RELATED PHENOMENOLOGICAL STUDIES OF ECONOMIC THEORY OF GAMES IN PANDEMIC SITUATION (CASE STUDY OF THE ECONOMY IN INDONESIA)

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Abstract

The purpose of this article is to examine and analyze the Phenomenological theory of economic theory of games with the case of the impact of the pandemic in Indonesia. This methodology is carried out with a brief review of several previous studies, so that it can be concluded concisely and in detail without conducting data testing. The results of the analysis of previous data and literature show that monetary policy is implemented in an effort to meet macroeconomic goals, namely maintaining economic stability, one of which is related to inflation and unemployment. In the pattern of discretionary policy, the monetary authority is allowed to determine the rate of inflation with the benefits obtained, including the development of economic activity. Barro-Gordon's monetary economic model explains the relationship between monetary authorities and the public in inflation policymaking through a game theory approach. It is this model that is then tried to elaborate through the approach of game theory. Marinatto-Weber explains the game of battle of sexes through a quantum mechanics approach by presenting quantum strategies in the game. The density matrix approach in the game produces a entangled quantum strategy while explaining the phenomenon of quantum entanglement. Marinatto-Weber's quantum game theory was tried-applied to barro-Gordon's model of monetary economics. The final result of the application of game theory corresponds to the final result of the classic version of the monetary economy game model. Quantum game theory explains more in the players' efforts to set the game strategy.

Keywords: Phenomologhical study, Economic Theory, Games Theory and Pandemic.

JEL Classification Codes: C73, E31, P44

1. Introduction

Studies on the topic of central bank institutional phenomenological are an issue that has come to the fore at this time and has not been done much research, especially in the case of the pandemic in Indonesia. Studies on the time inconsistency of monetary policy in Indonesia are also still very limited. A study conducted by Budiyanti (2009) found that there was a problem of time inconsistency of monetary policy in Indonesia in the period before and after the 1997 economic crisis. Budiyanti (2009) uses barro-gordon's quadratic linear standard model in explaining the time inconsistency problem of Indonesia's monetary policy. This model basically assumes that the central bank's preference for gap output is symmetric central bank preference. In other words, the central bank is considered indifferent to the positive and negative output gaps.

Economics studies how individuals and societies make choices that are limited by various constraints (Nasution et al., 2021). Various choices need to be made due to scarcity. Scarcity indicates limited resources, such as limited land for setting up factories, raw materials, labor and others (AL-Kasasbeh et al., 2021). Decision-making on various choices made by individuals or companies is studied in game theory. Game theory studies the behavior and interaction of economic agents (enterprises, consumers, and governments).

Barro and Gordon (1983) analyzed time inconsistency in monetary policy through Nash-style game theory equilibrium between the central bank and the private sector in the economy. The Barro-Gordon model assumes the central bank is capable of managing economic processes and directing its monetary policy to social welfare which also incorporates people's preferences.

The issue of the impact of the pandemic ccovid 19 on monetary policy is closely related to the issue of time inconsistency. Time inconsistent policies will potentially lead to low credibility of monetary policy, so that economic actors will form inflation expectations that are higher than the target announced by the authorities (Morens, 2009). If the problem of time inconsistency in monetary policy refers to the low credibility of monetary policy, the question arises whether the low credibility of monetary policy in Indonesia indicates the occurrence of time inconsistency problems in Bank Indonesia's monetary policy. Indonesia's monetary policy still faces time inconsistency problems, as reflected by suboptimal, sometimes too loose and sometimes too tight monetary policy.

Figure 1. Indonesia's Annual Inflation Data

Source: BPS 2022

Indonesia's inflation rate in 2021 remains low and stable despite rising global inflation. Inflation realization in 2021 was recorded at 1.87 percent (yoy), up from 1.68 percent (yoy) in 2020 and below the target range of 3±1 percent (yoy). The high persistence of inflation in Indonesia is due to monetary policy that is not yet fully credible (imperfect credibility). This imperfect credibility leads to a slow process of lowering inflation expectations by economic agents and actual inflation towards its target (Goodhart, 2020). The research also corroborates previous studies conducted by Revenna (2005). Revenna conducted a survey of 82 countries

and her study placed Indonesia's monetary policy in the category of "low credibility" because it had not achieved the inflation target.

2. Literatur Riview

Economic Game Theory

Economic games have become a well-established tool for studying social behavior (Freedman & Flanagan, 2017; van Dijk & De Dreu, 2021) due to several key advantages. First, the observations produced by economic games directly serve as the variable of interest and represent the to-be-measured construct a preference without the need for wide-ranging auxiliary assumptions (Archetti, 2011).

Game Theory (Luce & Raiffa, 1957; von Neumann & Morgenstern, 1944) and Interdependence Theory (Kelley & Thibaut, 1978; Thibaut & Kelley, 1959), there exist comprehensive theoretical frameworks that allow for precise description and analysis of game behavior. Specifically, Game Theory provides tools for the mathematical analysis of games as abstract models of interacting decision-makers (Ichiishi, 2014). The decision-makers or *players*, respectively, are represented by their preferences over the possible out-comes of the game, including outcomes for the self and others. By and large, Game Theory provides a framework to formally capture and analyze strategic interaction. This advantage is similar to the one offered, say, by item-response theory, which formally describes responses in a test and thus allows for superior test-design, better comparability, and use of tailored analyses and scoring methods (Gummerum, 2008). Interdependence Theory, in turn, focuses on the interpersonal structure of a game. Most prominently, it specifies how the formal situation (i.e., the game as is) is transformed into a subjectively perceived situation. In simple terms, Interdependence Theory adds psychological meaning to Game Theory and it is therefore an indispensable tool that helps to understand and explain observable game behavior.

In what follows, we provide an overview of several economic games that have been commonly used in research on interindividual, intragroup, and intergroup interactions. Besides describing the structural features and theoretical underpinnings of the games, we derive the (sub-) affordances each game involves. This provides clear predictions about which psychological processes (including social motives) should be afforded in a game to guide behavior and it also forms the basis for tailored selection (and combination) of games in research (Greif, 2002, Nasution et al., 2021). Building on this, we outline how the games can be adapted to manipulate the affordances in a game (including a summary of game variants), and we end with coarsely reviewing typical empirical findings based on each game.

Inflation

Inflation is the process of increasing the price of goods in general and is constantly caused by a decrease in the value of money at a certain period (Sinaga et al., 2020). This does not mean that the prices of that wide variety of goods rise by the same percentage (Vagnozzi, 2021).

Perhaps the increase may not coincide. The important thing is that there is a continuous increase in the general price of goods over a certain period. An increase that occurs only once (albeit with a fairly large percentage) is not inflation (Su, 2020). The tendency of prices to rise in general and continuously (Boediono, 2005). Inflation is the process of continuously increasing general prices over a certain period (Nopirin, 2007). Inflation occurs when the level of prices and general costs rises, the price of rice, fuel, car prices rise, wage rates, land prices, and all capital goods rise (Samuelson dan Nordhaus, 2003).

This price increase is measured using a price index. Some price indices that are often used to measure inflation include:

- Consumer price index

- Wholesale price index

- GNP (Gross National Pruduct) deflator (Coibion, 2020)

Barro and Gordon Model

Barro and Gordon (1983) analyzed time inconsistency in monetary policy through Nash-style game theory equilibrium between central banks and the private sector in the economy. The Barro-Gordon model assumes the central bank is capable of managing economic processes and directing its monetary policy to social welfare which also incorporates people's preferences. People only have action parameters in the form of inflation expectations. Time inconsistency will arise because: (a) the public must form its inflation expectations at the beginning of the period and hold them until the end of the game period, and (b) the central bank has full discretion in determining the strategy at all times. In this situation, the inflation target set at the beginning of the period will not necessarily be optimal at the end of the period, and will result in social losses for the central bank and society.

Mathematically, the Barro-Gordon model is formulated as follows. Central banks minimize social welfare loss function:

$$L = [b\,(U - U^*)^2 + \pi^2]$$

where $b > 0$ and initial inflation target $\pi^* = 0$. Unemployment is assumed to follow the expexted augmented Philips curve as follows:

$$U = U^n - \alpha\,(\pi - \pi^e)$$

With $a > 0$ and, $U = kU_n$ where $0 < k < 1$. Furthermore, it is assumed that the central bank has control over inflation through its monetary policy, so that the inflation rate will be in line with the growth of the money supply ($p = \mu$). Under these conditions there are no problems in the transmission of monetary policy. With this assumption, the central bank minimizes the social welfare loss function following:

$$Z = \{b\,[1 - k)U^n - \alpha\,(\pi - \pi^e)]^2 + \pi^2$$

By determining the conditions of the first order derivative, the optimal inflation rate is obtained π^{**} as follows:

$$- 2ab[\frac{\partial Z}{\partial \pi} = U^n - \alpha\,(\pi - \pi^e)]^2 + 2\pi = 0$$

$$\pi^{**} = \frac{ab(1-k)U^n}{1+a^2 b} + \frac{a^2 b}{1+a^2 b}\pi^e$$

$$\pi^{**} = \frac{ab(1-k)U^n}{1+a^2 b} + \theta\pi^e$$

Solution ** above indicates the existence of time inconsistency, where the target setting * = 0 becomes suboptimal at the end of the period. The existence of an expected augmented Philips curve causes the optimal inflation rate to be influenced by inflation expectations. Because in general the inflation expectation is e > 0, then the optimal inflation rate is also greater than 0 (π^{**} >0). Even if the inflation expectation is pe = 0, the optimal inflation will still be greater than 0 (π^{**} > 0). This is due to the social cost parameter (b) and the phenomenon of unemployment (k) as well as the deviation of inflation from the target (a). The inflation rate that is greater than zero (π^{**} > 0) can be sourced from inflation surprise, inflation bias and the inflation rule.

Inflation Surprise

Inflation is still possible even if the central bank sets an initial target for inflation $\pi^* = 0$, as long as the central bank does not seek to remove the inflation deviation from its target due to real sector conditions, or in other words if the central bank is pro-growth. Under these conditions the actual inflation is:

$$\pi^S = \frac{ab(1-k)}{1+a^2 b}U^n$$

Social cost of such inflation is:

$$L^S = \left\{ b\left[(1-k)U^n - \frac{a(ab(1-k)U^n}{1+a^2 b}\right]^2 + \left[\frac{(1-k)U^n}{1+a^2 b}\right]^2 \right\}$$

$$L^S = \frac{b[(1-k)U^n]^2}{1+a^2 b}$$

Inflation Bias

Although public expectations are rational so as to know the function of central bank losses and the Philips curve, the initial target for inflation $\pi^* = 0$nor will it be credible. In this condition the interaction between the central bank and the economic agent is Stackleberg game theory. Inflation expectations will be the same as the central bank's target, $\pi^e = \pi^*$. Thus the actual rate of inflation and successive social losses is:

$$\pi^{REH} = ab\,(1-k)U^n$$

$$L^{REH} = b[(1-k)U^n]^2 + [ab(1-k)U^n]^2$$

$$L^{REH} = b(1+a^2b)[(1-k)U^n]^2$$

Inflation Rule

Barro and Gordon (1983) argue that with rational expectations and game behavior of a stackleberg nature as above, social losses will be reduced by giving the central bank a rule that inflation $\pi = 0$ and the growth rate of the money supply = μ. In this condition, the rate of inflation and social losses with the rule is:

$$\pi^{RULE} = 0$$

$$L^{RULE} = b[(1-k)U^n]^2$$

The analysis above shows that the lowest social cost is in the condition of surprise inflation and the highest is in inflation bias, while inflation rule is in between. Thus, in the context of game theory, the Barro-Gordon model generates a prisoner's dilemma because the optimal strategy for both actors (the central bank and the public) gives adverse results to both.
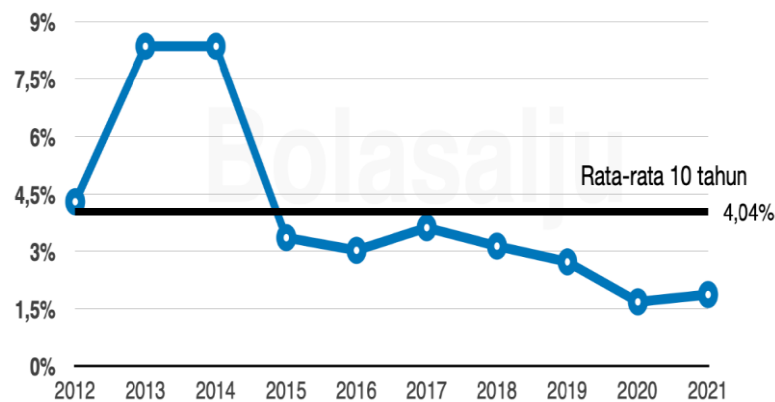

3. Methodology

The design of this study uses a literature review approach on phenomological studies from economic games theory. This methodology is carried out with a brief review of several previous studies and highlights economic cases measured from inflation in Indonesia during the pandemic, so that it can be concluded concisely and in detail without conducting data testing. We collect data and articles from various sources summarized into an overview of qualitative analysis.

4. Result and Disussion

Result

The results showed that the average achievement of inflation in the period after the pandemic was lower than the average inflation in the period before independence. Indonesia's inflation rate in 2021 remains low and stable despite rising global inflation. The realization of inflation in 2021 was recorded at 1.87 percent (yoy), up from the realization in 2020 of 1.68 percent (yoy) and was below the target range of 3±.1 percent (yoy).
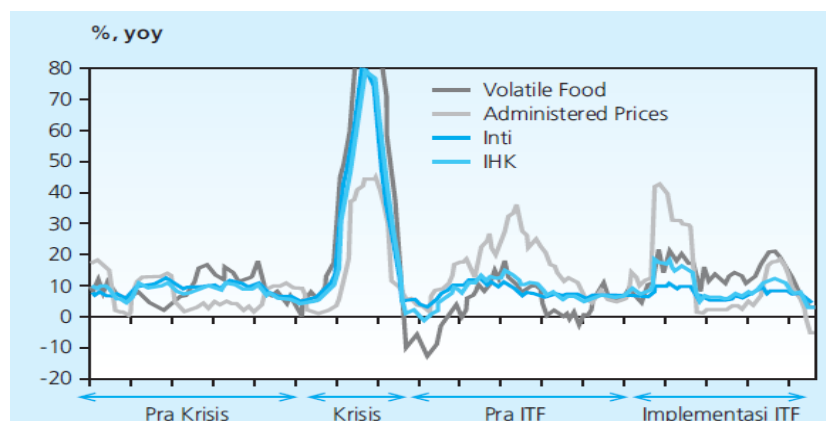
Figur 2. Inflation Rate in Indonesia

Source: Bank Indonesia, 2021

The figure above shows the trend of the inflation rate over the past ten years. It can be seen that the rate of inflation has decreased, but the achievement of inflation is not very encouraging, because it has only experienced a very small decline. This reflects the slow process of reducing inflation in Indonesia after the pandemic occurred. Several previous studies have also reported similarly, where the process of reducing inflation towards the target announced by the monetary authority is considered slow.

Inflation as measured by CPI is basically formed by 3 components, namely core inflation, administered prices, and volatile foods. The following figure 3 describes the decomposition of inflation in Indonesia for the pre-crisis period, crisis period, pre-ITF and the full ITF implementation period.

Source: Bank Indonesia, 2021

The chart above shows the cut of inflationary periods that have an impact on the forex rate. The effect of the inflation rate on the foreign exchange rate is explained based on the purchasing power parity theory or the theory of purchasing power parity or the equilibrium or similarity of purchasing power allowed gustav CASSEL. The basic concept underlying this

Purchasing Power Parity (PPP) theory is that the impulse of arbitration will lead to the equality of the price of goods measured in the same currency. This theory represents the application "law of one price".

The Law of One Price says that the presence of a competitive market structure and the absence of transportation costs and other obstacles to trade, the same products, which will be sold on different markets, will be sold at the same price when expressed in the same currency. There are two forms of Purchasing Power Parity (PPP), namely Absolute Purchasing Power Parity (PPP) Absolute and Purchasing Power Parity Relative (PPP) Relative :

1) Purchasing Power Parity (PPP) Absolut
   Absolute PPP is a rigid form of PPP. This absolute PPP version occurs if a bundle of goods in the domestic country is compared to the price of the bundle of goods abroad which is changed by the exchange rate to the size of the domestic exchange rate, then the price will be the same.
2) Purchasing Power Parity (PPP) Relatif
   When there are transportation costs, incomplete information, and the distorted effects of trade barriers in the form of tariffs and non-tariffs, ppp can relatively occur in such situations.

Discussion

The results of phenomological observations of the theory of game show that in the period after the pandemic, Bank Indonesia faced the problem of monetary policy time inconsistency. This can be seen from the significantness of the coefficient β. Coefficient β significantly indicates that the key parameter γ which is the asymmetric preference parameter is significantly different from zero. So it can be said that Bank Indonesia's monetary policy preference in the period after the pandemic is asymmetry to the output gap. The detection of the asymmetric preference parameter indicates that the monetary authority has an asymmetric policy preference in response to economic conditions that are experiencing recessions and booms. This means that Bank Indonesia gives different policy weight and treatment in responding to contracting economic conditions (negative output gap) and expansion (output gap positif).

Bank Indonesia in the period after the pandemic, there is no distinction between negative gap output and positive gap output. Negative gap output is relatively preferred over positive gap output. So the monetary authority has an incentive to give greater policy weight to the negative deviation of the output of its potential value (negative output gap) than when the economy experiences a positive deviation (positive output gap). Or in other words, it can be said that Bank Indonesia is more focused on the output gap during the recession period**.**

This is understandable, because when the economy experiences a contraction in the sense of a negative output gap, then by referring to the function of central bank losses in the form of linex, central bank losses will increase exponentially. Meanwhile, during a pandemic where there is a positive output gap, central bank losses in the context of the linex function only increase linearly. Thus the central bank has an incentive to focus more on the output gap

during the pandemic to stimulate short-term economic growth in an effort to minimize its losses. This condition indicates that monetary authorities have an asymmetric preference for gap outputs, by giving greater policy weight to negative gap outputs than to positive gap outputs. But such actions are very inflationary, since in the long run monetary policy is believed to be unable to affect economic growth. As a result output remained at its initial level, while inflation drove higher.

This condition is suspected to have strong relevance to the covid 19 pandemic situation. In this period, Bank Indonesia has various objectives, namely: first, regulating, maintaining and maintaining rupiah stability, and second, encouraging smooth production and development as well as expanding employment opportunities to improve the living standards of the people. The achievement of such goals is not always in line and often overlaps with each other. With this dual objective, Bank Indonesia's monetary policy preferences are asymmetry to the output gap, because in addition to maintaining price stability, bank Indonesia also acts as a development agent, which is obliged to provide employment opportunities. Thus, when the economy experiences sluggishness, Bank Indonesia has an incentive to make policy accommodations to increase employment opportunities and stimulate output, thus potentially compromising the goal of price stability. With the policy adjustments made by the monetary authority in response to the ongoing economic conditions, it reflects that Bank Indonesia's monetary policy is discretionary and time inconsistent.

Turning to the situation after the endemic, the problem of time inconsistency of monetary policy in this period is no longer detected, which can be seen from the value of the coefficient of β which is already statistically insignificant. The insignificant β coefficient implies that the asymmetric preference (γ) parameter is equal to zero. This means that Bank Indonesia's monetary policy preferences are symmetrical to the output gap (positive and negative). In other words, it can be said that Bank Indonesia is indifferent between a positive output gap and a negative output gap. A symmetrical preference for gap output reflects a consistent monetary policy and commitment to achieving low inflation goals, by reducing the discretionary element in response to the ongoing economic conditions (boom or recession). Thus, monetary policy in the pandemic period, Bank Indonesia has been symmetrical and consistent with the goal of achieving low inflation.

5. Concclussion

This discovery is thought to have strong relevance to pandemc's status in Indonesia. Monetary policy is implemented in an effort to meet macroeconomic objectives, namely maintaining economic stability, one of which is related to inflation and unemployment. In the pattern of discretionary policy, the monetary authority is allowed to determine the rate of inflation with the benefits obtained, including the development of economic activity. Barro-Gordon's monetary economic model explains the relationship between monetary authorities and the public in inflation policymaking through a game theory approach. It is this model that is then tried to elaborate through the approach of game theory. Marinatto-Weber explains the game of battle of sexes through a quantum mechanics approach by presenting quantum

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The independence of Bank Indonesia is marked by the birth of a law that expressly requires monetary policy to focus on achieving the goal of price stability as the sole goal of monetary policy, ignoring intervention from other parties. Policies with already symmetrical preferences in this period also showed improved monetary policy performance using the inflation targeting framework. Thus monetary policy preferences are symmetrical and focus on low inflation, so that accommodative elements can be reduced and temporal inconsistency problems can be avoided. This finding is in accordance with Rogoff's (1985) theory which states that in order to overcome the problem of time inconsistency, monetary policy must be delegated to an independent and conservative central bank. A conservative central bank is a central bank that prefers low inflation (inflation averse).

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