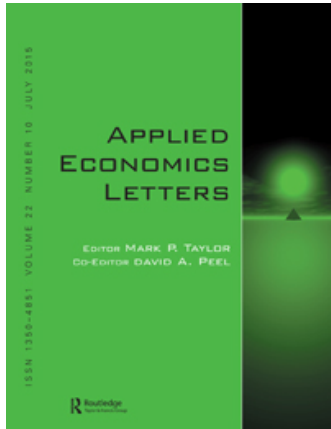


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Google search-based metrics, policy-related uncertainty and macroeconomic conditions

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Google search-based metrics, policy-related uncertainty and macroeconomic conditions

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We propose three novel measures of policy-related uncertainty based on the volume of Google searches for (i) ‘US stock market’; (ii) ‘US politics’; (iii) ‘US Fed’. In a VAR context, we find that a Google-search-based uncertainty shock has sizable adverse effects on US macroeconomic conditions. In particular, it produces (i) a drop in industrial production, consumer sentiment, equity prices, long-term rates and consumer credit; (ii) a rise in the unemployment rate. These effects are nearly identical to those generated by a shock to a standard policy-related uncertainty indicator. Our empirical findings suggest that a rise in the volume of internet searches for economic policy-related topics is a symptom of increasing uncertainty. It turns out that the proposed Google-search-based metrics meet standard policy-related uncertainty indicators.

Keywords: Google-search-based uncertainty; economic policy uncertainty; macroeconomic conditions

JEL Classification: E32

I. Introduction

Policy-related economic uncertainty has received an enormous amount of attention in the most recent literature, much of it devoted to examining its impact on the business cycle (Bloom, 2009; Colombo, 2013; Caggiano *et al.*, 2014; Nodari, 2014). Such attention has been mainly driven by the introduction of a freely available and intuitive economic policy uncertainty index (see Baker *et al.*, 2013). Among others, a common result is that uncertainty shocks can have sizable adverse effects on the real economic activity.

Specifically, they generate a drop in production and employment. Relatively little research, however, has addressed whether alternative policy-related uncertainty measures can produce similar impacts on real and financial aggregates. In the spirit of Dzielinski (2012), we propose three novel measures of policy-related uncertainty relying on the volume of internet searches: (i) an index based on the volume of Google searches on the word ‘US stock market’; (ii) an index based on the volume of Google searches on the word ‘US politics’; (iii) an index based on the volume of Google searches on the word ‘US Fed’.¹ As suggested by the economic

¹ In this respect, we differ from Dzielinski (2012), who proposes a more general metric based on the frequency of internet searches on the word ‘economy’.

psychology literature (see Da *et al.*, 2011; Liemieux and Peterson, 2011), our Google-search-based metrics are designed to reflect the degree of agent attention to policy-related issues.

In a VAR context, we examine whether a shock to one of this novel metric undermines real economic activity, as in the case of a standard economic policy uncertainty shock. In other words, do a ‘policy-related search behaviour shock’ affect US macroeconomic conditions? The answer is in the affirmative. In particular, we find that a Google-search-based uncertainty shock produces (i) a statistically significant drop in share prices, long-term rates, industrial production, consumer credit and consumer confidence; (ii) a rise in unemployment. These effects are qualitatively and quantitatively similar to those generated by a shock to standard policy-related uncertainty indicators (e.g. US economic policy uncertainty index, news-based uncertainty index, equity market-related uncertainty index, VIX).

Overall, our empirical findings suggest that the demand for information rises as uncertainty about the state of the economy increases. In other words, in presence of macroeconomic uncertainty the volume of Google searches for policy-related topics increases. This increasing demand for information makes economic agents more cautious. Specifically, (i) households and firms tend to postpone their consumption and investment decisions (i.e. *precautionary saving*); (ii) investors are less willing to buy risky assets (i.e. *flight-to-quality*).

The structure of the paper is as follows. Section II describes the data and the empirical strategy. Sections III and IV present our results. Section V concludes.

II. Data and Empirical Strategy

As in Dzielinski (2012), uncertainty is measured by means of internet searches. In practice, the volumes of Google searches on the words ‘US stock market’, ‘US politics’ and ‘US Fed’ serve as indicators of

policy-related economic uncertainty (*EUI*). We retrieve our monthly volume of internet searches that use ‘US stock market’, ‘US politics’ and ‘US Fed’ from Google Trends Graphs.² For comparison purposes, the standard economic policy uncertainty index developed by Baker *et al.* (2013) and other popularly known uncertainty indicators are used (i.e. the news-based uncertainty index and the equity market-related uncertainty index of Baker *et al.*, 2013; and the VIX). Figure 1 plots the three monthly Google-search based uncertainty indicators (Panel A) along with the US economic policy uncertainty index and major economic/political events (Panel B).

As US macroeconomic indicators, we use the industrial production index (*IP*), civilian unemployment rate (*UN*), total consumer credit (*CR*), university of Michigan consumer sentiment index (*CSI*). All macro-data are from the Federal Reserve Bank of St. Louis database. As financial indicators, we use the share price index (*SPI*) and the long-term interest rates (*LTR*) series. Both are from the OECD. Our data are monthly and run from January 2004 to December 2013.³

We analyse the impact of policy-related uncertainty shocks on real and financial aggregates in a VAR context. A common representation of a structural VAR model is as follows:

$$\mathbb{C}_0 \mathbb{Y}_t = \mathbb{A}_t + \mathbb{C}(L) \mathbb{Y}_{t-q} + \mathbb{V}_t \quad (1)$$

where $\mathbb{Y} = [EUI, SPI, LTR, CSI, CR, IP, UN]'$ is the vector including all endogenous variables, \mathbb{C}_0 denotes a contemporaneous coefficient matrix, \mathbb{A} is a vector of constants, $\mathbb{C}(L)$ is an autoregressive lag-polynomial and \mathbb{V} is a vector of structural innovations.⁴ All variables in our system enter in log form, except for the uncertainty index and interest rates, which are in levels.⁵ The ordering in \mathbb{Y}_t is based on the assumptions that policy-related shocks instantaneously influence asset prices, then consumer confidence, and finally macro quantities.

² The numbers on the graph provided by Google reflect how many searches have been done for a particular ‘word’, relative to the total number of searches done on Google over time. Notice that the data is normalized and presented on a scale from 0 to 100. For additional details see <https://support.google.com/trends/>.

³ The beginning of the sample is motivated by the availability of data on the volume of Google searches. We stress that Google trends start in 2004. A monthly index is chosen to match the frequency of the macro-variables.

⁴ VAR estimates are computed using HAC SE’s.

⁵ Notice that a VAR in log-levels provide consistent estimates of the IRFs even if there are co-integrating vectors (Sims *et al.*, 1990; Phillips, 1998). Because of the relatively small size of our sample we are not interested in modelling co-integrating vectors.

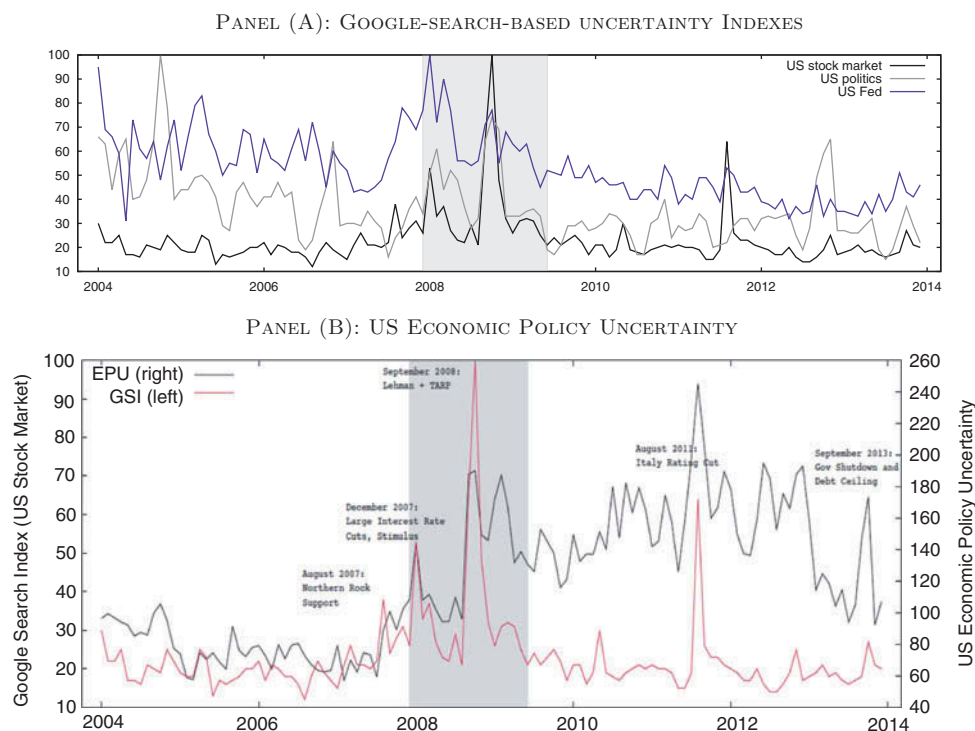


Fig. 1. Policy-related uncertainty. Sample: January 2004–December 2013

The BIC and HQC are used to select the optimal number of lags.⁶ A Cholesky decomposition – where uncertainty is ordered first – is used to compute impulse response functions.

III. Google-Search-Based Uncertainty and its Macroeconomic Effects

Figure 2 plots the impulse response functions of financial and real aggregates to different Google-search-based uncertainty shocks. In all cases, industrial production displays a statistically significant drop within 7 months, with a subsequent mild recovery from 10 months after the shock. The consumer credit exhibits a similar behaviour. A statistically significant increase in the unemployment rate and a rapid fall in the consumer sentiment

index are also observed. In addition, both equity prices and long-term interest rates display a rapid and statistically significant fall within 2/3 months, and a subsequent recovery from 4 months after the shock. On the one hand, we observe that a ‘search behaviour shock’ can have a sizable adverse effect on economic activity. In particular, a Google-search-based uncertainty shock tends to undermine consumer and business confidence.⁷ As a result, the consumption and investment decisions are postponed (i.e. *precautionary saving*). Of course, this affects aggregate demand as well as policymakers’ strategies. On the other hand, a higher level of uncertainty leads investors to sell risky assets and buy long-term bonds (i.e. *flight-to-quality*). Loosely speaking, an increase in the frequency of internet searches on policy-related topics stimulates consumption smoothing.⁸

⁶ Both criteria suggest a VAR(1).

⁷ We stress that our uncertainty indicators are fully driven by the individuals’ spontaneous behaviour, and thus, they can be used as ‘economic signals’ or ‘leading indicators’.

⁸ Notice that our results are robust to the following ordering: [*SPI, EUI, LTR, CSI, IP, CR, UN*]. Including the share price index as the first variable in the VAR ensures the impact of stock market levels is already controlled for when looking at the impact of ‘equity-based uncertainty index shocks’ (see also Bloom, 2009). Results are also robust to (i) the inclusion of extra macro-variables in the VAR (e.g. consumer price index, federal funds rate); (ii) ordering policy-related economic uncertainty last (i.e. EUI in our VAR does not rely on the contemporaneous movements of our macro-aggregates). Results are available upon request.

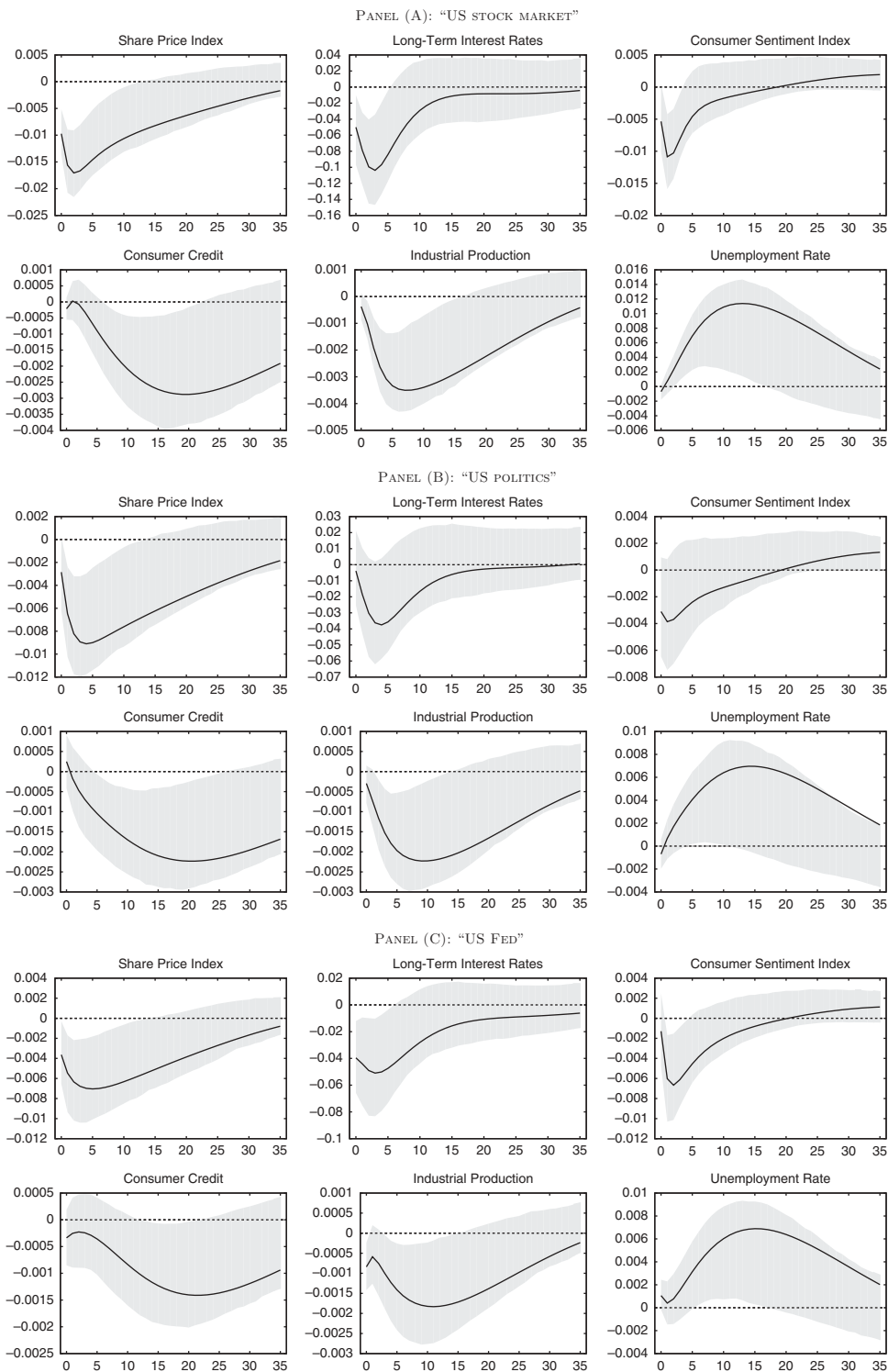


Fig. 2. Dynamic response to a Google-search-based uncertainty (GSI) shock

Notes: This figure reports impulse responses to a GSI shock. The unit of the horizontal axis is the number of months following the shock. In Panel (A) the GSI is based on the frequency of internet searches on the word ‘US stock market’. In Panel (B) the GSI is based on the frequency of internet searches on the word ‘US politics’. In Panel (C) the GSI is based on the frequency of internet searches on the word ‘US politics’. Solid lines and shaded areas identify point estimates and 90% level bootstrap confidence intervals, respectively.

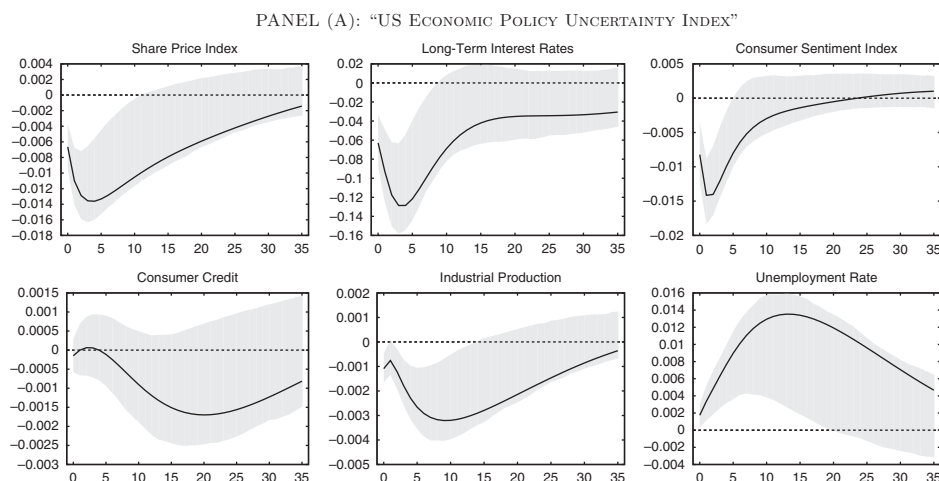


Fig. 3. Dynamic response to an economic policy uncertainty shock

Notes: This figure reports impulse responses to a US economic policy uncertainty shock. The unit of the horizontal axis is the number of months following the shock. The index of economic policy uncertainty is from Baker *et al.* (2013). Solid lines and shaded areas identify point estimates and 90% level bootstrap confidence intervals, respectively.

IV. Google-Search-Based Metrics vs. Policy-Related Uncertainty

Results presented in Fig. 2 are in line with those obtained by recent studies focusing on the macroeconomic impact of policy-related uncertainty. This suggests that our Google-search-based uncertainty metrics and the standard index of economic policy uncertainty developed by Baker *et al.* (2013) are strictly related.⁹ This is clear from Fig. 1 which reports the dynamics of our three web-search-based indexes (Panel A) and the Baker *et al.* (2013)'s economic policy uncertainty index (Panel B). In particular, we observe that spikes in both metrics tend to show up when major financial/political events occur. Therefore, in presence of increasing uncertainty, individuals seek information about policy-related topics more intensively.

Figure 3 presents the impulse responses to a standard economic policy uncertainty shock. Not surprisingly, these dynamic responses and those generated by a shock to the volume of internet

searches (see Fig. 2) are nearly identical. We stress that alternative uncertainty measures (e.g. news-based uncertainty; equity market-related uncertainty; VIX) give rise to similar dynamic responses (see Fig. 4).¹⁰

V. Concluding Remarks

We propose three novel measures of policy-related uncertainty which reflect the degree of households and investors attention to policy-related topics. Specifically, the volumes of Google searches on the words 'US stock market', 'US politics' and 'US Fed' are employed. We show that the macro-effects generated by a Google-search-based uncertainty shock are qualitatively and quantitatively similar to those generated by a standard economic policy uncertainty shock. It turns out that uncertainty about the state of the economy can be captured by the volume of Google searches for policy-related topics.

⁹ See Dzielinski (2012) for a detailed analysis on the relationship between web-search-based uncertainty indexes and alternative measures of uncertainty.

¹⁰ Results suggest that both the index developed by Baker *et al.* (2013) and the VIX serve as uncertainty indicators. This casts some doubts on the use of the VIX exclusively as a measure of global risk aversion and the Baker *et al.* (2013)'s index exclusively as policy-related uncertainty indicator (see Gauvin *et al.*, 2013). Of course, our findings confirm that the VIX and all the other policy-related uncertainty measures exhibit nearly identical patterns (see Colombo, 2013; Nodari, 2014).

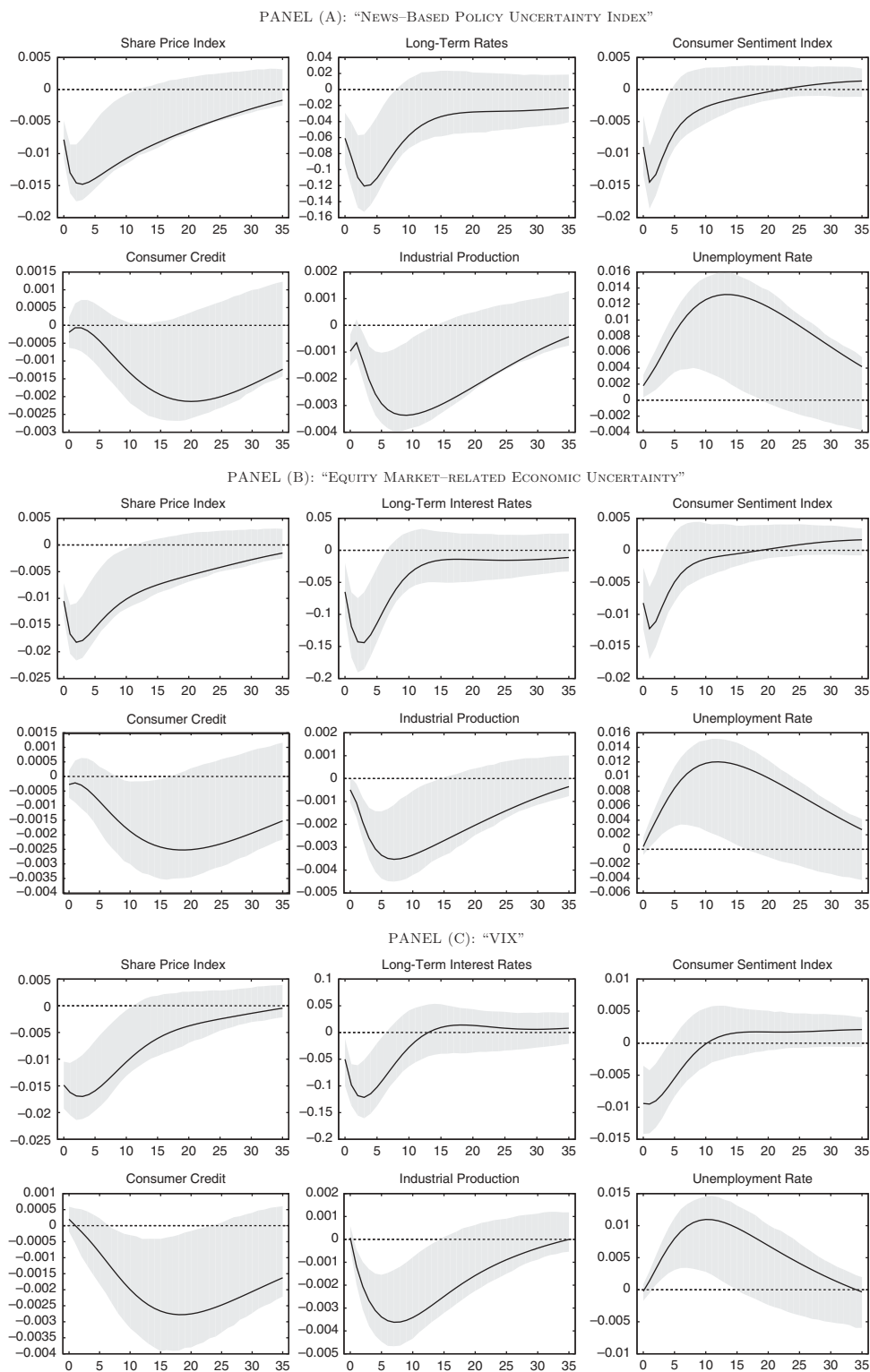


Fig. 4. Dynamic response to a policy-related uncertainty index shock

Notes: This figure reports impulse responses to a shock to different policy-related uncertainty indexes. The unit of the horizontal axis is the number of months following the shock. Both the news-based policy uncertainty index (PANEL (A)) and the equity market-related economic uncertainty index (PANEL (B)) are from Baker *et al.* (2013). The VIX (PANEL (C)) is from the Federal Reserve Bank of St. Louis database. Solid lines and shaded areas identify point estimates and 90% level bootstrap confidence intervals, respectively.

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