

# Economic Policy Uncertainty and Consumer Perceptions: The Danish Case\*

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## Abstract

This paper develops a newspaper based measure of economic policy uncertainty for Denmark using the method suggested by Baker et.al. (2016). We apply this measure to study the interrelationships between uncertainty, consumer confidence and a composite leading indicator. We find that uncertainty significantly affects household expectations about their own financial situation and for the Danish economy 12 months ahead, households become more pessimistic when uncertainty increases. The leading indicator is negatively related to uncertainty but exert less influence on consumer confidence than on uncertainty. EU economic policy uncertainty also affects household expectations as well as Danish economic policy uncertainty. Using disaggregated data on consumer confidence we find that males are on average more optimistic about the future developments of the economy and their own financial situation than females but they respond stronger to changes in uncertainty. Unemployed tend to be more optimistic than workers (a large share of the unemployed are young and young people tend to be more optimistic than older generations) but respond to uncertainty negatively. Middle income households and less skilled workers respond significantly to increases in uncertainty.

JEL: E00; E32, H31

KEY WORDS: Economic policy uncertainty; consumer confidence; Vector Autoregressive analysis

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# 1 Introduction

The financial crisis has spurred a renewed emphasis on the role of uncertainty in generating fluctuations not only on financial markets but also on the real economy. A critical issue is how uncertainty should be measured. The VIX index has often been used as a global measure of uncertainty but alternatives based on micro- and/or macro-data as well as other types of indicators have also been suggested in the literature. For example, Jurado et.al. (2015) propose a time series approach using a large range of micro- and macro-economic indicators, Bloom et.al. (2018) base their measure of uncertainty on total factor productivity in manufacturing establishments, whereas Castelnuovo and Tran (2017) use Google trends data.<sup>1</sup>

One strand of this literature builds on the idea that the intensity of newspaper reporting on current economic policy issues can be used as an indicator of economic policy uncertainty, see Baker et.al. (2016). The number of articles in major newspapers discussing economic policy forms the basis of such a measure. The underlying idea is that economic policy debate intensifies during periods with higher than normal uncertainty. Counting the number of newspaper articles mentioning uncertainty and a limited number of keywords in the same article allow them to compute an index reflecting economic policy uncertainty.

A surprising finding in Baker et.al. (2016) is that only very few keywords are necessary to capture economic policy uncertainty in the US economy. They divide the keywords into three categories, economics, policy and uncertainty, with a total of ten keywords and then they count the number of articles in each of the ten leading US newspapers containing at least one keyword in each category. The resulting data is then used to construct an overall index representing economic policy uncertainty in the US economy. The index is shown to capture important events in the US economy.<sup>2</sup> Using the same approach, they also construct indices for 11 other countries (Canada, China, France, Germany, India, Italy, Japan, Russia, South Korea, Spain and the U.K.) and a historical measure of economic policy uncertainty starting in 1900 for the US. Bloom, Baker and Davis have later developed indices using the same methodology for an additional four countries (Australia, Brazil, Mexico and Singapore) and published these series on the economic policy uncertainty homepage.

Recently the same method has been used to construct indices for an additional ten countries: Belgium (Algaba et.al., 2020), Chile (Cerda et.al., 2018), Colombia (Perico Ortiz, 2018), Croatia (Sorić and Lolić, 2017), Greece (Fountas et.al., 2018), Hong Kong

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<sup>1</sup>Bloom (2014) provides an overview of how uncertainty has been measured in the literature and how uncertainty may affect different sectors of the economy both in theory and results found in the empirical literature.

<sup>2</sup>Baker et.al. (2016) also construct category-specific EPU indices for the US.

(Luk et.al., 2020), Ireland (Zalla, 2017), the Netherlands (Kok et.al., 2015), Pakistan (Choudhary et.al., 2020) and Sweden (Armelius et.al., 2017).

This paper adds to this literature by applying the newspaper based methodology suggested by Bloom, Baker and Davis (2016) to construct indices of economic policy uncertainty for Denmark covering the period January 1991 until June 2021. We present first an index using the same categories and keywords as was suggested initially in their paper. To be counted in our index, an article must include at least one keyword in each of the three categories. Then we extend their list of keywords used to identify newspaper articles discussing economic policy issues. First, we add a new category, geographical location, containing the word “Denmark”. The reason for adding geographical location as a separate category is that Danish newspapers regularly are publishing articles on foreign policies, and these articles should not be included in our index focusing on the domestic Danish economic policy uncertainty. Then we add words relevant in the Danish context to the category of policy keywords, for example tax and tax reform. An article containing at least one keyword in the three categories economics, uncertainty and policy is counted if the article also includes the geographical location Denmark. We use web-scraping to extract articles using the Infomedia platform.

Having constructed these indices, we then analyze how newspaper initiated policy debates affect household expectations as measured by consumer confidence indices. In particular, we analyze the interrelationships between households expectations about the Danish economy and their own financial situation 12 months ahead with our measure of Danish economic policy uncertainty. We employ a Vector Autoregressive (VAR) model with three variables; our own EPU index, one of the two consumer confidence indices and a composite leading indicator for Denmark. This model allows us to study the interaction between the three variables in both reduced and structural forms. We can thus shed light on the relationships between forecasts of the Danish economy captured by the leading indicator and economic policy uncertainty and how the leading indicator affects consumer confidence. Denmark is a small open economy and dependent on developments in Europe and in the Euro Area. We therefore extend our base model by also allowing EU economic policy uncertainty to affect consumer confidence in Denmark. As a byproduct, our approach allows us to also investigate the size and importance of spillover effects from EU to the Danish economy. To the best of our knowledge, this is the first paper investigating all these different aspects in a developed small open economy. The only exception is Cerda et.al. (2018) focusing on real economy effects of uncertainty in the Chilean economy. As a further extension of the literature, we divide the consumer confidence data along different socioeconomic and demographic dimensions, gender, income, occupation, age and education, and analyze how these different groups are affected by economic policy uncertainty. To the best of our knowledge, there are no similar studies in the literature.

Our analysis relates to the recent literature aiming at finding the determinants of consumer confidence (see for example Jansen and Nahuis, 2003; De Boef et.al., 2004; Ramalho et.al., 2011; Boydstun et.al., 2018), how news affects consumer confidence (Alsem et.al., 2008; Goidel et.al., 2010; Boomgaarden et.al., 2011; Hollanders and Vliegenthart, 2011; Vliegenthart and Damstra, 2019; Boukes et.al., 2019), and how newspaper based EPU indices affects consumer confidence (Cerda et.al., 2018; Perić and Sorić, 2018).<sup>3</sup> There are two previous studies using Danish data, van Dalen et.al. (2017b) and Svensson et.al. (2017).<sup>4</sup> Both studies use a narrower sample of newspapers and/or a shorter sample. Our approach is different and our econometric model allows us to analyze interactions between economic policy uncertainty, consumer confidence and leading indicators.

We find that our economic policy index for Denmark significantly affects consumers expectations about their own financial situation 12 months ahead both in reduced form and in structural form VAR models. Economic policy uncertainty is negatively related to the leading indicator, whereas a better outlook for the Danish economy is associated with less uncertainty. There is substantial heterogeneity across different socioeconomic and demographic dimensions. This holds both for the average expectation as well as how strongly each group of households responds to increases in uncertainty.

The remainder of the paper is structured in the following way. Section 2 briefly reviews the literature on constructing economic policy uncertainty indices and the literature aiming at explaining changes in consumer confidence. Section 3 constructs and presents our new measure of economic policy uncertainty in Denmark. Section 4 discusses data provides descriptive statistics. In section 5 we discuss the empirical model and hypotheses to be tested. Section 6 contains our empirical analysis starting with tests of Granger non-causality hypotheses in the reduced form models and the analysis in the structural form VAR model. Section 7 contains panel data regression analysis using disaggregated consumer confidence indices. Section 8 concludes.

## 2 Review of related literature

This section provides a brief overview of the literature on economic policy uncertainty and the literature on news and consumer confidence.<sup>5</sup>

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<sup>3</sup>Our paper is also related to the literature on economics of information, see Stieglitz (2000) for an overview.

<sup>4</sup>In van Dalen et.al. (2017a) they study the effects of consumer confidence on newspaper reporting.

<sup>5</sup>For a recent survey of the literature on consumer confidence, uncertainty and macroeconomic outcomes, see Nowzohour and Stracca (2020).

## 2.1 Economic policy uncertainty

There are a number of different approaches to measure economic uncertainty in the literature (see Bloom (2014) for an overview of this literature and the main issues). A common measure of financial instability or uncertainty is the VIX index which is the implied volatility in the S&P 500 index. Macroeconomic uncertainty can be measured using the approach suggested by Jurado et.al. (2015) and Bloom et.al. (2018), or using internet search intensity as suggested by Castelnuovo and Tran (2017), for example. A third category is uncertainty in economic policy constructed using newspaper articles reporting on economic policy. Baker et.al. (2016) develop a measure of economic policy uncertainty by counting the number of articles in leading newspapers containing words related to economic policy. To construct a measure of US economic policy uncertainty they count the number of articles in the ten leading newspapers containing the two terms: “uncertainty” or “uncertain”; “economic” or “economy”; and at least one of the policy terms: “Congress”, “deficit”, “Federal Reserve”, “legislation”, “regulation” or “White House”. Similar indices are also constructed for a number of other countries including Canada, France, Germany and Japan.<sup>6</sup> At the moment, there are EPU measures published for 26 countries, either developed by Bloom, Baker and Davis (four additional countries) or by other researchers.<sup>7</sup>

Theoretical models suggest that uncertainty affects the macroeconomy and financial markets, see Bloom (2014) for an overview of the theoretical as well as the empirical literature. The early literature focused on investments (see for example Bernanke, 1983; Bloom, 2009 and Bloom et. al., 2018). Physical adjustment costs interact with uncertainty leading firms to postpone investments when uncertainty is high followed by increases in investments as uncertainty falls generating boom-bust cycles. Another strand of this literature suggests that uncertainty affects precautionary saving and thus consumption expenditures (for example Bansal and Yaron, 2004). In open economy models (for example Fernández-Villaverde et. al., 2011) increased uncertainty and therefore also saving lead to capital outflows reducing economic growth. Uncertainty also affects economic fluctuations through its interaction with financial frictions (see for example Gilchrist et.al., 2014; Christiano et.al., 2010). Higher uncertainty raising bond premia and capital costs of firms tend to reduce investment and output. There may also be a reversed relationship between risky behavior of investors and uncertainty. In a recession there will be incentives for investors to take on too much risk leading to an increase in uncertainty, see for example

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<sup>6</sup>All these measures are available on the EPU homepage <http://www.policyuncertainty.com>. The homepage also contains other measures of uncertainty, for example US equity market volatility and a measure concerning infectious disease equity market volatility tracker.

<sup>7</sup>The additional ten countries are Belgium (Algaba et.al., 2020), Chile (Cerdeira et.al., 2018), Colombia (Perico Ortiz, 2018), Croatia (Sorić and Lolić, 2017), Greece (Fountas et.al., 2018), Hong Kong (Luk et.al., 2020), Ireland (Zalla, 2017), the Netherlands (Kok et.al., 2015), Pakistan (Choudhary et.al., 2020) and Sweden (Armeliuss et.al., 2017).

Bachman and Moscarini (2011).

Beckmann and Czudai (2017) illustrate how economic policy uncertainty affects the exchange rate in a micro-based macromodel where the channel is through the interaction of uncertainty and fundamentals. Pástor and Veronesi (2013) provide a theoretical model linking economic policy uncertainty to stock prices. In their model, the announcement of an unexpected change in economic policy has two effects, one positive leading to higher future profits and one negative, the discount effect. Stock prices will fall if the discount effect dominates.

The newspaper based economic uncertainty index constructed using the Baker et.al. (2016) approach has been used in several different contexts, for example for studies of the macroeconomic effects of uncertainty (Baker et.al., 2016; Colombo, 2013; Karnizova and Li, 2014; Caggiano et.al., 2017; Luk et.al., 2020), stock market return and volatility (Baker et.al., 2019); bank credit growth (Bordo et.al., 2016); investment (Kang et.al., 2014); oil prices (Kang and Ratti, 2013); exchange rates (Krol, 2014; Beckmann and Czudai, 2017). In the next section we discuss earlier papers focusing on economic policy uncertainty and consumer confidence in more detail.

## 2.2 Consumer confidence and news

Carroll et.al. (1994) was one of the first papers to explore the links between consumer confidence and consumption and in particular the question whether consumer confidence had predictive power for future changes in consumption spending. They find that consumer sentiment has forecasting power for future consumption although other variables also significantly contributes. More recently, Cotsomitis and Kwan (2006) find that the out-of-sample forecasting power was limited, however. Gausden et. al. (2020) find stronger evidence suggesting that consumer sentiment can predict future consumption spending in the EU. However, they also find that the particular measure of economic sentiment to a large extent affects the empirical results. Çelik and Özerkek (2009) find that consumer confidence and personal consumption spending are cointegrated indicating a stable long-run relationship between these two variables. This implies that there is, at least, Granger causality in one direction.

Acemoglu and Scott (1994) focus on aggregate UK consumer confidence index. Even though their main interest is whether consumer confidence can help predict current and future consumption, parts of the analysis is aimed at analyzing the determinants of consumer confidence. They find that apart from lagged consumer confidence, real interest rates, inflation and the change in housing wealth significantly affect the aggregate consumer confidence index which in turn is found to be a leading indicator for consumption.

Bram and Ludvigson (1998) conduct a similar analysis but using US data. They also

extend the set of controls by adding labor income and stock prices to the variables used in Acemoglu and Scott (1994) and distinguish between the present condition component and the expectations component of consumer confidence. The focus is still on consumption and whether consumer confidence can add predictive power above the effects of controls. Their overall results suggest that consumer confidence adds forecasting power, in particular on households perception of job prospects.

Souleles (2004) using the Michigan survey data focuses on both the particular expectations formed by households and the question whether consumer confidence help predicts consumption. He finds that increasing consumer confidence led to reductions in saving but also noted significant excess sensitivity inconsistent with the permanent income hypothesis. Furthermore, excess sensitivity cannot be explained by demographic indicators. Garmaise et.al. (2020) constructs a newspaper based measure focusing on unemployment. Using the NewsBank database they count the number of articles published in the US containing the word unemployment. In their empirical analysis they find that an announcement of a 12-month local unemployment maximum leads to a 2 percent reduction in consumption. The response was found to be unaffected by later revisions of unemployment rates suggesting that consumers respond to false news in the same manner as they respond to bad news.

Bachmann and Sims (2012) and Benhabib and Spiegel (2019) both focus on how consumer confidence affects the real economy using data from the Michigan Consumer Survey. Common to both studies is that changes to consumer confidence have real economic consequences. Backmann and Sims find that consumer confidence contributes positively and significantly to the effects of government spending shocks on output during recessions but not during normal times. The response of consumer confidence to government spending shocks matters for the transmission of these shocks on output. Benhabib and Spiegel find that consumer sentiment significantly affect both output and private consumption expenditure at the state level in the US.

De Boef and Kellstedt (2004) and Ramalho et.al. (2011) support the findings in the earlier literature. De Boef and Kellstedt (2004) add political factors to the standard set of economic conditions as possible determinants of consumer confidence using US data. They find, consistent with previous research, that inflation, interest rate, and unemployment determine consumer confidence. Political factors such as the party of the President and positive media coverage also significantly contributes to explaining consumer confidence. Ramalho et.al. (2011) using Portuguese data found that consumer confidence in Portugal is determined by both economic and political factors (entrance to the Euro area and elections).

Jansen and Nahuis (2003) focus on stock market return only in a panel data setup using data for 11 European countries. They found that stock prices Granger-causes consumer

confidence in the short-term but that there was no bi-directional causality, that is, no evidence of Granger-causality from consumer confidence to stock market returns.

There is a growing literature focusing on how news reporting affects consumer confidence (Soroka et.al., 2015; Wu et.al., 2002; Alsem et.al., 2008; Boomgaarden et.al., 2001; Goidel et.al., 2010; Hollanders and Vliegthart, 2011; Vliegthart and Damstra, 2019). Common to these papers is that they collect own data on news coverage of economic and in some cases also political issues. Even though the data on news is collected using different approaches and covering different countries the results seem to suggest that what households read in newspapers influences their perception of the present economy and their expectations about their own future financial situation. This result holds for different sets of controls and is also robust to different econometric approaches.

One strand of this literature combines the economic policy uncertainty measure discussed above with the consumer confidence literature. Cerda et.al., (2018) construct a new measure of economic policy uncertainty for Chile following the Baker et.al., (2016) approach. They then use this constructed index to study the impact of uncertainty on the Chilean economy using Vector Autoregression (VAR) models. The effects as measured by forecast error variance decomposition are small overall, the impact on investment is in the range of 10-20 percent while those for GDP growth and unemployment is substantially smaller.

Perić and Sorić (2018) analyze a panel of economic policy uncertainty indices for 13 countries focusing on the effects of uncertainty on consumer confidence and GDP growth using a panel VAR model. Results are not uniform across all 13 countries, for some countries there is a bi-directional Granger causality between economic policy uncertainty and consumer confidence and for some other countries there is no causality at all. Overall, the results suggest a limited effect of uncertainty on consumer confidence and GDP growth.

Shapiro et.al. (2020) generate a new measure of economic sentiment based on economic and financial news articles from 16 newspapers in the US dating back to 1980 on both daily and monthly frequencies. They find that their news sentiment measure help predict Michigan Consumer Sentiment Index and the Conference Board's Consumer Confidence Index. In addition, the paper also estimates the effects of news sentiment on major macroeconomic variables finding significant effects supporting previous empirical analysis suggesting that sentiment help predict, for example, consumption.

To the best of our knowledge, there are two earlier papers on Danish news reporting and consumer confidence, van Dalen et.al., (2017b) considers uncertainty in macroeconomic news reporting and distinguish between positive and negative news, while Svensson et.al., (2017) concentrate on the effects of ambiguous macro-economic news distinguishing between news emanating in broadsheets, tabloids and on TV. In van Dalen et.al. (2017b) they measure economic uncertainty using keyword searches in the three most-

read Danish newspapers using the database Infomedia. Distinguishing between positive and negative news they find that positive news increased consumer confidence whereas negative news decreased consumer confidence significantly. Overall uncertainty only had minor effects. Svensson et.al. (2017) conduct a two-wave survey asking respondents about their perceived uncertainty related to news and then combined this with content analysis to construct the respondent’s news exposure to eight Danish news media outlets. Consistent with earlier literature, they find that there is a significant direct effect from uncertainty to consumer confidence. However, when focusing on indirect effects they find that ambiguous economic television news has a significant effect on economic uncertainty and on consumer confidence. Increased ambiguity tends to increase uncertainty and decrease consumer confidence. An interesting result was that ambiguity in newspapers does not significantly affect consumer confidence through uncertainty.

### 3 Economic policy uncertainty in Denmark

In this section we develop an index of economic policy uncertainty in Denmark. We will follow the main approach based on newspaper data suggested by Baker et.al. (2016) when constructing the index but we will add specific political keywords relevant in a Danish context.

Baker et.al. (2016) search newspaper articles for the United States with both computer and human revision and select policy keywords words based on this procedure. In their setting they find that the following words are of importance; "Regulation, deficit, federal reserve, white house, congress, legislation". We use the Danish translation of these words. The first three main rows of Table 1 show the corresponding keywords.

Denmark is a small open economy and it is likely that newspapers also report political events and political discussions in other countries, not least in the EU and in the Euro Area since Denmark has a fixed exchange rate versus the euro. These newspaper articles should not be included in our Danish index. We have therefore added a geography criterion, the word “Denmark” should be included as a keyword.<sup>8</sup>

In addition to the standard keywords, we also add a number of important political terms relating to local Danish political discussion to the category politics.<sup>9</sup> We add the words “fiscal policy”, “budget deficits”, “availability for work”, “unemployment”, “general election”, “tax” and “tax reform”. Denmark is a well-developed welfare state where fiscal

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<sup>8</sup>This approach is also used in other papers constructing newspaper based economic policy uncertainty index in small open economies, for example Luk et.al. (2020) constructing an uncertainty index for Hong Kong and Baker et.al. (2016) constructing an index for China.

<sup>9</sup>This is standard in the literature. For example, Kok et.al. (2015) constructing an EPU index for the Netherlands and Cerda et.al. (2018) constructing an EPU index for Chile add policy words such as tax, budget deficit, public expenditures for example.

policy is of major importance for the household economy. Moreover, tax policy is a controversial topic in Danish politics and attracts considerable interest in the public debate. Since tax policy is considered to be central in the Danish society, any discussion has a bearing on political uncertainty. Denmark has a large public sector, implying that taxes and discussions about tax reforms should be included in an index measuring economic policy uncertainty. The Danish population also considers “budget deficits, “employment” and “unemployment” as important parts of economic policy. Fears of increasing budget deficits and government debt are viewed as a problem that policymakers must address as well as any increase in unemployment. In this context, the word “reform” is central. We add this word as well as the word “tax reform” to our list of political keywords. Table 1 shows the extended list of keywords we use and the English translation.

The underlying data is collected using web scraping through Infomedia homepage. The advantages compared to manual collection of the data are that the number of wrongly collected data is minimized, and that the index can be easily updated each month. We use R and in particular the package R Selenium (Harrison, 2019) and the open source program Docker. We access Infomedia through the Royal Danish Library. One advantage using web scraping is that it is easy to avoid double-counting. In practice we use the following procedure: In the first step we choose one newspaper. Then we define the sample which is one month and then the computer program searches the newspaper for articles containing at least one keyword in each of the three categories and the geographical location and count the total number of articles. This procedure is repeated until we reach the end of the sample. Finally, the program checks for double-counting excluding any articles that appear more than once.

There are eight nation-wide newspapers in Denmark: Berlingske, BT, Børsen, Ekstrabladet, Information, Jyllands-Posten, Politiken and Weekendavisen. Five of these newspapers are available in Infomedia from 1991 whereas three only are available from August 1997 (Jyllands-Posten and Information) or December 2002 (Børsen).<sup>10</sup> We construct two indices, one covering five newspapers over the sample January 1991 until June 2021 using the standard keywords suggested by Baker et.al. (2016) and one index using the extended list of keywords.

Since there are seasonal effects in the number of articles in each newspaper in each month, we need to adjust the number of articles containing our keywords. Therefore, we also count the total number of articles in a newspaper mentioning the word “economy” (and the geographical location). The standard approach in the literature constructing economic policy uncertainty index is to use the word “today” or the word “economy”. We have as a robustness check also counted the number of articles containing the word “today” but the resulting index does not change.

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<sup>10</sup>These same newspapers are also used in Svensson et.al. (2017).

The resulting database then comprises the number of newspaper articles containing at least one of the keywords in the first three categories (economy, uncertainty and geographic location) and at least one keyword in the last two categories (politics and other political terms) as a share of total number of articles containing the words in the category economy and geographical location. As is standard we then standardize each of these series by dividing with the standard deviation.<sup>11</sup> Then we compute the average number of newspaper articles across all newspapers in each month, normalize this series to 100 using the average during the period January 1991 to December 2009. The resulting index is our measure of economic policy uncertainty in Denmark.

Table 1: Categories and keywords used to construct the Danish economic policy uncertainty index.

Category	Keywords
Economy (økonomi)	economy, economic (økonomi, økonomisk, økonomiske)
Uncertainty (usikkerhed)	Uncertainty, uncertain, turmoil (usikkerhed, usikker, usikkert, uro, urolighed)
Geographic location (geografi)	Denmark (Danmark)
Politics (politik)	Nationalbanken, central bank, ministry of finance, government, regulation, legislation, parliament, Christiansborg, budget deficit (Nationalbanken, centralbank, finansministeriet, regering, regulering, lovgivning, Folketinget, Christiansborg, underskud)
Other political terms (politisk udvidelse)	Fiscal policy, budget deficit, availability for work, unemployment, general election, reform, tax, tax reform (finanspolitik, budgetunderskud, ledighed, arbejdsløshed, folketingsval, reform, skat, skattereform)

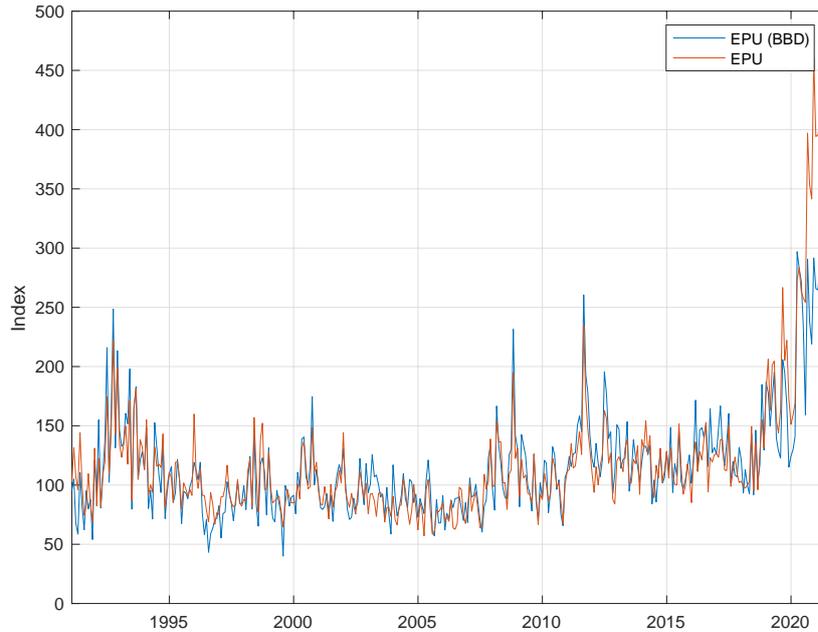
**Note:** The Danish language keywords used in web scraping are shown within parentheses.

Figure 1 shows our two indices constructed using the extended set of keywords (EPU) and constructed using only the keywords suggested by Baker et.al. (2016) (EPU (BBD)) covering the sample period 1991 to 2018. As is clear from the graph, the two series are very similar, peaks and troughs often coincide until 2019. When the covid-19 pandemic started to emerge in the beginning of 2020, we find large differences between our two indices. Using the standard keywords suggested by Baker et.al. (2016) the uncertainty index increased sharply. This reflects the number of newspaper articles discussing global and international consequences of the pandemic. Restricting the sample to only include articles focusing on the Danish economy we also find a sharp increase in uncertainty but not to the same extent as when excluding the geographical location keyword. The first

<sup>11</sup>Note that we follow the convention in the literature and compute the standard deviation using the sample January 1991 until December 2009. This implies that the standard deviation of the adjusted number of newspaper articles in each newspaper during this sample is equal to one.

news flash about an unknown illness caused by a virus was published by the nationwide TV channel TV2 and Jyllands-Posten on January 4, 2020. The correlation between the two EPU measures is about 0.9 suggesting that, in principle, it is irrelevant if we use the extended set of keywords or not. We will, however, from now on only use our extended measure of EPU.

Figure 1: Comparison of EPU index with and without extended set of keywords.



**Note:** EPU(BBD) is the index constructed using the standard keywords suggested by Baker et.al. (2016) whereas EPU is the index constructed using the extended set of keywords stated in Table 1.

Since two of the newspapers have low public credibility (Ekstrabladet and BT) we also construct an index without these news outlets. Figure B.1 in Appendix B suggests that there is only minor differences, the correlation coefficient is equal to 0.92. We also construct indices for seven newspapers starting in August 1997 and one index for all eight newspapers starting in December 2002. Figure B.2 in Appendix B compares these two measures with our preferred measure using five newspapers. The correlation coefficient between these different measures is in the range of 0.90-0.98 suggesting that they are very similar. Furthermore, most peaks and troughs coincide suggesting that adding newspapers does not affect the resulting measure of economic uncertainty.

It may be argued that the political views of newspapers may have an effect on news reporting. The conventional view is that five of the eight newspapers are leaning towards the right of the political spectrum whereas three are leaning left. However, it is a general view that all newspapers have become more political independent and it could be argued

that newspapers have moved towards the midpoint in order to attract readers. We have therefore decided not to exclude newspapers on political grounds. In general, the Danish population regards newspapers as credible.

In Figure 2 we show the constructed index. There are a number of peaks in the constructed index all corresponding to major events, either in Denmark or global events. In the beginning of the 1990s the Nordic countries including Denmark experienced banking and currency crises. In addition, uncertainty surrounded the verification of the Maastricht Treaty. Danish voters rejected the Maastricht Treaty in a referendum in 1992. A year later there was a new referendum on the Edinburgh Agreement allowing Denmark to remain outside the euro area. This time the Danish voters supported the new Treaty and the agreement was ratified.

A major labor market conflict erupted in Denmark in 1998. It was the first major conflict for 13 years. The outbreak was caused by the unexpected rejection of a joint mediation proposal that did not include another week of paid holiday (increasing the total number of holiday weeks to six). At the same time there was increased uncertainty concerning the upcoming referendum on the Treaty of Amsterdam held on May 28, 1998. What was special about this crisis and what made it so severe was that 450000 workers in the private sector went on strike leading to grave consequences for the most basic food products. The strike ended after 11 days when the government intervened and introduced a new law. The strike did not achieve its purpose of extending the holiday immediately. Instead it was agreed that a sixth week should be introduced in 2000. The Amsterdam Treaty was approved by the Danish voters in the referendum and the treaty came into effect in 1999.

The peak in the uncertainty index in the late 2000 and in 2001 is associated with first the IT-bubble crash in early 2000 and then followed by 9/11 in 2001 also generating high news reporting intensity.

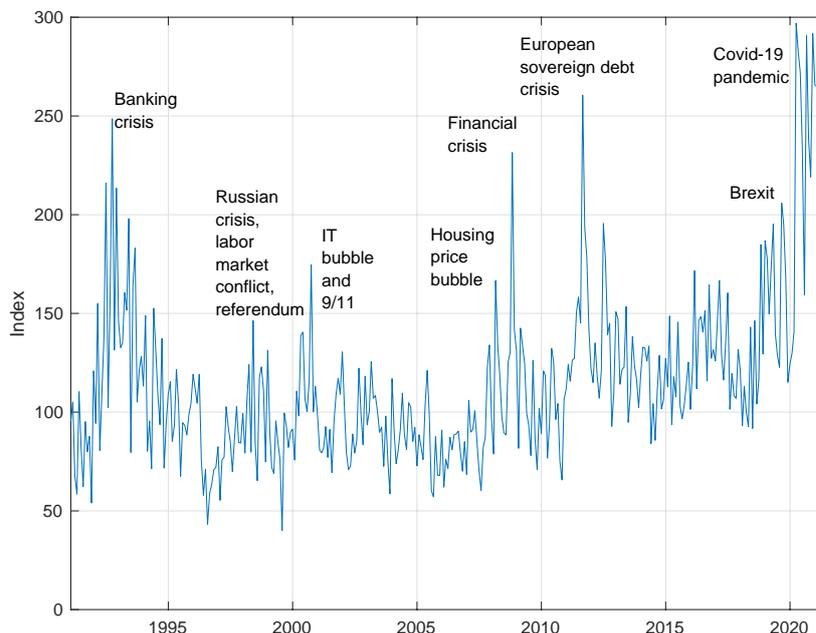
The increase in uncertainty observed after 2005 can be associated with the build-up of a housing price bubble. Real house prices increased substantially over the period of only a few years and then the bubble suddenly burst in the beginning of 2008. There is a peak in the uncertainty index in February 2008 and then another peak in October 2008. In 2008 Denmark also experienced its longest major conflict on the labor market, 59 days. The conflict mainly included workers in the public sector. The government decided this time not to intervene.

The uncertainty index has increased over time during the last couple of years, perhaps associated with Brexit which would have both economic and political consequences for Denmark. There is also the crisis that has led to a re-evaluation of immigration related policies in many countries including in Denmark. The overall performance of the Danish economy since the financial crisis has been fairly good in comparison to other European

countries in most respects except for real GDP growth where several of neighboring countries have had higher growth rates. It is likely that the rising uncertainty in Denmark can be associated mainly with events outside the country, brexit and the covid-19 pandemic, events that potentially affect the Danish economy negatively. Therefore, it is not surprising that local news media intensify its reporting relating to economic policy in Danish newspapers. Overall, we find that the index appears to capture main events in Denmark or events heavily affecting the Danish economy.

Most recently, and mentioned above, Denmark as well as other countries has been heavily affected by the current covid-19 pandemic that started in late 2019 and early 2020. Our aim in this paper is to evaluate if and by how much households revise their expectations about the development of the Danish economy and their own financial situation. Since newspaper reporting after the outbreak of the pandemic has been focused on the both the economic and health consequences of the pandemic we have decided to end our sample in December 2019. It is likely that households revise their expectations because of health considerations and not only on economic uncertainty. Therefore, we focus on the sample January 1991 until December 2019.

Figure 2: Danish economic policy uncertainty index January 1991 to June 2021.



## 4 EPU and consumer confidence

We will focus on the relationship between economic policy uncertainty (EPU) constructed in the previous section and household perceptions about their own financial situation 12 months ahead and about the Danish economy 12 months ahead as measured by the Danish consumer confidence data compiled by Statistics Denmark.<sup>12</sup> This data as well as other measures of consumer expectations has been compiled by Statistics Denmark on a monthly basis since 1974.<sup>13</sup> The survey covers several different questions regarding the household economic situation at present and 12 months ahead, general economic situation both present and 12 months ahead, intentions to buy a car and build or buy a home and so on. In total there are five questions related to household and general economic situation.<sup>14</sup> Questions are standardized and follow the convention when compiling such data in different countries. For example, the survey include questions such as: How do you think the financial situation of your household will be in a year compared to today? How do you think the economic situation in Denmark will be in a year compared with today? Do you expect to put money aside in order to save up over the next 12 months? Statistics Denmark is using omnibus surveys consisting of a representative sample of about 1500 persons drawn from the population of persons of ages between 16 and 74 residing in Denmark. Possible answers to the questions about the household financial situation and the Danish economy over the next 12 months, for example, are: Get a lot better (assigned the number 100), get a little bit better (50), stay the same (0), get a little bit worse (-50) and get a lot worse (-100). The answers are weighted into a net number which is the final measure of consumer expectation. There is no seasonal adjustment as Statistics Denmark cannot find any seasonal pattern.

As mentioned above, we will focus on the household expectation concerning their own financial situation 12 months ahead. We hypothesize that this is the measure that is most likely to be affected by news reporting. Even though the share of Danish households aged 12 years and older has been declining over the years (from over 50 percent in 2010 to 33 percent in 2018), most Danish households read news online (the share of households reading online news cites, newspapers or news magazines online has increased from 70 percent in 2013 to 83 percent in 2017). Since our measure of economic policy uncertainty includes not only printed newspapers but also online publications, it is likely that news reporting penetrates a large share of the Danish population and that intensified economic

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<sup>12</sup>Statistics Denmark (2020) provides a complete description of the surveys including validation of the data.

<sup>13</sup>The surveys have been conducted in all 12 months since 1996. In the previous years, Statistics Denmark did not conduct the survey in July. We have interpolated the data using the average of the measures in June and August.

<sup>14</sup>The surveys also include questions about prices, unemployment, major purchases, and saving.

policy debate may affect household expectations about their own future financial situation.

In addition to household expectations about their own financial situation 12 months ahead, we also use their expectations about the Danish economy 12 months ahead in our empirical analysis. One possible hypothesis is that households have superior information about their own current economic situation and therefore are in a better state to form expectations about their future economic situation than about the future path of the Danish economy. If households are more informed about their own economy, then we expect that the influence of EPU on their expectations about their own economy is more pronounced than on their expectations about the Danish economy.

Other factors may also affect household expectations as reflected in the consumer confidence index. Building on the previous literature on the determinants of consumer confidence indices (Acemoglu and Scott, 1994; Ramalho et.al., 2011; Soroka et.al., 2015; Jansen et.al., 2003; Boydston et.al., 2018 for example) we will also consider a control variable. We will use a composite leading indicator (CLI) as a general measure of the future state of the economy and use this variable as a control.<sup>15</sup> The CLI measure signals future turning points in economic activity using economic time series with similar cyclical fluctuations but precede those of the business cycle. To construct this measure, a large number of short-term indicators are used conditional on their economic significance, breadth of coverage, frequency, revisions of previously published data, timeliness and length. The resulting leading indicator reflects the expectation of the future business cycle.

Table 2 provides descriptive statistics of all time series whereas Table 3 shows cross-correlations and first order autocorrelation. We have also indicated whether the cross-correlation is significant at the 10 percent level using Bonferroni-adjusted significance levels. Of the two consumer confidence indices we only find that the financial situation of the household 12 months ahead (CCH) is significantly negatively correlated to EPU. This is somewhat surprising but these are only simple contemporaneous correlations and cannot reveal any causal relation.

The composite leading indicator (CLI) is significantly positively correlated to all three measures of consumer confidence as expected. An improved economic situation in Denmark is associated with an increase in consumer confidence. EPU is significantly negatively correlated with CLI, also as expected. It is likely that news paper reporting about economic policy in Denmark is negatively related to the expectations about the future stance of the Danish economy. A surprising result is that households expectations about their own economy is not highly correlated to their expectations about the Danish economy. Households may overestimate their own future economic situation in comparison to their expectations about the future state of the Danish economy. Comparing the averages of CCC and CCH we find that households are more optimistic about their own economy

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<sup>15</sup>The composite leading indicator is downloaded from OECD Main Economic Indicators.

Table 2: Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
CCH	343	12.65	2.96	1.80	19.00
CCC	343	2.30	9.38	-22.30	25.60
EPU	343	110.20	34.99	39.98	260.54
CLI	343	99.99	0.97	96.92	102.15
DCLI	343	0.0018	0.1626	-0.5612	0.4854

**Note:** CCC is the consumer confidence index, general financial situation in Denmark; CCH denotes the consumer confidence index, households financial situation 12 months ahead; EPU is the economic policy uncertainty index; CLI is the composite leading indicator; DCLI is the change in CLI.

than about the future Danish economy in general over the sample, see Table 2. We also find, in Table 3 that the change in the leading indicator is more correlated to CCC than to CCH.

The last columns of Table 3 show the first order autocorrelation of each time series including the 95 percent confidence bands. All series are autocorrelated but it is only the composite leading indicator that shows indications of possible random walk behavior. Both the level and the change are highly persistent and it is an open question whether these series contain random walks or not. Below, we will test for unit roots as well as for co-integration.

Table 3: Cross-correlations and first order autocorrelations.

	EPU	CCC	CCH	CLI	DCLI	$\rho_1$	[95 percent Conf. Interval]
EPU	1					0.557	[.446 .667]
CCC	-0.015	1				0.901	[.852 .950]
CCH	-0.320*	0.223*	1			0.690	[.615 .764]
CLI	-0.205*	0.281*	0.301*	1		0.985	[.965 1.005]
DCLI	-0.240*	0.294*	0.122*	0.078	1	0.963	[.928 .998]

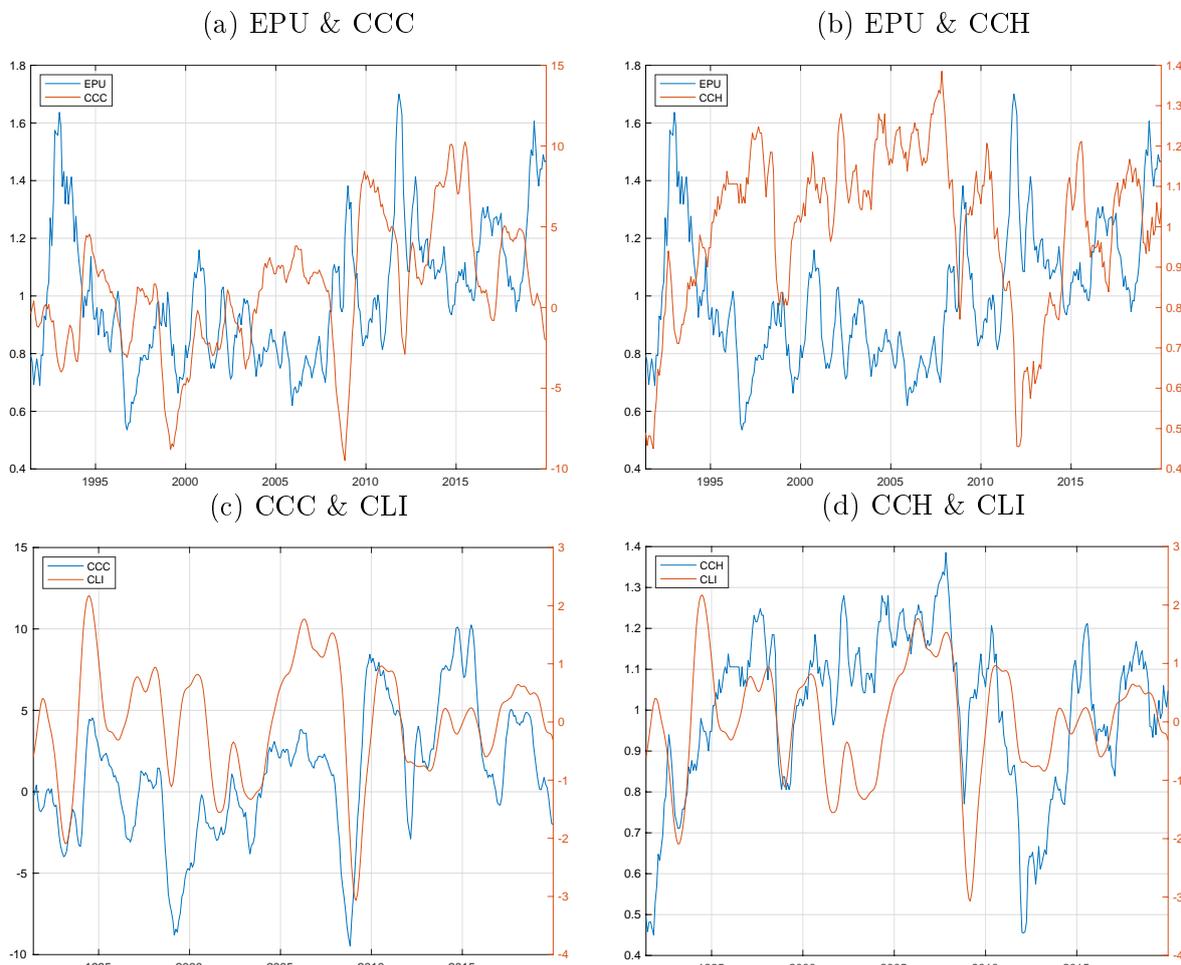
**Note:** \* denotes significance at the 10 percent level using Bonferroni-adjusted significance levels.

Figure 3 shows the two different consumer confidence series, EPU and the composite leading indicator. For illustrative reasons we have used a 5 months symmetric moving average filter, in the empirical analysis performed below we use the original data.<sup>16</sup> Figures (a) and (b) suggest that EPU is negatively correlated to household expectations about

<sup>16</sup>Figure B.3 in Appendix B shows the two unfiltered consumer confidence indices, households expectations about the Danish economy (CCC) 12 months ahead and their own financial situation (CCH) 12 months ahead. In Figure B.4 we show the EPU index and the composite leading indicator.

their own financial situation (CCH) but not necessarily to the financial situation of the Danish economy 12 months ahead. The contemporaneous correlation is significantly different from zero between EPU and CCH but not between EPU and CCC, see Table 3. It is surprising that there is no clear linkage between EPU and CCC. We would expect that households do not distinguish between their own financial situation from that of the Danish economy. The lower two graphs showing the two consumer confidence indices and the composite leading indicator suggest a general pattern, consumer confidence is highly positively correlated to the leading indicator, a conclusion also supported by the contemporaneous correlations, see Table 3. The leading indicator seems to be a good predictor of consumer confidence, a result consistent with previous results.

Figure 3: EPU, consumer confidence and composite leading indicator, 5 months symmetric moving average filtered data.



**Note:** EPU and the two consumer confidence indices are filtered using a 5 months symmetric moving average filter. The composite leading indicator is unfiltered.

In the next section we model the joint behavior of EPU, consumer confidence and the composite leading indicator. We will assume that these time series are generated by

a Vector Autoregressive (VAR) model allowing us to conduct tests both in the reduced form and in the structural form models. Our aim is to test whether there are statistically and economically significant relationships between EPU and consumer confidence.

## 5 Empirical model

We will now focus on the relationship between our extended EPU index constructed above and households expectations about their own financial situation 12 months ahead. In particular, we are interested in testing the hypothesis that intensified debate concerning economic policy forms the beliefs of households leading them to revalue their future financial situation. For this purpose we assume that a  $K$ -dimensional time series vector  $x_t$  comprised of EPU, consumer confidence index and its determinants can be modeled as the following Vector Moving Average (VMA) model

$$x_t = \nu + \sum_{j=1}^{\infty} \Phi_j \varepsilon_{t-j} \quad (1)$$

or, equivalently given by the Vector Autoregressive (VAR) model

$$A(L)x_t = \mu + \varepsilon_t \quad (2)$$

where  $\varepsilon_t$  is a white noise process with nonsingular covariance matrix  $\Sigma_\varepsilon$ ,  $\Phi(L)A(L) = I_K$ ,  $\Phi_0 = I_K$ ,  $\Phi_j = \sum_{i=1}^j \Phi_{i-j}A_i$ ,  $\nu = A(1)\mu$  and  $A(1) = (I_K - A_1 - \dots - A_p)$ .

Regardless of whether the model above is bivariate or higher-dimensional we can formulate hypotheses concerning the relationships between EPU, consumer confidence and other potential variables as restrictions on the moving average parameters in  $\Phi(L)$  (or equivalently on  $A(L)$ ). For example, if  $x_t = \begin{bmatrix} EPU_t & CCH_t \end{bmatrix}'$  standard Granger non-causality from  $EPU$  on  $CCH$  involves the restriction that the moving average parameters in the second row, first column are all equal to zero or, which is an identical restriction, that the parameters in the second row first column of the autoregressive polynomial are all equal to zero. A word of caution is warranted when using the term Granger non-causality. If, for example,  $EPU_t$  can be predicted more efficiently when also taking into account  $CCH_t$ , then  $CCH_t$  is said to Granger cause  $EPU_t$ . We cannot infer whether  $EPU$  causes  $CCH$  in the literally sense using this test, we can only infer that one variable can be forecasted more efficiently when also using historical values of the other variable.

In higher-dimensional systems we need to put restrictions on the moving average parameters (Lütkepohl, 1993; and Dufour and Renault, 1998).<sup>17</sup> It can be shown, as is

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<sup>17</sup>The distribution of the Wald test is derived in Lütkepohl (1993) where it is shown that a test for

done in these papers, that any indirect effects from a third variable is not included when testing parameters in  $A(L)$ . A test must therefore be conducted on parameters in  $\Phi(L)$ . Since many papers only consider restrictions on the autoregressive parameters in  $A(L)$  even in higher dimensional systems. As is shown in Lütkepohl (1993) Proposition 1, we only need to consider restrictions on the first  $p(K - 1)$  parameters in  $\Phi(L)$ .

Other interesting hypotheses from our perspective is on the accumulated impulse response function. The long-run multiplier  $\Psi_\infty \equiv \sum_{j=0}^{\infty} \Phi_j = A(1)^{-1}$ . Since these hypotheses involve the total effect of a shock to one of the variables in the system it may be of interest also to test the direct effect through hypotheses on  $A(L)$  or on  $A(1)$ . We test whether the relevant parameters in the long-run multipliers, the direct multiplier  $A(1)$  or the total long-run multiplier  $C(1)$  are equal to zero.

In addition to these tests applied on the reduced form VAR model, we introduce restrictions in order to identify a structural form VAR model. Consider the following structural form of the VMA model in equation (1). Let  $P$  be a  $K \times K$  matrix such that the VMA model can be written as

$$x_t = \nu + \sum_{j=0}^{\infty} \Phi_j \varepsilon_{t-j} = \nu + \sum_{j=0}^{\infty} \Phi_j P^{-1} P \varepsilon_{t-j} = \nu + \sum_{j=0}^{\infty} \Theta_j \omega_{t-j} \quad (3)$$

where we have defined the structural shocks as  $\omega_{t-j} = P \varepsilon_{t-j}$  and the structural impulse responses  $\Theta_j = \Phi_j P^{-1}$ . Since the model is found to be stable, we let  $P$  be a lower triangular Choleski decomposition of  $\Sigma_\varepsilon$  such that  $\Sigma_\varepsilon = PP'$ . We also normalize the structural shocks such as  $\mathbb{E}(\omega_t \omega_t') \equiv \Sigma_\omega = I_K$  such that the impulse responses represent the effect of a one standard deviation shock.

In all our models we assume that shocks to consumer confidence cannot affect EPU in the first period whereas shocks to EPU are allowed to affect CCH in the first period. This implies that we order the variables by placing  $EPU_t$  as the first variable in  $x_t$  in the bivariate models. When adding the composite leading indicator, we assume that shocks to  $EPU_t$  and consumer confidence cannot affect the leading indicator in the first period. We retain the order of consumer confidence and  $EPU_t$  as in the bivariate model.

## 6 Empirical analysis

### 6.1 Reduced form VAR analysis

In this section we will apply the Granger non-causality tests discussed in the previous section. In particular, we will test for direct and total Granger non-causality (restrictions

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total Granger non-causality is  $\chi^2$  distributed with  $p(K - 1)$  degrees of freedom.

on the autoregressive lag polynomial  $A(L)$  and on the moving average lag polynomial  $\Phi(L)$ ) and tests of direct and total neutrality (restrictions on the matrix  $A(1)$  and on the matrix  $\Phi(1)$ ). Before we can perform such a test, we need to determine the lag length in the VAR model. We do this in two steps. First we compute various information criteria (Akaike, Schwarz, Hannan-Quinn). This leads us to a preferred lag length. Then we use multivariate tests for autocorrelation in the residuals. Starting with the minimum lag length suggested by the information criteria we test for autocorrelation in the residuals for a lag order of 1 to 6 using a multivariate LM test. If the p-values on any of these suggest a rejection at the 10 percent level, we add one lag to the VAR model and test for autocorrelation in the residuals again. This procedure is repeated until p-values are all greater than 0.10. Applying this procedure we find that the lag lengths shown in Table B.1 in Appendix B.

One concern in applied time series analysis is the presence of unit roots and cointegration. For this purpose we apply the Johansen method testing for cointegration.<sup>18</sup> In Table 4 we report Johansen trace tests. While these tests suggest that we always can reject cointegration at the 5 percent level we note that the largest modulus is close to unity. The time series are persistent which is also evident in Table 3 above reporting first order autocorrelation of the data. However, as the trace test strongly suggest that the VAR models are stable and that the largest modulus is below unity, we continue under the assumption that the levels VAR model is stable.

Table 4: Johansen trace test in bivariate, trivariate and four-variable VAR systems.

Variables	Lag length	Modulus	Johansen trace test		
			$r = 0$	$r = 1$	$r = 2$
CCC & EPU	7	0.946	23.44***	7.28***	
CCH & EPU	6	0.956	35.60***	6.05**	
CCC, EPU & CLI	7	0.948	72.99***	24.12***	7.28***
CCH, EPU & CLI	7	0.959	86.57***	35.25***	5.64**

**Note:** Eigenvalue denotes the largest modulus in a levels VAR model. \*\*\* indicates significance at the 1 percent level and \*\* at the 5 percent level.

Let  $x_t = \begin{bmatrix} EPU_t & CCC_t \end{bmatrix}'$ , then we can test for Granger non-causality from  $EPU_t$  to  $CCC_t$  by testing whether the parameters  $A_{12,j} = 0$  for  $j = 1, \dots, p$  (since the model is bivariate this is identical to testing whether  $\Phi_{12,j} = 0$  for  $j = 1, \dots, p(K-1)$ ). In trivariate VAR models the former test is for direct Granger non-causality whereas the latter refers to total Granger non-causality. We may also be interested in long-run neutrality. This is a test whether  $A_{12}(1) = 0$  (for direct neutrality) and  $\Phi_{12}(1) = 0$  (for

<sup>18</sup>Note that we do not need any assumptions about unit roots to conduct this test, the only requirement is that at least one variable contains a unit root.

total neutrality). We use a standard Wald test to perform tests of these hypotheses. The long-run neutrality tests (the hypotheses that  $\Sigma A(i, j) = 0$  and  $\Sigma C(i, j) = 0$ ) are both  $\chi^2$  distributed with 1 degree of freedom whereas the test of the null hypothesis of no direct Granger non-causality ( $A(i, j) = 0$  for all  $j = 1, \dots, p$ ) is  $\chi^2$  distributed with  $p$  degrees of freedom and the test of the null hypothesis of no total Granger non-causality ( $C(i, j) = 0$  for  $j = 1, \dots, p(K - 1)$ ) is  $\chi^2$  distributed with  $p(K - 1)$  degrees of freedom.

Table 5 reports the results. We use the lag lengths determined by our procedure outlined above (and reported in Table B.1 in Appendix B). Both bivariate and trivariate VAR/VMA models are considered and the first hypothesis tested is whether  $CCC_t$  does not Granger cause (GC)  $EPU_t$  (denoted as CCC GC EPU in the table). Then we test the reverse hypothesis and use the same type of notation in the Table. Let us first look at the results testing whether  $EPU_t$  does not Granger cause consumer confidence index. This null hypothesis is rejected at the 10 percent level for both  $CCC_t$  and  $CCH_t$  in bivariate VAR models. These results suggest that news reporting on economic policy as captured by our  $EPU$  measure precede consumer expectations about their own economy as well as for the Danish economy over the next year. Turning to the question whether there is bi-directional causality we find no evidence for  $CCH$  but the null hypothesis that  $CCC_t$  precede  $EPU_t$  can be rejected at the 10 percent level. This latter result indicate that the two variables are related and that they both contain useful information when predicting one another.

Extending the model by adding the change in the composite leading indicator (DCLI) affect these results. There is still evidence of direct bi-directional causality between EPU and CCC but we cannot reject the null hypothesis of bi-directional causality between EPU and CCH at the 10 percent level. However, the sum of both the autoregressive and moving average coefficients are significantly different from zero. These results are unaffected by the inclusion of European EPU as can be seen in the last four rows of Table 5.

The overall results in Table 5 suggest that it is more likely that  $EPU_t$  precedes consumer confidence than the opposite. There is a bi-directional linkage between  $EPU$  and households expectations about the future Danish economy in the bivariate model and a direct, but not total, effect in the trivariate model. Our conclusion from these tests is that there is a relationship between EPU and the consumer confidence index in reduced form models. In the next section we turn to a structural VAR model estimating the impulse responses of the variables and the relative importance of EPU for consumer confidence.

Table 5: Granger non-causality and long-run neutrality tests in reduced form VAR models.

Variables in VAR	Hypothesis	$\Sigma A(i, j) = 0$	$\Sigma C(i, j) = 0$	$A(i, j) = 0$	$C(i, j) = 0$
EPU & CCC	CCC GC EPU	0.386	0.420	0.056	0.060
	EPU GC CCC	0.427	0.457	0.051	0.052
EPU & CCH	CCH GC EPU	0.195	0.277	0.776	0.776
	EPU GC CCH	0.007	0.055	0.088	0.084
EPU & CCC & DCLI	CCC GC EPU	0.288	0.319	0.035	0.204
	EPU GC CCC	0.291	0.277	0.076	0.322
EPU & CCH & DCLI	CCH GC EPU	0.131	0.303	0.389	0.921
	EPU GC CCH	0.010	0.083	0.101	0.507
EPU & CCC & DCLI & EPUEU	CCC GC EPU	0.576	0.358	0.127	0.528
	EPU GC CCC	0.890	0.703	0.043	0.410
EPU & CCH & DCLI & EPUEU	CCH GC EPU	0.060	0.683	0.174	0.982
	EPU GC CCH	0.018	0.119	0.309	0.939

**Note:**  $\Sigma A(i, j) = 0$  and  $\Sigma C(i, j) = 0$  refers to tests of long-run neutrality whereas  $A(i, j) = 0$  is the hypothesis of direct Granger non-causality and  $C(i, j) = 0$  is the test for total Granger non-causality. Only p-values are shown in the table. All tests are  $\chi^2$  distributed with 1 degree of freedom ( $\Sigma A(i, j) = 0$  and  $\Sigma C(i, j) = 0$  tests), or  $p$  degrees of freedom ( $A(i, j) = 0$  for all  $j = 1, \dots, p$ ) or  $p(K - 1)$  degrees of freedom ( $C(i, j) = 0$  for  $j = 1, \dots, p(K - 1)$ ). The lag lengths  $p$  are provided in Table B.1 in Appendix A.

## 6.2 Structural VAR analysis

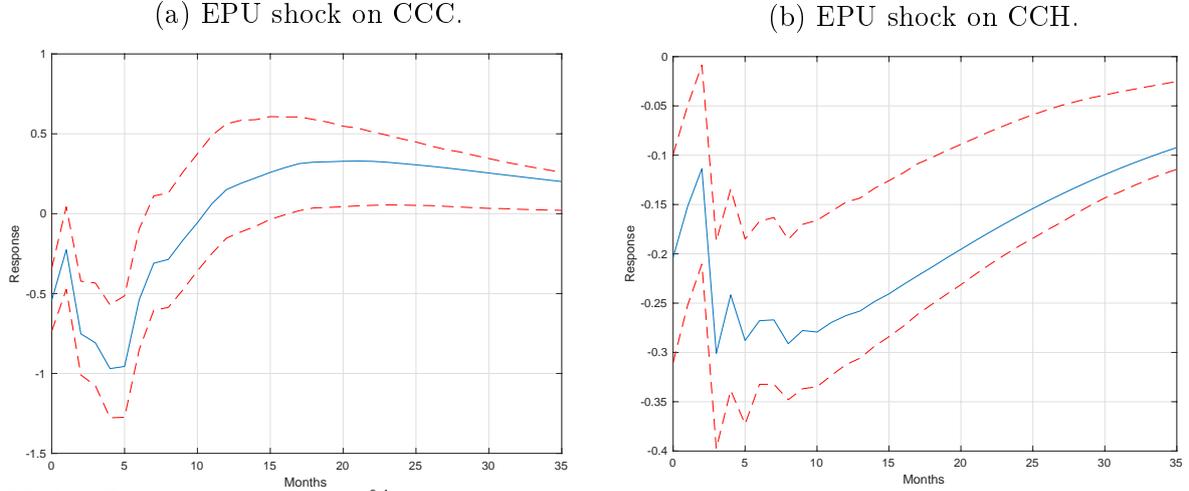
In this section we identify the VAR models estimated above using a Choleski decomposition with the ordering of the variables as follows; in the bi-variate cases we define the time series vector  $x_t = \begin{bmatrix} EPU_t & CCH_t \end{bmatrix}'$  and a model where we replace  $CCC_t$  with  $CCH_t$ .

Consider first the impulse response functions. The impulse response of CCC and CCH to a one standard deviation shock to EPU is shown in Figure 4 together with the 68 percent confidence bands computed using non-parametric bootstrap with 1000 trials.<sup>19</sup> The left hand figure (Figure 4a) showing the impulse response of CCC suggest that an increase in the intensity of public debate concerning economic policy reduces consumer confidence significantly in the short-run (the first 6 months). Then there is an overshooting effect where the response is significantly positive. In the long-run, CCC returns to its initial level since the VAR model is stable. The right-hand side graph (Figure 4b) shows that households perception about their own economy significantly falls when economic policy uncertainty increases. The effect is negative over both the short- as well as over the medium-term. The effect is not as strong as for households expectations about the Danish

<sup>19</sup>The impulse response of EPU to CCH shocks is insignificant and the forecast error variance decomposition suggest that only 2% of the forecast error variance of EPU is explained by CCH. These results are fully consistent with the Granger non-causality tests indicating a one-way causal link from EPU on CCH.

economy but much more persistent.

Figure 4: Impulse response of consumer confidence to a one standard deviation shock to *EPU* in a bivariate VAR model.



**Note:** Dotted lines show 68% confidence bands computed using non-parametric bootstrap with 1000 trials.

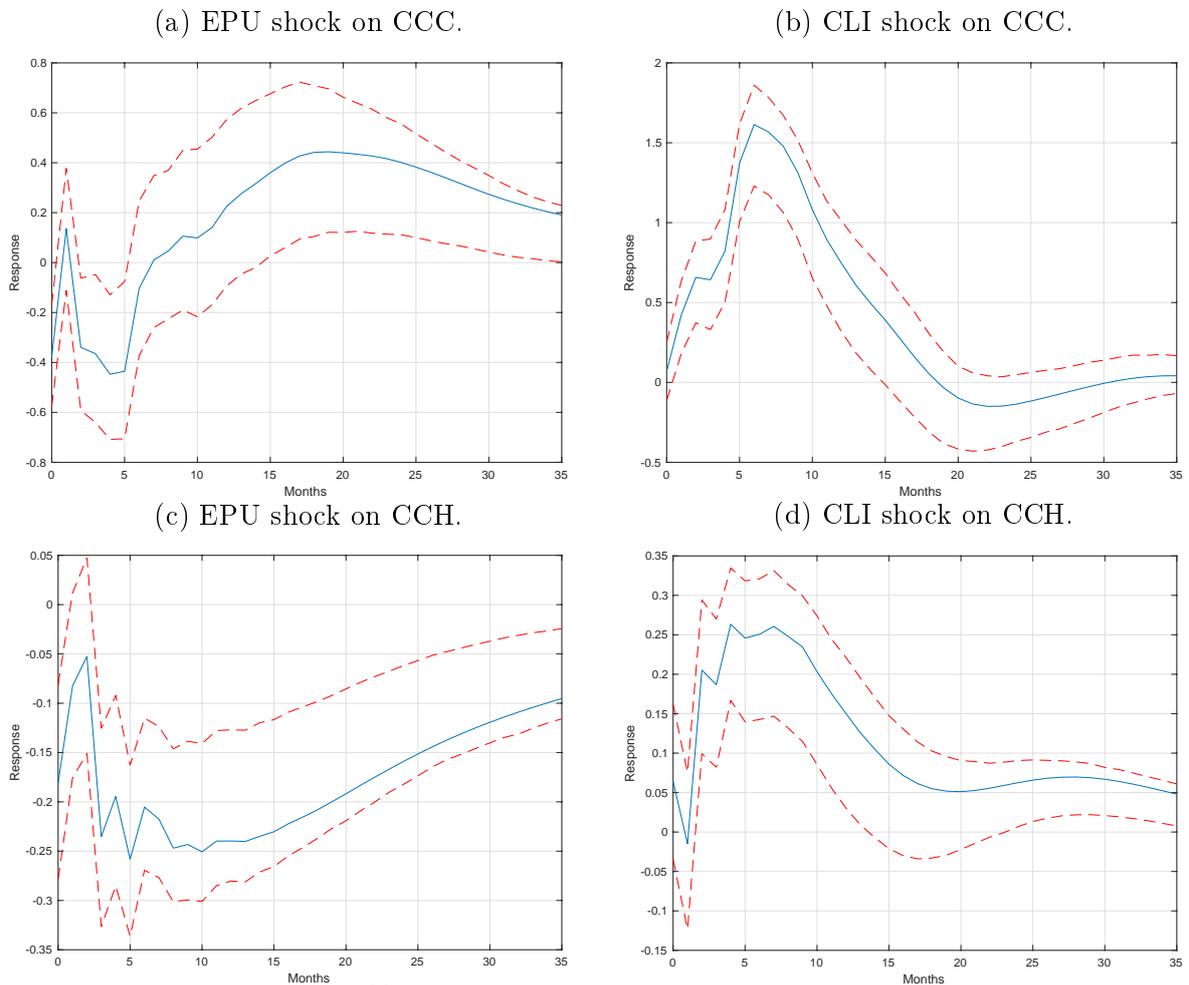
These results carry over to the trivariate models where we add the composite leading indicator. In this case we define the time series vector as  $x_t = \begin{bmatrix} CLI & EPU_t & CCH_t \end{bmatrix}'$  and use the corresponding lower triangular Cholesky decomposition to identify the structural model. Table 4 showed that we can always reject cointegration using the Johansen trace test in the trivariate system and that the levels VAR model is stable regardless of the consumer confidence index we use.

The impulse responses of CCC and CCH to a one standard deviation shock to *EPU* (the left hand side graphs) and to a one standard deviation shock to *CLI* (the right hand side graphs) in Figure 5 together with 68 percent confidence bands computed using non-parametric bootstrap with 1000 trials. Again we find that there is a significant and negative impact on consumer confidence from shocks to *EPU*. The upper left hand side graph (5a) showing the impulse response of CCC to an *EPU* shock suggests that consumers after an initial negative response turns more and more positive concerning the outlook of the Danish economy. After one year the impulse response is positive and significant. The impact of *EPU* shocks on consumers expectation about their own financial situation 12 months ahead, is always negative and significant regardless of the horizon (Figure 5c). There seems to be a significant difference between household expectations about their own situation and their expectation about the future Danish economy, the same pattern we found in the bivariate case.

The right hand side graphs in Figure 5 (Figures 5b and 5d) suggest that if the composite leading indicator increases, consistent with a better outlook for the Danish economy,

then consumers become more positive concerning both their own economic situation and the Danish economy. The responses are significant after the initial response. The impact is stronger on expectations about the Danish economy than on households own economy but the medium-term effect ceases to be significant after 14 months. The overall results support the idea that intensified news reporting about economic policy as captured by our EPU measure significantly lowers household expectations measured by consumer confidence indices and that a more optimistic outlook for the Danish economy as captured by the leading indicator leads households to become more optimistic.

Figure 5: Impulse response of consumer confidence to a one standard deviation shock to EPU and to a one standard deviation shock to CLI.



**Note:** Dotted lines show 68% confidence bands computed using non-parametric bootstrap with 1000 trials.

Next we turn to the question whether these structural shocks explain large portions of the the variation in consumer expectations. Table 6 reports variance decompositions in both the bivariate and the trivariate models together with 95 percent confidence bands re-

ported within parentheses below each estimate computed using non-parametric bootstrap with 1000 trials. Consider first the results from the bivariate models shown in the first two columns of Table 6. EPU shocks explain a sizable share of households expectations about their own economy 12 months ahead (CCH) but much smaller shares of their expectations about the Danish economy. Note that the remaining part of the forecast error variance is explained by own shocks to consumer confidence. At the 1 year horizon, EPU shocks explain 15 percent of the forecast variance of consumer confidence which rises to almost 28 percent at the 3 year horizon. In this respect, EPU shocks have a significant negative impact on consumer confidence and explain a fairly large part of the variation. The first column reporting the results for the VAR model with household expectations about the future Danish economy suggest that less than 10 percent of the variation in consumer confidence is explained by EPU shocks. There is a distinct difference between household expectation about their own economy and about the Danish economy.

The two right hand side columns in Table 6 report forecast error variance decomposition of consumer confidence to EPU shocks together with 95 percent confidence bands reported within parentheses below each estimate computed using non-parametric bootstrap with 1000 trials. In the table we only report the share of the forecast error of consumer confidence explained by EPU shocks. Comparing the bivariate and the trivariate cases we find that extending the models by adding CLI does not seem to affect results. The shares of the forecast error variance fall somewhat but the main conclusion is unaffected. EPU shocks explain larger portions of CCH than of CCC.

The VAR analysis also allows us to estimate forecast error variance decompositions of consumer confidence and EPU to a shock to CLI. Such an analysis is interesting by itself as it could reveal whether the composite leading indicator signals an upturn in the Danish economy is of importance for households when they form their expectations and also if this triggers an intensified economic policy debate. Soroka et.al. (2015) and van Dalen et.al. (2017) analyze the effects that the economy has on newspaper reporting. Our structural VAR model can shed light on this question also. Figure 6 shows the impulse response of EPU to a positive shock to the composite leading indicator in our two trivariate VAR models. According to these two graphs, EPU will fall significantly in case the leading indicator indicates an upturn in the economy. A more positive development in the economy generates less newspaper reporting and household expectations about their own as well as the Danish economy become more positive implying increasing consumer confidence. These results are consistent with the findings in Soroka et.al. (2015) where an upward change in the leading indicator leads to a decrease in the number of articles covering economic issues. For Danish data, van Dalen, de Vreese and Albæk (2017) show that negative news from the composite leading indicator increases the negative tone in newspaper articles and articles became more visible. Other research within this literature

Table 6: Forecast error variance decomposition of consumer confidence. The share explained by EPU shocks.

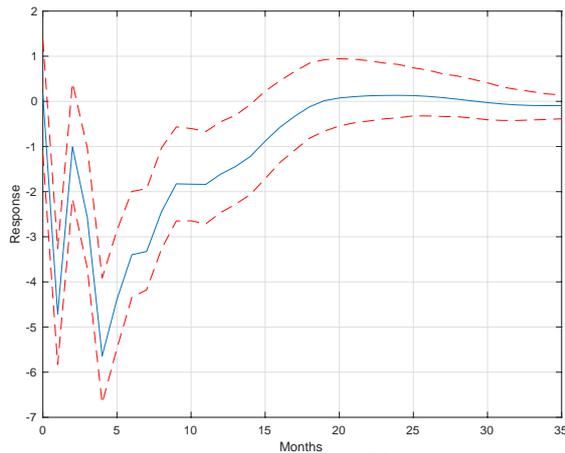
Horizon	Bivariate VAR		Trivariate VAR	
	CCC	CCH	CCC	CCH
1	0.019	0.012	0.01	0.01
	[0.001 0.061]	[0.000 0.043]	[0.000 0.044]	[0.000 0.043]
2	0.014	0.016	0.007	0.009
	[0.002 0.054]	[0.001 0.061]	[0.002 0.034]	[0.001 0.049]
6	0.061	0.059	0.017	0.028
	[0.010 0.173]	[0.019 0.151]	[0.005 0.086]	[0.008 0.096]
12	0.052	0.12	0.011	0.092
	[0.016 0.185]	[0.027 0.264]	[0.006 0.093]	[0.026 0.224]
18	0.052	0.159	0.019	0.132
	[0.021 0.191]	[0.031 0.332]	[0.008 0.144]	[0.030 0.291]
24	0.058	0.181	0.031	0.154
	[0.023 0.213]	[0.034 0.368]	[0.009 0.187]	[0.032 0.324]
30	0.063	0.193	0.039	0.166
	[0.023 0.232]	[0.035 0.387]	[0.009 0.207]	[0.032 0.342]
36	0.066	0.199	0.042	0.173
	[0.024 0.237]	[0.035 0.401]	[0.009 0.217]	[0.032 0.356]

**Note:** 95 percent confidence bands computed using non-parametric bootstrap with 1000 trials are shown within parentheses below each estimate.

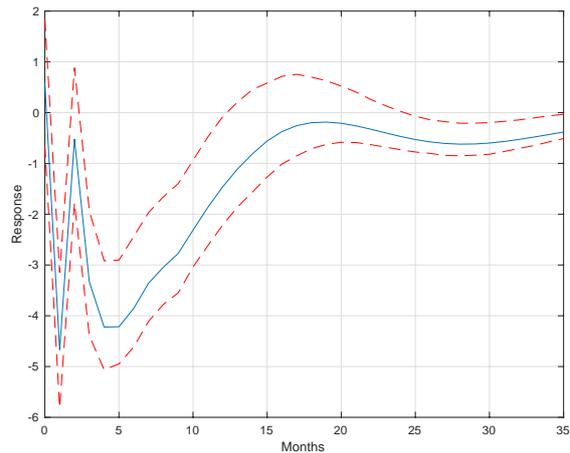
studying other countries also support these results (see for example Ju, 2008 and Fogarty, 2005).

Figure 6: Impulse response of EPU to a one standard deviation shock to CLI.

(a) CLI shock on EPU (VAR with CCC).



(b) CLI shock on EPU (VAR with CCH).



**Note:** Dotted lines show 68% confidence bands computed using non-parametric bootstrap with 1000 trials.

Table 7 reports the forecast error variance decomposition of consumer confidence and

Table 7: Forecast error variance decomposition of consumer confidence and EPU in trivariate VAR models. The share explained by shocks to CLI.

Horizon	CCC	EPU	CCH	EPU
1	0.002 [0.000 0.024]	0 [0.000 0.019]	0.001 [0.000 0.022]	0.001 [0.000 0.017]
2	0.002 [0.000 0.030]	0.031 [0.007 0.083]	0.001 [0.000 0.024]	0.03 [0.007 0.077]
6	0.073 [0.026 0.167]	0.091 [0.039 0.181]	0.041 [0.010 0.114]	0.075 [0.031 0.160]
12	0.118 [0.039 0.233]	0.126 [0.052 0.251]	0.082 [0.016 0.211]	0.114 [0.043 0.246]
18	0.127 [0.041 0.270]	0.131 [0.052 0.273]	0.084 [0.019 0.229]	0.114 [0.044 0.256]
24	0.127 [0.041 0.275]	0.131 [0.054 0.277]	0.082 [0.019 0.232]	0.112 [0.044 0.251]
30	0.130 [0.043 0.279]	0.131 [0.054 0.277]	0.083 [0.019 0.241]	0.112 [0.044 0.252]
36	0.133 [0.044 0.285]	0.133 [0.054 0.279]	0.084 [0.019 0.245]	0.113 [0.045 0.254]

**Note:** 95 percent confidence bands computed using non-parametric bootstrap with 1000 trials are shown within parentheses below each estimate.

EPU explained by CLI shocks together with 95 percent confidence bands reported within parentheses below each estimate computed using non-parametric bootstrap with 1000 trials. The tables reveals that CLI shocks are relatively important for both consumer confidence and EPU. The effect is stronger on CCC than on CCH but the effect on EPU remains fairly constant across the two models. At the 1 year horizon, CLI shocks explain almost 19 (13 percent) percent of the variation in CCC (CCH) and around 12 percent of the variation in EPU. This indicates that both consumers and newspaper editors pay attention to the general outlook of the Danish economy when forming expectations and when initiating a public debate on economic policy.

The general conclusion that can be drawn from this empirical analysis is that consumers are significantly affected by the economic policy debate in newspapers. A more intensified debate reflecting increased uncertainty forces households to lower their expectations about the future state of the overall Danish economy as well as their own financial situation in the coming year. The effect is more pronounced on households expectations about their own economy where 11-13 percent of the variation in consumer confidence is explained at the one-year horizon. These shares remain constant at the 3 year horizon. A better outlook for the Danish economy is more important for consumer confidence than for EPU, even though the differences are fairly small in general. These results are found both in the reduced form VAR model as well as in the structural VAR model and are con-

sistent with previous results suggesting a link from newspaper reporting onto consumer confidence.

### 6.3 External influences

Denmark is a small open economy tied to the Euro Area through its fixed exchange rate regime. On this background, the Danish economy is dependent on developments in the EU. Economic uncertainty in the Euro Area may spillover to the Danish economy and to household perceptions about their own future economy as well as the Danish economy in general. Furthermore, economic uncertainty in the Euro Area may spillover to and generate uncertainty in the Danish economy. To examine these issues we now extend our tri-variate VAR model analyzed in the previous section by adding a measure of economic policy uncertainty in the EU. This measure was developed by Baker et.al. (2016) and is published on the economic policy uncertainty homepage. The correlation coefficient is relatively large (0.5 and significant at the 5 percent level) indicating that economic policy uncertainty in EU and in the Danish economy are associated.

Let  $x_t = \left[ EPU_t^{EU} \quad CLI_t \quad EPU_t \quad CCC_t \right]'$  where  $EPU_t^{EU}$  denotes economic policy uncertainty index for the EU. Using the same procedure to find the lag length as above we find that 6 (7) lags is necessary to remove autocorrelation in the residuals in the VAR model with CCC (CCH).

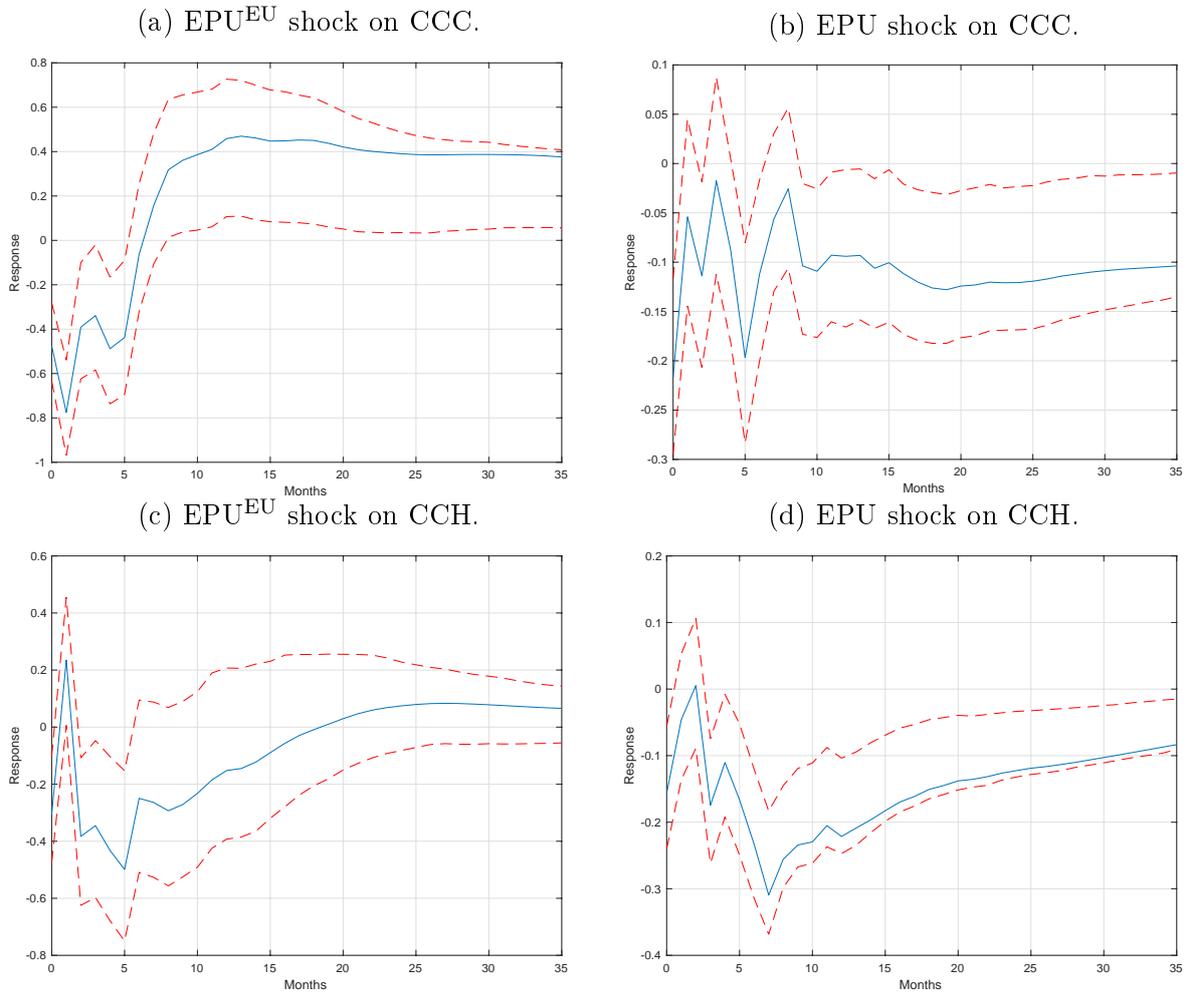
Turning to the structural model identified using a Cholesky decomposition as above and placing  $EPU^{EU}$  as the first variable and retaining the order of the other variables implying that no other shocks except its own shock affect  $EPU^{EU}$  in the first period. All shocks are allowed to affect consumer confidence in the first period. With these identifying assumptions we identify the four structural shocks allowing us to analyze the effects of both external and internal effects of economic policy uncertainty on the consumer confidence.

Figure 7 shows the impulse responses of the two consumer confidence indices to a one standard deviation shock to  $EPU^{EU}$  and to  $EPU$  and the 68% confidence bands computed using non-parametric bootstrap with 1000 trials. The results are consistent with what we found in bivariate and trivariate models above, consumer confidence declines if Danish or EU economic uncertainty increases. However, EU economic policy shocks have only short-run effects. significance up to 5 months. The effects from Danish economic policy uncertainty shows a high degree of persistence and is always significant.

There is a much stronger effect on consumers expectations about their own economy than expectations about the future of the Danish economy, see Figures 7b and 7d. The opposite holds for the effects of EU economic policy uncertainty. In this case there is a relatively strong and significant negative effect on consumer confidence about the Danish economy the first five months before the response turns significantly positive, see Figure

7a. By contrast, households do not seem to regard EU economic policy uncertainty as important for their own future economy. These differences, again, reflects the surprisingly low correlation between the two measures of consumer confidence.

Figure 7: Impulse response of consumer confidence to a one standard deviation shock to economic policy uncertainty.

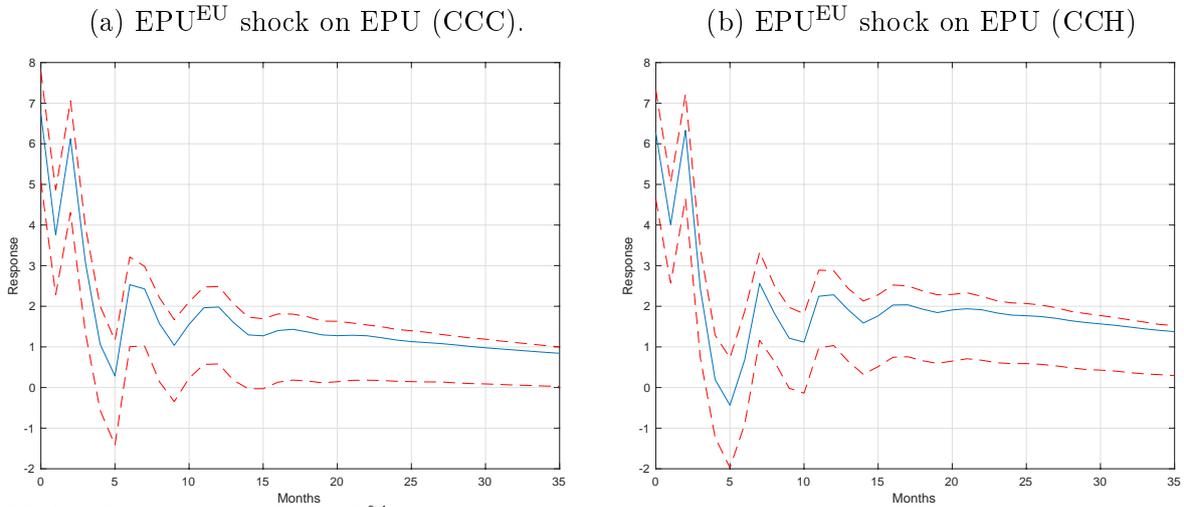


**Note:** Dotted lines show 68% confidence bands computed using non-parametric bootstrap with 1000 trials.

Is Danish economic policy uncertainty affected by EU economic policy uncertainty? To shed light on this question we show the impulse response of EPU to a one standard deviation shock to  $EPU^{EU}$  and the 68% confidence bands computed using non-parametric bootstrap with 1000 trials. An increase in EU economic policy uncertainty increases Danish economic policy uncertainty significantly regardless of the measure of consumer confidence we include in our VAR model. The size of the effects are comparable and the effect is significant even in the medium term. Given the fact that Denmark has a fixed exchange rate policy versus the Euro, it is not surprising that the economic policy

debate in Europe affects Danish newspaper reporting and thereby the Danish uncertainty measure.

Figure 8: Impulse response of EPU to a one standard deviation shock to EPU-EU.



**Note:** Dotted lines show 68% confidence bands computed using non-parametric bootstrap with 1000 trials.

To illustrate the relative importance of external and internal economic policy uncertainty we turn to estimates of the forecast error variance in Table 8. In columns denoted (a) and (c) we report the shares of consumer confidence explained by shocks to  $\text{EPU}^{\text{EU}}$  and EPU. Columns denoted (b) and (d) show the shares of EPU explained by  $\text{EPU}^{\text{EU}}$ . Confidence bands computed using non-parametric bootstrap with 1000 trials are shown within parenthesis below each estimate. The results in Table 8 are consistent with the findings above in bivariate and trivariate VAR models. Danish economic policy uncertainty has a stronger effect on consumer expectations about their own economy than on the Danish economy. At the one year horizon, for example, only 2 percent of CCC is explained by EPU whereas these shocks explain about 8 percent of CCH. Another striking result is that EU economic policy uncertainty explains large portions of household expectations about the Danish economy as well as on expectations about their own economy. At the longer horizons, however, we find that EPU shocks are much more important for expectations about the household's own economy. Shocks to the leading indicator exert almost the same influence on the two consumer confidence measures (not reported in the Table). At the one year horizon, this shock explains about 12 percent of the forecast error variance of consumer confidence.

Columns (b) and (c) report the shares of Danish economic policy uncertainty explained by  $\text{EPU}^{\text{EU}}$ . Here we note that there is a spillover effect, about 12 percent of the forecast error variance of EPU is explained by  $\text{EPU}^{\text{EU}}$ . Overall, we note that the confidence bands are quite wide regardless of how we formulate the VAR models suggesting that the

impact could be much stronger than what is indicated by the point estimates in the tables reporting forecast error variance decompositions.

The findings in this section suggest that there are significant spillover effects from EU to the Danish economy. An increase in economic policy uncertainty in EU tend to increase uncertainty in the Danish economy. Households pay attention to these potential spillover effects by revising their expectations, in particular expectations about the Danish economy. It is surprising that increases in uncertainty in the Danish economy do not affect household expectations about the Danish economy. The correlation between uncertainty in EU and in the Danish economy is quite large whereas it is low between the two confidence measures.

Table 8: Forecast error variance decomposition of consumer confidence and Danish economic policy uncertainty in four-variable VAR models. The share explained by shocks to economic policy uncertainty.

Horizon	(a) Shares of CCC		(b) Shares of EPU		(c) Shares of CCH		(d) Shares of EPU	
	$EPU^{EU}$	EPU	$EPU^{EU}$	EPU	$EPU^{EU}$	EPU	$EPU^{EU}$	EPU
1	0.016	0.007	0.074	0.014	0.014	0.007	0.065	
	[0.001 0.055]	[0.000 0.035]	[0.029 0.143]	[0.000 0.052]	[0.000 0.038]	[0.020 0.129]		
2	0.036	0.007	0.087	0.014	0.007	0.083		
	[0.006 0.099]	[0.001 0.029]	[0.039 0.164]	[0.001 0.057]	[0.000 0.042]	[0.031 0.153]		
6	0.033	0.018	0.119	0.024	0.021	0.118		
	[0.007 0.120]	[0.005 0.088]	[0.061 0.211]	[0.007 0.090]	[0.008 0.084]	[0.059 0.209]		
12	0.030	0.018	0.125	0.027	0.079	0.120		
	[0.014 0.112]	[0.005 0.124]	[0.063 0.235]	[0.010 0.114]	[0.022 0.185]	[0.062 0.221]		
18	0.044	0.017	0.132	0.034	0.104	0.135		
	[0.015 0.165]	[0.006 0.143]	[0.063 0.257]	[0.012 0.145]	[0.023 0.229]	[0.064 0.253]		
24	0.056	0.017	0.138	0.046	0.115	0.151		
	[0.017 0.205]	[0.007 0.148]	[0.063 0.269]	[0.014 0.183]	[0.023 0.248]	[0.067 0.275]		
30	0.065	0.017	0.143	0.055	0.122	0.163		
	[0.019 0.227]	[0.007 0.155]	[0.063 0.281]	[0.014 0.210]	[0.024 0.256]	[0.070 0.299]		
36	0.074	0.017	0.146	0.063	0.125	0.171		
	[0.020 0.245]	[0.007 0.157]	[0.063 0.284]	[0.015 0.233]	[0.025 0.266]	[0.070 0.314]		

**Note:** 95 percent confidence bands computed using non-parametric bootstrap with 1000 trials are shown within parentheses below each estimate.

## 7 Disaggregated consumer confidence data

This section focuses on consumer sentiment measured as the household expectation of their own financial situation 12 months ahead where the respondents have been categorized according to five criteria: gender, income, occupation, education and age. The

data is downloaded from Eurostat and covers the sample 1991:1-2019:7.<sup>20</sup> Income of the household is divided into quartiles. Total employment is divided into five groups: Self-employed and professionals; self-employed farmers; clerical and office employees; skilled manual workers; other manual workers; and other occupations such as unpaid work experience. A separate group consists of unemployed. Employment is also divided into full-time and part-time workers. There are three different levels of education: Primary; secondary; and further. Respondents are also categorized according to age: 16-29; 30-49; 50-64; and 65+. Unfortunately it is not possible to divide the data further since Eurostat does not publish the underlying individual data.

Descriptive statistics are shown in Table D.1. There are a number of interesting patterns that emerge from this table. Males seem to be more optimistic about the future financial situation than females, the mean is significantly higher for males than for females (the p-value of a standard t-test allowing for different standard deviations indicates significance at the 1 percent level). However, the standard deviation of consumer sentiment is higher for females (the p-value of a test whether the standard deviations are equal is 0.014). Optimism is falling with age. Young respondents are significantly more optimistic than retired respondents who are on average pessimistic (the average is negative). Optimism is significantly increasing with education (all p-values testing the null hypothesis that the means are equal suggest a rejection at the 1 percent level). These results do not carry over to income levels where we find no significant differences in the mean confidence. A surprising result is that unemployed seem to be more optimistic about their own financial situation 12-months ahead than all workers except for self-employed and professionals. Otherwise, optimism is increasing with occupation status. A possible reason why unemployed are more optimistic than employed workers is that the majority of the unemployed belongs to the youngest age group. Using data downloaded from Denmark Statistic suggest that the unemployment rate among individuals of ages 15-24 is on average 10 percent over the period 2000-2018 whereas the unemployment rate falls to around 4 percent for the age group 45-54. Table D.1 shows that households in the first age group 16-29 are significantly more optimistic than all other age groups and this carries over to the group of unemployed respondents who are typically young.

In general, we find that consumer sentiments of households within each category are significantly positively correlated (these results are not shown for brevity but are available upon request from the authors.) One exception is that consumer sentiment for households with primary education is significantly negatively correlated with households with further education. The same holds for clerical and office employees and other occupations.

To analyze this disaggregated data further we estimate panel data regressions for each

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<sup>20</sup>The data on total employment only exists up until April 2016. Eurostat introduced a new categorization in May 2016.

category independently. The regression equation is specified as:

$$CC_{i,t} = \alpha_i + \beta_0 CC_{i,t-1} + \sum_{j=1}^N \beta_j D_{j,t} \times EPUDK_{i,t} + \beta_1 EPUEU_{i,t} + \beta_1 CLI_{i,t} + \varepsilon_{i,t} \quad (4)$$

where  $D_{j,t}$  is a dummy variable which is equal to 1 for group  $j$  and zero otherwise allowing us to formally test whether groups respond to changes in Danish economic policy uncertainty to the same extent. We include one lag of the consumer confidence index (CC) and the contemporaneous Danish economic policy uncertainty (EPUDK). We have experimented with the inclusion of lags of economic uncertainty but find that only the contemporaneous effect is significant. We also include the same controls as above when estimating reduced form and structural form VAR model, the composite leading indicator for Denmark (CLI) and the economic policy uncertainty index for EU (EPUEU).

We use fixed effects and report Driscoll-Kraay standard errors that are robust to autocorrelation, heteroscedasticity and cross-sectional dependence. The number of observations is relatively large ( $>304$ ) whereas the number of groups is small ( $<7$ ) which suggests that the dynamic panel data regression can be efficiently estimated using OLS.

The complete estimates are provided in Table D.2 in Appendix C including formal tests for autocorrelation, heteroscedasticity and cross-sectional dependence. The table only reports the total effect of each group within each category of respondents. As expected we find that significant parameters are always negative suggesting that increased economic policy uncertainty reduces the optimism of the respondents irrespective of what group they belong to. However, there are significant differences across groups of respondents. The Pesaran test suggest presence of cross-sectional dependence supporting our choice of Driscoll-Kraay standard errors. There are also signs of both autocorrelation and heteroscedasticity also suggesting the use of robust standard errors.

Figure 9 shows the marginal effect of economic policy uncertainty on household expectations about their own financial situation 12 months ahead. The graphs report the total effect including 95 percent confidence bands where all estimates are based on the results shown in Table D.2 in Appendix C.

First of all, we find that there is no gender effect, see Figure 9a. Males do respond in the same way to increased uncertainty as females do. The confidence band is somewhat wider for females than for males. We conclude that males tend to be more optimistic about their own future financial situation but are affected by increased uncertainty to the same degree as females. In Figure 9b we show the estimates dividing the sample into age groups. With the exception of 65+ we find a negative and significant effect of increased uncertainty. A formal test whether the responses are significantly different across age groups suggest that only the response of 65+ is significantly different.

Figure 9c suggest a u-formed pattern of the responses across income quartiles. The marginal effect of both the 1st and the 4th quartiles are insignificantly different from zero whereas the effect is negative and significant for the 2nd and 3rd quartiles. There are significant differences across households with different levels of education, see Figure 9d. Households with primary education do not respond significantly to increased uncertainty. We also find that those households having further education reacts significantly more to increased uncertainty than those households having secondary education.

The final two graphs in Figure 9 provide estimates of the marginal effect for different groups of workers, disaggregated into type of work and then aggregated into full-time and part-time workers. In the last graph we also include unemployed. Figure 9e suggests that less skilled workers respond more negatively to increased uncertainty than self-employed and professionals and self-employed farmers. When comparing full-time and part-time workers we find no significant effect whereas unemployed respond by lowering their own expectation significantly, see Figure 9f.

The empirical results illustrate that there are differences across several dimensions. Males are more optimistic about the future but an increase in uncertainty has a similar effect on both males and females. Households with the highest income do not respond to increased uncertainty whereas the level of education is of more importance for how households respond to increased uncertainty. Unemployed households are more negatively affected then those who are employed even though unemployed are more optimistic on average compared to those who have a job.

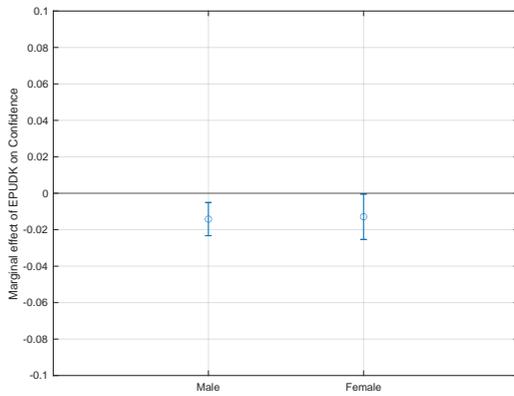
## 8 Conclusion

There is a growing number of papers constructing newspaper based indices reflecting economic policy uncertainty and the economic relevance of these indices is well-documented in the literature. We extend this literature in two ways. First, we derive the first monthly newspaper based economic policy uncertainty (EPU) index for Denmark. Earlier attempts to construct such an index for Denmark use a limited number of keywords and newspapers. Our index covers the main nationally distributed newspapers and an extended list of keywords. In particular, we extend the standard keywords suggested by Baker, Bloom and Davis (2016) by including keywords particular to the Danish economic debate and geographic location. Our constructed index is shown to capture main events and political debate in the Danish economy over the sample period 1991-2019, for example the banking crisis in the beginning of the 1990s, the Danish housing price bubble in 2007, and the European sovereign debt crisis.

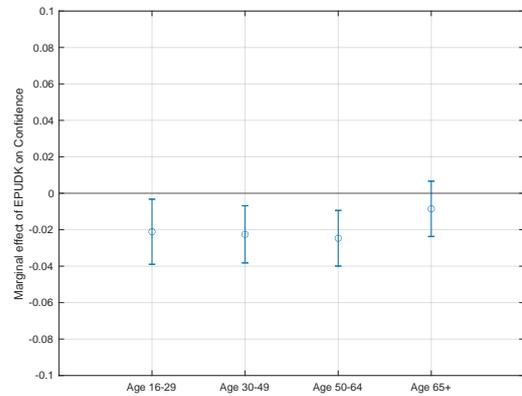
We then use this constructed index of economic policy uncertainty in an empirical analysis aiming at explaining consumer confidence. We focus on two sub-indices of consumer

Figure 9: Marginal effect of economic policy uncertainty on consumer confidence for different groups of households.

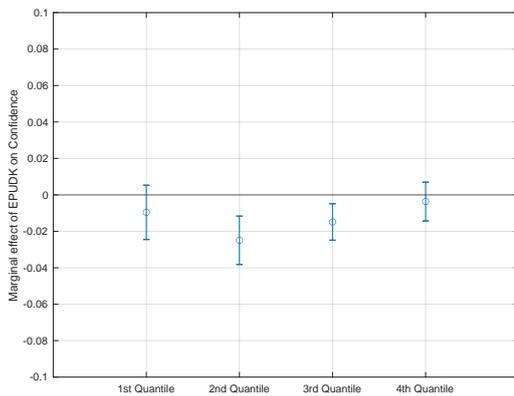
(a) Gender



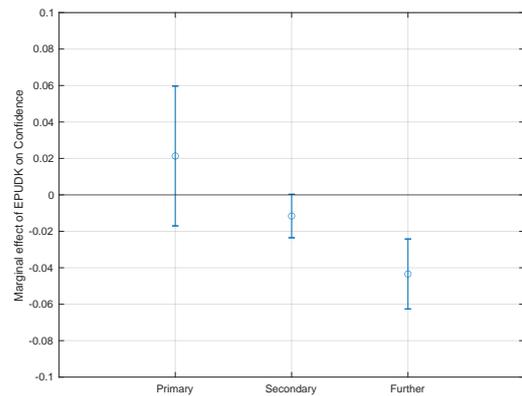
(b) Age



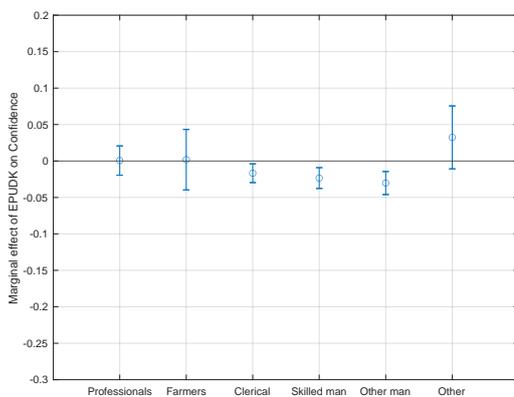
(c) Income quartiles



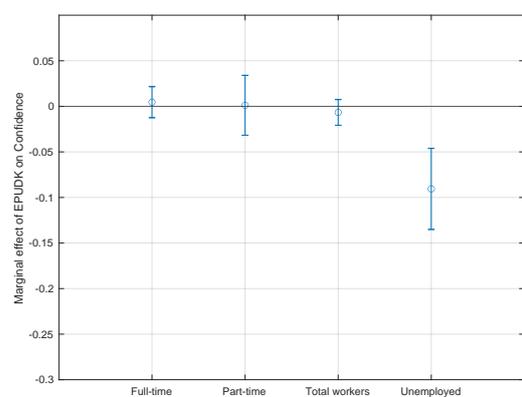
(d) Education



(e) Occupation: Disaggregated



(f) Occupation: Aggregated



confidence, both forward looking: household expectation about the Danish economy 12 months ahead and their expectation about their own financial situation 12 months ahead. The main hypothesis tested is whether increased economic policy uncertainty lowers consumer confidence. We apply a standard Granger non-causality tests in reduced form Vector Autoregressive (VAR) models as well as estimating impulse responses in a structural VAR model identified using a Choleski decomposition since the VAR model appears to be stable. We consider both bivariate VAR models each containing EPU and one of the two measures of consumer confidence and trivariate VAR models adding the composite leading indicator as a third variable.

We find that EPU affects consumer confidence, in particular consumers expectation about their own economy 12 months ahead. The Granger non-causality hypothesis is rejected at conventional significance levels and the impulse response of consumer confidence is always significantly negative implying that an increase in EPU lowers consumer confidence. EPU shocks explain 15-20 percent of the variation in consumer confidence at the 18 months horizon. Consumer expectation about the Danish economy 12 months ahead are less influenced by EPU suggesting that households regard increased economic policy uncertainty to be more relevant for their own economy than for the Danish economy. These results are in general consistent with previous findings for other countries where consumer confidence is indeed significantly affected by newspaper reporting.

We also find that there are important spillover effects from EU economic policy uncertainty, both on consumer expectations and on Danish economic policy uncertainty. We cannot (can) reject the null hypothesis of total (direct) Granger causality from EU EPU but find no evidence of bidirectional causality. In our analysis of structural VAR models, results suggest that the spillover effect is significant but not substantial, around 10 percent of the variation in EPU is explained by EU EPU at the one yera horizon and slightly increasing over the following two years. As in the bivariate and in the trivariate VAR models, uncertainty is more important for household expectations about their own future economy and less for the future Danish economy. Impulse responses are relatively unaffected when moving from bivariate to trivariate and then to a four-variable VAR model. The impact on households expectations about their own economy always fall significantly in the medium and long-term.

The available data also allow us to distinguish between different groups of respondents depending on gender, age, occupation, income and education. We find that males are on average more optimistic about their own financial situation than females but both groups respond to the same extent to increases in uncertainty. Optimism is negatively correlated to age, young respondents are significantly more optimistic about the future than older generations on average. However, there is no significant difference in how age groups respond to increased uncertainty except that the expectations of oldest cohort is

not significantly affected. Optimism and the effects of uncertainty are increasing with the level of education. Households with medium income are more affected by uncertainty than low and high income households. Unemployed seem to be substantially more optimistic about their own future financial situation than those who are employed. The reason for this is that the group of unemployed is dominated by young individuals who are on average more optimistic than other age groups. However, unemployed are significantly more affected by increasing uncertainty.

The results in this paper suggest that Danish households are reading newspapers and revise their own expectations about their own future economic situation. Their expectations are heterogeneous and households respond to increased uncertainty in different ways and to different extent.

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## Appendix A: Consumer expectations surveys in Denmark

This Appendix provides a brief overview of the consumer confidence indicators used in our empirical analysis. Statistics Denmark conducts a survey each month (data collection takes place in the first two weeks of the month and in a few days before the first day of the reference month) and publishes consumer confidence indicators relating to 12 questions, see Statistics Denmark (2020). The response rate is approximately 65 percent. In our paper we have focused on two indicators related to the following two questions:

- How do you think the financial situation of your household will be in a year compared to today?
- How do you think the economic situation in Denmark will be in a year compared with today?

Denmark Statistics is using omnibus surveys consisting of a sample of 1500 persons. After each interview, a personal weight is given with the aim of correcting for the effects of non-response and non-sampling. For questions regarding the household, the weight is attached to the family reflecting the number of persons aged 16 and over. A family is defined as one or several persons between 16 and 74 years living in the same accommodation and that they are related. The sum of the family weights is equal to the number of families living in Denmark.

There are five different answers to the two questions and they are all given different points between 100 and -100. The answers are: Got a lot better (100 points), got a little bit better (50 points), stayed the same (0 points), got a little bit worse (-50 points) and got a lot worse (-100 points). The individual answers are then weighted into a net figure which is an arithmetic average reflecting the difference between positive and negative answers. Note that until December 2004, the net figures have been calculated and published as whole figures. Since January 2005, the net figure is published with one decimal. There is no seasonal adjustment.

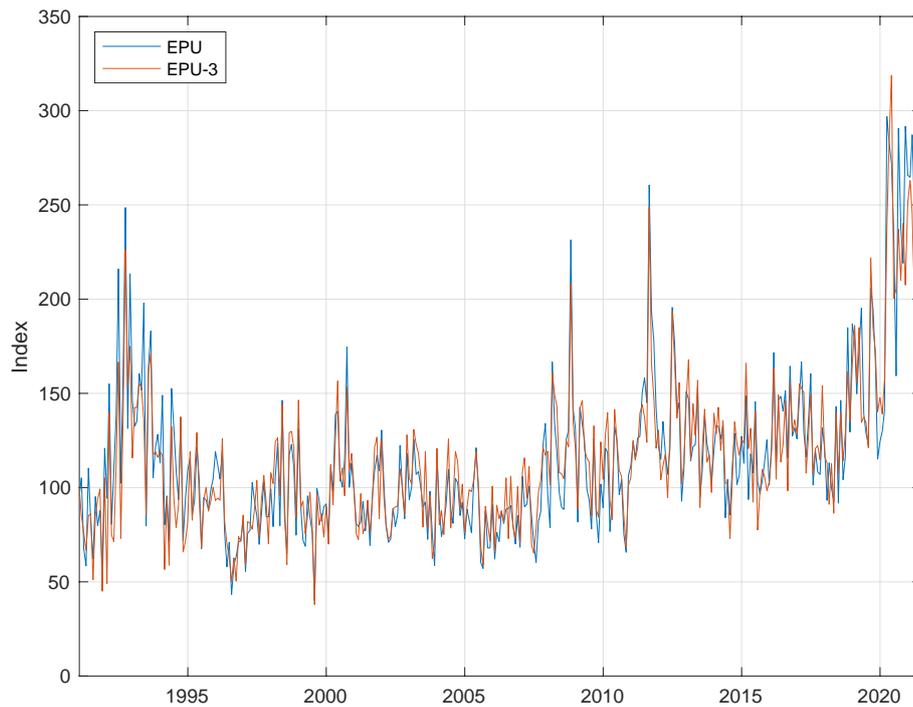
## Appendix B: Additional empirical analysis

Table B.1: Lag order determination in bivariate and trivariate VAR models.

Variables in VAR	FPE	AIC	HQIC	SBIC	No Autocorrelation
EPU & CCC	3	3	3	3	7
EPU & CCH	5	5	3	2	6
EPU & CCC & DCLI	4	5	3	3	7
EPU & CCH & DCLI	5	5	3	3	7

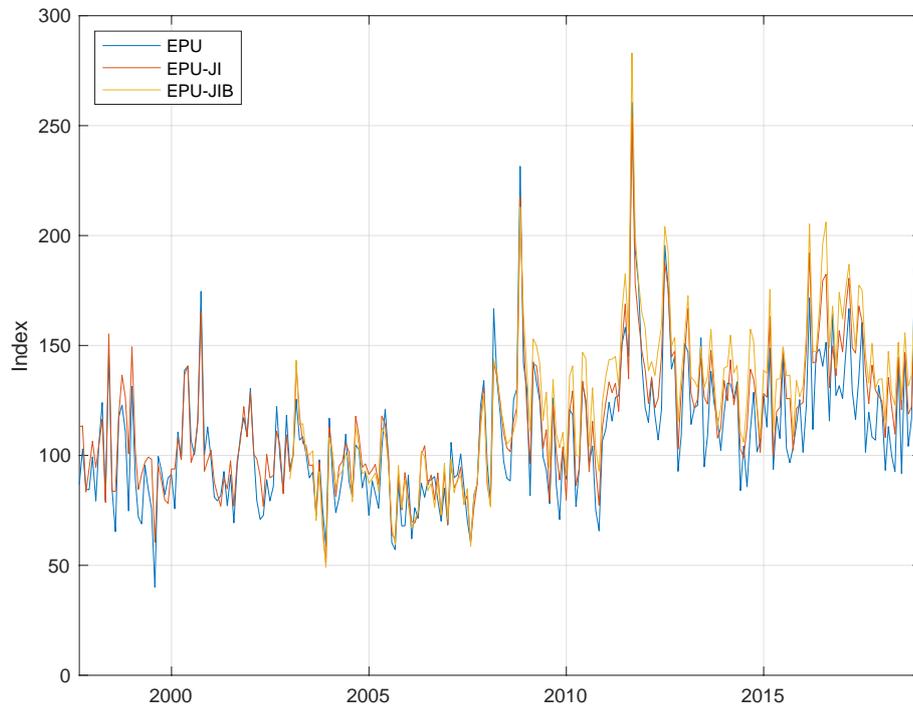
**Note:** FPE denotes the Final Prediction Error, AIC is the Akaike’s Information Criterion, SBIC is Schwarz’s Bayesian Information Criterion, HQIC is the Hannan and Quinn Information Criterion and “no autocorrelation” is the smallest lag order where there is no autocorrelation of order 1 to 6 at the 10 percent level using a multivariate LM test.

Figure B.1: EPU and EPU-3 for the big three Danish newspapers 1991:01 to 2021:6.



**Note:** EPU denotes our measure based on five newspapers, EPU-3 an uncertainty measure based on the big three Danish newspapers Berlingske, Politiken and Weekendavisen.

Figure B.2: EPU and extended EPU measures 1997:08 to 2021:6.



**Note:** EPU denotes our measure based on five newspapers, EPU-JI is EPU plus Jyllandsposten and Information, and EPU-JIB is EPU-JI plus Børsen.

Figure B.3: Consumer confidence indices, household expectation about the Danish economy 12 months ahead (CCC) and their expectation about their own economy 12 months ahead (CCH) 1991:1-2019:12.

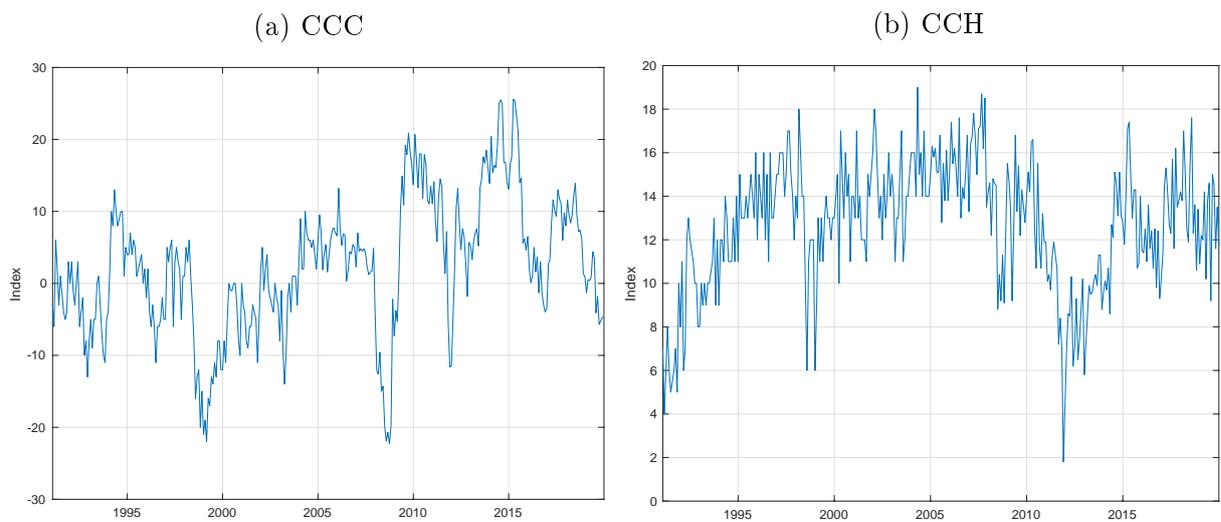
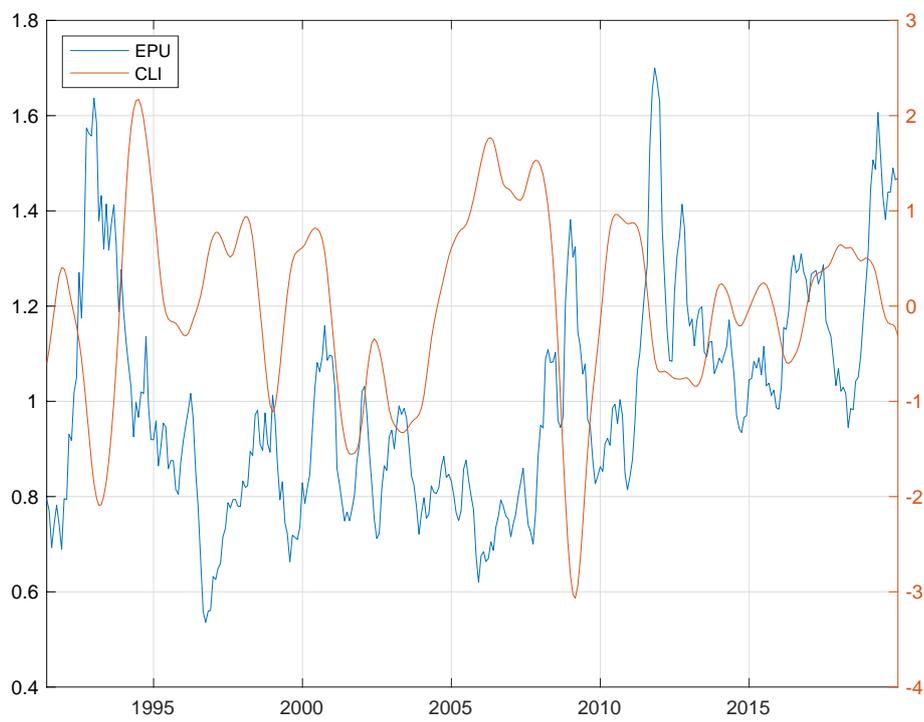


Figure B.4: EPU and composite leading indicator.



**Note:** EPU is filtered using a 5 months symmetric moving average filter. The composite leading indicator is unfiltered.

## Appendix C: Descriptive statistics and panel data regressions for disaggregated consumer confidence.

Table D.1: Descriptive statistics: Disaggregated consumer confidence data.

Variable	Obs	Mean	Median	Std. dev.	Min	Max
Male	343	14.2	14.6	3.6	-6.7	39.3
Female	343	9.5	10.1	4.3	-2.9	38.0
Age 16-29	343	28.3	28.3	5.1	13.3	47.6
Age 30-49	343	18.3	18.4	4.4	5.6	45.7
Age 50-64	343	3.6	3.9	4.5	-13.8	38.0
Age 65+	343	-5.5	-5.4	3.8	-16.4	18.9
Primary education	343	4.8	5.7	13.6	-52.9	44.1
Secondary education	343	10.2	10.4	3.6	-7.7	35.8
Further education	343	17.8	18.2	4.9	3.2	42.3
Self employed and professional	304	23.2	22.8	6.6	2.6	43.1
Self employed farmers	304	10.3	9.7	13.6	-27.5	53.3
Clerical and office employees	304	16.1	16.5	4.3	3.6	43.2
Skilled manual workers	304	14.8	15.0	5.4	-2.1	42.9
Other manual workers	304	13.4	13.8	6.1	-6.1	44.9
Other occupations	304	8.7	5.9	10.3	-42.6	39.1
Work full-time	304	16.2	16.7	4.0	2.8	43.0
Work part-time	304	14.2	13.7	10.7	-21.0	65.5
Total workers	304	14.2	14.1	4.7	-1.8	44.0
Unemployed	304	19.8	21.6	14.9	-11.7	53.9
Income Quartile 1	343	11.3	11.3	5.4	-3.6	41.0
Income Quartile 2	343	11.6	11.6	4.7	-1.2	39.0
Income Quartile 3	343	13.8	14.3	4.4	-1.4	45.0
Income Quartile 4	343	15.8	16.0	4.2	4.8	46.4

Table D.2: Fixed effect panel data regressions. Disaggregated consumer confidence data.

	Gender	Age	Education	Occupation 1	Occupation 2	Occupation 3	Income
Group 1	-0.014*** (.005)	-0.019*** (0.007)	0.021 (0.020)	0.001 (0.010)	-0.007 (0.007)	0.004 (0.009)	-0.010 (0.008)
Group 2	-0.013** (.006)	-0.017*** (0.005)	-0.012* (0.006)	0.002 (0.021)	-0.079*** (0.018)	0.001 (0.0168)	-0.025*** (0.007)
Group 3		-0.019*** (0.006)	-0.043*** (0.010)	-0.017** (0.006)		-0.090*** (0.023)	-0.015*** (0.005)
Group 4		-0.005 (0.005)		-0.023*** (0.007)			-0.004 (0.005)
Group 5				-0.030*** (0.008)			
Group 6				0.032 (0.022)			
Group 7				-0.102*** (0.020)			
# obs	684	1368	1026	2121	606	909	1368
# groups	2	4	3	7	2	3	4
R <sup>2</sup>	0.236	0.247	0.045	0.279	0.439	0.266	0.187
Autocorrelation	0.003	0.000	0.445	0.004	0.041	0.105	0.056
Heteroscedasticity	0.399	0.002	0.000	0.000	0.000	0.000	0.041
Cross-sectional dependence	0.000	0.000	0.004	0.000	0.311	0.001	0.000

**Note:** The table reports fixed effects panel data regression results with Driscoll-Kraay standard errors within parentheses below each point estimate. The reported parameter estimates represent the total effect of Danish economic policy uncertainty on consumer confidence measured as the household expectation of its own financial situation 12 months ahead. The regressions also include lagged consumer confidence, European economic policy uncertainty and the composite leading indicator. We use the following notation in the table: In the first column we simply distinguish between Males (group 1) and Females (group 2). The next column denoted Age distinguishes between respondents of ages 16-29 (group 1), 30-49 (group 2), 50-64 (group 3) and 65+ (group 4). In the next column denoted Education we distinguish between primary (group 1), secondary (group 2) and further (group 3) education of the respondent. In the column denoted Occupation 1 we distinguish between self employed and professional (group 1), self employed farmers (group 2), clerical and office employees (group 3), skilled manual workers (group 4), other manual workers (group 5), other occupations (group 6) and unemployed (group 7). In the column denoted Occupation 2 we distinguish between full-time workers (group 1), part-time workers (group 2) and unemployed (group 3) whereas in the column denoted Occupation 3 we only distinguish between total workers (group 1) and unemployed (group 2). In the column denoted Income we distinguish between quartiles, group 1 represents 1st quartile and so on. The table also reports number of observations, number of groups, within R<sup>2</sup>, the Born and Breitung (2016) test for autocorrelation, test for groupwise heteroscedasticity, and Pesaran's test of cross-sectional independence. Only p-values are reported for these three latter tests.