

Overview of models and methods for measuring economic agent's expectations

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Expectation examination approaches

Modern economic theory recognizes that the main difference between economics and natural sciences lies in the forward-looking decisions made by economic agents. Expectations play a key role in every segment of macroeconomics. In consumption theory the paradigm life-cycle and permanent income approaches stress the role of expected future incomes. In investment decisions present-value calculations are conditional on expected future prices and sales. Asset prices (equity prices, interest rates, and exchange rates) also clearly depend on expected future prices. Today we can distinct two major expectation paradigms and concepts, where the second became the mainstream approach for further development of expectation examination:

Adaptive expectations (AE) represent a hypothesis in economics which states that people form their expectations about what will happen in the future based on what has happened in the past. For example, if inflation has been higher than expected in the past, people would revise expectations for the future. Adaptive expectations played a prominent role in macroeconomics in the 1960s and 1970s. For example, inflation expectations were often modelled adaptively in the analysis of the expectations-augmented Phillips curve. The rational expectations revolution began with the observations that adaptive expectations, or any other fixed-weight distributed lag formula, might provide poor forecasts in certain contexts and that better forecast rules might be readily available.

Rational expectations (RE) state that agents' predictions of the future value of economically relevant variables are not systematically wrong in the sense that all errors are random. Equivalently, this is to say that agents' expectations equal true statistical expected values. An alternative formulation is that rational expectations are model-consistent expectations, so the agents inside the model assume the model's predictions are valid. In modern econometrics a silent consensus has been established that at the theoretical level the rational expectations hypothesis proposed by Muth (1961) has gained general acceptance as the dominant model of expectations formation. His thesis provides a theory-consistent framework based on a theory in which subjective expectations of individual decision makers are set to their objective counterparts, assuming a known true underlying economic model.

1. Development of expectation theory

Economic expectations are crucial in determining economic activity as they affect economic decisions of consumers, politicians, businesses and economic experts. One of the first records of how important the expectations are can be found in Keynes (1936), who emphasised their role in the amount of output, employment and savings. He divided the expectations into two types. First type is the short term expectations, which are concerned with the price the producer expects to get for its product at the time he starts the production process. The second, the long term expectations, are connected with what the entrepreneur can hope to earn in the future if he purchases his products as an addition to his capital equipment. The behaviour of each individual company is determined by its short term expectations, which largely depend on the long term expectations of other parties. The

amount of employment in certain firm depends on these various expectations. However, a change in expectations will only have full effect on employment over considerable period.

Samuelson (1948) showed that observation of consumption, price and income, combined with basic assumption of consumer theory, implies restrictions on the consumption bundles that this person would choose when having different budget sets with varying relative prices.

Muth (1961) argued that the economy generally does not waste information and that expectations depend on the structure of the entire system. Expectation as informed predictions of future events is the same as the predictions of the relevant economic theory. According to his opinion dynamic economic models do not assume enough rationality.

Another author who contributes to the concept of rational expectations as one of the central assumptions for many macroeconomic models is Lucas (1972). He studied the relation between the rate of change in nominal prices and the level of real output, a variant of Phillips curve. Demand shifts or monetary disturbances cause price movements. However, money expansion has no real consequences in case all agents and their expectations behave optimally. When placed in a setting in which the information conveyed to traders by market prices is inadequate to permit them to distinguish real shifts from monetary fluctuation. In this way monetary fluctuation leads to real output growth or fall.

McFadden (1974) showed that decisions made by people in random sample, combined with assumptions on the population distribution of preferences, enable estimation of probabilistic choice models. They can then be used to predict population choice behaviour in other settings.

Kahneman and Tversky (1979, 1981) worked on the uncertainty phenomena under which bounded rationality and expectations are formed, to explain divergences of economic decision making from neo-classical theory. Their prospect theory, which they illustrate with gambling and insurance business, distinguishes between an early phase of editing and a subsequent phase of evaluation. The editing phase consists of the preliminary analysis of the offered choices, while the former evaluates the prospects and chooses the one with the highest value.

The function of the editing is to organize and reformulate one's options as to simplify the subsequent evaluation choice. It can be affected by many things: one's attitudes towards uncertainty and money, information or misinformation regarding probabilities and outcomes and many others. In addition, people generally discard components that are shared by all prospects under consideration, which leads to inconsistent preferences when the same choice is presented in different forms. Gains and losses are defined relative to some neutral reference point, usually one's current assets. However, there can be a discrepancy between these two points, for example recent changes in wealth to which one has not yet adopted. A change of reference point can alter the preference order for prospects. The frame is controlled partly by formulation of the problem and partly by the norms, habits and personal characteristics of the decision maker or even to a level of aspiration. The way the frame is built represents a critical factor in the analysing of the decisions. Inconsistent responses to the same problems can be framing effect with contradictory attitudes towards risks connected with gains and losses. In other words, changing reference frame can determine whether a certain outcome is evaluated as a gain or a loss.

Gigerenzer (1991) argues that Kahneman's and Tversky's results do not reflect respondents' use of certain heuristic rules but are formed by the manner in which statistical information was presented to them. Asking questions in terms of frequencies can reduce the magnitude of the biases described by Kahneman and Tversky. Another argument is that their heuristics are vaguely, atheoretically formulated, what limits their explanatory power as generators of biases. Furthermore, according to Gigerenzer some of the biases characterized as errors may be inappropriate. Nevertheless, Tversky and Kahneman tried to explain formation of expectation in real life and put doubt on the assumption of rational expectations.

Despite the prevail and domination of RE models in modern economics, an empirical evidence confirmed that expectations formation is closely linked to point and density forecasting and as such is subject to data and model uncertainty. Assuming that individuals know the true model of the economy is no more credible than claiming that economic forecasts made using econometric models will be free of systematic bias and informational inefficiencies. This has led many investigators to explore the development of a weaker form of the rational expectations hypothesis that allows for model uncertainty and learning.

Evans and Honkapohja (2001) presented the updated approach to expectation examination in form of “adaptive learning”. It is a dynamic concept that combines RE with a certain aspects of AE. The rational expectations approach supposes that economic agents have a great deal of knowledge about the economy. In empirical work economists, who postulate rational expectations, do not themselves know the parameter values and must estimate them econometrically. It appears more natural to assume that the agents in the economy face the same limitations on knowledge about the economy. So the concept of adaptive learning assumes that agents adjust and revise their forecast (expectations) rules as new data becomes available over time.

Manski (2004) concludes that most empirical research today concern choice problems in which decision makers act with partial information. Common assumption is that persons form probabilistic expectations for unknown quantities and maximizes expected utility, i.e. people’s expectations are objectively correct given the information they possess.

These recent findings together with contemporary adaptive learning models, where experimental and survey data on expectations play an important role in providing better insights into how expectations are formed, emphasized the role of the survey expectations.

2. Survey expectations

Economists would ask people about their preferences and expectations when choice data alone do not suffice to reveal the formation of decisions with partial information. The collection of data on expectations of individual has its roots in the development of survey methodology in the years before Second World War, when economists began to understand the importance of future events on current decisions (Peseran and Weale, 2006). Use of sample surveys made it possible to collect information way beyond what was covered by administrative sources and full enumeration censuses.

The earliest systematic attempt to collect information on consumer expectations was the study in 1944 conducted by United States Department of agriculture. It tried to measure consumer sentiment. Currently the survey is run by the University of Michigan, with many other similar surveys conducted across OECD countries. Key aspect is that some of its questions have qualitative responses, e.g. respondents are simply asked whether they expect to be better off or worse off.

Household surveys were later complemented with business survey on the state of economic activity. Before Second World War countries did not have any formal indicators of sentiment. One of the first surveys with questions about the expectations of output growth, price increase in the near future, their recent movement and evolution of business environment was done by the *Institut für Wirtschaftsforschung* in Munich in 1948. This survey structure has since been adopted by other countries.

In 1946 Joseph Livingstone started a survey about expectations of inflation in which a number of economists participated. Data collected were related with the macro-economy as a whole. Another feature of the survey is that the respondents (as experts) were asked to give point estimates of their expectation. Later the Livingstone Survey has broadened in scope to collect information on expectations about a range of economic variables. The survey is

now conducted by the Federal Reserve Bank of Philadelphia. Several similar surveys of macroeconomic forecasts are also produced in USA.

However, economists were very sceptical of survey data at the beginning. In the 1950s and early 1960s they even reported negative evidence on the usefulness in predicting consumer purchase behaviour of expected household finances from such data. Juster (1966) proposes that surveys of consumer intentions to buy provides inefficient predictors of purchase rates as do not provide accurate estimates of mean purchase probability. Such surveys cannot detect movements in mean probability among non-intenders. Purchase probabilities have larger explanatory power of cross-section variance as their variable enables the formation of subgroups with systematically different purchase rates.

Dominitz and Manski (1997) designed a survey specifically to elucidate information on income uncertainty, and thereby produced an indication of subjective income uncertainty of households. They concluded that the best way of collecting data on the subjective distribution was to ask people about the probabilities that their incomes over the next twelve months would be below each of four thresholds, with the thresholds chosen in the light of reported current income. Respondents were also asked to report the lowest and highest possible amounts their household incomes might be.

In the last 20 years the surveys has increasingly been used to research probabilistic expectations of significant personal events (job loss, life expectancy, future income, etc). For example, the Survey of Professional Forecasters asks the respondents to provide probabilities within particular ranges, instead of point estimators.

3. Expectation measures in surveys

To sum up, there general measurement methods of economic expectation have been established over time (Stangl, 2008): qualitative measurement with category-rating scales (usually three-category scale), quantitative measurement with point forecast (e.g. 2% inflation rate) and measurement of economic expectation with subjective probabilities of particular events.

Qualitative measures are quite popular since it is easier and quicker to give qualitative response for respondents as they do not necessary need to consult their accounting records and the wording is simpler for the phenomena which may be too complex to be described in quantitative values. Therefore, such responses are less often a source of inaccuracies or inconsistencies.

On the other hand, three category scales are very limited. Available options may not be compatible with respondents' real opinions, which often gather answers towards central category and thus imprecision and information loss. In addition, there is almost no information on the dispersion of economic expectations, which is most commonly used as a proxy of uncertainty. These problems can be to high extent solved by point forecasts or quantitative information on outstanding orders, profits or turnover. However, because of the confidentiality issues or time constraints, companies usually do not report it.

Pesaran and Weale (2006) suggest two conversion methods for converting the proportions of qualitative answers into quantitative measures for the purpose of econometric expectations' analysis. The main conversion techniques are:

1. the probability approach of Carlson and Parkin (1975).
2. the regression approach of Pesaran (1984) and Pesaran (1987).

Their method assumes that respondents have a common subjective probability distribution over the future development of a variable and that they report a variable to go up or down if the median of their subjective probability distribution lies above or below a threshold level.

The upper and lower thresholds which mark the so-called indifference limen are derived from the respondents' aggregate answers and the time-series properties of past realizations of the macroeconomic variable under consideration. Most crucially, they assumed that the answers are normally distributed with symmetric thresholds and they imposed that the average value of past realizations and the average value of expectations must be equal, which is typically referred to as the unbiasedness of expectations.

As an alternative to the Carlson-Parkin Method, Pesaran (1984) developed the Regression Method. The basic idea is to use the relationship between realizations (measured by official statistics) and respondents' perceptions of the past (which is additionally queried in many surveys) and to estimate the indifference limen on the basis of this observable data. In order to quantify the respondents' expectations about the future development of the variable under consideration, Pesaran (1984) used these estimates and imposed them on the qualitative expectations data. Thus, in contrast to the aforementioned methods, quantitative expectations calculated by the Regression Method are a function of a specific regression model, rather than a function of a specific probability distribution.

Despite the apparent advantages in using quantitative surveys, qualitative surveys are widespread and considerable attention is paid to them in the real-time economic debate. It is therefore important also to consider their performance as measures of the state of the macro economy. There are three macroeconomic areas where qualitative surveys play the major role for obtaining the data to assess the expectations: inflation, output growth and consumer sentiment/consumer spending. The question of the link between expectational data and inflation has received more attention than the one between expectational data and output movements, partly because of the importance attached to inflationary expectations in a number of macroeconomic models, such as the expectations-augmented Philips curve and the assumption that a real interest rate can be derived by deducting inflationary expectations from the nominal interest rate. The studies of consumer sentiment were the first surveys to collect information on expectations. Dominitz and Manski (1997) provide a brief account of early attempts to assess their value. They explain how the surveys acquired a poor reputation because they seemed to have little capacity to explain future consumption.

Subjective probability distribution of future events is also an option in the survey. The results enable to calculate the variance, which incorporate individual uncertainty and heterogeneity of expectations. Mansky (2004) proposes another three advantages. First one is that probability is a well-defined absolute numerical scale for responses that enables interpersonally comparable responses. Furthermore, algebra of probability can be used to examine the internal consistency about different events. Last but not least, subjective probabilities can be compared with event frequencies, which allow the conclusion about the correspondence between subjective beliefs and reality.

Nevertheless, probabilistic questions are time demanding and tend to cause high cognitive load to respondents. Consequently, only these kinds of questions are applicable to only people familiar with probability distributions. Another point for consideration is general tendency of respondents to be optimistic, observed in variety of survey research.

Stangl (2008) proposes new measure of economic expectations. The visual analog scale (VAS) is a qualitative measurement method, but it overcomes most of the problems with traditional ones. Visual analog scales are rating scales on which a respondent ranks the preferences along a continuous line or scale. They are easy to understand and to handle by the respondents. VAS was first used in medical research as commonly used measures of feeling and pain intensity.

Application of VAS in other surveys has been difficult so far due to costly operationalization. With the burst of Internet surveys VAS has become easy to administer. Respondents can express the direction of their attitude as well as the magnitude on a 1 to 100 point scale, which put VAS close to interval scale measurement. By using graph scales it does not increase cognitive load for the respondent and information collected is much broader. The

distributional shapes of responses and various measures of dispersion allow detect cyclical turning-points earlier.

Stangl tests VAS for reliability for three reasons: the measure has not been used before, the Internet and self-administration may negatively affect the scale reliability and for the reason VAS responses overestimates people's discriminatory power relating to the subjects of interests. She also argues that VAS business expectations contain two components: heterogeneity of business expectations and uncertainty about the future economic development. Overall, VAS is found to be reliable and valid information on economic expectations.

Another of her findings is related to thresholds. They are asymmetrical around zero as the respondents weight future losses stronger than gains. This means that expected positive changes of economic situation have to be on considerably higher level before companies report expected improvement in comparison with expected negative changes that would make them report anticipated deterioration. This is also in line with Kahneman and Tversky (1981).

Moreover, macroeconomic uncertainty broadens the indifference interval what leads to a shift towards neutral category within the three category scale. According to Stangl (2008) results indicate that the higher is the macroeconomic uncertainty the earlier respondents turn to neutral category and the longer they remain within this state. The higher is the uncertainty, the more extreme is the response to future losses compared to the response to future gains.

The respondents in Stangl case were experts; economists and executives in managerial positions. VAS should therefore be further tested in general population to be accepted as the measurement method of economic expectations.

4. Methods for estimating expectations

Henzel and Wollmershäuser (2005) state that in empirical work expectations on future macroeconomic variables can be treated in two ways: one is to set-up a theory on how private agents form their expectations and the second way to introduce expectations into empirical models is through direct measures of expectations derived from surveys of house-holds, firms and other economic agents. The advantage of survey data is that expectations are given exogenously in the context of a model, and that the nature of the expectations' formation process can be investigated separately.

Kjellberg (2006) considers the following three methods as the most common for capturing expectations:

- futures method which utilizes financial market prices and derives market-based expectations implicitly from prices of traded futures contracts;
- the vector autoregression (VAR) forecast method which estimates a VAR-model and uses the out-of-sample forecasts of the model to proxy expectations of a variable;
- the survey method, which measures expectations by asking a sample of people about their expectations of a variable.

In his study he thoroughly compared different approaches performing a systematic comparative analysis of the methods where he tried to evaluate their suitability for the purpose of economic forecasting. He estimated expectations using Federal funds rate target (FFRT) and Federal funds rate (FFR). The FFRT is controller and used by the Federal Reserve Bank (FED) to implement U.S. monetary policy and it is an important macroeconomic and financial variable that is monitored by markets all over the world. FFR is the traded market rate that the FED, by open market operations, keeps close to their stated target rate (FFRT). They are typically very close.

His study revealed that despite of the fundamental difference among the methods used, the survey measure and the futures measure turned out to be highly correlated (value of the correlation coefficient is 0,81) which indicates that they manage to capture the same phenomenon, that is true expectations. The survey method consistently overestimated the realized changes in the interest rate. The VAR forecast method on the other hand showed little resemblance with the other methods.

5. Conclusion

Expectations and their measures remains an important subject, especially in contemporary times of global financial crisis and instability of financial markets. The economic subjects strive to reduce uncertainty by conducting different surveys and analyses, to produce reliable forecasts that would enable more accurate foreseeable future and stabilize the economy. Measuring and examination of expectations as a branch of economic science has received a major attention in the last two decades, but remains an ongoing development. With increased use of stochastic methods in economics and econometrics, estimation of expectations overcame the corporate environment, where companies surveyed the market to assess the demand for their products, and set itself as an important part of macroeconomics and economic policies.

Theory of rational expectations has established as a preferred hypothesis that represents the basis for the further development of the expectations' theory. Today the theory has evolved with the inclusion of adaptive learning, where present expectations dynamically change by implementation of additional available information. One of the approaches to examine this phenomenon is by using vector autoregression models (VAR) with a certain amount of lag within the impulses.

Besides technical econometric approaches modern authors have pointed out an increased importance of survey measures. A lot of attention has been put towards different types of surveys for different purposes: inflation forecasting, output forecasting, agents' sentiment forecasting etc. In recent years a lot of efforts have been put towards quantification of qualitative surveys and improving the qualitative measures. Future empirical evidence will test the robustness and efficiency of the current efforts.

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