Policy Uncertainty Shocks and Labor Market Dynamics in the U.S.*

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Abstract

We assess the impact of economic policy uncertainty on labor market dynamics in the U.S. by estimating a number of Factor-Augmented Vector AutoRegressive models. Uncertainty shocks are identified by isolating the unanticipated component of the economic policy uncertainty index recently developed by Baker, Bloom, and Davis (2012). Our results suggest that an unexpected hike in policy uncertainty trigger a significant increase in unemployment and job-separations, and a decrease in job-findings and vacancy-posting. Our findings speak in favor of the introduction of search frictions and sticky-wages in modern DSGE models of the business cycle. The contribution of policy uncertainty shocks to the dynamics of some key-labor market indicators is estimated to be larger than that of monetary policy shocks.

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1 Introduction

The U.S. unemployment rate has experienced a substantial upswing during the 2007-2009 economic downturn, moving from 4.4% in May 2007 to 10% in October 2009. Since then, employment has markedly but not fully recovered, and the unemployment rate is currently some 2% larger than its longer-run value, at least according to most FOMC participants (Bernanke (2012)). A number of other labor market indicators, including vacancies, the job-separation rate, and the job-finding rate, have shown a quite dynamic evolution since the beginning of the crisis.

Clearly, the identification of the drivers of the evolution of the U.S. economic labor market is of primary importance for policymakers.[1] Apart from usual suspects such as, for instance, monetary policy and technology shocks, the macroeconomic literature has recently focused on the macroeconomic effects of "risk" shocks.[2] In particular, the "economic policy uncertainty" indicator developed by Baker, Bloom, and Davis (2012) (BDD hereafter) has received a wide attention by academics as well as the public opinion.[3] Figure 1 superimposes such indicator over a number of labor market variables. Interestingly enough, a substantial correlation is detected in most cases. Policy uncertainty is highly correlated with the unemployment rate (0.66) and the job finding rate (-0.64), as well as with the vacancy rate (-0.49). Differently, the comovement with the job separation rate appears to be much milder, with a degree of correlation equal to 0.09.

Are shocks to economic policy uncertainty a relevant driver of the U.S. labor mar-

[1] According to the Federal Reserve Act, the promotion of maximum sustainable output and employment is one of the two ultimate goals of the Federal Reserve, the other one being the promotion of stable prices.

[2] A few picks are Ghilchrist, Sim, and Zakrajsek (2010), Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2012), Fernández-Villaverde, Guerrón-Quintana, Kuester, and Rubio-Ramírez (2012). See Bloom and Fernández-Villaverde (2012) for an extensive survey.

[3] A collection of articles in the press is available here: http://www.policyuncertainty.com/media.html .

ket dynamics? This paper answers this question by putting a Factor-Augmented Vector Auto-Regressive (FAVAR) model at work. The use of FAVARs to identify macroeconomic shocks goes back to Bernanke, Boivin, and Eliasz (2005), and it has been widely adopted by macroeconomic scholars since then. The power of FAVAR models rely in the information content of the vector employed by the econometrician, the idea being that of correctly identifying the shocks of interest by including sufficient information in the vector (Forni and Gambetti (2011)). Our vector, on top of the policy uncertainty and labor market indicators discussed above, includes a set of macroeconomic series typically employed to identify the shocks behind the U.S. macroeconomic volatilities. Moreover, it embeds the VIX, the "fear indicator" which has been recently shown to be a relevant factor for entrepreneurs' investment decisions (Bloom (2009)). Finally, it includes a factor estimated on the basis of a large dataset including some 150 time-series, which is intended to capture the otherwise omitted information in our FAVAR framework. A number of VARs, different as for the identification schemes at work as well as their information content, is then fitted to a dataset of U.S. quarterly data, 1985q1-2010q3.

Our main findings are the following. First, all labor market indicators modeled with our VAR react significantly to an increase in the economic policy indicator. In particular, an increase of 112 points of the uncertainty indicator, which is simulated to match the increase in the U.S. economic policy uncertainty from 2006 to 2011 as measured by the BBD index, is estimated to be responsible of an increase of the unemployment rate of more than 2% after six quarters. The job vacancy and finding rates are also shown to be substantially affected by such a shock, and display quite persistent, negative reactions, the largest one being of some -0.2% after five quarters. Differently, the job separation rate increases after the shock, and remains high for a number of quarters before going back to its pre-innovation level. Inflation is also found to be affected by policy uncertainty, but its reaction is quite imprecisely estimated. The federal funds rate takes values lower than its steady state reference, and follows a hump-shaped pattern before going back to the steady state.

We then conduct a forecast error variance decomposition to have a sense of the quantitative relevance of the policy uncertainty shocks. Interestingly, some 16% of the short-run and about 10% of the long-run volatility of the unemployment rate in our sample is estimated to be due to exogenous variations in policy uncertainty. This contribution turns out to be six times larger than that of monetary policy shocks in the short run, and comparable to such shocks at longer horizons. In general, our evidence points toward a substantial contribution of the policy uncertainty shocks to the U.S. labor market volatility and, via the systematic reaction of the Federal Reserve to fluctuations in unemployment and inflation, to that of the federal funds rate.

These results are interesting for two reasons. First, they show that shocks to policy uncertainty should be taken into account when designing policies aimed at contrasting the swings in the labor market. Second, they suggest that unemployment reacts negatively to an increase in policy uncertainty, a finding which is able to discriminate between competing classes of macroeconomic models. As shown by Basu and Bundick (2011) and Leduc and Liu (2012), Real Business Cycle models make the case for a reduction in unemployment due to an increase in uncertainty, the reason being the increased labor supply by households whose consumption is reduced because of a precautionary saving motive. Differently, in a model with search and matching frictions and sticky prices, unemployment increases due to the reduction in the value of a vacancy-worker match and in the level of aggregate demand. Hence, our finding lend support to the role of sticky prices in the transmission of the effects of policy uncertainty shocks.

Our paper is closely related to the empirical VAR literature on the macroeconomic effects of uncertainty shocks. Examples are Bloom (2009), Alexopoulos and Cohen

(2009), Bachmann, Elstner, and Sims (2012), Baker, Bloom, and Davis (2012). Differently with respect to these papers, which mainly investigate the evolution of indicators such as output, investment, and employment to uncertainty shocks, we put in evidence the impact of uncertainty shocks on unemployment and the in- and out-flows regarding U.S. labor market. Leduc and Liu (2012) also model a VAR with unemployment and nominal variables such as inflation and the federal funds rate, as we do. While being related to their paper, our work departs from theirs in that we consider the labor market in greater detail by scrutinizing the reaction of vacancies and job separation and finding rates to a shock to the level of uncertainty (on top of that of the unemployment rate). We do so by accounting for an extended information set, which includes two different measures of uncertainty jointly (BBD and VIX). Moreover, we tackle the issue of VAR non-fundamentalness by adding an estimated factor extracted from a large dataset including more than 150 variables.

The structure of the paper is the following. Section 2 ...

2 Empirical investigation

A description of our VARs, as well as the presentation of our results is presented below.

2.1 Baseline VAR

Our baseline VAR models the vector of variables $\boldsymbol{y}_t = [BBD_t, u_t, \pi_t, jv_t, js_t, jf_t, ffr_t]'$, where BBD_t stands for the economic policy uncertainty index as constructed by Baker, Bloom, and Davis (2012), u_t is the civilian unemployment rate, π_t is the quarterly, annualized GDP inflation rate, jv_t indicates the job vacancy rate, js_t is for the job separation rate, jf_t is the job-finding rate, and ffr_t is the federal funds rate.

The macroeconomic variables in our vector are all quite standard, the only exception perhaps being the economic policy indicator recently developed by Baker, Bloom, and

Davis (2012). Their index is constructed by employing three different components, i.e., a newspaper-based component related to the coverage of policy-related economic uncertainty, a fiscal component related to the number of federal tax code provisions set to expire in future years (a source of uncertainty for businesses and households, given that the Congress often extends them at the last minute), and a factor focusing on the disagreement among economic forecasters. We report a brief presentation of the index in our Appendix. The reader is referred to Baker, Bloom, and Davis (2012) for a more detailed presentation and an-in depth discussion of its properties.

We estimate a reduced-form VAR with four lags, a constant, and a trend per each equation. We identify a shock to the economic policy uncertainty index by appealing to a Cholesky triangularization of the estimated variance-covariance matrix of the reduced-form residuals. Given the ordering of the VAR presented above, this amounts to assuming the policy uncertainty index not to be affected by other shocks hitting the economy in the short-run (at time t). Clearly, this assumption is debatable. In the next Section we show that our results are robust to alternative orderings of the VAR. We take our VAR to U.S. quarterly data, 1985q1-2010q3. The beginning of the sample is justified by i) data availability as for the index developed by Baker, Bloom, and Davis (2012), and ii) our intention of avoid dealing with a sample possibly contaminated with a break in the systematic monetary policy reaction to inflation, which may have occurred in the early 1980s (Clarida, Galí, and Gertler (2000)). We intend to update our sample by including more recent observations soon.

Figure 2 shows the dynamic responses of the variables in the vector $\boldsymbol{y}$ to the so identified policy uncertainty shock. Such shock is calibrated as in Baker, Bloom, and Davis (2012) to match the increase in the U.S. economic policy uncertainty from 2006 to 2011 as measured by their index. Our impulse responses suggest that part of the dynamics observed in the U.S. labor market may indeed be due to unexpected variations in policy uncertainty. In particular, the unemployment rate reacts significantly and persistently, with a substantial increase estimated to be over 2% after six quarters, and a return to the steady-state after some three years. The job vacancy rate reacts negatively and significantly to such a shock, suggesting an impact of about 0.2% after some quarters, and a gradual return to the steady-state in about 10 quarters. The reaction of the job separation rate is estimated to be shorter-lived, but still substantial (almost 0.4%). Much more gradual is the return of the job finding rate to its pre-shock value, which is completed after some 11 quarters after following a U-shaped path. Interestingly enough, the inflation rate reacts negatively, with the lowest deflationary realization occurring one year after the shock. Such reaction is estimated to be significant in the fourth quarter after the shock. However, a substantial uncertainty surrounds it in general. Finally, the federal funds rate reacts negatively and persistently to a variation in the orthogonal stochastic element associated to the policy uncertainty index. This reaction is interpretable as policymakers being willing to counteract the recessionary and deflationary effects on an increase in uncertainty by loosening the cost of borrowing money by households and entrepreneurs.

2.2 Controlling for extra factors: VIX-VAR and FAVAR

Our results suggest that policy uncertainty shocks may be quite relevant to understand the evolution of the U.S. labor market in the last 25 years. Of course, our findings are conditional on a variety of assumptions. A particularly delicate one concerns the triangularity of our economic system in the short run. Our baseline VAR assumes our policy uncertainty indicator not to be affected by any other shock (apart from its own) at a given quarter. This short-run exogeneity assumption is clearly debatable. For instance, shocks to unemployment might very well lead to discussions over which monetary policy decision the Federal Reserve should undertake. Such discussions, if proposed by the media, may very well influence the perceived level of economic policy uncertainty by agents in the economy within a quarter. To tackle this issue, we estimate an alternative VAR in which policy uncertainty is ordered last, i.e., $\boldsymbol{y}_t^{\boldsymbol{EPULAST}} = [u_t, \pi_t, jv_t, js_t, jf_t, ffr_t, BBD_t]'$.

Other concerns may be related to endogeneity issues and informational sufficiency. For instance, an omitted common factor, such as uncertainty generated by sources other than economic policy, might very well induce movements in both BDD and the macroeconomic indicators modeled $\boldsymbol{y}$. An example which immediately comes to mind is the VIX, which is the "fear indicator" shown by Bloom (2009) to be one of the drivers of firms' investment decisions. Some credit in favor of this omitted factor hypothesis may be collected by regressing the estimated series of economic policy shock conditional on our baseline VAR on a constant and the lag of the VIX. Such regression returns a coefficient for the VIX regressor of about 2.17, with a p-value of 0.03 (computed by considering Newey-West HAC standard errors, with a lag-truncation equal to 3). This result casts doubts on the informational sufficiency of our VAR. Hence, a sensible choice is that of enriching our baseline VAR with the VIX, i.e., to model $\boldsymbol{y}_t^{VIX} = [VIX_t, \boldsymbol{y}_t']'$. This translates into testing-and-correcting for informational sufficiency the vector of variables we are modeling, so to be able to estimate the "true" effects of our policy shocks. Forni and Gambetti (2011) propose a procedure to formally check for a VAR's informational sufficiency. Practically, the shock that one is after should not be predictable. They suggest to compute factors from a large dataset and check if those factors have predictive power as for the candidate shock. We then estimate the policy uncertainty shock conditional on the estimation of a VAR $\boldsymbol{y}_t^{VIX}$ featuring equation-specific constants and linear trends, four lags, and a recursive contemporaneous structure. Then, we regress such shock on a constant and the lagged realizations of up to six factors extracted from a dataset of 150 time-series.[4] The choice of the number of factors is based on recent findings by Stock and Watson (2012), who find that six factors are enough to explain most of the volatility of the post-WWII U.S. macroeconomic dynamics even including the 2007-2009 recession. None of our F-tests supports the predictive power of our factors. As an informal proof of the informational sufficiency of our VAR, we also estimate a FAVAR $\boldsymbol{y}_t^{FAVAR} = [f_t^1, \boldsymbol{y}_t^{\boldsymbol{VIX}\prime}]'$, which enriches our VIX-augmented VAR with our first factor f_t^1.

Figure 3 superimposes the impulse responses obtained with these alternative VARs over the ones conditional on our baseline exercise. Our findings turn out to be quite robust to these perturbations of our benchmark exercise. The only noticeable difference regards the reaction of inflation, which turns out be statistically insignificant. As for the reaction of labor market indicators, we can state that policy uncertainty is clearly a factor behind their volatilities even when controlling for broader measures of uncertainty such as the VIX and possible omitted factors. Policy uncertainty appears to act as a negative demand shock in a model with labor matching frictions and sticky prices. In this sense, our results corroborate those in Leduc and Liu (2012).

2.3 Policy uncertainty shocks and macroeconomic volatilities

It is of interest to assess to what extent policy uncertainty shocks contribute to the volatility of the U.S. labor market and, more generally, the macroeconomic environment. Figure 4 depicts the forecast error variance decomposition at different horizons of some selected indicators to the policy uncertainty shocks. Clearly, such disturbance is a quite relevant one as for the U.S. macroeconomic environment. According to our estimates, some 16% of the short-run and about 10% of the long-run volatility of the unemployment

[4] As suggested by Forni and Gambetti (2011), we regress our candidate shock on an increasing number of factors, i.e., we regress it on (the lag of) the first factor first, and run a F-test to check for the latter's predictive power. Once verified that such factor does not contain any predictive power as for our candidate shock, we regress our shock on a constant and the first two factors, and re-run the F-test ... we go ahead up to the sixth factor included.

rate in our sample is due to exogenous variations in policy uncertainty. For the sake of comparison, Figure 4 reports also the contribution of the U.S. monetary policy shocks.[5] Interestingly, the contribution of shocks to policy uncertainty is six times larger than that of shocks to the federal funds rate in the short run, and comparable to such a shock at longer horizons. A contribution by policy uncertainty shocks larger (or, at least, not smaller) than that offered by monetary policy shocks is a regularity as for labor market-related indicators. In particular, the volatilities of the job vacancy and job finding rates is close to 20% in the very short run, and never falls under 12% over the horizons under investigation. The impact on the job separation rate is slightly smaller and fairly constant over time, with a contribution of about 10%. The role of policy uncertainty shocks is by no means confined to labor market variables. Policy uncertainty shocks are quite relevant in explaining the dynamics of the federal funds rate, with a contribution of 10%. Not surprisingly, monetary policy shocks explain a larger share of the volatility of the federal funds rate, with values varying over horizon by constantly exceeding 20%. Finally, in line with our impulse response function-evidence, the contribution of policy uncertainty shocks on the inflation rate is estimated to be marginal, and substantially smaller than that of unexpected variations of the federal funds rate.

3 The macroeconomic effects of policy uncertainty shocks: A structural interpretation

[to come] In short, we plan to use a modified version of the model by Leduc and Liu (2012) as a DGP to generate pseudo-time series and estimate Cholesky-VARs similar

[5] The monetary policy shocks are estimated by assuming a recursive scheme as for the contemporaneous relationships among the modeled variables. Following Christiano, Eichenbaum, and Evans (1999), we assume the variables in our VAR (but the federal funds rate) to be "slow moving" variables, i.e., variables that do not react to monetary policy shocks withing a quarter after the shock. The target of the federal funds rate has been set to "zero-to-25-basis points" since December 2008. This might affect the estimation of the contribution of the monetary policy shocks. We plan to undertake an investigation stopping the sample to 2008q3 to overcome this issue.

to the ones presented above. The aim is to identify the frictions which are relevant to replicate our VAR evidence based on actual data.

4 Conclusions

[to be added]

5 Appendix

This Appendix reports information on the source of the data used for our empirical investigation, the construction of the economic policy uncertainty index by Baker, Bloom, and Davis (2012), the computation of the factors employed to perform our FAVAR estimations, ...

5.1 Source of the data

[to come]

5.2 Economic policy uncertainty index by Baker, Bloom, and Davis (2012)

The paper by Baker, Bloom, and Davis (2012) reports a detailed explanation on the construction of the economic policy uncertainty index.

The excellent synthesis reported below is offered by the dedicated website

http://www.policyuncertainty.com/us_monthly.html .

Such synthesis goes as follows. "To measure policy-related economic uncertainty, we [Baker, Bloom, and Davis (2012)] construct an index from three types of underlying components. One component quantifies newspaper coverage of policy-related economic uncertainty. A second component reflects the number of federal tax code provisions set to expire in future years. The third component uses disagreement among economic forecasters as a proxy for uncertainty.

News Coverage about Policy-related Economic Uncertainty

Our first component is an index of search results from 10 large newspapers. The newspapers included in our index are USA Today, the Miami Herald, the Chicago Tribune, the Washington Post, the Los Angeles Times, the Boston Globe, the San Francisco Chronicle, the Dallas Morning News, the New York Times, and the Wall Street Journal. To construct the index, we perform month-by-month searches of each paper, starting in January of 1985, for terms related to economic and policy uncertainty. In particular, we search for articles containing the term 'uncertainty' or 'uncertain', the terms 'economic' or 'economy' and one or more of the following terms: 'policy', 'tax', 'spending', 'regulation', 'federal reserve', 'budget', or 'deficit'. In other words, to meet our criteria for inclusion the article must include terms in all three categories pertaining to uncertainty, the economy and policy.

To deal with changing volumes of news articles for a given paper over time, we normalize the raw counts by the number of news articles in the same newspapers that contain the term 'today'. We then calculate a backwards-looking 36-month moving average to smooth this series at a monthly level and to remove high-frequency noise. For each paper, we then divide the policy-related uncertainty counts described above by the smoothed value of the 'today' series. Finally, we normalize each paper's series to unit standard deviation from 1985-2010, sum each paper's series, and normalize the series to an average value of 100 from 1985-2010.

Tax Code Expiration Data

The second component of our index draws on reports by the Congressional Budget Office (CBO) that compile lists of temporary federal tax code provisions. Temporary tax measures are a source of uncertainty for businesses and households because Congress often extends them at the last minute, undermining stability in and certainty about the tax code.

The CBO reports contain data on scheduled expirations of federal tax code provisions in the contemporaneous calendar year and each of the following 10 years. We apply a simple weighting to these data in January of each year, multiplying expirations by $0.5\hat{}((T+1)/12)$ for T equal to the number of months in the future when the tax code provision expires. This weighting formula corresponds to an annual discount rate of 100 percent. We then sum the discounted number of tax code expirations to obtain an index value for each January, which we then hold constant during the calendar year. We utilize a high discount rate because many expiring tax code provisions are regularly renewed, and are unlikely to be a major source of uncertainty until the expiration date looms near.

Economic Forecaster Disagreement

The third component of our policy-related uncertainty index draws on the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. This quarterly survey covers a wide range of macroeconomic variables. We utilize the individual-level data for three of the forecast variables, the consumer price index (CPI), purchase of goods and services by state and local governments, and purchases of goods and services by the federal government. For each series, we look at the quarterly forecasts for one year in the future. We chose these variables because they are directly influenced by monetary policy and fiscal policy actions. We treat the dispersion in the forecasts of these variables as proxies for uncertainty about monetary policy and about government purchases of goods and services at the federal level. This approach builds on a long literature using disagreement among forecasters as a proxy for economic uncertainty.

For inflation, we look at the individual forecasts for the quarterly inflation rates four quarters in the future as measured by the CPI. To construct the dispersion component, we then take the interquartile range of each set of inflation rate forecasts in each quarter.

For both federal and state/local government purchases, we divide the interquartile range of four-quarter-ahead forecasts by the median four-quarter-ahead forecast and multiply that quantity by a 5-year backward-looking moving average for the ratio of nominal purchases, either federal or state/local, to nominal GDP. We hold the values of the forecaster disagreement measures constant within each calendar quarter. Finally, we sum the two indices, weighted by their nominal sizes, to construct a single federal/state/local index.

Constructing our overall policy-related economic uncertainty index

To construct our overall index of policy-related economy uncertainty, we first normalize each component by its own standard deviation prior to January 2011. We then compute the average value of the components, using weights of 1/2 on our broad news-based policy uncertainty index and 1/6 on each of our other three measures (the tax expirations index, the CPI forecast disagreement measure, and the federal/state/local purchases disagreement measure)."

5.3 Computation of the factors for our FAVAR approach

[to come]

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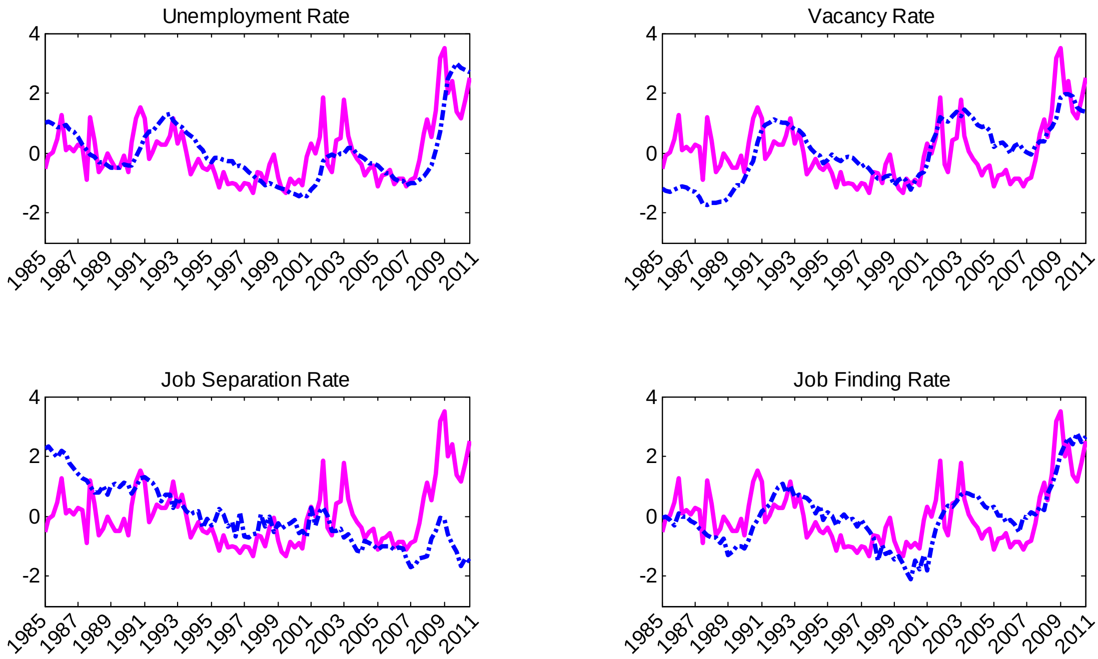

Figure 1: **Economic Policy Uncertainty and Labork Market Indicators.** Sample 1985q1-2010q3. Magenta solid line: Economic Policy Uncertainty indicator as developed by Baker, Bloom, and Davis (2012). Blue, dash-dotted series: Labor Market Indicators. Job vacancy and finding rates are flipped in sign. All series are standardized to ease comparison.

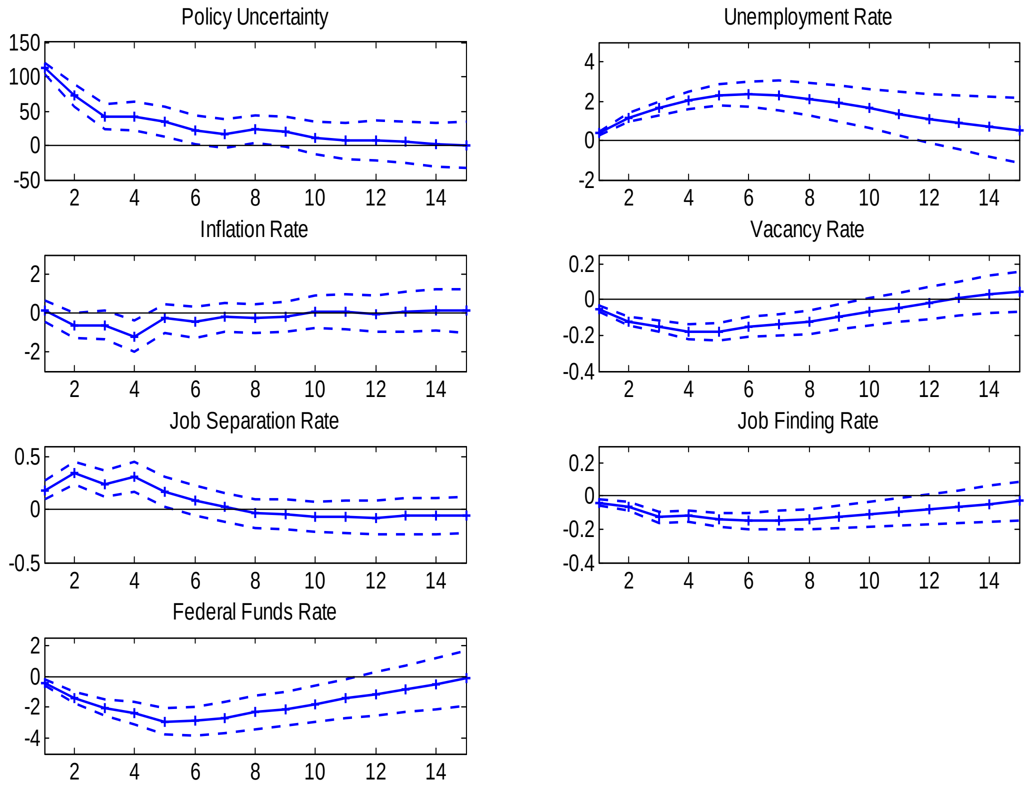

Figure 2: **Labor market dynamics conditional on an economic policy uncertainty shock.** Impulse responses to an 112 unit increase in the policy-related uncertainty index as in Baker, Bloom, and Scott (2012). Solid line with crosses: Mean estimate. Dashed lines: 68% confidence interval bootstrapped on the basis of 500 repetitions. Cholesky Vector Autoregression including the policy uncertainty index, unemployment rate, inflation rate, vacancy rate, job separation rate, job finding rate, and federal funds rate. VAR featuring a constant, a linear trend, and four lags. All rates expressed in percent. Solid 68% confidence bands bootstrapped on the basis of 500 repetitions.

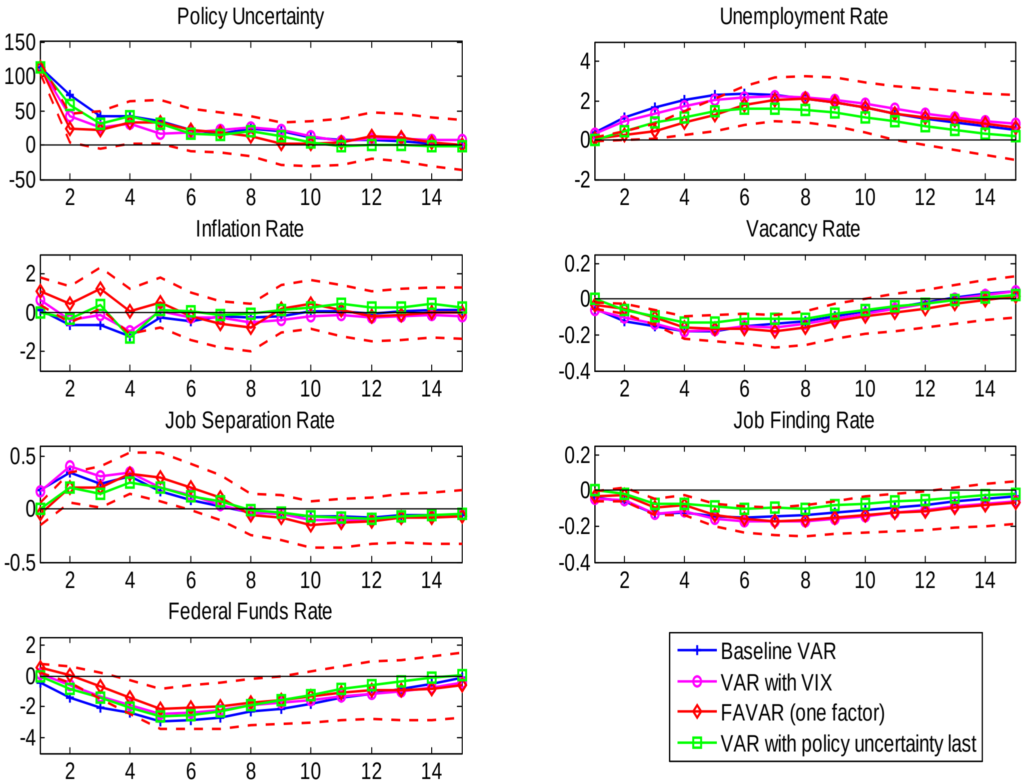

Figure 3: **Role of extra information in the identification of the uncertainty policy shock.** Impulse responses to an 112 unit increase in the policy-related uncertainty index as in Baker, Bloom, and Scott (2012). Reactions as indicated in the legend. Dashed red lines: 68% confidence interval bootstrapped on the basis of 500 repetitions and conditional on the FAVAR model. Cholesky Vector Autoregressions as explained in the text. VARs featuring a constant, a linear trend, and four lags. All rates expressed in percent. Solid 68% confidence bands bootstrapped on the basis of 500 repetitions.

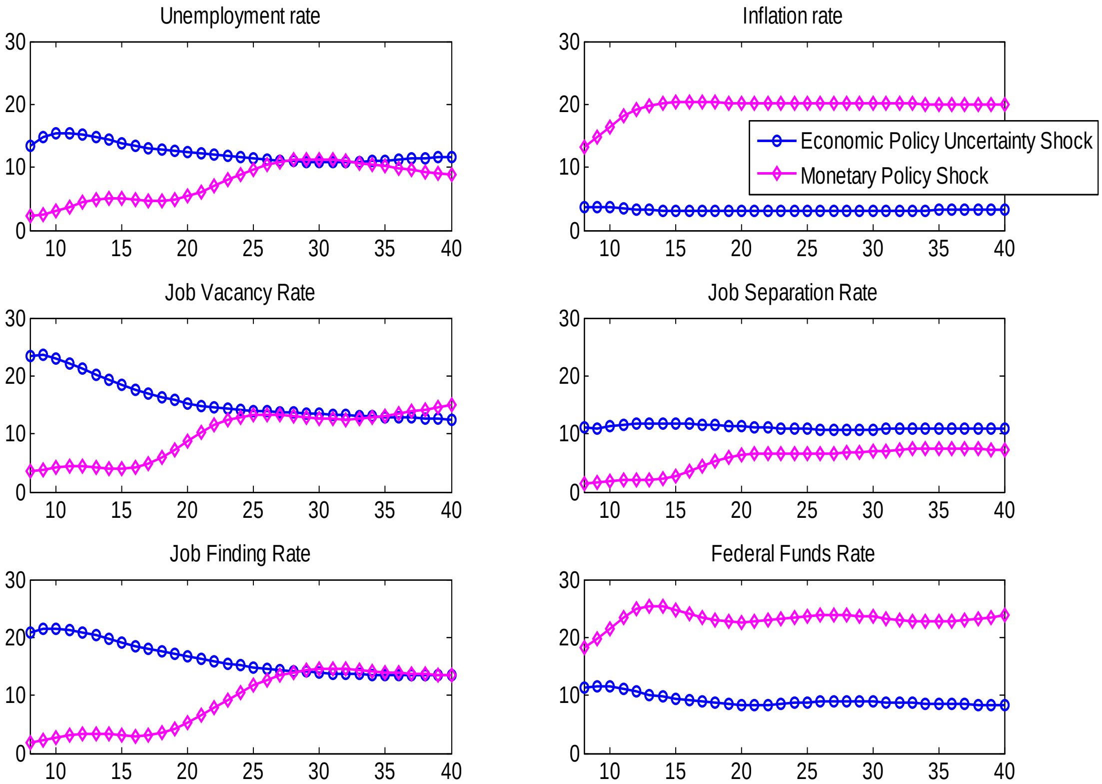

Figure 4: **Macroeoconomic volatilities: Contribution of the uncertainty policy shock.** Forecast error variance decomposition of selected macroeconomic variables at differnent horizons. Blue, circled lines identify the contribution of the policy uncertainty shock. Magenta, diamond-endowed lines indicate the contribution of the monetary policy shock.Results conditional on the FAVAR model.