from early 2024 to mid-2025 has been characterized by high nominal interest rates in the United States, as the Federal Reserve maintained its restrictive policy stance to curb inflation. The Fed began cutting rates in the latter half of 2024, and by mid-2025, officials were describing policy as "moderately restrictive" rather than simply "restrictive." Since the goal of a restrictive monetary policy is to lull aggregate demand through financial conditions, we use our method to find evidence about negative demand conditions.

We follow Rajan and Zingales (1998) and Sánchez and Kim (2017) and construct a financial dependence index for detailed NAICS sectors.[4] For this, we use firm-level data from Compustat for 1990-2019 to construct the ratio of capital expenditures minus cash flow from operations to capital expenditures for each firm, and then we take the median across firms for each industry. The main intuition is that sectors with a higher ratio of external financing for their investments are more dependent on the financial conditions of the economy and likely more sensitive to the level of interest rates.

Using our VAR, but with more disaggregated industry-level data, we identify supply and demand shocks and combine them with the financial dependence measure. Because 2024 and early 2025 were characterized by restrictive monetary policy, our analysis uses this period. Panel (a) of Figure 5 shows the relationship between demand shocks and financial dependence. The figure uncovers a mild negative relationship: Sectors with high levels of financial dependence, and thus more sensitive to high interest rates, show lower (or negative) demand shocks. Panel (b) uses a different measure, showing the share of months with negative demand shocks for each industry in this period. As the figure shows, industries with higher levels of financial dependence display a somewhat higher frequency of negative demand shocks, with the relationship being modestly positive.

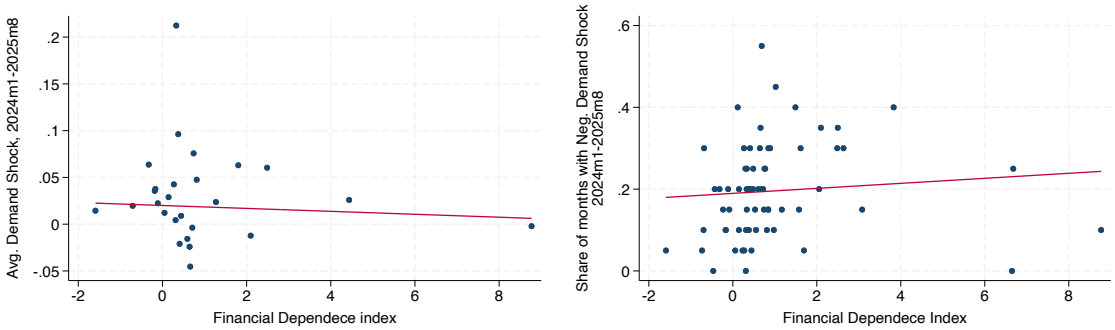
In this way, the method appears to recover useful economic information about labor market conditions. Restrictive monetary policy and high levels of interest rates during 2024 and 2025 can be linked to below-average demand conditions in industries more sensitive to interest rates.

4.2 Immigration in 2023 and 2024

After moderating during the early pandemic years, immigration to the United States saw significant increases during 2023 and 2024, with both authorized and unauthorized entries rising substantially.

[4] We thank Juan Sanchez for making his codes available to us.

Figure 5: Financial Dependence and Demand Shocks, Jan 2024-Aug 2025



(a) Bin-scatter plot: financial dependence and avg. demand shocks

(b) Share of months with negative demand shocks and financial dependence

Legal immigration pathways expanded through increased visa processing, while humanitarian programs for certain nationalities grew. Border encounters, though fluctuating month-to-month, remained elevated compared with pre-pandemic levels. This period also saw new border management policies implemented and processing centers designed to handle the increased flow.

This immigration surge coincided with robust job growth during 2023 and into 2024, as the U.S. labor market remained remarkably tight despite Federal Reserve efforts to cool the economy. Immigrant workers filled critical gaps across sectors experiencing acute labor shortages, particularly in hospitality, construction, healthcare, and agriculture. We use information on the share of immigrants employed in different sectors, measured by the share of non-native employed workers in the CPS, and connect this with labor supply conditions. Our hypothesis is that an expansion in labor supply will likely be more easily absorbed by sectors that already employ a larger share of immigrants, and we should observe more positive labor supply shocks in those sectors.

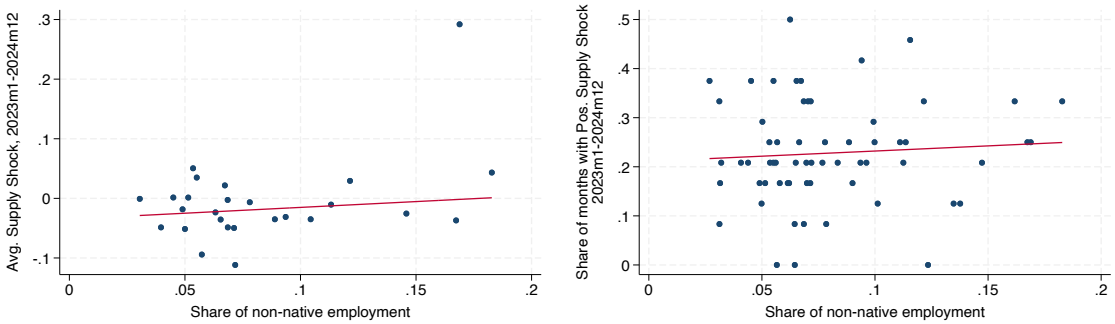
Figure 6 illustrates the relationship between labor supply shocks identified by the model for 2023-24 and the share of employed immigrants across sectors. Panel (a) shows a bin-scatter plot revealing a modest positive relationship between the share of non-native employment in a sector and supply shocks: Industries employing more immigrant workers tended to experience larger positive labor supply shocks in this period. Panel (b) shows complementary evidence, displaying the share of months an industry experienced positive supply shocks against the non-native employment share. Again, industries that historically employ more immigrants experienced a larger share of positive supply shocks, suggesting that our VAR method uncovers relevant economic forces in the data.[5]

4.3 Recent Developments: Immigration Policy in 2025

Since early 2025, immigration policies have rapidly changed, marking a significant departure from previous years. New measures aimed at reducing the inflow of immigrants and increasing the

[5]We stress that this is not a formal validation of our framework and that in this and the other cases presented, the empirical relationships are weak. The goal here is to provide some suggestive evidence that there is economic content to the shocks we identify. Clearly, there may be other explanations not related to interest rates or immigration for why supply and demand have changed in these periods.

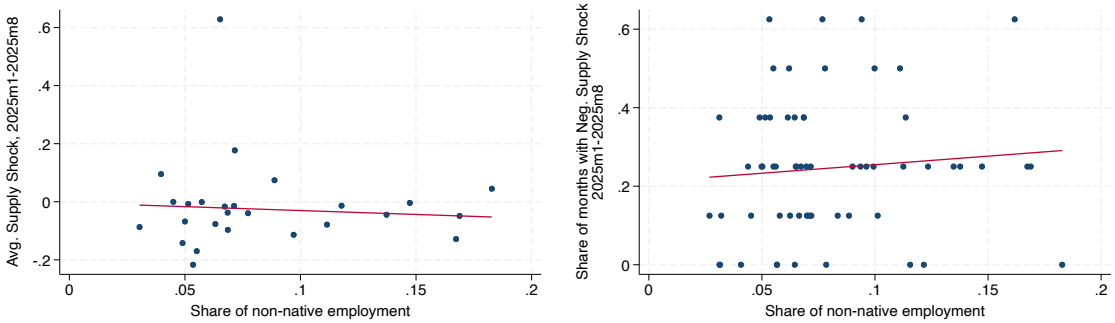
Figure 6: Immigration and Supply Shocks, Jan 2023-Dec 2024



(a) Bin-scatter plot: Share of non-native employment and avg. supply shocks

(b) Share of months with positive supply shocks and share of non-native employment

Figure 7: Immigration and Supply Shocks, Jan 2025-Aug 2025



(a) Bin-scatter plot: Share of non-native employment and avg. supply shocks

(b) Share of months with negative supply shocks and share of non-native employment

outflow have affected the supply of labor across different sectors of the economy. Industries such as agriculture, construction, hospitality, food services, and healthcare, which have traditionally depended heavily on immigrant workers, have reported concerns about labor shortages. Using the same measures as our previous example, we now explore whether immigration restrictions show up as negative labor supply in sectors that traditionally employ more immigrant workers.

Panel (a) in Figure 7 shows a slightly negative relationship, suggesting that restrictions to immigration in 2025 translate into negative labor supply conditions, which are stronger in sectors that traditionally employ more migrant workers. Panel (b) plots the share of months experiencing negative supply shocks and how this connects to the immigrant share. Industries with higher concentrations of immigrant workers tended to experience a greater share of months with negative supply shocks between January and August 2025.

In sum, the findings of this section support our view that the estimated "net" supply and demand shocks contain important economic information about labor market conditions across sectors.

5 Conclusion

Understanding whether labor market developments stem from supply or demand forces has fundamental implications for monetary policy. While the Federal Reserve can effectively influence labor demand through interest rate adjustments, it has limited capacity to address supply-side constraints arising from immigration policy, labor force participation decisions, or demographic shifts. Wage growth driven by excessive demand—when firms compete aggressively for workers in an overheated economy—both signals the need for monetary tightening and responds to it. Conversely, wage growth driven by supply restrictions—when fewer workers are available at any given wage—may generate persistent inflationary pressures that monetary policy cannot easily resolve.

In this article we develop a VAR-based decomposition method, related to a large literature on identifying shocks using sign restrictions, to identify supply and demand shocks in the labor market. Our contribution builds on Shapiro (2026)'s sign restriction methodology, decomposing the drivers of employment and wage growth into supply and demand components. This allows us to assess which forces dominated during different phases of the recovery and normalization in the post-pandemic years, informing both retrospective policy evaluation and prospective policy design.

The decomposition of employment and wage dynamics from 2022 through 2025 reveals a labor market that has undergone substantial rebalancing, though through different mechanisms across sectors and time periods. The immediate post-pandemic years were characterized by extraordinary demand pressures, particularly in goods-producing industries where pandemic-era consumption shifts and fiscal stimulus created acute labor shortages and rapid wage growth. As the Federal Reserve implemented restrictive monetary policy through 2022-23 and consumer spending patterns normalized, these demand pressures gradually dissipated. By 2024-25, the labor market had largely returned to more-balanced conditions in most sectors, with employment and wage growth approaching their long-run trends. However, this normalization process was asymmetric: Goods-producing sectors experienced sharper demand-side cooling, while service-providing sectors saw supply-side factors—particularly immigration policy—emerge as increasingly important determinants of labor market outcomes.

The policy implications of these findings are substantial and nuanced. First, the effectiveness of monetary policy in moderating labor demand is clearly evident in our results, particularly in financially dependent and interest-sensitive sectors such as construction and manufacturing. The Federal Reserve's tightening cycle successfully reduced demand-driven wage pressures without triggering widespread labor market distress, supporting a "soft landing" scenario. Second, the dramatic shift from positive to negative supply shocks in immigrant-intensive industries between 2024 and 2025 highlights the critical role of immigration policy in labor market dynamics. The surge in negative supply shocks coinciding with immigration restrictions suggests that supply-side policies can have rapid and substantial effects on labor markets, particularly in sectors like hospitality, construction, healthcare, and agriculture that rely heavily on immigrant workers.

Looking forward, the distinction between supply and demand drivers will remain crucial for economic forecasting and policy design. If future wage pressures emerge primarily from demand shocks—perhaps due to fiscal stimulus or accommodative monetary policy—conventional demand management tools remain appropriate. However, if supply-side constraints intensify—whether from demographic trends, immigration restrictions, or structural labor force participation changes—different policy responses may be warranted. Our methodology provides a framework for ongoing monitoring of these forces, allowing policymakers to distinguish between cyclical demand fluctuations requiring

monetary policy responses and structural supply shifts requiring a different set of policy interventions. As the labor market continues to evolve in the post-pandemic era, maintaining this analytical distinction will be essential for appropriate policy calibration and for achieving the Federal Reserve's dual mandate of maximum employment and price stability.

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