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The waxing and waning of regional economies: the chicken–egg question of jobs versus people

Mark D. Partridge [a] and Dan S. Rickman [b,*]

[a] *Department of Economics, 386 Stewart Hall, St. Cloud State University, St. Cloud, MN 56301-4498, USA*

[b] *Department of Economics, 338 College of Business, Oklahoma State University, Stillwater, OK 74078, USA*

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Abstract

A central question in urban and regional economics is whether people follow newly created jobs into regions, or whether jobs follow newly arrived migrants. This study revisits the issue by constructing structural vector autoregression (SVAR) models for the 48 contiguous states. The SVAR models contain long-run identifying restrictions based on a simple labor-market model. The empirical results suggest that labor-demand shocks are generally more important than migration labor-supply shocks, although labor-supply innovations in total account for a majority of state employment fluctuations. Thus, it is slightly more likely that people are following jobs. Yet, the relative importance of demand and supply shocks greatly varies by period and region.

Keywords: Structural VAR; Regional economic fluctuations

1. Introduction

One of the more debated questions among urban and regional economists is whether people follow newly created jobs into regions, or whether jobs follow newly arrived migrants. Even as this famous chicken–egg proposition has been widely studied, the controversy is far from settled. Of course, to some degree, the answer is yes to both questions, as shown by wide-ranging findings in previous studies. For example, Borts and Stein [9], Graves and Mueser [25], Greenwood and Hunt [26], and Muth [33] generally

* Corresponding author.
E-mail addresses: mpartridge@stcloudstate.edu (M.D. Partridge), rdan@okstate.edu (D.S. Rickman).

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argue that jobs primarily follow migrants. Alternatively, Blanchard and Katz (B&K) [6], Carlino and Mills [11], and Greenwood and Hunt [27] contend that it is jobs primarily inducing migration, at least in the short run.

The issue of whether jobs or people come first has implications for regional economic development policy. Regions routinely compare their economic performance to others, with employment growth more often than not used as the metric. Yet, policymakers need to ascertain the sources of their relative position to assess and adjust their economic-development efforts. For example, favorable job growth may tempt policymakers to conclude that their industrial recruiting efforts have been successful, where in reality it may have been the case that the region benefited from favorable population flows, which in turn stimulated employment. If costly policies were found to be ineffective, they could be redirected or abandoned.

The importance of region-specific firm and household shocks to overall regional fluctuations also is highlighted in VAR studies that decompose employment fluctuations into common-aggregate, common-region, common-industry, and idiosyncratic within-region shocks. As reported in Clark and Shin [15], these studies find that region-specific shocks account for about one-third of overall employment fluctuations, while shocks idiosyncratic to various industries within a region account for about one-fourth of employment fluctuations. In fact, Clark [14] finds that the declining importance of manufacturing has increased the role of region-specific shocks over time. Similarly, Davis et al. [17] find that region-specific shocks are a more important determinant of state unemployment fluctuations than aggregate shocks. Coulson [16] finds that local shocks are the most important factor in the evolution of local MSA employment, while Chang and Coulson [12] find that local shocks are most important for employment fluctuations in suburban and central city areas.

The primary reason why the jobs versus people debate has not been settled is the endogeneity of both factors. Regions that are experiencing rapid job creation likely attract new residents, while regions experiencing an influx of new migrants likely experience an increase in jobs. Previous studies have tried a variety of methods to sort out the causal effects. One early approach was to utilize instrumental variables in simultaneously estimating employment and migration equations (e.g., [11,33]). After examining the relative size of the migration response to job growth, and the employment response to migration, each factor's relative importance was assessed. Of course, the validity of such an approach requires exogenous identifying instruments, which can be problematic. Comparing the relative sizes of the migration and employment elasticities also generally leads to a conclusion that is invariant to time period and geographic unit of analysis. Finally, short-term and medium-term dynamics were not typically estimated, so that short-term versus long-term responses were not assessed.[1]

[1] In a somewhat related study, Bound and Holzer [10] examine the role of demand shifts, and population adjustments in response to those demand shifts, on labor-market outcomes for skilled and unskilled workers in metropolitan areas in the 1980s. They employ an instrumental variables approach to account for the simultaneity of employment and population. Since they were more interested in issues related to income inequality, not the jobs versus people question, they did not decompose their results into demand and supply components.

More recently, vector autoregression (VAR) models have been used to examine regional labor markets [3,4,6,17,18,30]. However, these models assumed that all contemporaneous employment innovations were labor-demand shocks.[2] Also, in some studies a separate VAR migration equation is not estimated, being calculated as the residual of employment growth, net of changes in the number of unemployed and in labor-force participation. Previous VAR models also typically did not include a wage (price of labor) equation. When wages were considered, they were viewed as more of a "shock absorber" that either mitigates the employment response, or quickens the labor-market dynamics. These weaknesses were not critical in examining the primary goals of the studies, which were to identify the length of time it takes for the labor market to reach its new equilibrium, and determine how many of the newly created jobs were taken by the original residents versus new residents. Yet, the independent roles of labor demand and labor supply were not directly disentangled.

VAR attempts to disentangle labor-demand influences from labor-supply influences are limited. Mathur and Song [32] performed Granger causality tests in an employment and population reduced-form VAR system as an indirect test of the chicken–egg proposition. However, the Granger causality approach omits the contemporaneous responses between variables, so no attempt is (or can be) made to decompose the innovations of the two variables into demand and supply components. Thus, the causality that is established is primarily useful for predictive purposes [39], not for structural inferences. Freeman [21] employed a two-equation VAR of employment and migration incorporating contemporaneous responses in an attempt to identify regional demand and supply influences. As in other VAR studies of employment and migration, he assumed that contemporaneous employment fluctuations equated with labor-demand shocks in a variance decomposition of employment forecasts. Yet, this is an even more restrictive assumption than those made by earlier studies that utilized the instrumental-variable approach (e.g., [11,33]).

Therefore, this study reexamines the jobs versus people issue using 1969–1998 state-level data to directly determine the roles of relative regional labor-demand shocks, versus relative supply shocks, in the waxing and waning of regional economies. The previous research is extended in three important ways. First, *wage changes* are directly used to identify labor-demand and labor-supply shocks. That is, favorable labor-demand shocks should generate greater employment and wages, while favorable labor-supply shocks should yield greater employment but declining relative wages. Second, by employing a *structural* VAR (SVAR) approach, identifying restrictions drawn from theory can be directly incorporated into the empirical estimation. In contrast to previous regional VAR studies, we do not assume that employment is labor demand, which imposes the stringent short-run restriction that population has no contemporaneous effect on employment. Rather we employ less restrictive long-run restrictions based on a simple labor-market model.[3] As Stock and Watson [39] note, economic theory or institutional knowledge is required

[2] B&K [6] did some sensitivity analysis using instrumental variables to ascertain the validity of this assumption. The jobs versus people question is answered only indirectly by examining whether the ordinary least square estimates differ from instrumental variable estimates.

[3] An example of a regional SVAR paper is Bayoumi and Eichengreen [5], which estimated a model for eight US regions to assess the prospects for the European Monetary Union. Following Blanchard and Quah [8], they

to establish correlation from causation. Use of the VAR as a simple statistical tool cannot solve the identification problem. Third, labor-supply shocks are decomposed into changes due to the original residents and changes due to migration. The decomposition directly allows for the possibility that new jobs can be taken by previously nonemployed original residents, as well as new migrants. So, not only is employment allowed to be contemporaneously influenced by migration, employment is also allowed to be determined by contemporaneous internal labor-supply innovations.

In what follows, the next section outlines a simple regional labor-market model. Section 3 details the empirical model, which is followed by the empirical implementation in Section 4. Section 5 presents the findings, with conclusions following in the final section. The general conclusion is that although labor-demand shocks dominate labor-supply migration shocks on average, their relative importance greatly varies across regions and time.

2. Theoretical model

An empirical regularity of state and regional economic evolutions is that state employment growth has been persistent over many decades [6,9]. For example, states that grew rapidly in the 1950s and 1960s also tended to grow rapidly in the 1970s and 1980s. At least in the medium to long run, differences in net-migration flows are suggested as the primary reason for differentials in job growth, although the ultimate causal factor behind the differential migration flows is not clear (new jobs or household amenities).[4] Yet short-run fluctuations in job growth are often assumed to result from labor-demand shocks [6,21, 30]. To further understand the sources of the short-run fluctuations in regional employment growth, we construct a simple labor-market model.

For purposes of illustration, we initially assume that labor demand equals supply, although we relax this assumption in the discussion of the empirical findings.[5] We follow the literature by assuming that firms sell their products in local, national, and international markets, where changes in export demand for the region's products shift labor demand. Also following convention, constant returns to scale (CRS) is assumed in aggregate production. This assumption implies that innovations in labor supply have no effect on labor productivity through favorable agglomeration effects or adverse congestion effects during the sample period [2,6,11,33]. Previous empirical studies suggest that the CRS assumption may not be far from reality in terms of times-series changes. For instance, Ciccone and Hall [13] found relatively modest agglomeration economies, in which a doubling of employment density yielded a six percent increase in productivity (also see

assumed aggregate demand shocks have only temporary effects on output while aggregate supply shocks have permanent effects.

[4] For example, the simple correlation between the annual state employment growth relative to the nation and net migration as a share of the population (including non-labor-force participants) is 0.71 between 1970–1998.

[5] B&K [6] presented a model with unemployment, but it did not change their main conclusions. Moreover, Bartik [4] and B&K show that labor-demand and labor-supply shocks result in only transitory changes in the unemployment rate, with the unemployment rate returning to the long-term equilibrium over time.

Glaeser et al. [22]). Over the course of decades that it takes the typical region's employment to double, the average *annual* gain in productivity would even be less consequential. Also, agglomeration economies can be offset by congestion costs as well as rising land costs [6,36]. Perhaps reflecting the two offsetting effects, Glaeser et al. [23] and Glaeser and Shapiro [24] essentially found no relationship between initial city population and subsequent population growth. Facilitating the CRS assumption are the usual assumptions that labor and capital are perfectly mobile, at least in the long run. Although we assume that CRS and perfect labor and capital mobility apply in the long run, we allow deviations from CRS in the short-run as firms and households make adjustments.

The formal presentation of the model follows B&K [6], and is best thought of from the perspective of a labor-demand/labor-supply graph with the wage rate on the vertical axis. Demand- and supply-side trends/innovations are simply factors that shift the respective demand and supply curves by shifting the intercept. Hence, the inverse labor-demand curve for state i, period t can be written as

$$w_{it} = \delta_{it} - \alpha n_{it}, \tag{1}$$

where w is the wage rate relative to the nation, n is employment relative to the nation, and the intercept δ is a labor-demand shifter that affects relative wage levels. Equation (1) assumes for expositional purposes that wages are only influenced by current employment, but we will allow wages to respond to past employment changes in the empirical analysis to capture sluggish wage adjustment.

Changes in the intercept δ reflect persistent and cyclical changes in labor demand including the transitory innovations that will be the focus of the empirical analysis. We assume δ evolves as follows:

$$\delta_{it} - \delta_{it-1} = g_i^{\mathrm{d}} - \beta \Delta w_{it-1}(\ell) + \varepsilon_{it}^{\mathrm{d}}, \tag{2}$$

where ε^{d} is an i.i.d. stochastic innovation term and ℓ is a lag operator. The negative response to lagged wage-rate changes reflects shifts that can occur as firms relocate to the state, or existing firms expand or contract based on changes in wage levels. The key feature of Eq. (2) is that g^{d} and innovations in ε^{d} both change the intercept δ, which in turn shifts the labor-demand curve in (1).

The change in relative wages along the demand curve can be derived by first-differencing Eq. (1). Then substituting in Eq. (2) yields the change in the relative wage rate as a function of the change in relative employment, lagged changes in wage rates, g^{d}, and ε^{d}:

$$\Delta w_{it} = g_i^{\mathrm{d}} - \beta \Delta w_{it-1}(\ell) - \alpha \Delta n_{it} + \varepsilon_{it}^{\mathrm{d}}. \tag{3}$$

g^{d} and ε^{d} in Eqs. (2) and (3) capture several factors. Foremost, ε^{d} reflects innovations in the demand for the region's products, which are affected differentially across the nation due to varying industry compositions. Closely related are national and state-specific productivity shocks that can have a non-neutral influence across regions depending on industry mix. For example, in their analysis of comovements in wages and employment, Partridge and Rickman [37] report that 29 of 30 states classified as dominated by relative demand shocks between 1983–1989 also experienced relative productivity shocks (for 1990–1996 the corresponding ratio is 24 of 28 states). They report that the relative demand shocks for many states were associated with the fluctuating fortunes of the energy, farm, and manufacturing sectors. More recently, supposed New-Economy productivity gains should have primarily benefited states with concentrations of information-technology industries. Finally, the g^{d} term captures long-term trend *changes* in labor demand associated with firm-productivity amenities that can lead to the persistent differences in job growth. These amenities can include public capital, state & local business environment factors such as taxes and regulations, and the existence of quality R&D centers.

The labor-supply sources for job growth can arise from changes in labor-force migration as well as changes in the internal labor supply of the original residents (e.g., through labor-force participation changes). We are primarily interested in *shifts* in labor supply so as to conform to the first-difference form of labor demand in Eq. (3). Thus, relative labor-supply *shifts* are decomposed into changes due to relative labor-force net migration, m, and internal labor-supply changes due to original residents, o. Taking these in order, we assume that labor-force net migration can be written as:

$$m_{it} = g_i^{\mathrm{sm}} + \phi^{\mathrm{m}}(\ell)\Delta w_{it} + \theta^{\mathrm{m}}(\ell)\Delta m_{it-1} + \varphi^{\mathrm{m}}(\ell)\Delta n_{it} + \varepsilon_{it}^{\mathrm{sm}}, \tag{4}$$

where migration labor-supply innovations are depicted by $\varepsilon^{\mathrm{sm}}$, while $\phi^{\mathrm{m}}(\ell)$, $\theta^{\mathrm{m}}(\ell)$, and $\varphi^{\mathrm{m}}(\ell)$ respectively represent net-migration's responsiveness to changes in the region's current and lagged relative wage rate, the lagged relative net-migration rate, and current and lagged relative employment growth.

Regarding (4), higher current and lagged relative wage growth generally induces positive net-migration flows until expected utility differentials (including amenities) are equalized across regions net of fixed relocation costs.[6] Besides relative wages, potential migrants respond to expected job opportunities [35,40,41], which are approximated by current and lagged job growth. Yet, past migration not only *indirectly* affects current migration through its effect on past employment growth, but it also can *directly* influence current migration flows through factors such as return-migration and chain-migration.[7] Moreover, the lagged responses to employment and migration, which may be quantitatively large, also reflect migration delays that can occur from imperfect labor-market information and liquidity constraints that arise from moving costs or housing transaction costs. The g^{sm} term captures persistent factors such as natural amenities that generally have long-term trend effects on migration flows. Finally, $\varepsilon^{\mathrm{sm}}$ reflects net labor-force migration innovations such as changes in preferences for environmental amenities, as well as demand and supply shocks in other regions that alter net-migration patterns in a non-neutral spatial manner (e.g., the decline in California's fortunes in the early 1990s led to greater migration into Oregon and Washington).

To incorporate changes in the supply of the original residents, we utilize the assumption that total labor supply equals total labor demand. Therefore, Eq. (5) shows that relative

[6] Treyz et al. [41] establish the importance of wages in determining inter-regional migration flows, in which they could not reject the equality of effects on migration of a general wage change across all industries, versus a wage change attributable to its composition of industries.

[7] Besides accounting for the persistent elements in migration through g^{sm}, the lagged migration response captures a "self-perpetuating" effect where migration flows can lead to further migration flows [17,26]. The empirical evidence below suggests that this has a significant effect on current migration.

labor-force growth (or employment growth) equals labor-force net migration plus original-resident labor-force changes:

$$n_{it} - n_{it-1} = m_{it} + g_i^{\mathrm{so}} + \phi^{\mathrm{o}}(\ell)\Delta w_{it} + \varphi^{\mathrm{o}}(\ell)\Delta n_{it-1} + \varepsilon_{it}^{\mathrm{so}}. \tag{5}$$

Stochastic shocks to original-resident labor supply are reflected by $\varepsilon^{\mathrm{so}}$, while g^{so} captures factors associated with the long-term trend growth in the original-resident labor force including natural population growth and labor-force attitudes and attachment. The $\phi^{\mathrm{o}}(\ell)$ term represents the supply responsiveness of original residents to current and lagged changes in the relative regional wage rate, and $\varphi^{\mathrm{o}}(\ell)$ denotes their responsiveness to expected job opportunities. By separating out net labor-force migration in Eq. (4), Eq. (5) clearly shows the independent contribution of internal or original-resident labor-supply changes to regional labor-force growth (or employment growth).

Equations (1)–(5) define the labor-demand and labor-supply curves, and more importantly, detail the *shifts* in the curves. For example, increased wage rates associated with a favorable labor-demand shock (ε^{d}) attract both nonemployed original residents and new migrants into the region's labor force. We expect that as migration costs are overcome, new migrants continue to flow into the region as a result of their lagged responses to wage and job growth. One advantage of the model is that it allows for the possibility that in the long run, original residents gain *some* of the newly created jobs (Bartik [3]), as well as the possibility that migrants take *all* of the newly created jobs (B&K [6]).

Regarding labor-supply innovations, a favorable original-resident internal labor-supply shock depresses wage growth in the short run, and in turn, reduces the net-migration rate. Migration innovations also invoke a similar wage and original-resident response. Original residents and migrants likely respond differentially to wage-rate changes and changes in expected job opportunities. Yet with CRS in aggregate production assumed in the long run, supply *innovations* have no long-run impact on wage rates.

3. Empirical model

Using Eqs. (3)–(5), a reduced-form VAR representation of relative wage growth, relative net labor-force migration, and relative employment growth can be written as

$$x_t = C + A(\ell)x_{t-1} + e_t, \tag{6}$$

where x_t is the column vector $(\Delta w_t, m_t, \Delta n_t)'$, C is a vector of constant terms, capturing persistent trends in x over the period, e_t is the column vector $(e_{wt}, e_{mt}, e_{nt})'$, $A(\ell)$ is a 3×3 matrix with elements equal to the polynomials $A_{ij}(\ell)$, ℓ is a lag operator.

Because of the contemporaneous endogeneity of wages, migration, and employment, the residuals of the reduced form (e_t) are correlated. Each residual is a composite of the orthogonal structural shocks contained in Eqs. (3)–(5) (ε^{d}, $\varepsilon^{\mathrm{sm}}$, and $\varepsilon^{\mathrm{so}}$):

$$e_t = A(0)\varepsilon_t, \tag{7}$$

where $A(0)$ is a 3×3 matrix of unknown contemporaneous responses of the x_t to the structural shocks. Knowledge of the contemporaneous responses in $A(0)$ is required to calculate the structural shocks from the reduced-form residuals.

To identify the contemporaneous responses, we utilize the expression for the variance–covariance matrix of the reduced-form VAR residuals (Σ_e) derived using Eq. (7):

$$\Sigma_e = E\big(e_t e_t'\big) = A(0)E\big(\varepsilon_t \varepsilon_t'\big)\big(A(0)\big)' = A(0)\Sigma_\varepsilon\big(A(0)\big)'. \tag{8}$$

The right-hand side of Eq. (8) contains 18 ($2n^2$) unknown parameters. The assumption of orthogonality of the variance–covariance matrix of structural errors (Σ_ε) provides six identifying restrictions. An additional three restrictions are obtained by normalizing the diagonal elements of $A(0)$ to equal unity, which implies that each endogenous variable increases one unit to an innovation in its structural component. Since Σ_e contains six ($n(n+1)/2$) unique elements, providing six restrictions, three ($n(n-1)/2$) additional restrictions are required for identification.

The first two restrictions derive from the long-run assumption of CRS in the theoretical model. Specifically, since only labor-demand innovations affect relative wage rates in the long run, each supply innovation has no long-run effect on wage rates (although their short-term response is not constrained).[8] The long-run effect of supply innovations can be thought of as shifts in the supply curve along a horizontal (CRS) long-run demand curve. Note that even though labor-supply *innovations* are not allowed to affect wages in the long-run, that does not mean that labor supply is constrained to have no long-run influence on wages whatsoever. That is, if long-term trend labor-force growth is affecting long-term *trend* wage growth due to favorable agglomeration economies or unfavorable congestion effects, this effect would be captured by the constant term in the reduced-form wage equation. In assessing their relative importance on wages, bear in mind that a labor-supply *innovation* in a single year is simply a deviation from the long-run trend, which means that any net long-term productivity effects through the *overall* long-term change in the labor-force will likely overwhelm the innovation effect. Ultimately, the validity of the restrictions will be evaluated according to the theoretical consistency of the empirical results.

The remaining required identifying restriction is obtained by assuming that the sum of migration impulse responses to internal labor-supply shocks equals zero, which implies that labor-demand innovations and own innovations are solely responsible for cumulative long-run migration fluctuations. For example, the restriction means that in a given year, a one-time original-resident labor-supply innovation will not have persistent effects on migration flows in the long term (e.g., after ten years). This restriction does not fall from the theoretical model, but it is based on the previously described stylized fact that cumulative net-migration flows are persistent, implying that these flows should not be influenced by original-resident innovations in labor-force participation or unemployment that occurred far in the past. Rather, the persistent net-migration flows observed during recent decades are primarily explained by factors such as firm amenities that influence long-run wage levels and productivity, or fixed household amenities such as weather that influence the attractiveness of the state [6,24]. The restriction could lead to an understatement of the role

[8] Blanchard and Quah [8] show that in cases where in reality there are small long-run effects from variables whose innovations are constrained to have no long-run influence, the identifying SVAR restrictions still recover approximately correct results. For example, regarding the CRS restriction, the results will be approximately correct if demand innovations such as productivity shocks are the primary source of long-run wage changes.

of internal labor-supply innovations and an offsetting overstatement of the role of migration innovations. However, the roles of demand versus labor-supply migration shocks should be relatively unaffected. Finally, short-run responses of migration to internal labor-supply innovations are not restricted, and if the long-run restriction is only slightly binding, the discussion in footnote 8 notes that the understatement of the role of original-resident labor-supply innovations is likely very small (which our results will suggest).

To see how the long-run restrictions are imposed, we utilize the impulse responses as given by the moving average representation of the reduced-form VAR, and substituting in Eq. (7):

$$x_t = \left[I - A(\ell)\ell\right]^{-1} A(0)\varepsilon_t = \phi(\ell)\varepsilon_t, \tag{9}$$

where $\phi(\ell)$ is a 3×3 matrix that represents the impulse responses of the 3×1 vector x_t to the vector ε_t. Let $\phi_{vs}(\ell) = \sum_i \phi_{vsi}\ell^i$ denote the long-run impulse responses of variable v to innovation s, where i denotes time period that is summed over from zero to infinity. The three long-run restrictions then imply that $\phi_{vs}(\ell)$ equal 0 for: v equal to wage rates and s equal to both migration labor supply and internal labor supply; and v equal to migration labor supply and s equal to internal labor supply. From the representation of $\phi(\ell)$ in Eq. (9), the long-run restrictions include elements from the inverted reduced-form VAR and the contemporaneous response matrix $A(0)$, which then provides the three required additional restrictions on $A(0)$ in the variance–covariance expression in Eq. (8). Once $A(0)$ is obtained, ε_t can then be solved from e_t using Eq. (7).

Each variable v's (e.g., employment) forecast variance can then be decomposed into the proportions attributable to each innovation k (VDF):

$$\mathrm{VDF}(v, k, j) = \frac{\sum_{i=0}^{j-1} \phi_{vki}^2 \sigma_k^2}{\sum_{s=1}^{3} \sum_{i=0}^{j-1} \phi_{vsi}^2 \sigma_s^2} \times 100, \tag{10}$$

where j denotes the number of forecast steps, and the denominator reflects the total forecast variance.

Even though long-run restrictions avoid the imposition of contemporaneous restrictions that can defeat the purpose of assessing the jobs/people question, long-run restrictions are only worthwhile if they are realistic [19]. To assess their plausibility, alternative models should be examined, and the short-run impulses should be examined for their consistency with theory [20]. Hence, a key advantage of our regional framework is that there will be 48 different cases to consider for consistency. However, we go far beyond this step and utilize a priori knowledge about specific regions. For example, based on common knowledge and previous literature [37], demand shocks should play a relatively more important role over the entire sample period in Energy and Rustbelt states, while migration shocks should be relatively more important in Sunbelt states. Findings to the contrary would increase skepticism of the approach, even if the short-term impulses were consistent with theory. Results from particular sub-periods also are examined for their plausibility. For example, not only are Energy states expected to experience relatively large demand shocks on average over the entire sample period, but the specific demand shocks should be positive when energy prices were high in the latter 1970s, while the innovations should become negative when energy prices collapsed in the mid 1980s. Finally, the models are subjected to numerous sensitivity tests to examine the robustness of the results.

4. Implementation

The SVAR model described above is estimated for each of the lower 48 states for 1970–1998. We define the variables in Eq. (6) as relative to the nation because our focus is on relative state economic fluctuations. An added advantage of defining the variables relative to the nation is that it implicitly differences out common national productivity and cyclical effects.[9]

Relative wage-rate growth is based on total wages and salaries from the REIS 1969–1998 CD-ROM (US Department of Commerce, June 2000), and is defined as state wage-rate growth minus national wage growth.[10] Using annual wages allows us to capture the effect of favorable (or unfavorable) demand shocks on the already employed that would raise average weekly hours and average weeks worked per year, even when average hourly wages are sticky in the short term [7]. Yet, there is the possibility of inadvertently treating supply shocks of the already employed as demand shocks when using annual wages, but further analysis discussed below suggests that this concern is probably very minor. Nonetheless, as a check of the model's robustness, we substitute average weekly earnings for annual earnings in sensitivity analysis.

For relative employment growth, the national job growth rate is subtracted from the state job growth rate using non-farm payroll data from the US Department of Labor website (http://www.bls.gov/datahome.htm). The relative net-migration rate is calculated by subtracting US net migration (mostly immigration) as a share of US population from state net migration as a share of state population. Census migration estimates are used for the 1980s and 1990s (http://www.census.gov/), while for the 1970s, state migration is derived as the residual of population change net of the natural change.[11]

For the impulses to approach zero in the long run, stationarity of the variables is required. Based on Augmented Dickey–Fuller (ADF) tests, unit roots in each of the variables were rejected for all states except for relative migration in Ohio.[12] This finding is not unexpected because the variables are defined as rates of change relative to the nation. Since the long-run-restriction SVAR approach is an alternative method to cointegration for

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[9] RATS econometric software was used for the estimation utilizing an SVAR RATS procedure written by Norman Morin.

[10] Although the wages of farm workers are included, only 900 thousand out of a US total of 133 million wage and salary workers were farm workers in 1998. Those engaged in farming occupations are primarily proprietors.

[11] Using US Census Bureau data, net migration for the 1990s is calculated as the sum of net international migration, net domestic migration, and net federal movement. Migration in the 1980s is obtained from the Census Bureau residual series, which implicitly contains the sum of the 1990s components. In the absence of Census Bureau estimates for the 1970s, we use the residual method. We estimate births and deaths each year to obtain the natural increase in state population. The total change in population less the natural increase yields a residual that is interpreted as the sum of the net-migration components. Birth and death rates from *Vital Statistics of the United States* are used in the calculations.

[12] Where rejected, the p-value was less than or equal to 0.01, except for wage rates in New Jersey, in which the null was rejected at the 0.05 level. The number of lags included in the ADF tests were derived from the optimums for the VAR equation system for each state.

capturing long-run equilibrium relationships among variables, cointegration pretests were not performed.[13]

The number of lags included in each equation is based on the optimum Schwarz Bayesian Information Criterion (BIC) statistic, with the maximum number of lags set equal to four years. The number of lags is restricted to be equal across equations for each state, but can differ by state. For all but four states, the optimum lag length based on the Schwarz BIC is equal to one year.[14] The Schwarz BIC criterion is chosen because it tends to yield shorter lag structures than other alternatives, where a shorter lag length has been suggested as one approach to improving the reliability of inferences drawn from VARs containing long-run restrictions (Faust and Leeper [20]). The robustness of key results to an alternative lag-setting process is discussed below.

Due to several factors associated with using sub-national data, our empirical findings may understate the responses to labor-market shocks. First, the law of large numbers implies that shocks within a larger region such as a state will offset each other, or some labor-market responses *within* a state will be lost.[15] Likewise, by using annual data, some of the labor-market shock is dissipated outside of the state, while a shock that occurs near the end of the year may not produce a labor-market response until the following year. If monthly or quarterly data were available, some (but not all) of these problems could have been avoided. However, a positive feature of annual wage data is that by using changes in annual wages, low-frequency movements that are not of interest are eliminated while preserving the intermediate-run effects that are of interest [1]. Another concern is that because there is not any annual data source on labor-force migration, our migration data is for the *entire* population. This means that the migration of *non*-labor-force participants such as retirees is included in this figure. Thus, for a positive net-migration shock, some of the supposedly favorable labor-supply shock that would reduce wages may actually be a labor-demand shock that partially offsets this decline (e.g., migrant retirees who demand products). Yet, many retiree migration patterns are stable, which are reflected in the constant terms of the regional migration equations. And shifts in retiree migration patterns likely are captured as demand innovations in the wage equation.

5. Empirical results

Once the structural errors are calculated, we can address whether demand shocks versus supply shocks are primarily responsible for the relative state employment fluctuations by decomposing the employment-forecast variances. The shocks also can be examined by period to explain the cyclical patterns of relative state fluctuations. In addition to state-

[13] Quah [34] and Hansson [28] discuss the close relationship between SVAR models that are integrated of order one or less (such as ours) and structural common-trends cointegration models.

[14] The optimal lag length equals three in Connecticut, and two in California, Massachusetts, and South Dakota.

[15] Using metropolitan areas instead of states would have the advantage of considering more homogeneous labor markets. Unfortunately, data availability problems and changes in metropolitan-area definitions made this infeasible. Yet, state data has the key advantage of better capturing farm and energy production shocks that predominate in non-metropolitan areas, which will be seen to be an important empirical feature.

specific statistics, we also report some averages for Census regions and aggregations of states into functional groupings of Sunbelt, Rustbelt, Energy, and Farm states.[16] We first examine the impulse responses to check their theoretical consistency.

5.1. Impulse responses

Figure 1 contains the unweighted average of the 48 state impulse response functions. Each of the three equations for each state was subjected to one standard deviation shocks in the three structural errors. The magnitude of the impulse responses then depends upon both the size of the relative shock and the sensitivity of the variable to the shock.[17]

The average wage-rate impulse response to each standard deviation shock is given in panel (a). By definition, average wage rates increase in response to labor-demand shocks, increasing until about the eighth year. Consistent with theoretical expectations, wage rates negatively respond to shocks in migration labor supply. They also respond negatively to internal labor supply, which may occur from a combination of innovations in natural labor-force growth and labor-force participation (and unemployment by relaxing the labor demand equal to labor supply constraint). Migration labor-supply shocks are initially a larger source of the decline, but by three years the difference disappears. Reflecting the restrictions on the effects of labor supply, the wage rate returns to its original value in the long run in both cases. Being unrestricted in the short run, the relatively quick return to zero of the labor-supply responses suggests that the assumptions of no long-run impacts of supply innovations on wage rates are reasonable approximations (see Keating [31] for a related discussion). If the restrictions were unreasonable, we would have expected the cumulative response to linger far away from zero for an extended period as the restriction only binds when time approaches ∞.

Panel (b) displays the average migration impulse response to each shock. Over the long run, labor-demand shocks are on average a modestly greater source of migration fluctuations than innovations in migration itself. Consistent with theory, migration responds negatively to an increase in internal labor supply, rising to zero in the long run as the labor market equilibrates. Also, the relatively rapid return to zero suggests that it

[16] Sunbelt states include Arizona, California, Florida, and Nevada. Rustbelt states are classified in two ways. First is a narrow grouping of East North Central region states (Michigan, Illinois, Indiana, Ohio, and Wisconsin). We also report a broader "Rustbelt" grouping in some tables that adds Pennsylvania. The energy states include Colorado, Louisiana, Montana, Oklahoma, Texas, West Virginia, and Wyoming. The farm states include Iowa, Montana, Nebraska, North Dakota, and South Dakota (note that Montana is viewed as both a Farm and Energy state). They are selected on the basis of having by far the largest shares of civilian employment in farm occupations in 1980, which is close to the midpoint of the sample period (from the US Department of Labor *Geographical Profile of Employment and Unemployment*).

[17] In six states, the responses generally did not fit theoretical expectations, suggesting that demand and supply innovations were not identified, possibly because the Schwarz BIC criteria produced a too restrictive lag structure. Hence, these states were reestimated using optimal lag lengths based on the Akaike Information Criterion (AIC), which tends to give longer lag lengths. The resulting (AIC) lag lengths generally improved identification for these states: four for Louisiana, Ohio, and New York; three for Delaware and Wyoming; and two for Kansas.

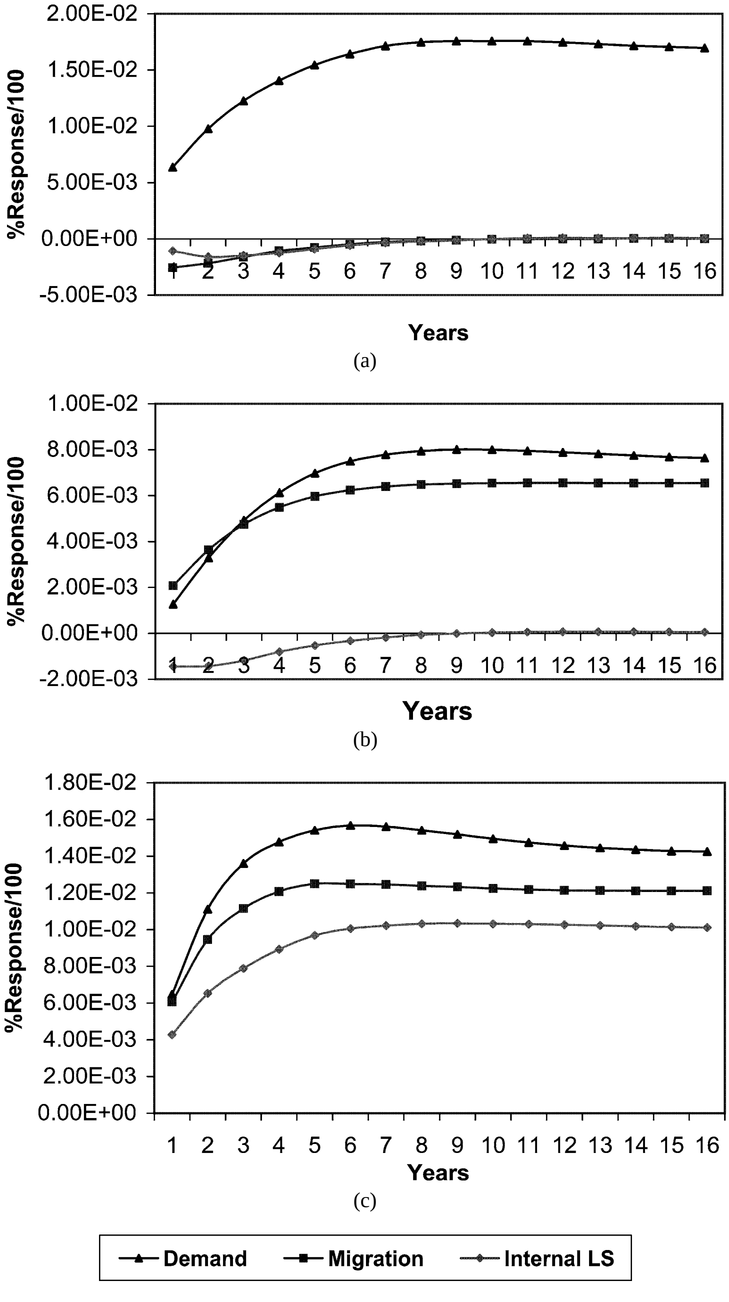

Fig. 1. Impulse functions. The unweighted average wage (a), migration (b), and employment (c) response over the lower 48 states to a one standard deviation shock to labor demand, migration labor supply, and internal labor supply.

is a reasonable approximation to assume that migration flows are not affected by internal original-resident labor-supply innovations in the long run.[18]

As shown in panel (c), employment responds positively to all three structural shocks. Labor demand shocks are the leading cause of employment fluctuations in the long run, followed by migration shocks and internal labor-supply shocks. This result is most consistent with the findings of Carlino and Mills [11] and Greenwood and Hunt [27], that people primarily follow jobs and not vice versa. Yet, our results also point to migration innovations as an important source of job growth fluctuations, while the two labor-supply shocks together produce a majority of employment fluctuations on average.[19] It would be useful to find the confidence intervals for these impulse functions, but Faust and Leeper [20, p. 348] show that it is not known how to compute "meaningful confidence intervals for work under the long-run (restriction) scheme." Thus, even as the long-run restrictions allow us to directly examine the jobs/people question without assuming contemporaneous exogeneity, it does come at some expense.

An advantage of long-run restrictions is that the estimated short-run responses are not imposed, but rather can be tested against theory. As noted earlier, short-run responses that are found to be consistent with theory support the accuracy of the long-run restrictions. In a sense, the estimated short-run responses serve the same purpose as standard over-identification tests [5]. In our case, the average short-run impulse functions are consistent with theoretical expectations of a positive (negative) relationship between changes in wages and employment in response to labor-demand (supply) innovations.[20]

Even as the average short-run responses in Fig. 1 fit theoretical expectations, they do not show how consistent these expectations are met. Akin to examining alternative models, consistency across the 48 individual state models would provide further evidence on the robustness of the structural inferences derived from the long-run restrictions. Faust and Leeper [20] also contend that problems such as finite sample sizes and multiple sources of demand and supply innovations are other reasons to examine the consistency across alternative SVAR models. Fortunately, a key advantage of our regional approach is that we do not have to be as concerned with policy feedbacks such as in macro models where supply and demand innovations can be further confounded (e.g., Federal Reserve reactions to an energy shock).

The state-specific results (not shown) reveal that the short-run responses consistently follow expectations. By construction, all variables respond positively to own innovations in all states. Regarding responses to other innovations, 44 states have a cumulative second-

[18] To further test the long-run restrictions, we regressed the current period state (relative) net-migration rate on the estimated internal labor-supply shocks in a pooled model. Contemporaneous and six years of lagged internal labor-supply shocks were included as independent variables. Only the contemporaneous values were statistically significant (or close to significant). We also regressed relative migration *individually* on each of these estimated lagged internal labor-supply shocks. Again, only the contemporaneous internal labor-supply shocks were significant, suggesting no long-run effect.

[19] In results not shown, the New England and South Atlantic regions generally have the fastest responses, while the Mountain and West South Central states have the slowest responses.

[20] If the long-run wage innovations were in reality primarily the result of supply influences (e.g., positive changes in amenities), there would have been a negative long-run relationship between wages and employment innovations.

year negative wage response to labor-supply migration, while 45 states have a comparable negative wage response to internal (original-resident) labor-supply innovations. Correspondingly, by the second period, 47 states have a cumulative positive migration response to a labor-demand shock, and 46 states have a cumulative negative migration response to a shock in internal labor supply. Finally, regarding cumulative second-year employment responses, all 48 states have positive responses to migration shocks, while 46 states have a positive response to innovations in labor demand.[21]

5.2. Variance decomposition

Further insights into how much state employment fluctuations result from innovations in labor demand versus labor supply can be obtained from a decomposition of the forecast variance of relative state employment growth. Table 1 reports the percent of forecast variance of relative state employment growth attributable to relative labor-demand shocks (D), relative migration labor-supply shocks (M), and relative internal (original-resident) labor-supply shocks (IS). Calculations are given for forecast horizons of 1, 2, and 15 years ahead.

In Table 1, relative labor demand shocks account for the largest share of the relative employment forecast variance. The unweighted-average ranges from 43.4% for 1-year-ahead forecasts, to 46.5% for 15-year-ahead forecasts, with most decomposition patterns becoming stable by the second period.[22,23] In 20 states, employment fluctuations are primarily demand driven at all forecast horizons. Comparable figures for migration labor supply, and internal labor supply are 13 and 6 states, respectively.

Although the results generally favor labor demand, we find a smaller role for it than VAR studies that assumed contemporaneous employment shocks were labor demand.

[21] In sensitivity analysis, replacing the annual wage rate in Eq. (6) with the weekly rate for workers covered by unemployment insurance (and using the same lag structure) produced only slightly less consistent results. The following cumulative second period responses were obtained: 41 states had negative wage-rate responses to migration as well as to internal labor supply; 44 states had positive migration responses to labor demand and 46 states had negative migration responses to internal labor supply; and 43 states had positive employment responses to labor demand and all states had positive employment responses to migration. Using an optimal lag length based on weekly wage rates (not annual wage rates) corrected these responses in a few cases.

[22] Weighted-average results using state employment as the weight are nearly identical. State variance decompositions for wage rates and migration are available from the authors upon request. The average forecast variance of wage rates explained by labor-demand shocks are 70.9, 72.3, and 75.0% for 1-, 2-, and 15-year-ahead forecasts. For migration, 45.6% of the 1-year ahead forecast variance is accounted for by its own innovations, falling to 44.2% in the 2-year ahead forecasts, and 42.3% in the 15-year ahead forecasts. For the 15-year ahead migration forecasts, demand shocks become more important, accounting for 45.1% of the forecast variance.

[23] In sensitivity analysis, the variance decomposition of employment was also calculated based upon the optimal lag length determined by the Akaike Information Criterion (AIC). This increased the lag length in 22 states from that based on the BIC. Nevertheless, employment remained primarily demand driven across all forecast horizons for 20 states. On average, demand shocks accounted for 40.7, 46.1, and 49.0% of employment forecast variance for the 1-, 2-, and 15-year-ahead forecast horizons. Yet, using a longer lag length based on the AIC did increase the variance decomposition share of demand innovations in Minnesota, Missouri, and Tennessee from the relatively small shares reported in Table 1 (especially in the long run, not shown). Regardless, in those cases, the leading roles played by either migration or internal labor supply were unchanged.

Table 1
Variance decomposition of relative employment growth (%)

State	D(1)	M(1)	IS(1)	D(2)	M(2)	IS(2)	D(15)	M(15)	IS(15)
AL	25.9	65.6	8.5	30.2	55.5	14.3	32.7	45.1	22.2
AR	41.9	12.8	45.3	42.1	14.2	43.8	42.2	14.5	43.3
AZ	48.3	51.6	0.1	45.5	51.7	2.8	42.8	53.5	3.7
CA	6.7	4.2	89.1	40.0	13.4	46.5	20.6	62.7	16.7
CO	23.1	69.9	7.0	45.7	48.6	5.7	60.3	35.2	4.4
CT	98.9	0.5	0.5	92.1	3.6	4.2	72.5	21.7	5.8
DE	2.7	55.6	41.7	2.2	62.4	35.4	10.0	61.0	29.0
FL	46.8	53.0	0.2	48.0	48.5	3.5	46.8	44.3	8.8
GA	42.6	35.3	22.1	42.7	33.0	24.2	42.4	32.6	24.9
ID	92.2	3.6	4.2	86.1	9.0	4.9	83.3	10.8	5.9
IL	47.7	29.2	23.1	47.7	28.6	23.8	47.7	28.4	23.9
IN	65.5	27.3	7.2	50.7	40.7	8.6	45.7	43.6	10.7
IA	78.8	13.6	7.6	73.0	19.1	7.9	64.3	25.6	10.1
KS	28.8	68.0	3.2	35.5	48.4	16.1	35.4	38.3	26.3
KY	49.4	10.4	40.2	39.0	28.7	32.3	33.5	31.7	34.8
LA	68.1	30.4	1.5	83.8	15.5	0.8	88.2	10.0	1.9
MA	17.8	79.2	3.0	33.0	65.4	1.6	54.0	41.8	4.1
MD	27.4	29.3	43.3	26.8	31.4	41.8	27.0	31.5	41.6
ME	86.7	1.1	12.2	68.9	9.3	21.8	66.1	9.2	24.7
MI	50.5	38.1	11.4	52.8	36.0	11.2	53.5	35.4	11.1
MN	0.6	32.9	66.5	11.4	26.8	61.8	15.1	25.7	59.2
MO	0.0	84.1	15.9	0.0	83.9	16.0	0.0	83.9	16.1
MS	83.0	12.9	4.1	73.7	15.9	10.4	65.0	15.0	20.0
MT	41.8	54.2	4.0	57.6	37.6	4.8	67.3	26.9	5.8
NE	17.1	8.2	74.6	23.8	13.0	63.2	33.4	16.2	50.4
NH	39.9	49.8	10.4	34.0	54.7	11.3	30.7	56.7	12.6
NV	24.1	67.4	8.5	26.2	64.7	9.1	27.5	63.6	8.9
NJ	23.3	40.1	36.6	17.9	48.4	33.7	15.2	52.2	32.7
NM	56.1	33.1	10.8	62.5	24.3	13.2	65.4	22.2	12.4
NY	99.2	0.0	0.7	99.1	0.0	0.8	91.6	2.3	6.1
NC	20.6	29.4	50.0	23.6	28.2	48.1	23.9	28.2	47.9
ND	34.9	24.7	40.3	50.5	16.4	33.0	55.4	15.2	29.4
OH	28.5	9.6	61.9	35.6	19.4	45.0	37.2	19.1	43.7
OK	67.1	32.8	0.1	67.3	30.2	2.5	65.6	29.1	5.2
OR	86.9	13.0	0.2	87.2	11.3	1.6	85.5	10.7	3.8
PA	8.9	53.5	37.6	15.2	50.3	34.5	21.7	46.8	31.6
RI	5.1	37.3	57.6	8.1	40.9	51.0	9.2	41.3	49.5
SC	63.2	3.5	33.4	57.6	11.1	31.3	55.2	14.4	30.4
SD	45.4	44.1	10.5	58.3	34.0	7.8	58.8	26.4	14.8
TN	0.0	71.5	28.5	2.0	62.9	35.1	3.7	57.9	38.3
TX	57.9	31.9	10.1	71.0	21.1	7.9	77.8	15.7	6.5
UT	22.8	65.5	11.7	29.0	55.8	15.2	35.2	49.0	15.8
VT	38.6	46.0	15.5	30.4	46.2	23.4	35.1	40.2	24.7
VA	14.3	26.9	58.9	36.6	21.9	41.5	42.7	20.1	37.2
WA	49.4	42.9	7.7	45.4	44.9	9.7	42.4	46.0	11.5
WV	60.0	34.0	5.9	54.7	39.3	6.0	49.6	43.9	6.5
WI	69.8	19.7	10.5	71.0	18.1	10.8	71.5	17.5	10.9
WY	55.7	17.2	27.1	81.0	6.9	12.1	83.5	5.1	11.4
AVE	43.0	34.7	22.3	46.2	33.2	20.7	46.5	32.7	20.8

The variance decomposition of relative employment growth at 1, 2, and 15 year intervals for labor-demand (D), migration labor-supply (M), and internal labor-supply shocks (IS).

For example, if we instead employed a Cholesky decomposition within an employment-migration VAR system, the results tilt more strongly in favor of labor demand. When we assume no contemporaneous effect of population on employment, 94.8% of employment variance is explained by labor demand, which compares to 72.8% when we instead assume that employment has no contemporaneous effect on migration.[24] However, given that contemporaneous exogeneity has been noted as not very plausible for periods of a month or a quarter [39], it is highly implausible for a one-year period. In addition, there is no role in this two-equation employment/population VAR for internal labor-supply shocks to explain employment variation. To be sure, our internal labor-supply innovations play a stronger role in the long run than found by traditional VAR approaches [6,18], but only a modestly smaller role than found by Bartik [3,4].[25]

As noted above, these demand/supply patterns would be even more convincing if certain known a-priori differences across regions were also evident in the model's results. Regarding the Sunbelt states of Nevada and Arizona, labor-supply migration shocks underlie most of the relative employment fluctuations. This is particularly noteworthy given that a significant portion of their migration is *non-labor-force* retiree migration, which is more of a labor-demand shock. In fact, Florida's employment forecast variance is more evenly split between demand shocks and migration supply shocks. For California, internal labor supply is most important in the short run, with migration dominating in the longer run, although as described below, this may be related to unmeasured illegal immigration (especially in the 1990s). Overall, for the four Sunbelt states, migration labor-supply innovations account for an average 56% of the variance of employment changes by 15 years (not shown), while demand innovations account for about 34%. This pattern is consistent with a priori expectations that labor-force migration is relatively more important in these states.

As might be expected, Energy states are primarily demand driven, with demand shocks accounting for over 70% of employment fluctuations on average at a 15 year interval, and migration only accounting for 24% (not shown). In Louisiana, Oklahoma, Texas, West Virginia, and Wyoming, employment fluctuations are dominated by demand shocks over all forecast horizons. Relative migration shocks are most important in Montana and Colorado in the one-year-ahead forecasts, with demand shocks dominating in the fifteen-year horizon. The greater influence of relative migration shocks in Montana and Colorado is likely related to their natural amenity-attractiveness. For example, households displaced

[24] We also found that the greatest number of instances of Granger causality was for employment Granger-causing migration (28 states), where migration only Granger-caused employment in two states. However, using the Cholesky decomposition for our three-equation VAR, the average percent of the fifteen-year employment variation accounted for by wage-rate innovations across all six possible orderings was only 11.3%. Of course, each ordering implies a different theoretical model [39], and wage rates most likely do not possess a pure labor-demand interpretation in most, if not all, of these orderings.

[25] Finding a somewhat surprisingly large internal labor-supply component in the variance decomposition suggests that it is unlikely that our results are seriously understating internal labor-supply shocks relative to migration supply shocks. When weekly wages were used in place of annual earnings (see footnote 21), the variance decomposition suggested that internal labor-supply and demand shocks accounted for similar shares of employment fluctuations.

by negative demand shocks in other states, all else being equal, likely relocate to amenity-rich areas, providing positive relative migration (supply) innovations.

Like the Energy states, employment forecast variance in the Rustbelt and Farm states are more likely the result of labor-demand innovations, which was expected given the key role that national and foreign markets play for their products. In the Rustbelt East North Central region, demands shocks are more important on average than in the rest of nation, accounting for 51% of employment fluctuations after 15 years (migration's share was only 29%, not shown). Labor demand dominates in Illinois, Indiana, Michigan, and Wisconsin. Yet, internal labor-supply shocks are most important in Ohio, while migration labor-supply shocks play a key role in Pennsylvania (which is outside the ENC region). In the Farm states of Iowa and South Dakota, demand innovations dominate at all forecast horizons. This is noteworthy given the use of total non-farm employment. Although a decline in the farm sector has negative spillovers on the non-farm sector, the decline in the farm sector becomes an internal supply source of non-farm employment as workers transfer to the non-farm sector or take second jobs. Not surprisingly then, for the 1-year-ahead forecast horizon in North Dakota, and all forecast horizons in Nebraska, internal labor-supply shocks dominate in explaining the employment forecast variance. As might be expected though, this effect significantly diminishes in importance over time in explaining employment fluctuations. By 15 years, demand shocks account for 56% of Farm-state employment fluctuations on average, migration shocks only account for 22%, and the rest being explained by internal labor supply (not shown).

5.3. Labor market shocks by period

Table 2 provides information on which states experienced the greatest shocks, both positive and negative. The shocks are calculated for three equal-length periods, which roughly correspond to US business cycles.[26] The ranking of the magnitude of the shocks are calculated for regions, as well as the 10 states with the largest average positive shocks, and the 10 states with the most negative average shocks. In general, the calculated shocks correspond to well-known patterns of regional fluctuations during the sub-periods, which further supports our long-run-restrictions approach. That is, not only do regions behave as expected in terms of the relative influence of demand/supply innovations over the entire period, but they behave as expected *within* certain sub-periods.

Table 2(a) contains the average state ranking by regional classification according to the magnitude of the shock, going from most positive to most negative for each period. Coinciding with the booming energy industry during 1975–1982, the Energy states on average had the largest positive demand shocks. In fact, Table 2(b), which shows the top- and bottom-ten states, Oklahoma, West Virginia, Colorado, and Texas are in the top ten. In contrast, the Rustbelt states had the most negative demand shocks with Wisconsin, Illinois, and Michigan appearing in the bottom-ten. The New England states had the largest positive

[26] In appendices available from the authors, MI, a manufacturing state, and WY, an energy state, had the largest variation in demand shocks over the entire period. Also, significant differences in speeds of adjustment of reduced-form variables to exogenous shocks were found, suggesting that pooling the entire sample would be inappropriate.

Table 2
Ranking of component shocks by period

(a) Average state rank of shock size by region and period

Region	1975–1982 Dem	1975–1982 Mig	1975–1982 Int LS	1983–1990 Dem	1983–1990 Mig	1983–1990 Int LS	1991–1998 Dem	1991–1998 Mig	1991–1998 Int LS
New Eng	27	9.7	16.7	10.2	28.8	38.2	26	37.3	12.8
Mid Atl	28.7	13.3	20	13	23	38.3	16.3	24.7	23
E.N. Cen	40	24	19.8	25.8	18	22	7.6	25.4	38.6
W.N.Cen	18	32.9	35.6	30.1	23.4	20.4	22.7	13.9	27
South Atl	29.6	23.4	23.9	20.3	21.1	17.5	30.4	24.5	32.1
E.S. Cen	16.3	34.3	28.5	29.3	31.3	13.8	33	11.5	30.5
W.S. Cen	14	23.5	34	33.5	35.8	24.5	38.3	23	15.3
Mountain	17.6	32.1	22.8	32.3	26.9	21.8	23	24.1	18.9
Pacific	34.3	17.7	15	21.7	9.3	37.3	20.7	42.3	19
Rustbelt	41.2	21.8	21.7	22.2	16.5	24.8	10.2	25.5	33.8
Sunbelt	24.8	20.8	14.5	16.5	18.3	39.8	20.8	45.0	8.3
Farm	21.8	34.8	41.8	31.8	27.4	11.4	30.2	12.8	29.8
Energy	9.4	22.1	26.6	36.9	38.7	23.1	34.6	16	25.3

(b) Top/bottom ten states ranking by size of shock and period

Rank	Dem	Mig	Int LS	Dem	Mig	Int LS	Dem	Mig	Int LS
1	OK	RI	NV	RI	NV	SC	MI	MT	NH
2	WV	FL	NH	VT	WA	AR	CO	WY	NV
3	ND	VT	GA	MD	RI	NE	MN	ND	ME
4	CO	NH	WY	PA	MN	SD	AZ	ID	MN
5	NM	MD	WA	NJ	WI	NC	IN	GA	UT
6	MO	ME	NJ	NH	MI	DE	WA	MS	TX
7	MN	TX	VT	NV	OR	IL	NY	KS	FL
8	UT	WY	WI	ME	VA	ID	IL	TN	OR
9	TX	IL	ME	CA	PA	TN	NV	NC	NM
10	MS	OH	MI	NC	NE	CA	MO	AL	PA
39	RI	SC	IA	MO	KS	PA	VT	CA	IL
40	MD	ID	TX	WA	ID	WA	ME	NM	NE
41	GA	MS	MT	UT	TX	FL	AR	TX	TN
42	OR	NC	MS	IN	FL	WI	OK	VT	NJ
43	WI	MN	ID	TX	OK	NJ	AL	OR	KY
44	IA	NE	SC	NM	NH	TX	LA	RI	WY
45	IL	MI	AR	WV	CO	VT	SD	WA	IN
46	NC	TN	NE	ND	ME	MN	WV	AZ	MD
47	PA	AR	RI	OK	WY	NH	SC	NV	MI
48	MI	MT	SD	CO	ND	NV	WY	FL	GA

The average state ranking of the labor-market shocks within each region during the indicated time period. A value of 1 is given to the state with the largest (positive) shock and 48 is given to the state with the smallest (negative) shock.

migration labor-supply shocks, and second largest among Census regions for internal labor-supply shocks. Rhode Island, Vermont, New Hampshire, and Maine had among the largest migration labor-supply shocks.

By 1983–1990 regional fortunes changed. With the energy bust, the Energy states had the most adverse labor-demand shocks with Texas, West Virginia, Oklahoma, and Colorado all listed as having among the most negative demand shocks. The New England and Mid Atlantic states registered the most favorable demand shocks, likely reflecting the benefits of Reagan-era defense spending and a boom in financial services. Rhode Island, Vermont, New Hampshire, and Maine all show up in the top-ten. Also related to defense spending, California had the ninth largest average demand shock in this period. The Pacific states had the most favorable migration labor-supply shocks, with Washington at second, and Oregon at number seven. The Farm states had the most favorable internal labor-supply shocks, consistent with farm workers reallocating themselves to the non-farm sector during the 1980s farm crisis.

As noted elsewhere [37], regional patterns are less well-defined in the 1991–1998 period. The East North Central region experiences the strongest relative demand shocks, led by Michigan, Illinois, and Indiana. The Energy states continue to languish with the most negative relative demand shocks, as the energy sector shed nearly one-quarter of its jobs in the 1990s nationwide [29]. Texas and Colorado leave the bottom ten as they become more diversified, while Oklahoma and West Virginia are now joined by Louisiana and Wyoming in the bottom ten.

The East South Central states had the largest relative migration labor-supply shocks. Perhaps surprisingly, the Sunbelt states had the most negative relative shocks, with Arizona, Nevada, and Florida in the bottom three and California in the bottom ten. Although Arizona and Florida had net-migration rates above the national average over the period, demand effects such as retiree migration (likely captured as a demand innovation) apparently dominated the supply effects of labor-force migration. Yet, the pattern is consistent with the relative trend of job growth rates converging across the nation in the 1990s, with Sunbelt states growing a little slower, and other regions growing a little faster. The Sunbelt states also had the largest internal labor-supply shocks, with Nevada second and Florida seventh. One possible interpretation is that our measure of internal original-resident labor supply may reflect some illegal immigration that was not fully included in the official migration number because the Census Bureau underestimated illegal immigration by about 3 million during the 1990s [38]. Further support is provided by the fact that the border states of Texas and New Mexico also appear in the top-ten for internal labor-supply shocks (while not shown was California at 11th).

6. Conclusions

This study revisits the long-debated chicken–egg question of jobs versus people using data on the lower US 48 states. A primary contribution is that state labor markets are modeled using a variant of the long-run restrictions SVAR approach of Blanchard and Quah [8], which avoids assuming short-run exogeneity. The long-run restrictions are based on a structural labor-demand and supply model, in which demand shocks are identified as comovement in employment and wages, while supply shocks are identified by inverse movements. Another key contribution is that along with labor demand and migration labor supply, internal labor supply (i.e., changes in labor-force participation, natural labor-force growth, etc.) is explicitly modeled as having an independent impact on job-growth.

The empirical results suggest that the long-run identifying restrictions are not very binding, while short-run wage and employment movements are consistent with economic theory. We also subjected the models to extensive sensitivity analysis and calculated numerous decompositions of the empirical results. This extensive investigation supported the plausibility of the overall approach. Labor demand shocks are found to be more important on average than migration innovations in determining state employment fluctuations, indicating that people are slightly more likely to be following jobs rather than the converse. Yet, labor-supply shocks in total (from migration and internal labor supply) account for a majority of employment fluctuations on average. By region, Sunbelt states are more influenced by labor-force migration shocks, but labor-demand shocks are paramount in Rustbelt, Farm Belt, and Energy states. Nonetheless, across all regions, the relative importance of the shocks varies over time. We believe that this is the first study to provide a specific accounting for employment fluctuations due to innovations in labor demand, migration, and (internal) original-resident labor supply in assessing the jobs versus people question. Determining the innovation sources remains to be addressed in future research.

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