Quantifying Uncertainty and Identifying its Impacts on the Turkish Economy

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Abstract

In this study, firstly, we construct indices reflecting the financial uncertainty and the uncertainty perception of different agents such as consumers, firms and forecasters. Then, we develop an index of Economic Policy Uncertainty based on newspaper coverage frequency. In a dynamic factor model framework, we combine these indices to obtain an aggregate measure of economic uncertainty for the Turkish economy. Finally, by using this measure, we investigate the impact of uncertainty on economic activity via vector autoregression models. Empirical evidence shows that uncertainty has adverse impacts on economic growth, consumption and investment in Turkey. The impacts typically take two to three quarters to reach the maximum effect and the most severe effects of uncertainty are observed on investment.

Özet

Bu çalışmada ilk olarak finansal belirsizlik ile firma, tüketici ve tahmin edicilerin belirsizliğini yansıtacak endeksler hesaplanmıştır. Daha sonra gazete haberlerine dayanan Ekonomi Politikası Belirsizliği endeksi geliştirilmiştir. Oluşturulan bu endeksler dinamik faktör modeli çerçevesinde birleştirilerek Türkiye için toplulaştırılmış bir ekonomik belirsizlik göstergesi hesaplanmıştır. Çalışmada ayrıca, bu ölçüt kullanılarak belirsizliğin ekonomik faaliyet üzerindeki etkisi vektör otoregresyon modellerinden faydalanılarak araştırılmıştır. Ampirik sonuçlar Türkiye'de belirsizliğin ekonomik büyüme, tüketim ve yatırım üzerinde olumsuz etkileri olduğunu göstermektedir. Ayrıca, belirsizliğin azami etkilerinin iki ile üç çeyrek arası bir sürede ortaya çıktığı ve en belirgin etkinin yatırımlarda gözlendiği sonucuna ulaşılmıştır.

Non-technical Summary

Economic uncertainty is commonly defined as a situation in which agents do not have perfect knowledge about the current state of the economy and ability to forecast the likelihood of future events. In an environment of heightened uncertainty, agents postpone their decisions and await better information. This tends to make monetary tools less effective and policy makers might need more aggressive policies than expected in order to stimulate the economy. Accordingly, in recent years substantial attention has been devoted to economic uncertainty as a potential factor in business cycle fluctuations.

The accurate measurement of economic uncertainty is very difficult due to its unobservable nature. In this study, we develop an aggregate economic uncertainty measure for Turkey that comprises a wide set of individual uncertainty measures. In this respect, we construct indices reflecting the financial uncertainty and the uncertainty perception of different agents such as consumers, firms and forecasters. Then, we develop Economic Policy Uncertainty index for Turkey which is based on newspaper coverage frequency counts of articles in major Turkish newspapers that contain specific terms related to the economy, policy and uncertainty. Subsequently we combine these indices in a dynamic factor model framework to construct an aggregate uncertainty measure. The aggregate economic uncertainty measure proposed in this study may have an advantage over other uncertainty measures in that it better captures diverse dimensions of uncertainty-including differential effects for firms, households, forecasters, financial markets and the economic policy. With this indicator, policy-makers can monitor the uncertainty in the overall economy more easily than trying to monitor many separate indicators.

Empirical evidence shows that recessions are strongly associated with elevated uncertainty. An important empirical finding is that the heightened uncertainty has detrimental effects on economic growth, consumption and investment. It should be highlighted that the impacts typically take two to three quarters to reach the maximum effect and the most severe effects of uncertainty are observed on investment. This finding supports the idea that firms adopt a "wait and see" behaviour in high uncertainty periods by avoiding irreversible choices such as fixed investments.

1. Introduction

Several economic crises seen in the world in the recent years have increased the interest in the concept of economic uncertainty and instigated many studies on this subject. Although economic uncertainty is a highly debated subject, the variety of conceptual differences and calculation methods makes it a complex and multidimensional phenomenon.

 The accurate measurement of economic uncertainty is very difficult due to its unobservable nature. Nevertheless, the recent literature proposes various measures for quantifying it and documents its relationship with the real economic activity. Measures proposed include the volatility of stock market returns (Leahy and Whited, 1996; Bloom, 2009), the cross-sectional dispersion of firm profits, sales, or productivity (Campbell et al., 2001; Kehrig, 2011; Bloom et al., 2014), the cross-sectional dispersion of survey-based forecasts (Bachmann et al., 2013) and the appearance of certain "uncertainty-related" words in news (Alexopoulos and Cohen, 2009; Bachmann et al., 2013; Knotek II and Khan, 2011; Baker et al., 2016). These measures, which depend solely on a single source of uncertainty, have been criticized for not being a good proxy for the aggregate economy since the macroeconomic effects of different uncertainty measures are likely to vary, given the data transmission and the channels covered.

Subsequently, several studies propose aggregate measures based on a number of uncertainty proxies for measuring economic uncertainty. Jurado et al. (2015) define uncertainty as the conditional volatility of the forecast error of a variable. They calculate forecast error-based uncertainty measure for hundreds of variables separately or in a factor augmented vector autoregression system (FAVAR), and then aggregate them. Carriero et al. (2016) offer a similar framework in that they utilise a large VAR model with errors whose stochastic volatility is driven by two common unobservable factors, representing aggregate macroeconomic and financial uncertainty.

Another strand of literature combines different types of uncertainty measures to obtain an aggregate indicator. Haddow et al. (2013) and ECB (2016) use financial data, survey-based measures showing firms' and households' uncertainty perceptions and a number of press articles citing 'economic uncertainty' to construct several uncertainty indices. The underlying idea is that using different types of uncertainty indicators, which show different economic units' uncertainty perceptions, enables researchers to capture various possible transmission channels of uncertainty.

In this study, we first attempt to develop an aggregate economic uncertainty measure for Turkey that comprises a wide set of individual uncertainty measures. In this respect, we construct indices reflecting the financial uncertainty and the uncertainty perception of different agents such as consumers, firms and forecasters. Then, we develop Economic Policy Uncertainty index for Turkey which is based on newspaper coverage frequency counts of articles in major Turkish newspapers that contain specific terms related to the economy, policy and uncertainty. Subsequently we combine these indices in a dynamic factor model framework to construct an aggregate uncertainty measure. Finally, by using this

measure, we investigate the impact of uncertainty on economic activity via vector autoregression (VAR) models. Our findings show that heightened uncertainty has adverse impacts on economic growth, consumption and investment. Besides, the impacts typically take two to three quarters to reach the maximum effect and the most severe effects of uncertainty are observed on investment. Results also suggest that aggregate uncertainty measure is more informative than some of the sub-uncertainty indices.

To the best of our knowledge, this study is the first that constructs an aggregate uncertainty measure and identifies its impacts on the Turkish economy. What distinguishes this study from its peers in the literature is that it covers firms' and consumers' uncertainty perceptions as well.

The paper is organized as follows. In Section 2, we summarize the transmission channels from uncertainty to economic activity. In Section 3, we describe the data and the methodology used in the construction of the uncertainty indices. In Section 4, we briefly discuss the historical evolution of uncertainty in Turkey. In Section 5, we present the statistical properties of the uncertainty indices. In Section 6, we discuss the results of the VAR estimation and review the impact of uncertainty on economic activity. Finally, Section 7 concludes.

2. Transmission Channels of Uncertainty to the Economy

Uncertainty may affect the whole economy through different channels. The first one is related to consumers. In times of heightened uncertainty, individuals may not be confident about their future labour income stream. With these concerns in mind, they may prefer to consume less in the current period and save more to retain a smooth path of consumption. This behaviour is called precautionary savings motive (Carroll, 1996). As emphasized by ECB (2016), this motive is likely to reduce consumption and growth in the short term, but its medium-term effect is ambiguous. If savers choose to keep their savings in the domestic economy, higher savings are expected to enable investment by lowering the costs of finance. However, if savings increase in excess of domestic financing needs, they are likely to be invested abroad, implying that heightened uncertainty reduces domestic demand (Fernández-Villaverde et al., 2011; ECB, 2016).

The second channel is related with the irreversibility of choices of both consumers and firms. Under elevated uncertainty, they may postpone irreversible investment and consumption decisions and wait for more information to make a better decision. In such a case, the real option value of delay increases as uncertainty increases. For consumers, irreversible choices represent purchases of big and expensive items, such as durable goods. According to Gudmundsson and Natvik (2012), durable consumption decreases more than other consumption items when uncertainty rises.[1]

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[1] Our estimation results confirm that this observation is also valid for Turkey. Bivariate VAR estimation between durable goods consumption and financial uncertainty index in the post-global financial crisis period reveals that rising uncertainty negatively affects durable goods consumption. Meanwhile, no statistically significant relationship is observed between non-durable goods (and also semi-durable goods) consumption and financial uncertainty index. We get the same result when we replace financial uncertainty with aggregate uncertainty index.

In high uncertainty periods, firms may be unsure about their future sales and profits and avoid irreversible choices such as fixed investments that may incur sunk costs. This "wait and see" behaviour may harm investment and productivity (Dixit and Pindyck, 1994; Bernanke, 1983) as well as future supply capacity of the economy. Salaries, compensations, social insurance payments and employee trainings are some major cost items of firms. Accordingly, employment decisions of firms may also be considered as an irreversible decision and may be negatively affected by heightened uncertainty (Bentolila and Bertola, 1990).

Uncertainty may influence monetary and fiscal policy decisions as well. In heightened uncertainty periods, policies such as tax cuts, interest rate cuts or economic stimulus packages may be implemented to mitigate uncertainty.[2]

Economic agents may also suffer financially from rising uncertainty, which may cause an increase in the risk premium. This, in turn, leads to a decline in asset prices and financial wealth of investors holding these assets. Under such circumstances, borrowing may become more expensive since the cost of credit is negatively related with the financial wealth of investors. Thus, lower and more volatile asset prices may complicate firms' ability to reach financial sources needed to accomplish their operations and prevent them from investing. Besides, rising uncertainty creates downside risks both for households' labour income and firms' sales. These risks may adversely affect banks' incentives to provide loans to households and firms while tightened credit conditions may lead to under-investment and consumption (Gilchrist et al., 2010).[3]

In addition to these channels, uncertainty has long-term adverse effects on income equality and welfare. A rise in uncertainty may cause a decrease in the labour income of workers and it may as well limit workers' access to credits. Aizenman and Pinto (2004) argue that investment in human capital is frequently self-financed, and thus, the ability to finance investment in human capital is tied to the wealth of the household. So, in the absence of complete insurance markets, greater volatility is likely to increase the dispersion of income among households, leading to a drop in average investment as more households face credit ceilings, which will accordingly reduce the accumulation of human capital. And this, in turn, is expected to harm growth. Aizenman and Pinto (2004) also discuss the effects of uncertainty on welfare through its relationship with consumption and investment. Due to the complex and multidimensional nature of the economy, such as considerations about completeness of financial markets and the depth of insurance markets, they conclude that the effects of uncertainty on welfare are ambiguous and state-dependent.

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[2] Recently, we observe these effects in Turkey. In late 2016 and early 2017, an expansionary fiscal policy has been implemented to avoid the downward effects of increased uncertainty on consumption and investment expenditures. In this regard, private consumption tax rate on white goods and furniture and real estate purchase tax rate are decreased. Besides, some tax incentives are also carried into effect for commercial vehicles. Such expansionary policies have also been implemented after the 2009 global financial crisis.

[3] Although not given due to space constraints, we observe a negative and highly correlated relationship between uncertainty and credit standards (valid both for commercial and household credits). The only exception of this inverse relationship is the last period in which credit standards are less stringent despite the heightened uncertainty. However, this is thought to be due to the increase in the credits used within the scope of the Credit Guarantee Fund and does not reflect the expected dynamics of the economy.

3. Data and Methodology

Uncertainty may affect economic agents through different channels with different sources such as wars, political factors, natural disasters and unexpected changes in economic policies (Bloom et al., 2013). To capture all these effects, we cover a wide range of different proxies to construct an aggregate uncertainty measure. In constructing this measure, all the available series used in peer studies (Haddow et al., 2013 and ECB, 2016) are analysed. In addition to this, we investigate a broad set of survey indicators to construct consumers' and firms' uncertainty indices which are not covered in the aforementioned studies. In this respect, we construct uncertainty indices in the following sub-categories.

1. Financial uncertainty
2. Consumers' uncertainty
3. Firms' uncertainty
4. Forecasters' uncertainty

In the construction of these uncertainty indices we follow a common routine. We firstly collect all the available indicators at a monthly frequency in the longest possible span.[4] Then, routine data transformations such as seasonal adjustment and stationarity checks are implemented to obtain noise-free and stationary variables. The stationarity of the series is investigated using several unit root tests and those having unit roots are transformed into stationary series by taking the first difference. For each series in the sub-categories[5], we construct volatility indicators by estimating GARCH models and other volatility indicators such as standard deviation and interquartile range.[6] These volatility indicators are assumed to proxy uncertainty.[7] Then the performance of each uncertainty indicator is examined according to the following criteria: i) a good volatility model with valid model diagnostics ii) high graphical coherence between volatility indicators and macroeconomic variables, i.e. gross domestic product (GDP), private consumption and investment iii) high cross-correlation coefficient between volatility indicators and macroeconomic variables. The series that fulfil these conditions are selected to get into the uncertainty indices. After that, the selected uncertainty indicators in each sub-category are standardized to mean zero and unit standard deviation to eliminate scale differences. And then, they are

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[4] For a full list of variables analysed in the construction of the indices see Table 4 in appendix. Table 4 summarizes included series, excluded series together with the reasons to exclude them and data sources.

[5] Except the series that are volatility indicators by definition.

[6] In the calculation of the conditional volatility using GARCH model, we first estimate an ARMA model for each indicator using usual lag length criteria such as Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). Then, we estimate the conditional volatility of the forecast using a GARCH(1,1) model.

[7] There is no consensus on definition of uncertainty, risk and volatility concepts in empirical research. For example Patton and Timmermann (2010) study disagreement among professional forecasters, but they don't relate this disagreement to measures of uncertainty. Whereas Rossi et al. (2016) makes a distinction between Knightian uncertainty and risk using forecast densities obtained from U.S. Survey of Professional Forecasters. Jurado et al. (2015) use the forecast error variance as a measure of uncertainty. Gudmundsson and Natvik (2012) use standard deviation and number of news containing "economy" and "uncertainty" as uncertainty measure. Denis and Kannan (2013) use both implied volatility of stock exchange and the dispersion of one-year ahead forecasts of GDP as a measure of uncertainty. Casarin and Foroni (2016) use the standard deviations of the GDP growth projections taken from surveys as the uncertainty measure. For a detailed literature survey regarding the calculation of volatility (whether using standard deviations or GARCH models) and to which phenomenon it is attributed (to variability or uncertainty) see Cariolle (2012). In this study we couldn't make a distinction between Knightian uncertainty and risk due to the data unavailability. Instead, we calculate volatilities by using statistical techniques such as standard deviation, interquartile range and GARCH models and use these measures as proxies for uncertainty.

combined into a single uncertainty index via the Dynamic Factor Model (DFM). Detailed information about each uncertainty index is given in the following sub sections.

3.1. Financial Uncertainty Index

Financial indicators are most commonly used uncertainty indicators in empirical studies. Several reasons are thought to play a role in this choice. First of all, indicators like currency futures, currency forwards, currency options, equity prices and bond yields inherently contain financial market participants' expectations about future economic conditions. For this reason, the variations in these indicators are evaluated as a good indicator of uncertainty. Besides, these indicators can be observed at a very high frequency and may give very timely information regarding uncertainty perceptions. Despite these advantages, there are some drawbacks of these indicators. For example, depending on the changes in risk aversion, financial market volatility may fluctuate irrespective of the economic uncertainty (ECB, 2016). For this reason, financial uncertainty is not considered solely as an overall economic uncertainty indicator in this study.

To construct financial uncertainty index, we investigate volatility measures calculated for a wide set of indicators, such as: stock exchange, VIX, EMBI, CDS, loan and deposit interest rates spread, 2 years Treasury bond interest rate, USD/TL exchange rate, credit standards and banks expectations about future economic conditions taken from Bank Loans Tendency Survey. Stock exchange volatility is considered as an uncertainty measure about firms' equity prices. And this in turn may reflect uncertainties regarding firms' demand and business conditions. VIX, EMBI and CDS show uncertainties concerning global financial conditions. Implied exchange rate volatility is an indicator of cost pressures and therefore highly important for almost all economic units. It affects many macroeconomic variables, from consumption expenditures to production and investment decisions of firms. Interest rate and credit standards volatility provide uncertainty regarding financial tightening. Finally, questions from Bank Loans Tendency Survey capture uncertainties about credit supply and demand conditions.

After evaluating all the indicators according to their performance, the following series are selected to construct financial uncertainty index. [8]

- Stock exchange return (BIST-100 all shares index)
- VIX
- Implied USD/TL exchange rate volatility
- EMBI Turkey
- Realized interest rate volatility
- CDS

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[8] Volatility measures calculated for loan and deposit interest rates spread and Bank Loans Tendency Survey questions give poor results in terms of cross-correlation. Besides, Bank Loans Tendency Survey has been conducted on a quarterly basis.

In the construction of this index, stock exchange volatility is calculated using a GARCH model whereas interest rate volatility is defined as the standard deviation of daily values of 2 years Treasury bonds interest rate. Implied USD/TL exchange rate volatility is taken from Bloomberg. Since VIX, EMBI and CDS are already volatility indicators these series are used as they are; no GARCH models are estimated for them.

The coverage of financial uncertainty index proposed in this study overlap to a great extent with those given in peer studies (Haddow et al., 2013 and ECB, 2016). However, there are also some series which are not covered in this study due to data constraints. The financial uncertainty indicators constructed for developed countries contain implied equity market volatility, implied bond market volatility and implied interest rate volatility. But, since the option market is not deep enough in Turkey, we use implied USD/TL exchange rate volatility and realized volatility indicators for stock exchange and interest rates.

3.2. Consumers' Uncertainty Index

Consumers' uncertainty perceptions about the economy can be affected both from their own economic situation and from the general economic situation. For example, people's concerns about future employment opportunities and wages may affect their spending behaviour. Likewise, uncertainties about the general economic situation can cause consumers to reduce their expenditures, and in particular to delay large amount expenditures, such as housing and durable goods. In this regard, survey based uncertainty measures are considered as a good indicator of uncertainty faced by households.

In the construction of the consumers' uncertainty index we analyse all the questions of both Bloomberg HT[9] and TURKSTAT-CBRT[10] consumer surveys. Volatility measures are calculated by estimating GARCH models to the consumer confidence indices and the balance values of survey questions[11]. After a detailed analysis, following series are selected to enter to the index.

- Consumer confidence index (Bloomberg HT, TURKSTAT-CBRT)
- Financial situation expectation of households (over the next 12 months, Bloomberg HT, TURKSTAT-CBRT)
- General economic situation expectation (over the next 12 months, Bloomberg HT, TURKSTAT-CBRT)
- Financial situation of households (compared to previous year, Bloomberg HT, TURKSTAT-CBRT)

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[9] Bloomberg HT is implementing the consumer survey that is used to be implemented by CNBC-e until July 2015.

[10] TURKSTAT-CBRT Consumer Tendency Survey is carried out as a monthly survey in cooperation with the Turkish Statistical Institute (TURKSTAT) and Central Bank of the Republic of Turkey (CBRT).

[11] The balance is calculated as the difference between the percentages of positive and negative responses and 100 is added to this difference, thus forming a separate diffusion index for each question.

- General economic situation (compared to previous year, Bloomberg HT, TURKSTAT-CBRT)
- Assessment on purchasing money on durable goods (Bloomberg HT)
- The probability of buying or building a home (over the next 12 months, TURKSTAT-CBRT)
- Expectations regarding the number of unemployed people (TURKSTAT-CBRT)

3.3. Firms' Uncertainty Index

Like consumers' uncertainty index, the main data source used in firms' uncertainty index is the business surveys. Answers given to survey questions reflect uncertainty perception of respondents directly and therefore, they are better measures of uncertainty compared to macroeconomic variables such as sales and production indices.

In the construction of this index, we aim to create an unbiased indicator and therefore to maintain a balance between the manufacturing, trade and service sector indicators. For this reason, we calculate volatility indicators using all the questions of "Business Tendency Survey" (conducted by CBRT) for manufacturing sector, "Services Sector Tendency Survey" (conducted by TURKSTAT) for service sector and "Retail Trade Sector Tendency Survey" (conducted by TURKSTAT) for retail trade sector.[12]

Availability of micro data of consumer and firm related surveys enables us to calculate volatility proxies from the unit's expectations. However, if the questions relate to the personal situation of the households or the enterprises, the calculated volatility proxies may not reflect completely the aggregate uncertainty and may contain some idiosyncratic issues, which blur the outlook (ECB, 2016). Therefore, we prefer to calculate GARCH-based volatilities of firms' expectations. According to the results of cross-correlations and graphical analysis, we select the following series as inputs to firms' uncertainty index.

- Opinions about the general course of business in firm's industry (CBRT - "Business Tendency Survey")
- Export orders expectation (over the next 3 months, CBRT - "Business Tendency Survey")
- Domestic market selling price expectation (over the next 3 months, CBRT - "Business Tendency Survey")
- Retail trade confidence index (TURKSTAT, "Retail Trade Sector Tendency Survey")
- Retail trade sales (over the next 3 months, TURKSTAT, "Retail Trade Sector Tendency Survey")

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[12] We also calculate volatility measures using the indicators taken from the "Construction Sector Tendency Survey" (conducted by TURKSTAT). But these indicators are eliminated from the analysis due to their poor performance. Construction investment generally involves sunk costs and therefore can be considered as an irreversible investment. For this reason, there may not be a sudden decrease in the construction activity during periods of heightened uncertainty. This feature of the construction sector is believed to explain the incompatibility between the construction investment and the uncertainty measures calculated from the construction sector survey.

- Services sector confidence index (TURKSTAT, "Services Sector Tendency Survey")
- Demand-turnover expectation (over the next 3 months, TURKSTAT, "Services Sector Tendency Survey")

3.4. Forecasters' Uncertainty Index

Like financial indicators, disagreement among professional forecasters is another commonly used uncertainty measure in empirical studies (see Zarnowitz and Lambros, 1987; Bomberger, 1996; Denis and Kannan, 2013; Haddow et al., 2013; ECB, 2016). In the construction of forecasters' uncertainty indicator, we use "Survey of Expectations" conducted by CBRT. This survey is implemented to professional forecasters from financial and real sector since 2001. The survey is highly reputable and its outcomes are widely used both in conjectural analysis and empirical studies regarding Turkish economy. By using micro data of this survey, we first estimate standard deviations and interquartile ranges of forecasters' responses. An increase in the dispersion shows diverse opinions about the economic outlook of the forecasters and implies that it is becoming more difficult and uncertain to forecast future economic developments. As a second method, we calculate GARCH-based volatilities of expectations. At the end, we prefer to use interquartile ranges since they overlap more with the uncertainty periods. The following series are selected for the forecasters' uncertainty index.

- Expected CPI over the next twelve months (CBRT, "Survey of Expectations")
- Expected USD/TL exchange rate in the interbank foreign exchange market by the end of the year (CBRT, "Survey of Expectations")
- Expected GDP growth rate for the current year (CBRT, "Survey of Expectations")

3.5. Economic Policy Uncertainty Index

We develop an economic policy uncertainty (EPU) index for Turkey based on newspaper coverage frequency following the approach in Baker et al. (2016). In the construction of the EPU, the text archives for six major Turkish newspapers (Cumhuriyet, Hürriyet, Milliyet, Sabah, Türkiye and Yeni Şafak) are used from January 1998 onwards.

For each newspaper, the number of news articles containing at least one term in each of the economy, uncertainty and policy categories is utilised. The economy and uncertainty terms include any word beginning with "econ" and "uncertain", respectively. The policy terms include "Central Bank of Turkey", "The Grand National Assembly of Turkey", "Ministry of Finance", "parliament", "government deficit", "tax", "taxation", "taxes", "senate", "regulation", "policy", "budget" and "spending".[13] Since the number of the news varies across newspapers and over time, the number of raw counts of economic policy uncertainty news is scaled by the total number of economic news. The total number of economic

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[13] The grammatical variations of these words are also searched.

news is taken as the number of news in the economy category. In the next step, these scaled news are standardized by dividing through their standard deviation to have a unit standard deviation. Then, the overall monthly EPU index for Turkey is obtained by averaging these standardized series across the six newspapers by month. Finally, the EPU index is divided by its average and multiplied by 100 to obtain the normalized EPU Index.

3.6. Aggregate Economic Uncertainty Index

After calculating all the sub-uncertainty indices, we employ factor models to combine information from all of the sub-uncertainty indices to obtain an aggregate uncertainty index. The rationale behind an aggregate index is that economic agents' uncertainty perception may differ and therefore no single uncertainty indicator may completely represent the whole economy. [14] Following Camacho and Perez Quiros (2010), we use a small scale DFM model to find the common component of the five sub-uncertainty indices. Then we name this common component as "aggregate economic uncertainty index".

Table 1 presents the weights of sub-uncertainty indices in the aggregate index. As it can be seen from this table, the EPU index has the lowest share. The weights of the remaining series are close to each other. The weights of financial and firms' uncertainty indices are slightly higher than the weights of forecasters' and consumers' uncertainty indices.

Table 1. Weights of sub-uncertainty indices in the aggregate index (percentage)

Forecasters' uncertainty index	Financial uncertainty index	Firms' uncertainty index	Consumers' uncertainty index	EPU index
20	26	27	20	6

4. Evolution of Uncertainty in the Turkish Economy

All the sub-uncertainty indices indicate mostly the same periods for heightened uncertainty (Figures 1 to 5). Since the EPU index has the longest time span, the rise in uncertainty in years 2001 and 2002 can only be observed in this index.

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[14] For example, financial uncertainty indicators are largely affected from external conditions and short-term idiosyncratic movements which generally don't have an economical basis. Consumers' and firms' uncertainty indices are calculated from survey questions, and survey-based measures may involve uncertainty as well as confidence shock. The Economic Policy Uncertainty index may be influenced by several factors. For example, "uncertainty" may not be a widely used word for describing blurred economic outlook in the society. Besides, the press in the country may not be independent enough to handle problematic issues. And lastly, with regard to forecasters' uncertainty, the divergence in the forecasts may result from other factors such as differences in forecast techniques, differences in information sets and differences in views of forecasters about the economy (Haddow et al., 2013; ECB, 2016).
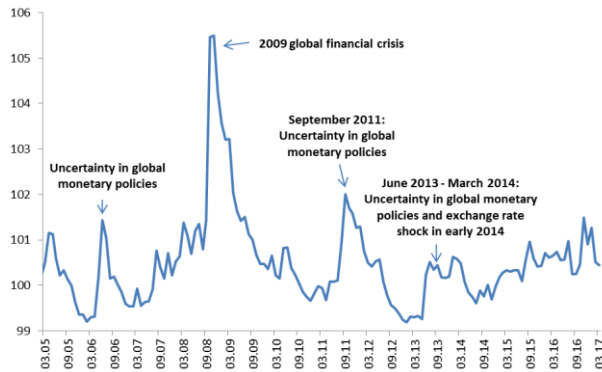
Figure 1. Financial Uncertainty Index
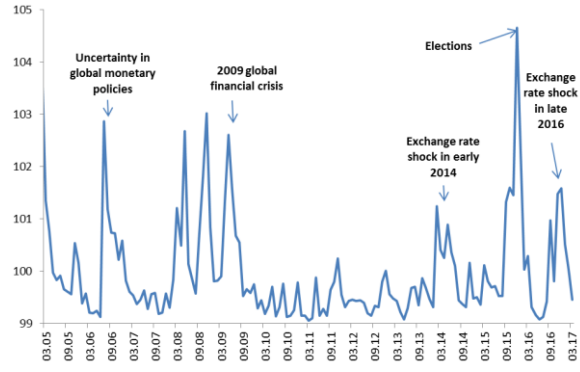

Figure 2. Consumers' Uncertainty Index
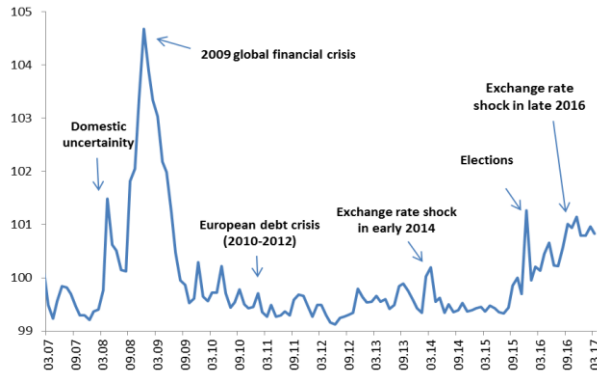

Figure 3. Firms' Uncertainty Index

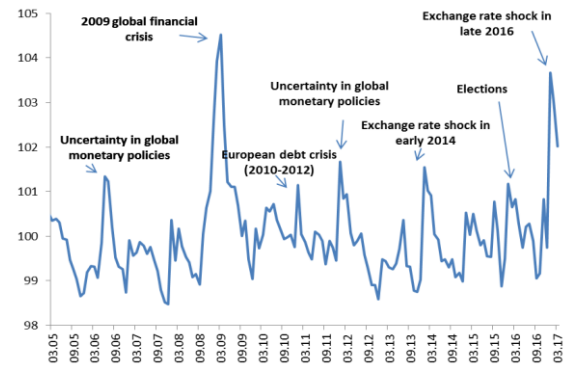**Figure 4. Forecasters' Uncertainty Index**

Figure 5. EPU Index for Turkey
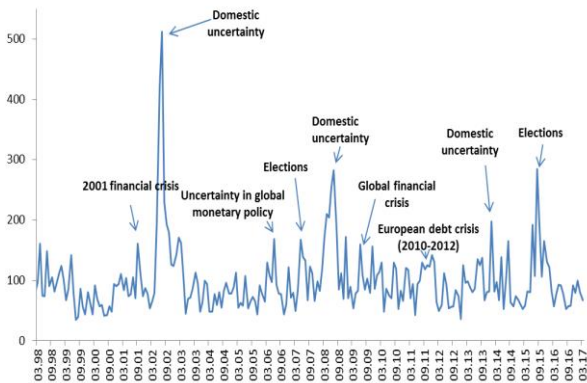
Figure 6. Aggregate Economic Uncertainty Index
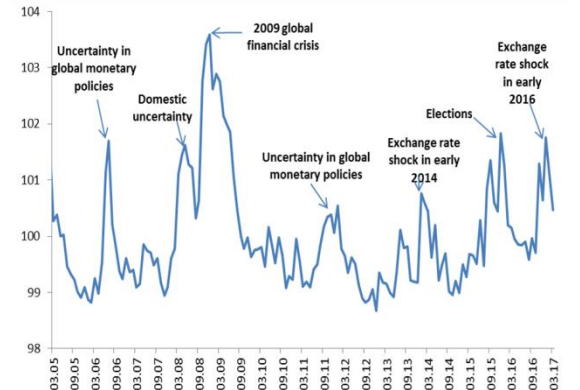
After the parliamentary elections in 1999, Turkey adopted an IMF-led exchange rate-based disinflation program for the years 2000-2002. The program was implemented without a major problem in early 2000. But the widening in the current account deficit, delays in the implementation of structural reforms in the second half of 2000, and deviations from the privatization targets raised concerns in domestic and external markets. This uncertain outlook caused a decrease in capital inflows, which created a rise in interbank money market interest rates. Rising interest rates caused deterioration in the financial situation of banks with maturity mismatches in their balance sheets. And these developments

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created financial crises in November 2000 and again in February 2001. With the crises, the pegged exchange rate system was abolished, the stock exchange crashed, overnight interest rates went up and the TL depreciated against the US dollar sharply. In the period between the February 2001 crisis and August 2001, and the one-month period following the attacks on September 11, interest rates remained high and the Turkish lira continued to depreciate despite improvements in the economic fundamentals. Accordingly, concerns were raised about the sustainability of domestic debt in this period. In the aftermath of the crisis, Turkey started to implement a new economic program called "Strengthening the Turkish Economy".

In early 2002, this economic program was revised to enhance the resilience of the economy against shocks and decrease vulnerability in case of any possible crisis. But the uncertain political outlook created concerns over the sustainability of the program. The EPU index reached an all-time peak value in July 2002. However, the approval of the election date as November 2002, the agreement on the EU Harmonization Laws and the commitment to the economic program reduced the uncertainty.

The next heightened uncertainty period identified in all indices corresponds to the second quarter of 2006. In May 2006, Turkey was exposed to a currency shock caused by the interest rate hikes by the central banks of advanced countries. The effects of this shock were immediately visible in inflation expectations. Besides, the high volatility in global markets in this period led to deterioration in the predictability of international markets, a rise in risk premiums and a decrease in global stock market indices. Consequently, large capital outflows were observed in emerging markets including Turkey. In this period, the TL depreciated against the US dollar and the Central Bank of Turkey introduced interest rate hikes to control inflation.

In 2007, the presidential and parliamentary elections created an uncertain political outlook in Turkey. After the elections in July, the uncertainty in the economy decreased but it started to increase again in 2008 due to both global financial problems and domestic uncertainties. The deepening of the global financial crisis in the last quarter of 2008 led to a wave of financial deleveraging that caused a rise in sovereign credit risk premium and a depreciation of the Turkish lira against the US dollar. The global financial crisis in 2009 is another heightened uncertainty period observed in all uncertainty indices.[15]

Another rise in uncertainty was observed between 2010 and 2012. In this period, a spike was observed in almost all indices except consumers' uncertainty index. The most decisive feature of this period was the problems observed in developed countries, that is, sovereign debt crisis in Europe and

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[15] Consumers' uncertainty index shows similarities with financial and firms' uncertainty indices but as a distinctive feature, the index shows more volatility at some heightened uncertainty periods. For example, consumers' uncertainty index exhibits a zig-zag movement during the 2008-2009 period. When we look at the sub-items to find out the sources of this movement, we see that the expectations regarding future economic developments (both households' own financial situation and the general economic situation) exhibit a similar zig-zag pattern. Since future economic developments are indeterminate, this type of indicators may show higher volatility during stressed economic times. But what is important here is that although there is a zig-zag movement, consumer uncertainty is at high levels during the crisis period.

the recession worries regarding the United States (US) and Europe. When we look at the subcomponents of the firms' uncertainty index, we see that the increase in this period mainly stemmed from the increased volatility in export orders. As a matter of fact, exports to Europe declined during this period.

The next heightened uncertainty period observed in all indices appeared in 2013 and 2014. Both domestic and external factors are thought to have played an important role in this outlook. The Fed announcement regarding tapering in May 2013 caused an uncertainty in the global monetary policy. Additionally, a domestic turbulence occurred in late 2013 and the exchange rate dramatically deteriorated following these events.

2015 was a year in which both internal and external uncertainties rose again. On the external front, uncertainties surrounding global monetary policies and growth concerns, geopolitical tensions and European immigration crisis were the main sources of the rising uncertainty. On the internal front, the two elections that took place in June and November 2015 constituted the main factors of the rising uncertainty. Consequently, all uncertainty indices increased considerably in the second half of 2015.[16]

And finally, we see a rise in uncertainty in the second half of 2016 as a result of the domestic turbulence in this time period. During that time, the Turkish lira depreciated significantly and there was deterioration in the domestic demand outlook except the demand for goods which was supported by the incentives introduced. As a matter of fact, there was an increased volatility in all sub items in this period.[17,18]

5. Statistical Properties of the Uncertainty Indices

The dynamic interrelations between uncertainty indices are summarized with pairwise cross-correlations in Table 2. It can be seen overall that uncertainty indices have high correlations among each other. It is clear from Table 2 that the economic policy uncertainty has a strong leading role with a lead time of 4 to 8 months.[19] The financial uncertainty tends to lead firms', consumers' and forecasters' uncertainties with a lead time of 1 to 2 months. Firms' and consumers' uncertainties tend to move together and they lead the forecasters' uncertainty by 2 months.

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[16] An investigation of the sub-items of consumers' uncertainty index reveals that there was a significant increase in consumers' uncertainty perception regarding the general economic situation during the November 2015 parliamentary elections period. An examination of the sub-items of firms' uncertainty index indicates that the increase in the index is due to the trade and services sectors which are more related to domestic demand. Besides, it should be noted that the loss of income in the tourism sector also contributed to the heightened uncertainty in retail trade sector in this period.

[17] An analysis of the sub-items reveals that the increase in the consumers' uncertainty index in the second half of 2016 mainly stemmed from the increased volatility regarding consumers' own financial situation.

[18] As it can be seen from Figure 1, there has been an upward trend in firms' uncertainty index since the last quarter of 2015. Some internal factors such as terrorist attacks in big cities, geopolitical tensions, domestic uncertainties in 2016; and external factors such as uncertainties regarding global monetary policies, Europe's migrant crisis, Brexit and finally the presidential elections in the US are thought to have played an important role in this upward trend.

[19] Although the results are not reported here, we estimated a VAR model using the five sub-uncertainty indices. According to estimation results, an EPU-based uncertainty shock causes a positive and significant shock on consumers' and firms' uncertainty indices. In other words, uncertainty-related news affect people's uncertainty perception.

Table 2. Cross-correlations between uncertainty indices

	Financial uncertainty index	Firms' uncertainty index	Consumers' uncertainty index	Forecasters' uncertainty index	EPU index
Cross-correlations between uncertainty indices					
Financial uncertainty index *(-/+ i)*	1				
Firms' uncertainty index (-/+ i)	0.80*(+1)*	1			
Consumers' uncertainty index (-/+ i)	0.37 *(+1)*	0.50 *(0)*	1		
Forecasters' uncertainty index (-/+ i)	0.56 *(+2)*	0.64 *(+2)*	0.27 *(+3)*	1	
EPU index (-/+ i)	0.48 *(-6)*	0.46 *(-7)*	0.37 *(-4)*	0.39 *(-8)*	1
Aggregate economic uncertainty index	0.83 *(0)*	0.84 *(0)*	0.64 *(0)*	0.66 *(0)*	0.39 *(0)*

Table 3 displays the cross-correlation coefficients between uncertainty indices and economic activity indicators. The real GDP, the real investment and the real private consumption are defined in terms of gap, i.e. in terms of deviations of actual variables from their trend values.[20] In general, the cross-correlation coefficients indicate that uncertainty indices lead economic activity indicators. The aggregate uncertainty indicator records the largest value of cross-correlations and it leads GDP and private consumption by one quarter and investment by three quarters.

Table 3. Cross-correlations between uncertainty indices and economic activity indicators

	GDP	Private Consumption	Investment
Financial Uncertainty	-0.67 (-1)	-0.72 (-2)	-0.77 (-3)
Firms' Uncertainty Index	-0.69 (-1)	-0.70 (-1)	-0.75 (-2)
Consumers' Uncertainty Index	-0.44 (-3)	-0.44 (-1)	-0.41 (-2)
Forecasters' Uncertainty Index	-0.53 (-1)	-0.52 (-1)	-0.50 (-1)
Economic Policy Uncertainty Index	-0.52 (-4)	-0.55 (-4)	-0.52 (-4)
Aggregate Uncertainty Index	-0.67 (-1)	-0.74 (-1)	-0.76 (-3)

The table shows maxima of cross-correlation functions and the numbers in the parentheses show the corresponding leads of uncertainty indices.

Figure 7 shows the mean of uncertainty indices over the recession and recovery phases of the business cycle.[21] As can be seen from this figure, all uncertainty indices are clearly countercyclical, rising in recessions and falling in expansions. These findings are similar to those of Baker et al. (2016), who also report uncertainty increases during recessions both for the US and on the global scale. Besides, it should be highlighted that consumers', firms' and financial uncertainty are, on average, much larger than forecasters' uncertainty and economic policy uncertainty during recession periods.

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[20] We remove the trend from economic activity indicators using the Hodrick-Prescott filter.

[21] The recession and recovery dates are identified in the framework of OECD methodology (OECD, 2012). Accordingly, after the seasonal adjustment of the Industrial Production Index, the trend component is derived using double HP filter. Then, the peak and trough dates are identified according to Bry-Boschan algorithm.

Figure 7. Cyclical Variation of Uncertainty Indices

Financial Uncertainty Index

Consumers' Uncertainty Index

Firms' Uncertainty Index

Forecasters' Uncertainty Index

Economic Policy Uncertainty Index

Aggregate Economic Uncertainty Index

6. The Impact of Uncertainty on Economic Activity in Turkey

It is of particular importance for policy making to determine to what extent uncertainty shocks affect the economy. Since the causality between uncertainty and macroeconomic variables is difficult to identify, we estimate vector autoregressive (VAR) models to capture the endogenous interactions among uncertainty and macroeconomic variables. The VAR modelling also allows identification of uncertainty shocks and quantification of their consequences on economic activity.

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The VAR specifications in this study include four variables: the aggregate uncertainty measure, the real exchange rate, the real interest rate and one of three macroeconomic indicators, which are real GDP, real investment and real private consumption.[22] In these specifications, variables except the aggregate uncertainty measure are defined in terms of gap, i.e. in terms of deviations of actual variables from their trend (equilibrium) values. This ensures that these models focus on the cyclical movements in the economy. The variables are detrended using HP filter in order to transform the variables as deviations from their trend. The models are estimated for the period 2006Q4-2017Q1, using quarterly data.

The real exchange rate is the CPI-based real exchange rate and the gap of this variable is included in the model to capture the role of external inflationary pressure. The real interest rate is calculated by using the one-year government debt securities interest rate and the expectation of annual CPI inflation at the end of the next 12 months (Survey of Expectations). The real interest rate gap reflects the indirect external link in the transmission mechanism between monetary policy actions and the real economy via changes in domestic interest rates.

We use Cholesky decomposition for the structural identification in VAR models. The system is identified following the standard recursive ordering procedure with the order following the listing of the variables above. The ordering of variables is decided by taking into account the transmission channel of uncertainty.[23] The appropriate lag-length for the VAR is one and decided by means of the final prediction error and the information criteria of Akaike, Schwarz and Hannan-Quinn.

Figure 8 plots the impulse response functions of GDP, investment and consumption to one standard deviation uncertainty shock along the 95% confidence band. In the impulse response functions, the size of response in each macroeconomic indicator shows how the impact of uncertainty changes is distributed across the measures of the economic activity. Meanwhile, the timing of these responses shows how long the real effects of uncertainty shocks may persist. The simulation horizon is set equal to 20 quarters (five years). As can be seen from impulse response functions, an uncertainty shock has depressing effects on the real economy. Notably, a one standard deviation increase in uncertainty is found to generate a significant decline in GDP, investment and consumption. The responses typically take two to three quarters to reach the maximum effect, and then revert back. GDP reacts negatively to an uncertainty shock, with a peak impact reached after three quarters at around – 1.4%, and the response

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[22] To ensure economic stability, public sector can implement countercyclical policies during the expansion and contraction periods of the business cycle. But this behaviour of the public sector may becloud the analysis of the relationship among economic variables. For this reason, public sector excluded macroeconomic variables have been used in this study. For GDP, we used public consumption excluded GDP. For consumption we used private sector consumption. But, since the investment series in the revised GDP are not published in public and private sector distinction, we used the total investment series in the estimations.

[23] As a robustness test we change the ordering of the variables in the VAR and placed the uncertainty index at last. The idea behind this ordering is to think uncertainty as an endogenous variable rather than an exogenous driver (see Ludvigson et al., 2016; Plante et al., 2017; Fajgelbaum et al., 2017; Choi, 2017). But changing the order of the variables didn't make a significant change at the results. We also checked Granger causality between GDP (public consumption excluded) and aggregate uncertainty index. According to results, there is significant Granger causality from uncertainty to GDP at lags from 2 to 4 but no Granger causality is observed from GDP to uncertainty. Only at the first lag, a two-way causality, from uncertainty to GDP and vice versa, is observed between the variables.

is significantly negative for up to eight quarters. The response of consumption to a shock in uncertainty displays similar dynamics, with a decrease peaking two quarters after the shock at -1.4% followed by a rebound. Noticeably, the uncertainty shock leads to a strong decline in investment with a peak impact after three quarters at -3.1%. Overall, the results of the VAR analysis provide evidence that uncertainty negatively affects the economic activity in Turkey and the investment reacts the most to uncertainty shocks.

Figure 8. Impact of Uncertainty on Macroeconomic Variables
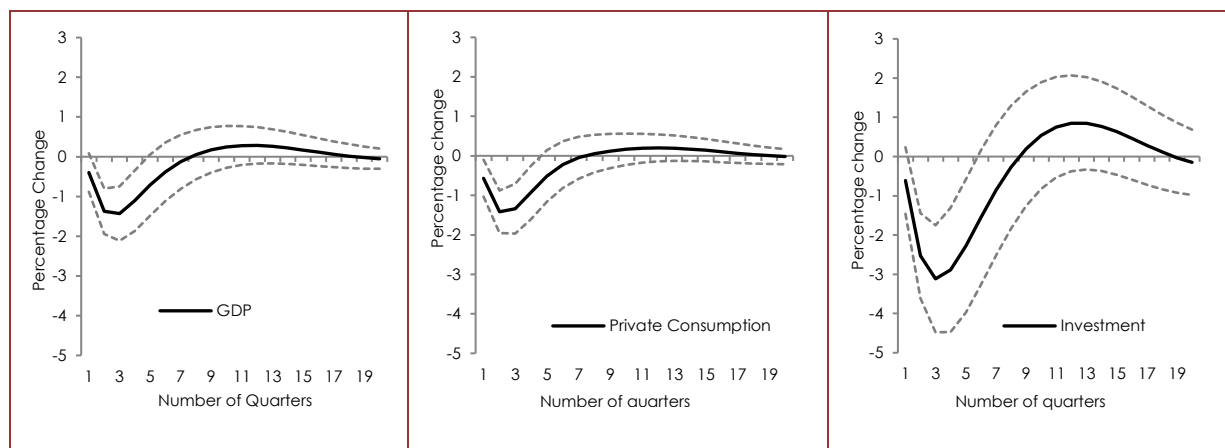
To examine the performance of uncertainty indicators separately, we re-estimated the VAR models using the sub-uncertainty indices. In general, impulse-responses given in Figure 9 are in the same direction with the impulse-responses obtained by using aggregate uncertainty index. When we analyse the results from the perspective of sub-uncertainty indices we see that firm's uncertainty and financial uncertainty shocks have the highest negative impact on macroeconomic variables. However, GDP does not change significantly in response to a consumers' uncertainty shock and the response of private consumption and investment is limited. The uncertainty indicator to which the macroeconomic variables react most quickly is the forecasters' uncertainty with a peak impact reached at lags 1 and 2. Finally, response of macroeconomic variables to a one standard deviation increase in EPU seems to be limited compared to other sub-uncertainty indices. When we look at the results from the perspective of macroeconomic variables we see that investment has the highest negative response to uncertainty shocks among the analysed macroeconomic variables.

Overall, the results show that shocks to some of the sub-uncertainty indices have limited impact on the examined macroeconomic variables and favour the use of the aggregate index in a general macroeconomical framework. However when the interest is on a more specialized subject, the information content of the analysis may be enhanced with the use of sub-uncertainty indices.

7. Conclusion

In this study, we introduce an aggregate measure of economic uncertainty by combining various uncertainty measures into one indicator. The aggregate economic uncertainty measure proposed in this study may have an advantage over other uncertainty measures in that it better captures diverse dimensions of uncertainty-including differential effects for firms, households, forecasters, financial markets and the economic policy. With this indicator, policy-makers can monitor the uncertainty in the overall economy more easily than trying to monitor many separate indicators. Besides, the aggregate economic uncertainty index is partially forward-looking as the survey questions we use are generally related to expectations regarding the future economic outlook. Thus, the index proposed in this study gets the edge over its counterparts since most of the uncertainty measures in the literature are calculated on an ex-post basis (see Jurado et al., 2015; Rossi and Sekhposyan, 2015; and Scotti, 2016).

Empirical evidence shows that recessions are strongly associated with elevated uncertainty. An important empirical finding is that the heightened uncertainty has detrimental effects on economic growth, consumption and investment. It should be highlighted that the most severe effects of uncertainty are observed on investment. This finding supports the idea that firms adopt a "wait and see" behaviour in high uncertainty periods by avoiding irreversible choices such as fixed investments.

References

Aizenman, J., and Pinto, B. (2004). Managing volatility and crises: a practitioner's guide overview, National Bureau of Economic Research, No. w10602.

Alexopoulos, M. and Cohen, J. (2009). Uncertain Times, Uncertain Measures, University of Toronto, Department of Economics Working Papers.

Bachmann, R., Elstner, S. and Sims, E. R. (2013). Uncertainty and Economic Activity: Evidence from Business Survey Data, American Economic Journal: Macroeconomics, 5(2), 217–249.

Baker, S., Bloom, N. and Davis, S. (2016). Measuring economic policy uncertainty, The Quarterly Journal of Economics, 131 (4): 1593-1636.

Bentolila, S. and Bertola, G. (1990). Firing Costs and Labour Demand: How Bad is Euro Sclerosis?, Review of Economic Studies, 57(3), 381-402.

Bernanke, B. S. (1983). Irreversibility, Uncertainty and Cyclical Investment, The Quarterly Journal of Economics, 98(1), 85-106.

Bloom, N. (2009). The Impact of Uncertainty Shocks, Econometrica, 77(3), 623-685.

Bloom, N., Kose, M. and Terrones, M. (2013). Held Back by Uncertainty, Finance and Development, 50(1), 38-41.

Bloom N., Floetotto, M., Jaimovich, N., Saporta-Eksten, I. and Terry, S. J. (2014). Really Uncertain Business Cycles, US Census Bureau, Center for Economic Studies Working Papers, 14-18.

Bomberger, W.A. (1996). Disagreement as a measure of uncertainty, Journal of Money, Credit and Banking, 28(3), 381-392.

Camacho, M. and Perez-Quiros, G. (2010). Introducing the euro-sting: Short-term Indicator of Euro Area Growth, Journal of Applied Econometrics, 25(4), 663-694.

Campbell, J. Y., Lettau, M., Malkiel, B. G. and Xu, Y. (2001). Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk, The Journal of Finance, 56(1), 1-44.

Cariolle, J. (2012). Measuring Macroeconomic Volatility. Fondation pour les Etudes et Recherches sur le Developpement International, Working Paper No: 114.

Carriero, A., Clark, T. E., and Marcellino, M. G. (2016). Measuring uncertainty and its impact on the economy, Federal Reserve Bank of Cleveland Working Paper, No: 16-22.

Carroll, C. (1996). Buffer-stock Saving and the Life Cycle/Permanent Income Hypothesis, NBER Working Paper No. 5788.

Casarin, R., Foroni, C., Marcellino, M., & Ravazzolo, F. (2016). Uncertainty Through the Lenses of A Mixed-Frequency Bayesian Panel Markov Switching Model, IGIER Working Paper No. 585.

Central Bank of the Republic of Turkey, Annual Reports.

Choi, S. (2017). Variability in the effects of uncertainty shocks: New stylized facts from OECD countries, Journal of Macroeconomics, 53 (2017), 127–144.

Denis, S. and Kannan, P. (2013). The Impact of Uncertainty Shocks on the UK Economy, IMF Working Paper, WP/13/66.

Dixit, A. and Pindyck, R. (1994). Investment Under Uncertainty, Princeton University Press, Princeton.

ECB (2016). The Impact of Uncertainty on Activity in the Euro Area, Economic Bulletin Article, Issue 8.

Fajgelbaum, P., Schaal, E., and Taschereau-Dumouchel, M. (2017). Uncertainty traps, The Quarterly Journal of Economics (2017): qjx021.

Fernández-Villaverde, J., Guerrón-Quintana, P., Rubio-Ramírez, J. and Uribe, M. (2011). Risk Matters: The Real Effects of Volatility Shocks, American Economic Review, 101(6), 2530-2561.

Gilchrist, S., Sim, J. and Zakrajsek, E. (2010). Uncertainty, Financial Frictions, and Investment Dynamics, 2010 Meeting Papers No. 1285, Society for Economic Dynamics.

Gudmundsson, J. and Natvik, G. J. (2012). That Uncertain Feeling - How Consumption Responds to Economic Uncertainty in Norway, Norges Bank Staff Memo No.23.

Haddow, A., Hare, C., Hooley, J. and Tamarah, S. (2013). Macroeconomic Uncertainty: What Is It, How Can We Measure It and Why Does It Matter?, Bank of England Quarterly Bulletin, 53(2), 100-109.

Jurado, K., Ludvigson, S. C. and Ng, S. (2015). Measuring Uncertainty, American Economic Review, 105(3), 1177-1216.

Kehrig, M. (2011). The Cyclicality of Productivity Dispersion, Center for Economic Studies Working Papers, 11-15.

Knight, F. H. (1921). Risk, Uncertainty, and Profit. Library of Economics and Liberty.

Knotek II, Edward S. and Khan, S. (2011). How Do Households Respond to Uncertainty Shocks?, Federal Reserve Bank of Kansas City, Economic Review, 96(2), 05-34.
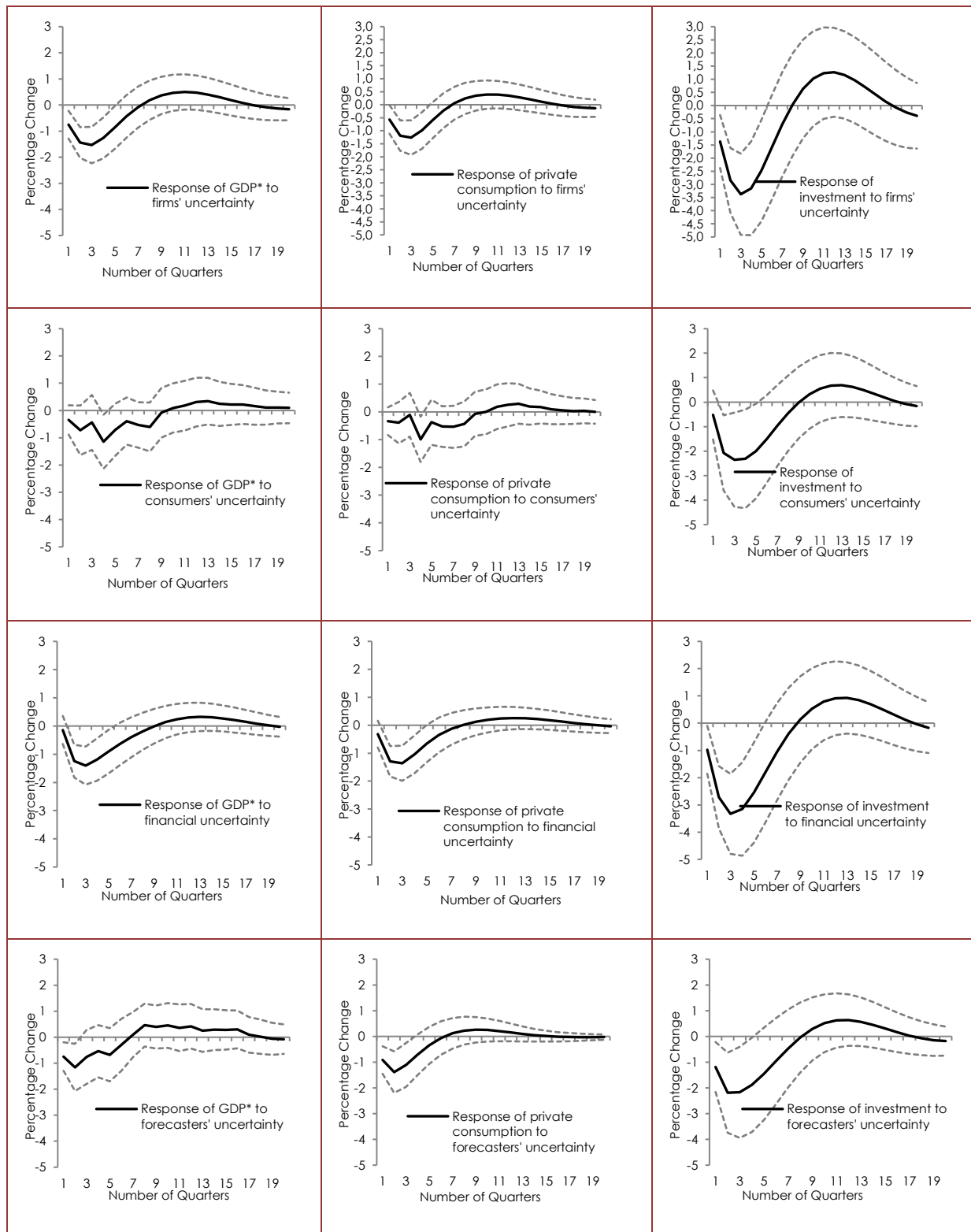
Leahy, J. and Whited, T. (1996). The Effect of Uncertainty on Investment: Some Stylized Facts, Journal of Money, Credit and Banking, 28(1), 64-83.

Ludvigson, S. C., Ma, S., and Ng, S. (2015). Uncertainty and business cycles: exogenous impulse or endogenous response?, National Bureau of Economic Research, No. w21803.

OECD (2012). OECD System of Composite Leading Indicators. http://www.oecd.org/std/leading-indicators/41629509.pdf

Patton, A. J., and Timmermann, A. (2010). Why do forecasters disagree? Lessons from the term structure of cross-sectional dispersion, Journal of Monetary Economics, 57(7), 803-820.

Plante, M., Richter, A. W., and Throckmorton, N. A. (2016). The zero lower bound and endogenous uncertainty, The Economic Journal, Doi: 10.1111/ecoj.12445.

Rossi B. and Sekhposyan, T. (2015). Macroeconomic Uncertainty Indices Based on Nowcast and Forecast Error Distributions, American Economic Review Papers & Proceedings, 105(5), 650-55.

Rossi, B., Sekhposyan, T. and Soupre, M. (2016). Understanding the Sources of Macroeconomic Uncertainty, CEPR Discussion Paper No. DP11415.

Scotti, C. (2016). Surprise and Uncertainty Indexes: Real-time Aggregation of Real-Activity Macro Surprises, Journal of Monetary Economics, 82, 1-19.

Zarnowitz, V. and Lambros, L.A. (1987). Consensus and uncertainty in economic prediction, Journal of Political Economy, 95(3), 591-621.
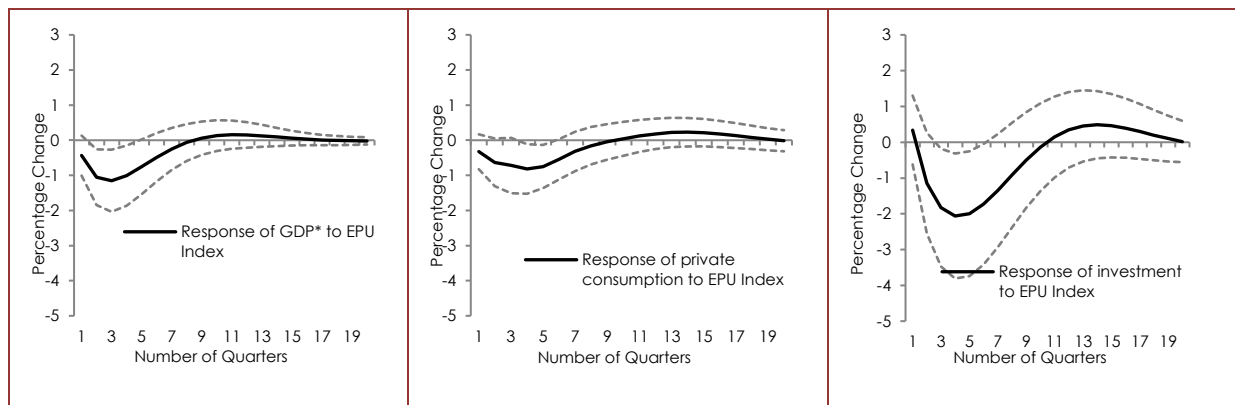
Appendix

Table 4: Data Used in the Analysis

Financial Uncertainty Index		
Included Series		
Name	**Source**	
Stock exchange return (BIST-100 all shares index)	CBRT	
VIX	Bloomberg	
Implied USD/TL exchange rate volatility	" "	
EMBI Turkey	" "	
Realized interest rate volatility	CBRT	
CDS	Bloomberg	
Excluded Series		
Name	**Source**	**Reason**
Open market repo and reverse repo transactions, net proceeds	CBRT	Same information content with stock exchange return
Commercial loan interest rate - deposit interest rate spread	" "	" "
Expectations Regarding General Economic Activity	CBRT, Bank Loans Tendency Survey	Quartely data
Consumers' Uncertainty Index		
Included Series		
Name	**Source**	
Consumer confidence index	Bloomberg HT, TURKSTAT-CBRT	
Financial situation expectation of households (next 12 months)	" "	
General economic situation expectation (next 12 months)	" "	
Financial situation of households (compared to previous year)	" "	
General economic situation (compared to previous year)	" "	
Assessment on purchasing money on durable goods	Bloomberg HT	
The probability of buying or building a home (next 12 months)	TURKSTAT-CBRT	
Expectations regarding the number of unemployed people	" "	
Excluded Series		
Name	**Source**	**Reason**
Assessment on spending money on semi-durable goods (next 3 months compared to past 3 months)	TURKSTAT-CBRT	Short sample size and low cross correlation with private consumption
Assessment of saving conditions	" "	" "
Statement on current financial situation of household	" "	" "
The probability of saving (next 12 months)	" "	" "
The probability of borrowing money (next 3 months)	" "	" "
Assessment on consumer prices change rate (last 12 months)	" "	" "
Expectation for consumer prices change rate (next 12 months comp	" "	" "
Expectation for wages change rate (next 12 months compared to past 12 months)	" "	" "
The probability of buying a car (next 12 months)	" "	" "
The probability of spending money on home improvements or renc	" "	" "
Firms' Uncertainty Index		
Included Series		
Name	**Source**	
Opinions about the general course of business in firm's industry	CBRT, Business Tendency Survey	
Export orders expectation (next 3 months)	" "	
Domestic market selling price expectation (next 3 months)	" "	
Retail trade confidence index	TURKSTAT, Retail Trade Sector Tendency Survey	
Retail trade sales (next 3 months)	" "	
Services sector confidence index	TURKSTAT, Services Sector Tendency Survey	
Demand-turnover expectation (next 3 months)	" "	
Excluded Series		
Name	**Source**	**Reason**
Production assessment (past 3 months)	CBRT, Business Tendency Survey	A good volatility model cannot be estimated
Current level of overall orders	" "	" "
Current level of export orders	" "	" "
Current stock of finished products	" "	" "
Production expectation (next 3 months)	" "	" "
Selling price change (next 3 months)	" "	" "
Employment change (next 3 months)	" "	" "
Factors limiting production	" "	Quartely data
Current production capacity	" "	Quartely data
Number of production months assured by current overall orders	" "	Quartely data
Change in total orders (past 3 months)	" "	Low cross correlation with GDP
Change in export orders (next 3 months)	" "	Low cross correlation with GDP
Change in competitive position on the domestic market (past 3 mo	" "	Quartely data
Change in competitive position on foreign markets inside the EU (p	" "	Quartely data
Change in competitive position on foreign markets outside the EU (	" "	Quartely data
Total orders expectation (next 3 months)	" "	Low cross correlation with GDP
Current domestic orders	" "	A good volatility model cannot be estimated
Change in domestic orders (past 3 months)	" "	" "
Domestic orders expectation (next 3 months)	" "	Low cross correlation with GDP
Change in fixed investment expenditure (next 12 months compared	" "	Low cross correlation with GDP
Change in average unit cost (past 3 months)	" "	Low cross correlation with GDP
Change in average unit cost (next 3 months)	" "	A good volatility model cannot be estimated
Inflation rate expectation (producer prices, next 12 months)	" "	Similar information content with "Domestic market selling price expectation"
Change in short term Turkish Lira credit interest rate (next 3 mont	" "	A good volatility model cannot be estimated
Retail trade sales (past 3 months)	TURKSTAT, Retail Trade Sector Tendency Survey	" "
Orders expectation placed with suppliers (next 3 months)	" "	" "
Business situation (past 3 months)	TURKSTAT, Services Sector Tendency Survey	" "
Demand-turnover (past 3 months)	" "	" "
PMI	IHS Markit, ISO	" "
PMI - Production expectation	" "	" "
PMI - New orders expectation	" "	" "
PMI - New export orders expectation	" "	" "
Forecasters' Uncertainty Index		
Included Series		
Name	**Source**	
Expected CPI over the next twelve months	CBRT, Survey of Expectations	
Expected USD/TL exchange rate in the interbank foreign exchange market by the end of the year	" "	
Expected GDP growth rate for the current year	" "	

Figure 9. Impact of Sub-Uncertainty Indices on Macroeconomic Variables

Percentage Change — Response of GDP* to EPU Index

Number of Quarters
1 3 5 7 9 11 13 15 17 19

Percentage Change — Response of private consumption to EPU Index

Number of Quarters
1 3 5 7 9 11 13 15 17 19

Percentage Change — Response of investment to EPU Index

Number of Quarters
1 3 5 7 9 11 13 15 17 19

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(Evren Erdoğan Coşar Çalışma Tebliği No. 18/04, Şubat 2018)

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