Abstract

In this study, we propose a new methodology to extract the expected real interest rate uncertainty and disagreement measures with the use of micro data on Turkish treasury inflation indexed bond auctions. We argue that these newly formed indicators do not have the problems associated with other model and survey based uncertainty and disagreement measures. We also examine the effects of real interest rate uncertainty on investment by comparing not only the measures commonly used in literature but also the new ones that we construct. Estimation results indicate that real interest rate uncertainty has a positive effect on private investment. This is at odds with the effects of model based disagreement measures on private investment.

Keywords: Treasury Auctions, Inflation Indexed Bonds, Real Interest Rate Uncertainty, Real Interest Rate Disagreement, Investment

JEL Codes: D44, D81, E22, E27, E43

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1. Introduction
The process of making an investment decision requires assessing the likelihood of the future events. However the indefinite structure of the upcoming events causes the economic agents’ expectations differentiate from each other due to uncertainty, which occupies an important place in the investment literature.

In theoretical literature Hartman (1972) and Abel (1983) show that increased price variance raises the expected return of the capital thus, may result in a higher investment. Later, by introducing option pricing methodology to the irreversible investment models, Bernanke (1983), McDonald and Siegel (1986), and Dixit and Pindyck (1994) show that increased uncertainty may reduce the investments. This is mainly due to the increased uncertainty raises the variance of the future returns, in other words, increases the value of the call option to delay. More recently, however, Abel et al. (1996) introduce a more general model of irreversibility including the put option in addition to the call option and they come to a conclusion that uncertainty has ambiguous effects on investment decision.

Similarly, potential importance of uncertainty over investment has also stimulated the empirical literature. However, the inclusion of uncertainty measures in econometric models highlights three main points: Firstly, most of the studies in the literature use historical data to construct an uncertainty measure. However, since uncertainty is fundamentally a forward-looking phenomenon, the findings in the literature may be flawed. Only few studies employ forward looking variables in their analyses. Ferderer (1993) uses interest rate term premium, while Pattillo (1998) and Lensink et al (2005) make use of probability of expected sales as a measure of forward looking uncertainty.

Secondly, there is a need for using the relevant measurements of uncertainty in order to reach correct results within the economic analysis. Rather than the confidence associated with each expectation (named as uncertainty) using dispersion across expectations (named as disagreement) as a measure of uncertainty is a flawed way. Yet, the inexistence of uncertainty measures has necessitated disagreement measures to be used as a proxy for uncertainty in literature. Since the distribution of individual expectations is not generally requested from survey participants and cannot be derived from the market data, the disagreement among the survey participants or the realized volatility captured from the data are frequently employed as a proxy for uncertainty. However, the literature related with uncertainty offer mixed support for the proposition that disagreement is a useful proxy for uncertainty. Lambros and
Zarnowitz (1987) evaluate the disagreement and uncertainty as conceptually distinct variables and showed that uncertainty and disagreement generally do not share a common time series pattern. Oppositely, Giordani and Söderlind (2003) argue that two measures are highly correlated and thus disagreement could be used as a proxy for uncertainty. More recently, Rich and Tracy (2006) and Lahiri and Sheng (2010) found mixed results for the proposition that disagreement is a good proxy for uncertainty.

Thirdly, it is critical to derive the accurate measurements of uncertainty in order to obtain correct results within the economic analysis. Existing measures of uncertainty can be partitioned into main two categories depending on whether they are model based or survey based. Model based measures are inferred directly from the market data itself whereas survey based measures are derived from the forecasts of the relevant data. Nevertheless, these so called methodologies have their own cons. Model (or market) based approaches produce disagreement measures rather than uncertainty and generally presume the survey participants use same modeling structure while shaping their expectations (see Engle 1982, Engel, 1983). Moreover, model based approaches do not take into account the regime changes and have certain shortcomings. For example, Giordani and Söderlind (2003), empirically argue that uncertainty measures generated through time-series methods do not match those generated from the survey data.

On the other hand, an important shortcoming of the survey based measures, as highlighted by Croushore (1993) and, Giorsani and Söderlind (2003), is the lack of full information of the survey respondents with regard to the survey questions. Besides, since there is no accountability for the predictions, forecasters may simply give nonsense answers or biased answers (Laster et al (1999)). Additionally, survey based measures usually provide only point forecasts, enabling only the disagreement measures to be calculated. To derive the expectations’ uncertainty, one needs respondents’ degree of confidence attached to the point expectations. Yet, there are only few surveys that contain such information.

In this paper, we propose a new methodology in order to construct more reliable measures for uncertainty. More precisely, we generate forward looking real interest rate uncertainty and disagreement measures by using treasury auctions data set. Then, we mainly analyze the effects of uncertainty on investment by comparing the defective measures commonly used in literature with the new ones that we construct. According to our results, real interest rate
uncertainty has a positive effect on investment change whereas real interest rate disagreement has either negative or insignificant effects.

The remainder of the paper is as follows: Next section introduces the data and the methodology behind the new uncertainty measures and also presents the other measures commonly used in the literature. Section 3 discusses the effects of uncertainty and disagreement measures on investment. Section 4 concludes the paper.

2. Measures for Real Interest Rate Uncertainty and Disagreement

2.1. Auction based Uncertainty Measures

In this section, we propose a new methodology in order to construct more reliable measures for uncertainty and disagreement. To do so, we use the data set of Treasury auctions by employing individual bids submitted by primary dealer banks in these auctions. Thus, our focus is mainly on bids submitted to inflation indexed bonds. Since, the primary dealer banks submit relatively higher number of individual bids to each auction; our data base and methodology also provide us the opportunity to construct new measures not only for disagreement but also for uncertainty.

We argue that these newly formed indicators do not have the above-mentioned problems associated to survey and model based measures: First of all, treasury auctions data base enables us to derive a proxy for uncertainty as well as disagreement. Secondly, since the submitted bids may have effect on auction participants’ expected profit/loss, they need to give their full effort in shaping their auction bids instead of giving non-sense answers. Thirdly, our proposed measures for uncertainty and disagreement probably reflect the common consensus for the economic outlook since our sample space encompasses primary dealer banks, which are professionals and regularly doing analysis about the economy, corresponding nearly 90 percent of Turkish banking sector in terms of reserve requirement liabilities,. Fourthly, treasury auctions are closely monitored not only by the auction participants but also by other market players as well. Thus, the auction results directly affect the pricing behavior of other economic agents. Finally, treasury auctions data base enables us to focus on long term expectations rather than the short term ones.
2.1.1 Auction Data

In the paper, we examine the micro data of Turkey’s Treasury auctions for the inflation indexed bonds with the maturity of 5 and 10 years. The first inflation indexed bond was issued in February 2007 with the maturity of 5 years. Then, in 2010, Turkish Treasury started to issue inflation indexed bonds with the maturity of 10 years. Within the sample period that covers February 2007 and June 2015, we observe 55 auction calendars in which inflation indexed bonds were issued. We employ multi price auction bids submitted by participants. Each multi price auction bid consists of nominal amount and the price level, and the successful bidders purchase the securities at their own bid prices. The number of bids submitted to multi price auctions for inflation indexed bonds and corresponding total amounts of submitted bids are shown on the following Figure 1 respectively.

**Figure 1. Details of Treasury Auctions for Inflation Indexed Bonds**

As shown in Figure 1, average numbers of bids submitted to inflation indexed bonds is 79, whereas the total amount of submitted bids for inflation indexed bonds fluctuates around 3 billion Turkish Liras (TRY). We have been observing a slightly downward trend in the number of bids for linkers since the spike experienced in 2010. Besides, it is observed that Treasury sells 1 billion TRY worth inflation indexed bonds on average, excluding non-competitive sales to primary dealer banks and public institutions (Figure 1-b).

Since, the participants’ bids contain the price levels, the corresponding compound interest rates for each bids are calculated according to standard bond calculation methods. The (amount) weighted average interest rates of each auction for inflation indexed bond are depicted on the Figure 2. Accordingly, implied real rates dropped from two-digit rates to
single digits after the financial crisis and have been hovering around 2.88% since the beginning of 2010 with remarkable sensitivity to the global and domestic turmoil periods. The lowest real rate was observed just before the FED tapering signal with the help of the supportive global liquidity conditions. Recently we have been observing upward trend in real rates possibly due to the increase in Turkey’s risk premium.

2.1.2. Methodology

Treasury auction database provides us the opportunity not only to monitor market expectations regarding the real interest rate but also to construct new measures for both real interest rate uncertainty and disagreement. Figure 3 depicts the evolution of the distribution of real interest rates of submitted bids in some selected auctions between February 2007 and June 2015. The frequency distributions are illustrated with the use of Gaussian kernel smoothing function. We also presented the statistical properties of the distribution of auction implied figures on Figure 4. As illustrated on left panel, the levels of kurtosis and skewness are consistently above the levels of 3 and 0 respectively implying the non-normality of the real rate expectations. Moreover, fatter long right tails are observed especially in times of global and domestic turmoil. On the right panel, inter-percentiles ranges of submitted bids are depicted as additional measures of uncertainty among auction participants, primary dealer banks. As it is clearly grasped from the figure, the percentile ranges for different levels demonstrate upward swings during the periods of global and domestic turmoil. From Figure 3 and 4, one can conclude that uncertainty measures do not always exhibit fairly symmetric bell shaped distribution. Thus, it is not reasonable to use the ARCH or GARCH models that
assuming all the agents in the economy have homogenous expectations and conditional volatility of the relevant variable comes from a normal distribution.

Figure 3: Dispersion of Real Interest Rate of Treasury Auctions Participants Bids (percent)
To take the actual distribution of the expectations into consideration, which are generally non-normally distributed, we construct new measures for real interest rate disagreement and uncertainty. We propose some auction based input variables, namely $AWR_{it}$, $MaxRs_{it}$, $MinRs_{it}$ and $AWR_{t}$. These variables and their respective calculation methods with the use of maximum, minimum and weighted average compound interest rates of individual bids submitted by each bank are as follows:

$maxRs_{it}$: This variable reflects the maximum interest rate of bids submitted to the inflation indexed bond auction by the same individual bank at time $t$.

$minRs_{it}$: This variable reflects the minimum interest rate of bids submitted to the inflation indexed bond auction by the same individual bank at time $t$.

$AWR_{it}$: This variable reflects the weighted average real interest rate of each individual bank and is calculated through the following equation with the use of nominal (amount) weighted average interest rate of all bids submitted to the inflation indexed bond auction.

$$AWR_{it} = \frac{\sum_{j=1}^{m} (Nom_{ij} \times (Inflation\ Indexed\ Bid\ Rate_{ij}))}{\sum_{j=1}^{m} Nom_{ij}}$$

(1)

$AWR_{t}$: This variable reflects the weighted average real interest rate of all participant banks and is calculated through the above equation.
Accordingly, the new measures of real interest rate uncertainty and disagreement are generated from micro treasury auctions data with the following methodologies:

**Real Interest Rate Disagreement Measures:** The new disagreement measures defined as interbank (between) variation in expected real interest rate are calculated with the utilization of input variables of $AWRs_{it}$ and $AWRs_{t}$. Expression (2) reflects the average distance (basis points) of all participant primary dealer banks’ weighted real interest rate expectations from the overall auction based market expectations while expression (3) represents the dispersion of $AWRs_{it}$ for all participant PD banks for the same auction calendar ($t$):

$$\text{RealDisM}_{1t} = \frac{\sum_{i=1}^{N_t} \text{absolute}(AWRs_{it} - (AWRs_{t}))}{N_t}$$  \hspace{1cm} (2)

$$\text{RealDisM}_{2t} = \text{sd. dev}(AWRs_{it})$$  \hspace{1cm} (3)

**Real Interest Rate Uncertainty Measures:** The uncertainty measure defined as intrabank (within) variation in expected real interest rate is calculated with the use of $MaxRs_{it}$ and $MinRs_{it}$ of each participant PD bank. Expression (4) reflects the average difference (basis points) between the upper and lower bound of auction based real interest rate expectations of all PD banks for the same auction calendar ($t$). Expression (5) reflects the average dispersion of all individual submitted bids of all participant PD bank for the same auction calendar ($t$):

$$\text{RealUncM}_{1t} = \text{average}(MaxRs_{it} - MinRs_{it})$$  \hspace{1cm} (4)

$$\text{RealUncM}_{2t} = \text{average}(Sdt. Dev(all bids_{it}))$$  \hspace{1cm} (5)

**Figure 5. Real Interest Rate Uncertainty and Disagreement Measures from Auctions**
We illustrate our new measures for real rate disagreement and uncertainty together with highlighted global and domestic turmoil periods on Figure 5. As shown, both real interest rate disagreement measures are fluctuating around nearly 11 basis points, while real interest rate uncertainty measures are fluctuating around 26 and 9 basis points respectively. Regarding the turmoil periods, sharp pickups are observed in all type of measures indicating that external common shocks strongly affect both of these series just like many other financial variables.

2.2. Model Based Uncertainty Measures

As for model based real rate disagreement measures, we employ the univariate GARCH\(^1\) model in line with the literature and we try to capture the conditional variances for three market based data; (i) 1 year realized real interest rates, which are calculated through the deduction of realized year over year inflation rates from the 1 year nominal interest rate observed a year ago, (ii) 1 year expected real interest rates, which are calculated through the deduction of expected year over year inflation rate from the currently observed 1 year nominal interest rate and (iii) 5 year expected real interest rates derived from secondary market transactions of inflation indexed bonds with maturities higher than 4 years. Figure 6 depicts both the levels of these market based data and their respective conditional variances derived from univariate GARCH models.\(^2\)

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\(^1\)We estimate the following model for each disagreement measure:

\[
R_t = \beta_0 + \sum_{i}^{i} \beta_i R_{t-i} + \epsilon_t \\
\epsilon_t \sim N(0, h_t) \\
h_t = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \alpha_2 h_{t-1}
\]

where \(R_t\) reflects the respected monthly changes in real rate and \(i\) represents optimal lags of dependent variables in the mean equation. GARCH(1,1) is selected over other GARCH specifications according to Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

\(^2\) We could not derive the survey based uncertainty measures since there is no survey available in Turkey about the real interest rates.
3. Estimation and Results

3.1 Data

Since we attempt to associate both auction and model implied measures of real interest rate with quarterly fixed capital investment of private sector (as the ratio of GDP of Turkey), we have taken the simple averages of monthly model based and auction based figures within the same quarter. Our sample space consists 34 quarters between Q1 2007 and Q2 2015. All data obtained from Central Bank of the Republic of Turkey.

3.2 Estimation

In this section, we try to analyze the link between investment and uncertainty. Due to our small sample size, we have constructed regression equations just with the inclusion of i) lagged of dependent variable, and ii) the relevant uncertainty variable and its first lag.
Uncertainty measures used in estimations can be categorized under three headings as (1) auction based real rate uncertainty, (2) auction based real rate disagreement and (3) model based disagreement measures. The descriptive statistics for the variables can be seen in Table 1.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Private Sector Fixed Capital Investment/GDP Ratio</td>
<td>0.001</td>
<td>0.001</td>
<td>0.148</td>
<td>-0.143</td>
<td>0.068</td>
</tr>
</tbody>
</table>

### Auction Implied Real Rate Uncertainty Measures

<table>
<thead>
<tr>
<th>Metric</th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average of (Bank Level Max-Min Bids)</td>
<td>0.209</td>
<td>0.194</td>
<td>1.750</td>
<td>0.042</td>
<td>0.295</td>
</tr>
<tr>
<td>Average of (StDev of Bank Level Bids)</td>
<td>0.092</td>
<td>0.076</td>
<td>0.421</td>
<td>0.022</td>
<td>0.075</td>
</tr>
<tr>
<td>StDev of All Bids</td>
<td>0.143</td>
<td>0.116</td>
<td>0.584</td>
<td>0.041</td>
<td>0.113</td>
</tr>
<tr>
<td>Percentile Range 1% of Submitted Bids</td>
<td>0.743</td>
<td>0.577</td>
<td>3.100</td>
<td>0.220</td>
<td>0.600</td>
</tr>
<tr>
<td>Percentile Range 5% of Submitted Bids</td>
<td>0.456</td>
<td>0.350</td>
<td>1.890</td>
<td>0.140</td>
<td>0.374</td>
</tr>
<tr>
<td>Percentile Range 10% of Submitted Bids</td>
<td>0.337</td>
<td>0.270</td>
<td>1.430</td>
<td>0.090</td>
<td>0.288</td>
</tr>
<tr>
<td>Percentile Range 25% of Submitted Bids</td>
<td>0.156</td>
<td>0.130</td>
<td>0.680</td>
<td>0.085</td>
<td>0.113</td>
</tr>
</tbody>
</table>

### Auction Implied Real Rate Disagreement Measures

<table>
<thead>
<tr>
<th>Metric</th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Distance of AWRs</td>
<td>0.104</td>
<td>0.087</td>
<td>0.478</td>
<td>0.025</td>
<td>0.085</td>
</tr>
<tr>
<td>StDev of AWRs</td>
<td>0.128</td>
<td>0.105</td>
<td>0.484</td>
<td>0.034</td>
<td>0.095</td>
</tr>
</tbody>
</table>

### Model Based Disagreement Measures

<table>
<thead>
<tr>
<th>Metric</th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year Realized Real Rate Volatility</td>
<td>2.188</td>
<td>2.088</td>
<td>3.422</td>
<td>1.829</td>
<td>0.358</td>
</tr>
<tr>
<td>1 year Expected Real Rate Volatility</td>
<td>1.374</td>
<td>0.909</td>
<td>6.047</td>
<td>0.111</td>
<td>1.302</td>
</tr>
<tr>
<td>5 year Expected Real Rate Volatility</td>
<td>0.070</td>
<td>0.037</td>
<td>0.540</td>
<td>0.011</td>
<td>0.106</td>
</tr>
</tbody>
</table>

In the estimation, we use uncertainty measures in levels and private sector investment in first differences due to non-stationary investment data. With these explanations, we can write the regression equation for the change in private investment as:

\[
\Delta \text{inv}_t = \alpha + \beta_1 \Delta \text{inv}_{t-1} + \beta_2 \text{unc}_t^i + \beta_3 \text{unc}_{t-1}^i + \epsilon_t
\]

(6)

Here, “inv” refers to the fixed capital investment of private sector as the ratio of GDP. The variable “unc” represents the “i” type uncertainty measure. Equation (6) is estimated by OLS and the standard errors are corrected with the heteroscedasticity consistent covariance matrix estimator described in White (1980).

### 3.3 Results

Estimation results, presented in Table 2, indicate that all contemporaneous effects of uncertainty measures are insignificant and hence, we can conclude that uncertainty can be effective on investment with a one quarter lag. According to the results, uncertainty measures
derived from the auction bids have significant positive impact on investment. This positive effect of uncertainty can be explained by greater uncertainty makes expandability costly (Abel et al. (1996)). In other words, future acquisition price of capital may be higher than its current acquisition price, which increases the incentive to invest.

On the other hand, model based disagreement measures have negative effects on investment whereas auction based disagreement measures have positive but statistically insignificant effects on investment.

Consequently, our findings show that using model based uncertainty measures as a measure of uncertainty may give completely different results. This can be explained by the fact that GARCH models can only produce uncertainty measures that are backward-looking and thus based on predetermined information. Moreover, model based GARCH methods assume that all the agents in the economy have homogenous expectations and conditional volatility of the relevant variable comes from a normal distribution. This not a good assumption if agents have heterogeneous beliefs and if their expectations are not symmetrically distributed around the expected value of the relevant variable.

Table 2: Estimation Results—Uncertainty/Disagreement and Investment

<table>
<thead>
<tr>
<th>Auction Implied Real Rate Uncertainty Measures</th>
<th>ΔPrivate Sector Fixed Capital Investment (t-1)</th>
<th>Independent Variable (t)</th>
<th>Independent Variable (t-1)</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average of (Bank Level Max-Min Bids)</td>
<td>0.627*** (0.159)</td>
<td>-0.027 (0.085)</td>
<td>0.048*** (0.035)</td>
<td>0.400</td>
</tr>
<tr>
<td>Average of (StDev of Bank Level Bids)</td>
<td>0.619*** (0.17)</td>
<td>-0.145 (0.030)</td>
<td>0.182* (0.088)</td>
<td>0.389</td>
</tr>
<tr>
<td>StDev of All Bids</td>
<td>0.627*** (0.165)</td>
<td>-0.102 (0.103)</td>
<td>0.163** (0.076)</td>
<td>0.427</td>
</tr>
<tr>
<td>Percentile Range 1% of Submitted Bids</td>
<td>0.635*** (0.165)</td>
<td>-0.011 (0.018)</td>
<td>0.035*** (0.013)</td>
<td>0.434</td>
</tr>
<tr>
<td>Percentile Range 5% of Submitted Bids</td>
<td>0.620*** (0.197)</td>
<td>-0.030 (0.051)</td>
<td>0.044* (0.024)</td>
<td>0.413</td>
</tr>
<tr>
<td>Percentile Range 10% of Submitted Bids</td>
<td>0.612*** (0.197)</td>
<td>-0.071 (0.086)</td>
<td>0.059** (0.028)</td>
<td>0.421</td>
</tr>
<tr>
<td>Percentile Range 25% of Submitted Bids</td>
<td>0.650*** (0.197)</td>
<td>-0.094 (0.133)</td>
<td>0.181*** (0.096)</td>
<td>0.457</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Auction Implied Real Rate Disagreement Measures</th>
<th>ΔPrivate Sector Fixed Capital Investment (t-1)</th>
<th>Independent Variable (t)</th>
<th>Independent Variable (t-1)</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Distance of AWRs</td>
<td>0.590*** (0.176)</td>
<td>-0.151 (0.217)</td>
<td>0.130 (0.136)</td>
<td>0.388</td>
</tr>
<tr>
<td>StDev of AWRs</td>
<td>0.612*** (0.176)</td>
<td>-0.117 (0.179)</td>
<td>0.153 (0.187)</td>
<td>0.412</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model Based Disagreement Measures</th>
<th>ΔPrivate Sector Fixed Capital Investment (t-1)</th>
<th>Independent Variable (t)</th>
<th>Independent Variable (t-1)</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year Realized Real Rate Volatility</td>
<td>0.639*** (0.197)</td>
<td>0.023 (0.923)</td>
<td>-0.037* (0.020)</td>
<td>0.490</td>
</tr>
<tr>
<td>1 year Expected Real Rate Volatility</td>
<td>0.585*** (0.177)</td>
<td>-0.008 (0.015)</td>
<td>0.005 (0.008)</td>
<td>0.267</td>
</tr>
<tr>
<td>5 year Expected Real Rate Volatility</td>
<td>0.606*** (0.177)</td>
<td>0.065 (0.061)</td>
<td>-0.133*** (0.044)</td>
<td>0.390</td>
</tr>
</tbody>
</table>

Note: Dependent variable is the change in private fixed capital investment to GDP ratio. Each row represents distinct regression of dependent variable on respective independent variable named in each row. Standard errors adjusted for autocorrelation problems are in parentheses. 
*** p<0.01, ** p<0.05, * p<0.1. All variables are stationary, excluding private fixed capital investment, in their levels according to Augmented Dickey-Fuller unit root test. Private sector fixed capital investment to GDP ratio is used as the independent variable. Market priced based measures are obtained through GARCH(1,1) process.
4. Conclusion

In this paper, we constructed new measures of real interest rate uncertainty (within variations) and disagreement (between variations) for Turkey with the use of individual bids submitted by primary dealer banks for the inflation indexed bonds auctions. This paper contains its own unique characteristics in terms of contribution to the literature by providing new measures for uncertainty in addition to disagreement eliminating the shortcomings of other survey and model based measures.

According to our results, uncertainty measures derived from the auction bids have significant positive effects on investment. Meanwhile, we find that the disagreement measures derived from the GARCH methodology have negative effects on investment whereas disagreement measures obtained from the auction bids have insignificant positive effects on investment.

Additionally, these findings also show the importance of selecting proper uncertainty measure for an empirical study. Using model based measures as an uncertainty proxy may give completely different results.

Finally, there exists a need for reliable measures reflecting the uncertainty and disagreement about the course of future economic activity in order to design appropriate monetary policy stance. In this context, our methodology is believed to enhance the effectiveness of the policy making by introducing new proxies for the central banks. Besides, economies with inadequate professional surveys also gain the opportunity to construct historical uncertainty and disagreement measures for real interest rate with such methodology.

REFERENCES


