Economic Policy Uncertainty in Ireland

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Abstract

This investigation provides an alternative technique for assessing business cycles in Ireland. I construct a new index of economic policy uncertainty (EPU) based on newspaper coverage frequency. I compile thousands of articles from one of Ireland's most widely circulated newspapers from 1985-2016, each containing key terms that are positively associated with policy-driven uncertainty in the Irish economy. The index displays sharp spikes in conjunction with Brexit, the Great Recession of 2008, the Good Friday Agreement of 1998, and the Eurozone Conversion of 1999, as well as fluctuations around political elections and terrorist activity. Furthermore, the index telegraphs shocks to macroeconomic variables such as the interest rate, stock market, industrial production, and employment.

Keywords: economic uncertainty, policy uncertainty, business cycles, fluctuations

JEL: C63, D80, E22, E50, E66, G18

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1 Introduction

Textual analysis is a nascent but auspicious method in the field of econometrics. It has shown particular promise as a mechanism for generating public uncertainty indices. The public tends to receive its information from the news where the absence of valid information causes uncertainty.[1] Assuming the public consults the news for political, fiscal, and monetary matters, the contents of the news are excellent indicators for gauging public response and uncertainty. Specifically, by quantifying the frequency and types of words printed over time, one can observe the correlation of these "anxiety-inducing" words with major economic events. Politics are particularly prevalent topics within newspapers and therefore make the most sense as the base for an uncertainty index.

I construct a new measure of economic policy uncertainty (EPU) for Ireland based on newspaper coverage frequency. Figure 1 displays my EPU index which is derived from thousands of articles published from 1985-2016, each containing at least one term indicative of change in the economy, uncertainty, *and* government policy. The EPU index captures major events from the past including Brexit, the Anglo-Irish Agreement, the Belfast Agreement, and the Gulf Wars; it also records recent events such as Occupy Dame Street, the Great Recession, and the Irish Bailout, as well as presidential elections, emigration periods, and attacks by the Irish Republican Army.

I assess the reliability of the index in a number of ways. First, I find that the index modestly correlates with the VIX which proxies for the absence of an Irish Stock Exchange volatility index. Secondly, I compare my EPU index with those generated by Baker *et al.* (2015). The much stronger correlation between the Irish index and their United States index is statistically significant, as well as correlations with their United Kingdom, European, and Spanish indices. Thirdly, I confirm that the index efficiently performs its function by capturing both major and minor events expressly resulting from changes in economic policy.

Finally, I evaluate the economic events of policy uncertainty through the lens of structural vector auto-regressions (VARs) which are fitted to the Irish data and identified through short-run restrictions. The VAR results suggest that a policy uncertainty innovation equivalent to the actual EPU increase

[1] 'Uncertainty is forward looking while volatility is realized. Volatility is a proxy for uncertainty since it is easier to measure. There are many broad concepts of uncertainty including Bayesian uncertainty or ambiguity, and risk and Knightian uncertainty. Whereas risk can be quantifiably measured, Knightian uncertainty is unmeasurable or impossible to exactly describe. Knightian uncertainty is named after Frank Knight who lucidly made the distinction between the concepts of risk and uncertainty 1921.' Curran (2015).

of 70 points from 2004-2006 to 2009-2011 is associated with an estimated decline of 0.5% in the Irish Stock Exchange (ISEQ). Causality cannot be claimed from these VAR results, but they do suggest that policy uncertainty shocks have macroeconomic consequences.

Section 2 reviews the relevant literature. Section 3 explains the construction of the data and the EPU index. Section 4 presents the VAR model to explore the dynamic effects of policy shocks on the macroeconomy. Section 5 offers conclusions and suggestions for future research.

2 Literature Review

The central article to my literature review is "Measuring Economic Political Uncertainty" by Baker *et al.* (2015), which provides both an empirical and theoretical framework for the investigation. They created an EPU index for the United States by using relevant articles from ten newspapers, assessing uncertainty levels in the annual "Beige Books," and calculating changes in private and corporate revenue as the result of tax implementation and expiration. Over the years, they have extended their method to other countries, as well as have completed rigorous robustness and proof-of-concept tests which include: research assistants manually reviewing thousands of articles; examining effects of political bias in newspapers; capturing economic and political events such as the 9/11 Attack, the Lehman Bankruptcy, and the 2010 midterm election; and comparing the index to the stock market, VIX, and other measures of volatility. The overwhelming majority of their findings confirm the plausibility of their index structure.

Review of previous literature on these topics includes studies regarding the impact of political, fiscal, and monetary policy on economic uncertainty, the effect of this uncertainty on macroeconomic variables, and the usefulness of textual analysis as a tool in econometrics. Alexopoulos and Cohen (2015) applied textual analysis to the New York Times in order to determine the role and impact of policy on business cycles and the financial market. Boudoukh *et al.* (2013) further illustrated the sensitivity of stock prices to words used in news media with positive and negative connotations. Furthermore, Jo and Sekkel (2015) analyzed consensus survey forecasts to measure economic uncertainty, while Gentzkow and Shapiro (2010) assessed the degree to which politically-charged words in articles help newspapers maximize circulation by appealing to the optimal level of political slant. All of these examples illustrate the legitimacy of textual analysis in econometric research.

Research on the macroeconomic ramifications of uncertainty is extensive, particularly the effects on volatility. Economic policy uncertainty severely

dampens stock market volatility as proven by Arnold and Vrugt (2008), Bernal *et al.* (2014) and Liu and Zhang (2015). Similarly, Gulen and Ion (2015), Rodrik (1991), and Kang *et al.* (2014) have shown that uncertainty causes capital investment and productivity to plummet. Moreover, investment consistently suffers from regulatory adjustments of taxes (e.g. Hassett and Metcalf (1999)), regional conflicts (e.g. Chau *et al.* (2014)), and post-recession fiscal reform (e.g. Higgs (1997), Pástor and Veronesi (2013)). Overall, political, fiscal, and monetary shocks all influence uncertainty, therefore stimulating macroeconomic variable activity.

3 An Economic Policy Uncertainty (EPU) Index for Ireland

I built the economic policy uncertainty (EPU) index by textually analyzing a major Irish newspaper. Several factors contribute to the newspaper selection process with the most difficult obstacles being availability and accessibility. Many of Ireland's newspapers are either not publicly and electronically archived, or contain periodic gaps spanning months or years. Circulation and geographic coverage were other important factors. High circulation is usually an indicator of public-certified credibility, so these newspapers are most likely to influence public uncertainty. Also, I require that all papers be circulated daily with an archive history starting in 1985 at the latest. Ultimately, only one newspaper fits these criteria: The Irish Times.

Selection of articles was a surgical process. Articles must contain one or more terms from each of the following categories: economy, uncertainty, and policy. The search accounts for grammatical variations of the words as well. Specifically, "economy," "economics," or "economic;" "uncertainty," or "uncertain;" "regulation," "legislation," "Dáil," "deficit," "government," "central bank," or "Taoiseach." The search technique used is called "web-scraping." Code is written in C# and executed by Microsoft SQL Server which then scans the archives and compiles the data in excel. In order to control for variation in article volume between newspapers and over time, I sort the selected articles by month and year, and scale them against the total number of articles published per month. Using a method similar to Baker *et al.* (2015), I standardize the data to unit standard deviation between 1985 and 2016, then normalize the newspaper data to a mean of 100 between 1985 and 2016. Thus the EPU index.

Although the index is noisy due to reliance on a single newspaper, it exhibits unmistakable spikes and drops during the months of major economic

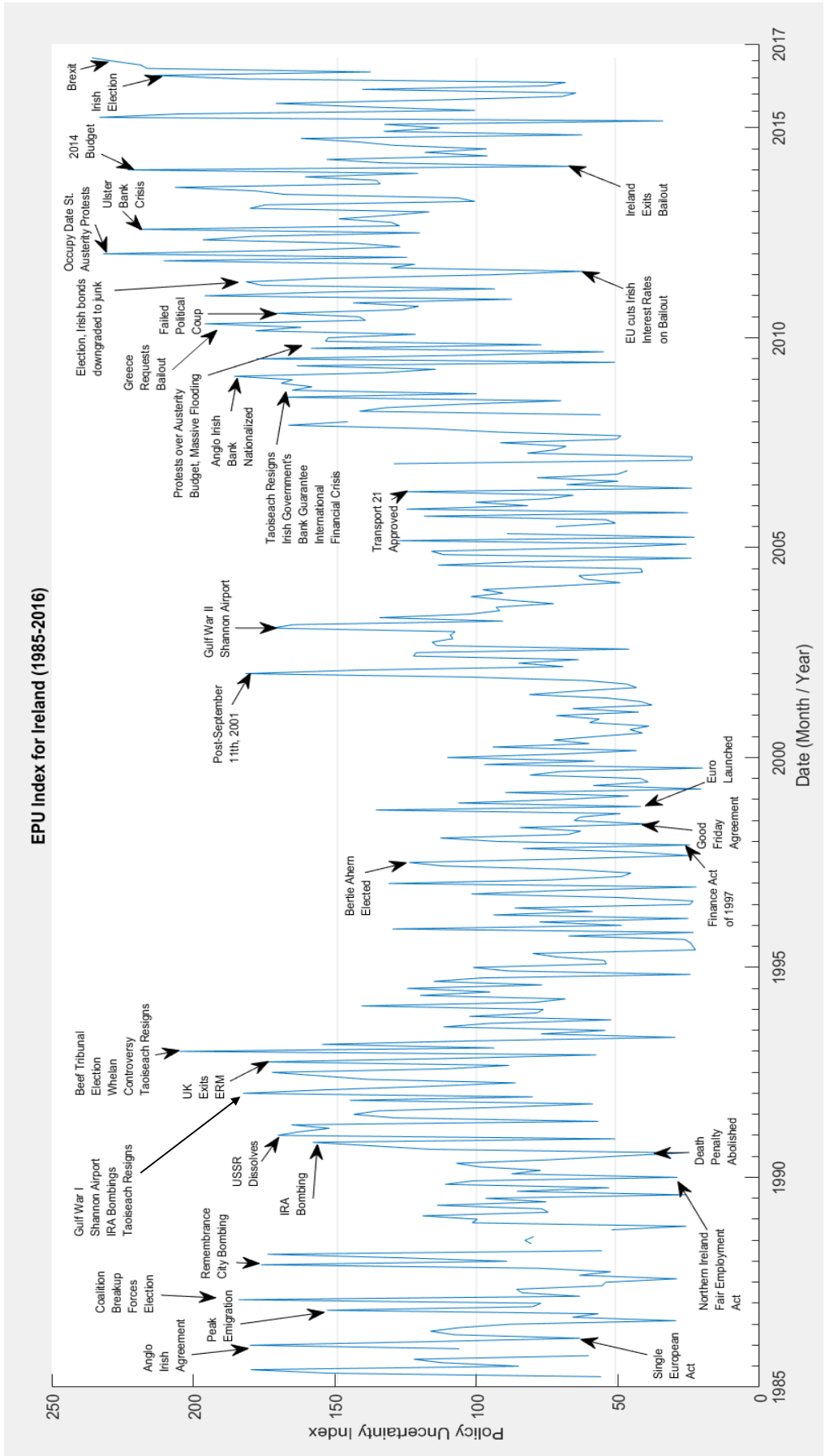

Figure 1: EPU Index for Ireland

events. We can see that the EPU index clearly tracks (i) foreign policy shocks: Anglo-Irish Agreement, Single European Act, Northern Ireland Fair Employment Act, and Collapse of the USSR; (ii) domestic and international conflicts: IRA assaults, Remembrance City Bombing, Gulf Wars 1 and 2, 9/11 Attacks, and failed political coups; (iii) economic and financial crises: Finance Act of 1997, Eurozone Conversion, Greece Crisis, austerity measures, Anglo-Irish Bank nationalization, Irish Junk Bond Status, Ulster Bank Crisis, Occupy Dame Street, and the end of the Irish Bailout; and (iv) political elections for Taoiseach and government offices as well as announcements of fiscal budgets. Ultimately, the index proxies for movements in policy related economic uncertainty.

The correlation coefficient between the EPU index and the VIX is 0.12. Ultimately, the index should correspond with Irish fear and uncertainty but the VIX monitors panic in the United States and world financial markets rather than panic in Ireland. As such, it would be ideal to compare the data with an implied volatility index of the Irish Stock Exchange which is currently difficult to obtain. Even so, I compare my EPU index with those generated by Baker *et al.* (2015). The correlation between the Irish index and their United States index (0.48) is statistically significant, as well as with their United Kingdom (0.62, 0.61), European (0.47, 0.49), and Spanish (0.38, 0.32) indices.[2] (Significance is preserved by both Spearman and Pearson correlation coefficient tests, given respectively). It makes sense that the highest correlation is with the United Kingdom because of its close relationship with Ireland; it is also logical that Ireland more closely follows domestic European uncertainty than the international United States VIX. However, a direct comparison of these indices is compromised due to differences in construction. (For example, different newspapers, tax code expirations (U.S. index), and forecast disagreements (U.S. index)). Regardless, for a country like Ireland this EPU index is quite useful given the lack of alternative uncertainty measures.

4 Uncertainty and Macroeconomic Performance

4.1 Vector Auto-Regressions (VARs)

To gauge whether policy uncertainty shocks foreshadow weaker macroeconomic performance, I conduct a vector auto-regression (VAR) analysis in-

[2]The United Kingdom index begins in 1997, the European index in 1997, and the Spanish index in 2001. Of course, we could look at the same timespan but we want to maximize the coverage.

cluding the following five variables: the EPU index, the Irish Stock Exchange (ISEQ), the interest rate, employment, and industrial production. I use a monthly frequency from January 1985 to January 2016. ISEQ data comes from the Central Statistics Office of Ireland (CSO), which is combined with archived data and rescaled to be 1000 during the base year, January 1988. The European Central Bank (ECB) marginal lending rate serves as the interest rate which is downloaded from both CSO Ireland and the ECB Statistical Data Warehouse. Employment is also taken from CSO Ireland, which is live register and seasonally adjusted. Finally, the industrial production data is collected from the International Monetary Fund (IMF) International Financial Statistics. These are the five variables included in the VAR study.[3]

I ran a VAR to analyze the short-run dynamic behavior of the variables as well as the impact of various shocks. Specifically, I use a structural VAR of order p which takes the form:

$$\mathbf{A}x_t = \mathbf{B}_1 x_{t-1} + \mathbf{B}_2 x_{t-2} + ... + \mathbf{B}_p x_{t-p} + \Gamma \mathbf{Z}_t + \epsilon_t$$

$\mathbf{A}$ and $\mathbf{B}$ are matrices of coefficients, ϵ_t is a vector of unobservable zero mean white noise processes, and $\mathbf{Z}_t$ gives the deterministic terms (constant drift and time trend). I experiment with different lag values and find that 14 months is optimal, consistent with the recommended standard 12 for monthly data. Optimality is evaluated using Akaike's Information Criterion (AIC) for which 14 yields the minimum value.

The VARs are explored using the logarithms of the ISEQ index, employment and industrial production. See Figure 3 for the VAR results. Initially, concern arises over the upward trending behavior of variables such as industrial production, which would void the stationarity assumption. However, I control for this by introducing the deterministic time trend parameter $\Gamma \mathbf{Z}_t$ into the regression. Furthermore, the first difference of the VARs - while rather noisy - appears in Figure 4. Constant variance and mean centered at zero suggest the stationary nature of the data.[4] In addition, I estimate the VAR with OLS equation by equation using Ambrogio Cesa-Bianchi's VARToolbox in MATLAB.

[3]See appendix A for more about the data.

[4]In addition, Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests fail to reject trend stationarity for first-differences of the variables.

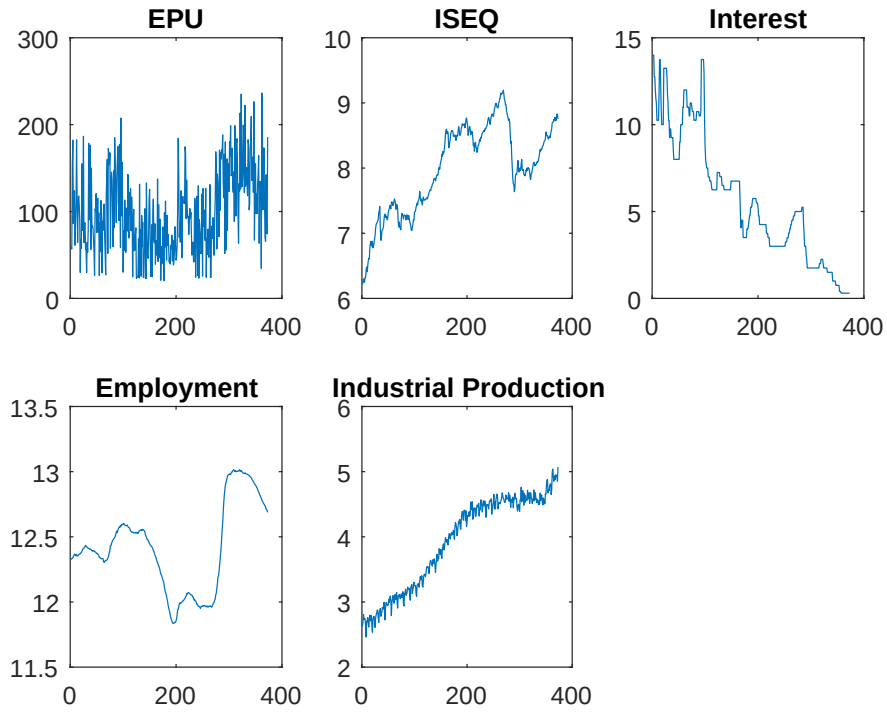

Figure 2: Data for VAR

4.2 Identification and Robustness Tests

The structural VAR is identified by zero short-run restrictions. In particular, the Cholesky decomposition has the following order: EPU, log(ISEQ index), interest rate, log(employment) and log(industrial production). The ordering of the VAR implies that the EPU index affects all other variables and is unaffected by them contemporaneously, making it the most exogenous variable in the system. Similarly, the logarithm of ISEQ contemporaneously influences all variables while reactive only to the EPU index. The interest rate contemporaneously changes variables besides the EPU index and the logarithm of ISEQ while responsive only to the latter two. Moreover, the logarithm of employment contemporaneously affects only itself and the logarithm of industrial production while reactive only to the other three variables. Finally, the logarithm of industrial production is the least exogenous variable given that it behaves contemporaneously with itself while affected by every other variable.

Robustness checks are completed for numerous aspects of the model. I

find the model to be stable (hence stationary) and invertible, which is necessary for the reliability of the results. Jarque-Bera evaluates the normality of all five variables whereas Engle's auto-regressive conditional heteroscedastic (ARCH) test assesses whether the series displays conditional heteroscedasticity. Residuals for the EPU index, ISEQ, and employment heteroscedastic and residuals for each variable other than employment are non-Normal. These findings are further checked by residual plots, auto-correlation plots, and Q-Q plots which may also be found in Appendix B. The graphs echo a similar story as most of the statistical tests conducted.

4.3 Impulse Response Functions and Forecast Error Variance Decompositions

Additionally, impulse response functions for the logarithms of industrial production and employment to EPU shocks are presented in Figure 3. January 2004 through December 2006 were just before the financial crisis and Great Recession; January 2009 through December 2011 included Ireland's recession, the sovereign debt crisis, and the advent of particularly stringent fiscal austerity budgets. Between these two periods, the average value of the EPU index rose by 70 points. Impulse responses are measured in percentages. From the impulse responses for industrial production, it is clear that its relationship to the EPU index is strictly negative and statistically and economically significant in places. Other variables are qualitatively consistent with findings in Baker *et al.* (2015) but are not significant.

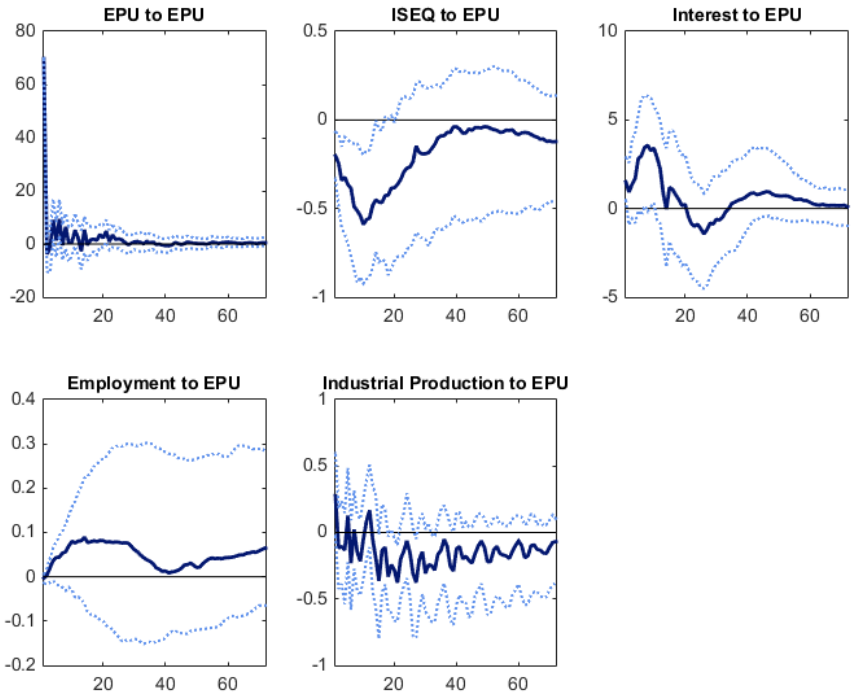

Figure 3: Impulse Response Functions

Finally, I conduct forecast error variance decompositions for each of the five variables; these plots can be found in Appendix B. For the EPU index, ISEQ and the interest rate appear to be responsible for a majority of the variance, whereas employment and industrial production are negligible, at least in the short-run. The interest rate is largely unaffected by other variables. Industrial production is made up of employment and ISEQ variance. Employment is strongly influenced by ISEQ and vice versa in the short-run.

5 Conclusion

I develop a new measure of economic policy uncertainty for Ireland. This new measure is used to investigate the effects of policy uncertainty on the Irish Stock Exchange, the interest rate, industrial production, and employment. These findings are broadly consistent with economic theories regarding the consequences of uncertainty shocks. The estimated effects demonstrate that policy uncertainty innovations in Ireland have negative impacts on macroeconomic and financial variables such as industrial production and stock mar-

ket indices. Additionally, these results reinforce the integrity of newspaper textual analysis as an econometric tool, especially for interpreting public attitude and expectations. As more and more data becomes available and archived online, the possibilities for analyses on a variety of political, financial, and economic are limitless.

As far as improvements for future research are concerned, it would be extremely beneficial to incorporate more newspapers into the index. At the moment, electronic archives of these papers are not available, but if a legion of research assistants were able to audit and record these articles then the index would radically improve. There are several rewards to expanding the data pool. For starters, averaging over multiple newspapers would help. Also, since there is modest fluctuation in the article counts, increased data would make the relative magnitude of events more obvious. Moreover, although there is nothing to suggest meaningful political bias in the EPU index, diversification of newspapers would highlight and account for political slant (which Baker *et al.* (2015) found to be negligible). Another feature to augment the index would be textual analysis of uncertainty references in the House of Oireachtas' session transcripts or the Irish Central Bank's Quarterly Bulletin. Furthermore, daily rather than monthly data would enhance the index, and it would be fascinating to extend the timeline back to the early 1900s. Finally, generating an implied volatility index for the ISEQ would allow me to confirm the magnitude of the correlation between EPU events and stock market volatility.

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Appendix A Data Used in VAR

In addition to the EPU index described in the main part of the paper, I included four additional variables in the VAR exercise. The ISEQ index was downloaded from CSO Ireland by combining tables fim04 and fim05; this was the price index of ordinary stocks and shares by month scaled such that the base was January 1988. The interest rate is the ECB's marginal lending rate and was obtained from the ECB's Statistical Data Warehouse (key: FM.B.U2.EUR.4F.KR.MLFR.LEV.). Since this data set only starts in January 1999, archived data from CSO Ireland (table fim09) is used to extend the coverage back to January 1985. Employment is the total number of persons on the live register obtained from CSO Ireland (seasonally adjusted, table LRM02). Industrial Production was sourced from the International Monetary Fund's (IMF) International Financial Statistics database.

A.1 First Differences of Data

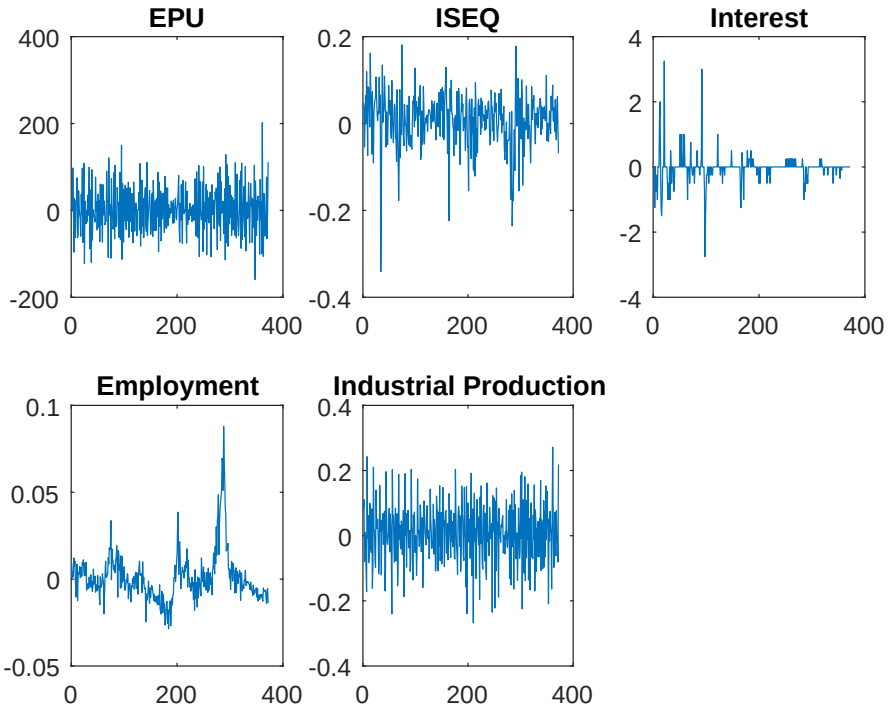

Figure 4: First differences of data for VAR

Appendix B Robustness Checks

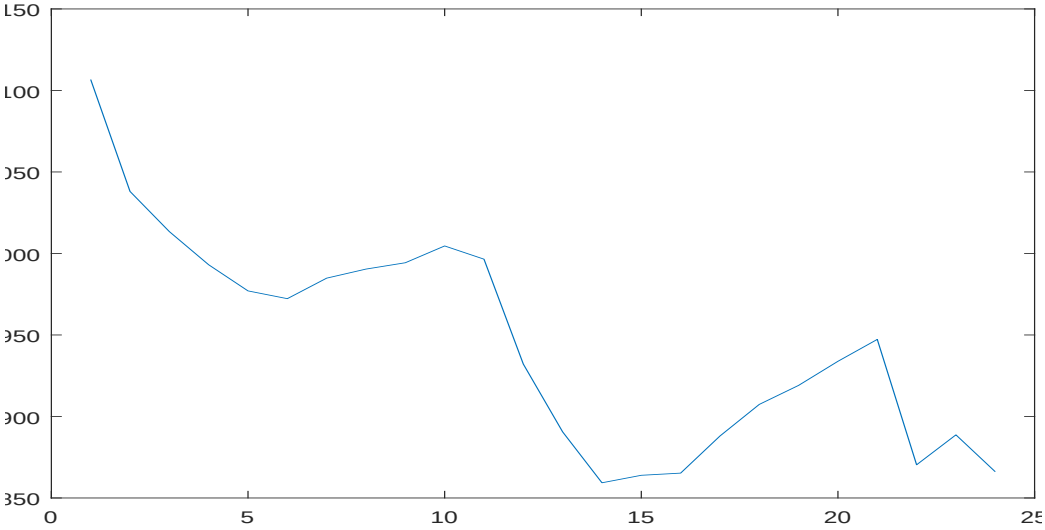

Figure 5: AIC for lag lengths

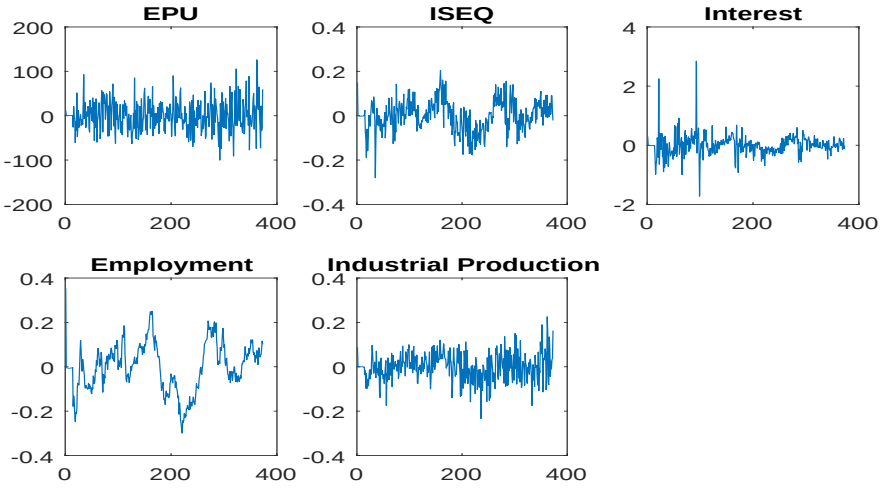

Figure 6: Residuals from VAR

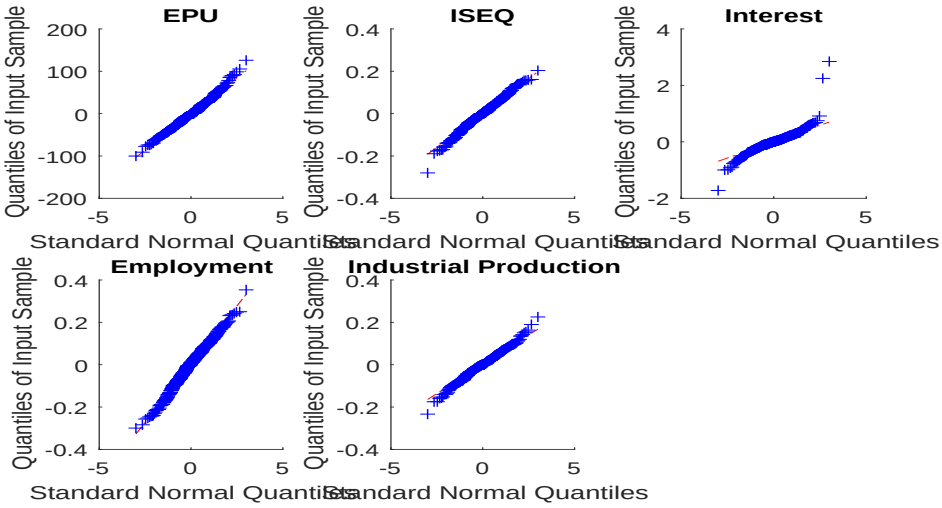

Figure 7: Normality from VAR Residuals

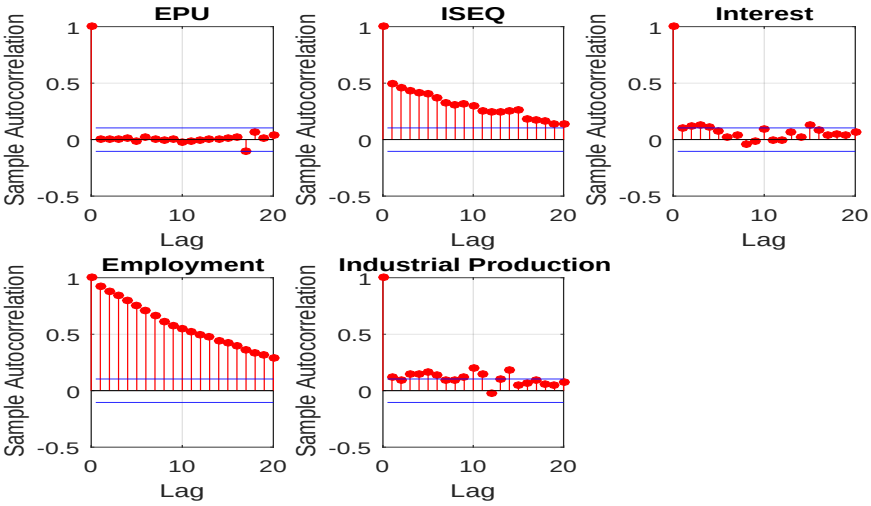

Figure 8: ACF of VAR Residuals

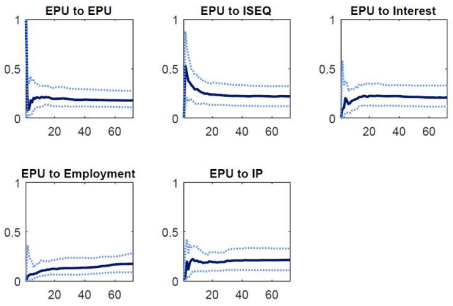

Figure 9.1: FEVD for EPU

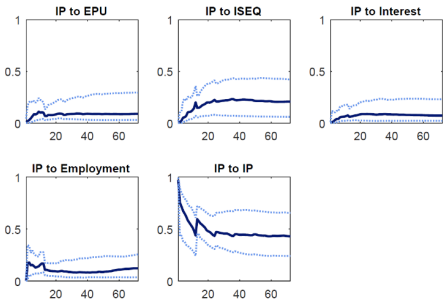

Figure 9.2: FEVD for Industrial Production

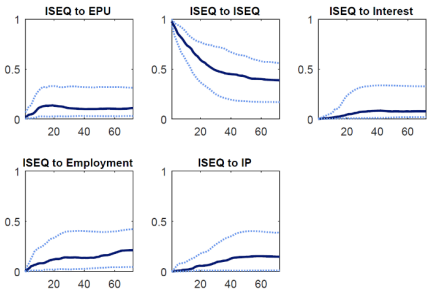

Figure 9.3: FEVD for ISEQ

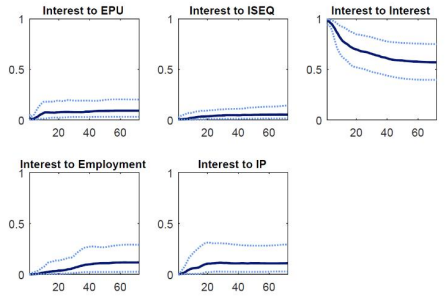

Figure 9.4: FEVD for Interest

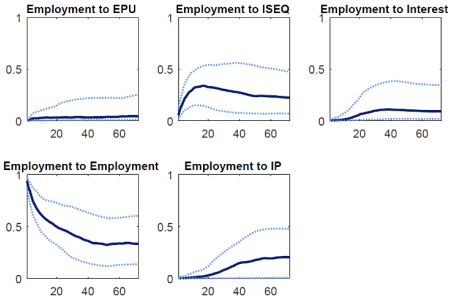

Figure 9.5: FEVD for Employment

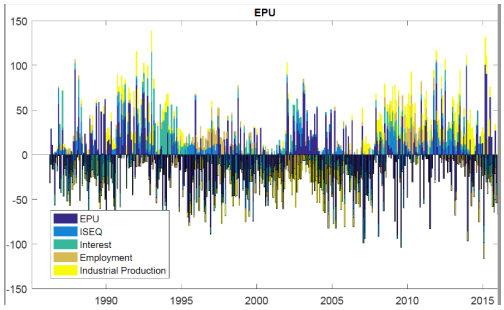

Figure 10.1: HD for EPU

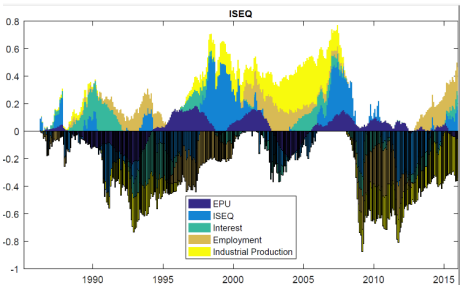

Figure 10.2: HD for ISEQ

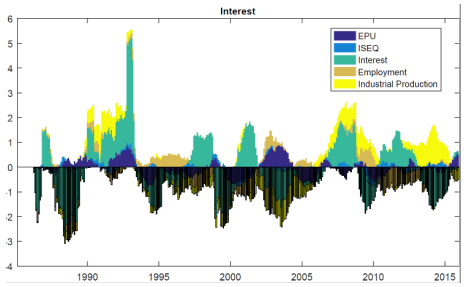

Figure 10.3: HD for Interest

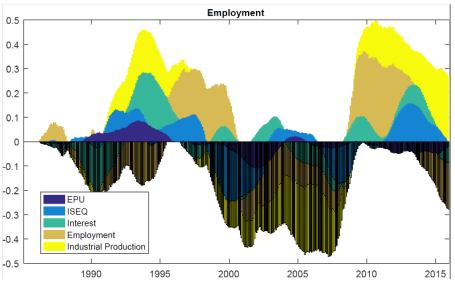

Figure 10.4: HD for Employment

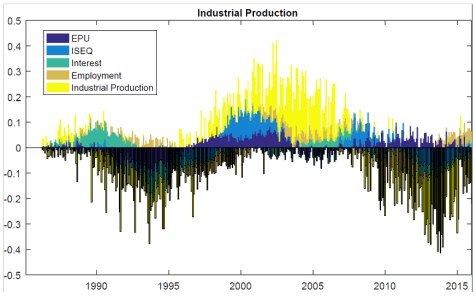

Figure 10.5: HD for Industrial Production