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Measuring Uncertain Economic Conditions: A Survey of Economic Conditions Index, Monetary Conditions Index and Monetary Rules

Mengukur Keadaan Ekonomi Tidak Menentu: Suatu Tinjauan Mengenai Indeks Keadaan Ekonomi, Indeks Keadaan Monetari dan Peraturan Monetari

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Abstract

Uncertain economic conditions refer to the unforeseen upcoming events in the economy. A certain measurement of uncertain economic conditions is necessary to serve as a benchmark to measure the conditions. The objective of this paper is to survey the contemporary theoretical developments of the measurements of uncertain economic conditions, namely economic uncertainty index, monetary conditions index (MCI) and monetary rules. This article also reviews the variants in each theoretical measure of uncertain economic conditions. The survey of the best measure of uncertainty economic conditions may help to contribute to address the economic uncertainties precisely.

Keywords economic uncertainty index, monetary rules, monetary conditions index, uncertain economic conditions, uncertainty

Abstrak

Keadaan ekonomi tidak menentu merujuk kepada peristiwa-peristiwa yang tidak dapat dijangka pada masa hadapan dalam ekonomi. Pengukur bagi keadaan ekonomi tidak menentu adalah perlu untuk menjadi penanda aras untuk mengukur keadaan ini. Objektif kertas ini adalah untuk meninjau perkembangan kontemporari teoritikal ukuran keadaan ekonomi tidak menentu, iaitu indeks ekonomi tidak menentu, indeks keadaan monetari (MCI) dan peraturan monetari. Artikel ini juga meninjau variasi dalam setiap teoritikal ukuran keadaan ekonomi tidak menentu. Tinjauan ukuran keadaan ekonomi tidak menentu yang terbaik boleh membantu untuk menyumbang dalam menangani ketidaktentuan ekonomi dengan tepat.

Kata kunci *indeks ekonomi tidak menentu, peraturan monetari, indeks keadaan monetari, keadaan ekonomi tidak menentu, tidak menentu*

INTRODUCTION

Uncertain economic conditions refer to the unforeseen upcoming events in the economy (Bloom, Kose & Terrones, 2013). Many researchers strive to search the best way to reduce the economic problems associated with an uncertainty (Mises, 1949). No doubt, the perfect knowledge on the uncertain economic conditions is essential to achieve the goals of the monetary policy (e.g., price stability, output stability and inflation stability) (Orphanides & Williams, 2007). However, the results on uncertain economic conditions from the empirical studies could not provide suitable and meaningful outcomes. Ellsberg (1961) and Epstein (1999) explain that the model created by researchers deliver limited information from the empirical data and too much effort has been applied in estimating the characteristic of human beings under variety situations. On the other hand, Poole (2005) states that the increasing uncertain decisions on monetary policy can cause adverse effects on economic stability. Therefore, a question remains whether the measurements of economic-uncertainty-variant constructed by the researcher can best explain the uncertain economic conditions.

A certain measurement of uncertain economic conditions is necessary to serve as a benchmark to measure the uncertain economic conditions. Jenkins and Longworth (2002) emphasize that the central bank must overcome the uncertain economic conditions in conducting the monetary policy. In the nineties, the interest rate rule, namely Taylor rule has received a great attention in estimating the output and inflation uncertainty by using the interest rates (Mandler, 2007). Besides that, the combination of the exchange rate and interest rate, namely monetary conditions index (MCI) also serves as an important tool in measuring output uncertainty in the nineties (Deutsche Bundesbank, 1999). On the other hand, the economic uncertainty index constructed by the researchers predict the uncertain economic conditions concerning the stability of the macro variables (i.e.,output and inflation) and policy variables (i.e., interest rate and exchange rate).

Most of the measurements of the uncertain economic conditions published by the researchers are based on positive analysis[1]. For example, Atta-Mensah (2004) creates the economic uncertainty index to measure the effects of the uncertain economic conditions on the money demand using GARCH techniques. Baker, Bloom and Davis (2013) construct the economic policy uncertainty index to measure the uncertain economic policy from three types of fundamental components, namely the frequency of newspaper coverage on economic policy uncertainty, the number of federal tax code provisions set to expire and disagreement among the economic predictors regarding the government policy. However, in recent study, Gan (2014) has published a paper that focus on the normative analysis[2]. Gan (2014) has constructed the economic uncertainty index to measure the uncertain economic conditions.

This paper is motivated by the fact that not many studies survey the measure dealing with the best uncertain economic conditions.[3]For instance, Hamalainen (2004) reviews the literature of the Taylor rule and its development in measuring the inflation and output. Srour (2003) and Cateau (2005) examine the Taylor rule under certain degree of uncertain economic conditions. Orphanides (2007) reviews the development of the Taylor rule and the role of Taylor rule in positive and normative monetary policy analysis. On the other hand, Costa (2000) and Osborne-Kinch and Holton (2010) survey the development of MCI as well as its limitations. Next, Deutsche Bundesbank (1999) focuses on both Taylor rule and MCI in their survey. The study proposes the advantages and shortcomings of the Taylor rule and MCI. From the above discussion, therefore, the survey of the best measure of uncertainty economic conditions may help to contribute to address the economic uncertainties precisely (Bernanke, 2010).

The objective of this paper is to survey the contemporary theoretical developments of the measurements of uncertain economic conditions, namely economic uncertainty index, MCI and monetary rules. This paper also reviews the variants in each theoretical measure of uncertain economic conditions. The approach of economic uncertainty index includes Atta-Mensah's approach, Baker, Bloom and

[1] Positive analysis is to deal with the question of 'what it is' and focus on the facts and cause-and-effect relationships in the economy.

[2] Normative analysis is to deal with the question of 'what it ought to be' and includes judgments regarding what the economy should be (Caplin & Schotte, 2008; Case, Fair & Oster, 2009).

[3] The best uncertain economic conditions supposed to encompass the least general economic structure but not partial economic structure.

Davis's approach and Gan's approach; the approach of MCI includes Freedman's approach, Bofinger and Wollmershäuser's approach and Burger and Knedlik's approach; and the approach of the monetary rules includes Friedman's approach and Taylor's approach. The main innovative of this paper is the literature surveys on the economic uncertainty index, MCI and Taylor rule, which could be benefited to the policymakers and public observers in the sense of knowledge and tools selection for the policy decision making.

The rest of the article is organized as follows. Section 2 reviews the theoretical literature on the measurements of the uncertain economic conditions with their limitations. The finding of this article is presented in Section 3. Section 4 concludes the paper.

THEORETICAL LITERATURE REVIEWS

The accuracy of the measurements of the uncertain economic conditions is vague. Bernanke (2010 and 2012) motivates the researchers to come out with a tool to overcome the crisis before the crisis occurs by making decisions under uncertainty. There are various measurements used by the researchers to measure the uncertain economic conditions. However, in this paper, the researcher only focuses on some well-known measurements of uncertain economic conditions, namely the economic uncertainty index, the monetary conditions index and the monetary rules.

i. Economic Uncertainty Index

Three approaches of economic uncertainty index are discussed in this section, namely Atta-Mensah's approach, Baker, Bloom and Davis's approach and Gan's approach.

a. Atta-Mensah's approach

Atta-Mensah (2004) has constructed the economic uncertainty index to examine the uncertain economic conditions. The index is constructed based on six main indicators of uncertain economic conditions, namely the level of economic activity, the mood of the stock market, uncertain inflation, uncertain exchange rate, long-term interest rates and short-term interest rates. By using generalized autoregressive conditional heteroscedasticity (GARCH) approach, the volatility of each indicator is extracted and the estimated weight for each indicator's volatility is then total up to construct the economic uncertainty index. He assumes that the indicators of the economic uncertainty index are weighted equally. The inputs of the economic uncertainty index areas follows:

$$U = \sum_{i}^{n} \alpha_i \left(\frac{vol_i - \overline{vol_i}}{\sigma_{vol}} \right) \qquad (1)$$

where the economic uncertainty index is given by U, vol_i which is the volatility of the indicators of uncertain economic conditions (i.e., stock market, bond market, uncertain monetary policy, outer shocks and the economic activity), $\overline{vol_i}$ is the average volatility, σ_{vol} denotes the standard deviation of volatility and α_i represents the weight attached to each factor. The measure of volatility is the proxy of the risk and uncertainty.[4](*Note*that the volatility of each indicator of uncertain economic conditions is extracted from GARCH method). Some studies have applied the economic uncertainty index constructed by Atta-Mensah, for instance, Puah (2008) and Jackman (2010) have applied the economic uncertainty index created by Atta-Mensah in their study to examine the relationship between the uncertain economic conditions with the demand for money.

[4] The study assumes that the risk and uncertainty are equal.

b. Baker, Bloom and Davis's approach

Baker, Bloom and Davis (2013) construct an index to measure the policy uncertainty, namely the economic policy uncertainty (EPU). They developed their index based on the components that measure different aspects of uncertain economic policy which includes (i) news coverage regarding the policy-related uncertain economic conditions; the articles from 10 large US newspapers (e.g., USA Today, the Miami Herald, the Washington Post and etc.) which discuss the uncertain economic conditions (ii) tax code expiration data which reflects the number of federal tax code provisions set to expire in future years and (iii) economic predictor disagreement (i.e., consumer price index (CPI) forecast disagreement and federal consumptions disagreement) that adopted disagreement among economic predictors as a proxy for uncertainty. The EPU is constructed by normalizing the components of uncertain economic policy by the standard deviation and the average value of the components calculated by using the weights of 1/2 on the news-based policy uncertainty index, and 1/6 on each other measures, namely the index of tax expiration, CPI forecast disagreement and federal consumptions disagreement. The two additional weighting methodologies are used to calculate the EPU which includes 'equal the weight of the news-based measure, the predictor disagreement measure and the tax expiration measure' and 'apply the principle component factor analysis on the news-based policy uncertainty index, index of tax expiration, CPI forecast disagreement and federal consumptions disagreement'. The inputs of the economic policy uncertainty are as follows:

$$EPU = \sum_{i}^{n} x_i \qquad (2)$$

where x_i denotes the index of the components that contributes to the uncertain economic policy, namely news-based policy uncertainty index, index of tax expiration, CPI forecast disagreement and federal consumptions disagreement. Among other researchers, Bloom, Kose and Terrones (2013) and Kliesen (2013) have discussed the economic policy uncertainty index developed by Baker, Bloom and Davis (2013).

c. Gan's approach

Recently, Gan (2014) has developed the optimal economic uncertainty index based on a structural model by using normative approach. His optimal economic uncertainty index encompasses macro variables (e.g., output and inflation) and policy variables (e.g., interest rate and exchange rate).The optimal measure of the economic uncertainty index is subjected to the central bank loss function. The grid search method is used to compute the economic uncertainty index. The inputs of the economic uncertainty index can be defined as follows:

Minimize the loss function

$$E_t \sum_{\tau=0}^{\infty} \beta^{\tau} L_{t+\tau}$$

subject to

$$y_{i_t} = \delta_1 x_{1,i_t} + \delta_2 x_{2,i_t} + \cdots + \delta_{k-1} x_{k-1,i_t} + \omega_{i_t} \ ,$$

$$i = 1, \ldots, N; k = 1, \ldots, K; t = 1, \ldots, T.$$

$$U_t = \alpha_k y_{i_t} + \varpi_t \qquad (3)$$

where U is the economic uncertainty index, y is the dependent variable and x is the explanatory variable; these variables are in gap form at its equilibrium level (i.e., deviation of the actual value from the potential values). δ and α are coefficients. ω and ϖ are errors. L denotes the central bank loss function; it is assumed that the current policy focus on low and stable inflation.

ii. MCI

The central bank of Canada is the first central bank which adopted the MCI. Besides Canada, several central banks across countries such as Netherlands, Norway and Sweden also use the MCI as a tool to measure the changes in monetary policy (Hansson& Lindberg, 1994). This section reviews the MCI in three different approaches, namely Freedman's approach, Bofinger and Wollmershäuser's approach and Burger and Knedlik's approach. Bofinger and Wollmershäuser (2001) and Burger and Knedlik (2004) have constructed the MCI in an optimal form.

a. Freedman's approach

Freedman's approach (1994) is the most conventional MCI which includes the combination of the interest rates and exchange rates. In this approach, the policy makers can only target the interest rates to change the monetary conditions. On the other hand, the MCI can only be change indirectly through the changes in interest rates (i.e., the interest rates is the only independent tool in MCI). The inputs of MCI are as follows:

$$MCI = \beta_1 \Delta r_t + \beta_2 \Delta e_t \qquad (4)$$

where Δr_t denotes the percent changes in the short-term real interest ratesand Δe_t is the changes in the real effective exchange rates. β_1 and β_2 denote the weights for the real interest rates and real effective exchange rates, respectively. The value of MCI increases when both of the real interest rates and real effective exchange rates increase, hence, indicates tighter monetary conditions. Among others, Freedman's MCI approach is applied by Costa (2000), Qayyum (2002) Kannan, SanyalandBhoi (2006) and Osborne-Kinch and Holton (2010).

b. Bofinger and Wollmershäuser's approach

Bofinger and Wollmershäuser's (2001) develop MCI that combines the interest rates and exchange rates. The MCI developed by Bofinger and Wollmershäuser's (2001) relies on two economic models (i.e., aggregate demand curve and aggregate supply curve) that subjected to the central bank loss function. In this approach, the policy makers can target both interest rates and exchange rates independently (i.e., the interest rates and exchange rates can serves as independent tool to change the monetary conditions). The inputs of the MCI can be defined as follows:

$$\alpha_1 r_t - \alpha_2 \Delta q_t = MCI_t = \varepsilon - \beta(p_t - E_{t-1} p_t) \qquad (5)$$

where $\propto_1$ and α_2 denotethe elasticity of interest rate and the elasticity of exchange rate, respectively. r_t is the real interest rates and Δq_t is the changes of real exchange rates. ε denotesthe real shocks (i.e., demand shocks minus supply shocks) and β is the coefficient of price. The terms in the bracket represents the deviation of the of the actual price level, p_t from the expected price level, $E_{t-1} p_t$.[5] Among others, Burger and Knedlik (2004) have followed Bofinger's and Wollmershäuser's approach to construct their MCI.

[5] *Note* Since this paper has page limitations, this paper could not encompass the discussion of the method used to construct the MCI. Therefore, further discussion of the method applied in the study can refers to Bofinger and Wollmershäuser (2001).

c. Burger and Knedlik's Approach

Burger and Knedlik's MCI approach (2004) is the function of interest rates and exchange rates. In this approach, the interest rates and exchange rates are used as two independent tools to fine tune the monetary conditions. This approach used MCI to propose optimal interest rates and optimal exchange rates to ensure internal and external equilibrium. By using the assumption that the economy is at its equilibrium level, the constructed MCI is postulated at the optimal level which is subjected to the loss function of the central bank. The inputs of the general MCI are as follows:

$$MCI_{t+1}^{optimal} = \beta_1 \Delta r_{t+1}^{target} + \beta_2 \Delta e_{t+1}^{target} \qquad (6)$$

where Δr_{t+1}^{target} denotes the changes in the interest rates target and Δe_{t+1}^{target} is the changes in the exchange rates target. β_1 and β_2 denote the weights of interest rates and exchange rates respectively. Among the researchers who applied Burger and Knedlik's approach in their study are Knedlik (2005), Gan and Kwek (2008) and Poon (2009).

ii. Monetary Rules

Two approaches of the monetary rules are presented in this section, namely Friedman's approach and Taylor's approach.

a. Friedman's approach

Milton Friedman is the father of monetary policy rule who developed the monetary targeting rule. Friedman (1960) has developed the k-percent rule, in this approach, the policy makers should increase the money supply by a constant percentage rate every year. Friedman argues that the k-percent rule is simple and may protect the monetary policy from the outside political pressures. The inputs are defined as follows:

$$M_s = \propto + kt + \varepsilon \qquad (7)$$

where M_s denotes the money supply, k denotes the fix percentage rate and ε represents the random white noise term. Among other researches who adopted Friedman's approach in their study are Scheide (1989), Evans (2003) and Kilponen and Leitemo (2008).

b. Taylor's approach

The Taylor Rule was proposed by the U.S economist John B. Taylor. Taylor (1993) has made a huge contribution in the monetary policy field with a very simple characterization of the Federal Reserve's monetary policy. The Taylor rule is a simple monetary policy rule which link the level of the policy rate to deviations of inflation from its target and of output from its potential (the output gap) (Hofmann & Bogdanova, 2012). The inputs of the Taylor rule can be defined as follows:

$$i = r^* + \pi + 0.5(\pi - \pi^T) + 0.5y \qquad (8)$$

where i denotes the nominal policy rate; short-term nominal interest rate (the nominal interest rate cannot fall below zero)[6], r^* denotes the real interest rate at its equilibrium level, π denotes the current period of inflation rate, π^T denotes the inflation target of central bank and y represents the output gap of the current period. This approach assumes thatthe equilibrium real interest rate, r^* and the target of

[6] In theory, nominal interest rates could fall below zero if money holdings were taxed or financial assets were not freely convertible into cash.

inflation, π^T are equals to2. Few researchers such as Clarida, GaliandGertler (1998 and 2000), Gerlach and Schnabel (2000), Srour (2003), Hamalainen (2004), Cateau (2005) and Orphanides (2007) have adopted the Taylor rule in their empirical studiesto evaluate how the central banks lead the monetary policy. Billi (2009) constructs the optimal Taylor rule by adopting the Taylor rule.

FINDINGS

Based on the discussion above, each measurement, namely economic uncertainty index, MCI and monetary rules have their own main limitations. Firstly, the economic uncertainty index is the model created by the researchers such as Atta-Mensah (2004) and Baker, Bloom and Davis (2013) is not in an optimal form and it is not based on the economic structure. Ouliaris (2012) states that there is no economic model that can represent the reality perfectly. On the other hand, Gan (2014) uses the small structural model in measuring the uncertain economic conditions. The study does not include other variables such as government borrowing, foreign exchange reserve, stock prices, trade deficit and price for other assets into the function of economic uncertainty index to increase the scope of analysis.

On the other hand, the limitations of MCI are still recognized by some researchers although MCI is simple to calculate and easy to understand (Eika, Neil & Ragnar,1996; Ericsson, Jansen, Kerbeshian & Nymoen, 1998; Stevens, 1998). The limitation of the MCI constructed by Freedman (1994) is that the MCI only targets the interest rates although MCI is the combination of exchange rates and interest rates. Next, the MCI developed by Bofinger and Wollmershäuser's (2001) only relies on the two models (i.e., aggregate demand curve and aggregate supply curve) may not be sufficient to represent the whole economy. The MCI constructed by Burger and Knedlik's approach is based on a partial model (i.e., aggregate demand curve) although studying the optimal MCI as Burger and Knedlik (2004) assumes that the optimal MCI exists only if the economy is at its long-run equilibrium. Costa (2000) argues that the MCI and monetary policy does not have a direct relationship, thus, MCI is not sufficient to influence the monetary policy.

Besides that, the monetary rules also have their own limitations. The Taylor rule (1993) only includes interest rates in his model may not be sufficient. Svensson (2003) states that the role of the Taylor rule in the monetary policy should be doubted as the Taylor rule may not solve the problem of instability in inflation and output gap. He suggested that variables such as the foreign output and foreign interest rate the real exchange rate and terms of trade should be included. On the other hand, Friedman's k-percent rule is too simple and may not be sufficient for the monetary policy as simple rules cannot predict the uncertain conditions (Bernanke, 2003).

Other than the main constraint discussed in this section, this study finds that the measurements of uncertain economic conditions are typically lingered around by the estimation problem. These issues include measuring the variables (i.e., potential or equilibrium level of the variables), using the contemporaneous or lagged data in estimating the uncertain economic conditions, and econometrically estimating the coefficients to specify the value of each measurements of uncertain economic conditions. However, the distinctive among measurements of economic uncertainty is the optimal economic uncertainty index proposed by Gan (2014) offers a new taught of economic measurement which encompass both macro variables (i.e., output and inflation) and policy variables (i.e., interest rate and exchange rate). This measurement is unlike the economic uncertainty index constructed by Atta-Mensah (2004) which does not have any theoretical base while the monetary conditions index is a partial equilibrium study that only focus on the exchange rates and interest rates, and the monetary rules only emphasis the importance of interest rates.

CONCLUSION

The objective of this paper is to survey the contemporary theoretical developments of the measurements of uncertain economic conditions, namely economic uncertainty index, MCI and monetary rules. This paper also reviews the variants in each theoretical measure of uncertain economic conditions. In doing so, the survey of the best measure of uncertainty economic conditions may help to contribute to address

the economic uncertainties precisely. In line with this discussion, this paper finds that the measurement of the uncertain economic conditions is subject to the problem of model specification and estimation problem. This paper also finds that there is no close discussion on the normative analysis of full uncertain economic conditions, except for the optimal economic uncertainty index proposed by Gan (2014). This paper can benefit further studies and investigations on the existing measurements of uncertain economic conditions which consequently benefit both policy makers and public observers to mitigate the crisis.

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