Macroeconomic and Monetary Determinants in Analyzing Recurrence Time for Inflation and Deflation Cycles

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Abtracts:

This study applies the parametric shared-frailty model to explore the likelihood of inflation (deflation) recurrence time in twenty-six countries. This empirical model concentrates on macroeconomic and monetary determinants affecting on the probability of existing time to inflation (deflation) period. Affecting the inflation existing time is the influence of seven determinants as stock returns, real exchange rate, industrial production index, GDP per capita, government expenditure, money supply and reserve assets. Whereas deflation reoccurrence time is impacted by stock returns, GDP per capita and reserve assets. By a means of the parametric shared-frailty model, it creates an extra econometric tool for researchers and policymakers to make plans and strategies in response to implement inflation policy.

Keywords: Inflation, Deflation, The Parametric Shared-Frailty Model.

1. Introduction

In macroeconomic policies of a country, controlled inflation at low level is always considered carefully and become an important goal. The stability in price is a main factor in determining the growth rate in economy; therefore fiscal policy and monetary policy will be considered strictly to maintain inflation at an expected rate. Friedman (1977) mentioned on the changing in inflation leading to unstable responses by monetary makers, which might induce unpredictable about the future inflation. It is very normal in many countries that if inflation presents high and variable rates, the economy will have to bear a lot of risk and take a long time to recovery. Guerrero and Parker (2006) showed the bidirectional causality between inflation and recession when examine this relationship among 94 countries. The deflation rate is at high level which caused the decrease in growth rate although it is not usually stimulate recession. Fisher (1993) indicated that inflation decreased economic growth through declining capital in investment, productivity growth and budget deficits. Thus, they concluded that inflation at low level and small deficits were not need for high growth even examining in long periods. Moreover, Khan and Senhadji (2001) revealed that inflation in developing countries has been found a threshold of 11% of inflation rates. If the inflation rate was higher than this threshold, it would have negative impact on economic growth. The study of Bick (2010) also confirmed for this theory by using a generalized panel threshold model. Therefore, inflation controlling goal is always considered by the central banks when implementing monetary and fiscal policies, especially for developing countries. The question is raised up how long an economy can be stayed in inflation or deflation period and which determinants affect the time of inflation or deflation period.

Inflation and deflation issues have attracted the attentions from many researchers in literature for a long time. A huge number of studies have analyzed the volatility of inflation among many groups of countries all over the world such as G7, emerging countries or ASEAN countries (Bikker and Kennedy, 1999; Choudhry, 2001; Komain and Timothy, 2010; Narayana and Narayan, 2013). Samuelson and Solow (1960) analyzed the issues of archiving and maintaining the stable inflation rate. Nicholas (2004) studied the causal associations between inflation uncertainty and output growth using panel data from the G7 countries. The result emphasized on inflation influences on output growth and caused inflation uncertainty. Other study mentioned the turning points of inflation can be indicated through examining the influences of the leading indicators in the economy. It is very important to control monetary policy and maintain the inflation at stable rate when peaks and troughs are identified clearly in inflation cycles (Healther and Sophia, 2001). Furthermore, inflation is studied in many different countries like Bangladesh, Spain, India, Mexico, Turkey and etc, that has been shown in the papers of Akhand (2010), Marika et al. (2008), Narayana and Narayan (2013), Pazarbaşioğlu and Ötker (1997) and Ziya and Süleyman (1990), respectively.

A number of studies have been conducted as an important step toward linking macroeconomics and monetary variables with inflation (deflation) existing time. The correlation between inflation (deflation) periods can be found through the researches of Cagan (1974), Francisco (1999), Harrison (2000), Arize et al. (2004), Celasun (2006), Bill et al. (2008), Marika et al. (2008) and Durai and Bhaduri (2009). The impacts of monetary policies received the attentions from scholars such as Eugene (1981), Davis and Toma (1995), Gonzalez et al. (1997), Peter (2008), Gianni and Gabriel (2013) and Syed and Sajid (2013). The presence of macroeconomics and monetary variables might be explained for the differences and may influence on the likelihood of inflation and deflation periods.

This research discusses about the survival model that are derived from biological sciences and applied in business effectively by of Pazarbaşioğlu and Ötker (1997), Gonzalez et al. (1997), Catanach and Perry (2001), Tudela (2004) and Chen (2010). The survival model considers about the exit timings and analyzes of death in biological statistics and failure of economics. This kind of model is utilized popular in biological sciences, however, still limited in business, especially in finance. To the best of our knowledge, no formal empirical literature has studied yet the influence of the process of recurrence of the inflation (deflation) in a period of time.

This paper employs parametric shared-frailty models to investigate the inflation and deflation in twenty six countries and examines the inflation (deflation) cycle reoccurrence. To deal with questions such as how long an economy can be stayed in inflation or deflation period and what kind of determinants affects the time of inflation (deflation) period, this study uses six macroeconomics variables such as industrial production index, stock index, gross domestic production (GDP) per capita, real exchange rate, unemployment and government expenditure; and five monetary variables like money supply, interest rate, hot money growth rate, reserve assets and M2/reserve ratio.

The contributions of this paper are as follows. First, this study implements a new model that known as the parametric shared-frailty model in indicating the determinants that influence on the inflation (deflation) period through forty-two years period of time across twenty six countries. The relationships between macroeconomic and monetary variables and inflation (deflation) period have been represented. Second, the paper considers the influence of macroeconomic and monetary determinants whether have significant negative (positive) impacts on each recurrence time of inflation (deflation) periods. Third, this study examines whether any difference between the macroeconomic and monetary determinants that impacts on the inflation and deflation period and how they shorten or lengthen the reoccurrence of inflation (deflation) period.

The paper is structured as follows. The next section briefly reviews the methodology of parametric shared-frailty model. Section 3 introduces the data and hypothesis. Section 4 presents the empirical results. Finally, section 5 concludes.

2. Parametric shared-frailty models

The parametric shared-frailty model has been mentioned in the studies of Pazarbaşioğlu and Ötker (1997), Gonzalez et al. (1997), Catanach and Perry (2001) and Tudela (2004). This model is utilized to estimate the survival timing that used to implement analyses of death in medical statistics and now is applied in economics. Based on theoretical econometric literature, this study uses the shared-frailty regression specification to examine the timing of inflation and deflation in 26 countries. Clayton (1978) and Hougaard (2000) addressed the shared-frailty model which concentrated on the survival time of repeated measurement.

The survival model is assumed to be correlated for observations through countries in the same group; the hazard is identified as followed:

$$h(t_{ij} \mid x_{ij}, \alpha_i) = \alpha_i h(t_{ij} \mid x_{ij}), \tag{1}$$

where α_i is a frailty that is proposed to have a mean of one and a variance, θ stands for some unobserved observation-specific effect. $x_{i,j}$ denotes the covariates for the observation ($j = 1,\ldots, n_i$) within a group

through different countries ($i = 1, \ldots, G$) at time t. Furthermore, if $\alpha_i < 1$ or $\alpha_i > 1$ is a decrease or an increase in the hazard, afterward the subjects experienced a decreased risk or an increased risk, respectively (Cleves et al., 2004).

The relationship between hazard and survivor functions can be identified as:

$$S\left(t_{ij} \mid x_{ij}, \alpha_i\right) = \left\{S\left(t_{ij} \mid x_{ij}\right)\right\}^{\alpha_i}, \tag{2}$$

where $S\left(t_{ij} \mid x_{ij}\right)$identifies the survival function related to a standard parametric model. This study has utilized the accelerated failure-time metric to estimate the transformed hazard function, which might be specified as $\ln t_{ij} = \sigma_{ij} w_{ij} + \beta_x x_{ij}$, where $\lambda = e^{-\beta_x}$ is a positive hazard rate parameter and $p = 1/\sigma_{ij}$ known as a positive scale parameter. Note that β_x addresses the parameters. The application of five parametric log-linear survival distributions: Weibull, Exponential, Gompertz, Log-normal and Log-logistics (Greene, 2002) has denoted in Table 1.

According to the parametric survival distributions as functioned by $(t_{0ij}, t_{ij}]$, the likelihood of the shared-frailty model is denoted as:

$$L\left(t_{ij} \mid t_{0ij}, \alpha_i\right) = \left\{\frac{S\left(t_{ij} \mid x_{ij}\right)}{S\left(t_{0ij} \mid x_{ij}\right)}\right\}^{\alpha_i} \left\{\alpha_i h\left(t_{ij} \mid x_{ij}\right)\right\}^{c_{ij}}. \tag{3}$$

The incorporating between the frailties α_i for the *i*th group (*Gi*) might be denoted as below:

$$L\left(G_i\right) = \int_0^{\infty} \alpha_i^{c_i} \prod_{j=1}^{n_i} \left[\left\{\frac{S\left(t_{ij} \mid x_{ij}\right)}{S\left(t_{0ij} \mid x_{ij}\right)}\right\}^{\alpha_i} \left\{h\left(t_{ij} \mid x_{ij}\right)\right\}^{c_{ij}}\right] g\left(\alpha_i\right) d\alpha_i, \tag{4}$$

where $C_i = \sum_{j=1}^{n_i} c_{ij}$ is the number of inflation and deflation periods across countries (Gutierrez, 2001).

The unconditional survival function in this study has been applied as:

$$S_\theta\left(t_{ij} \mid x_{ij}\right) = \int_0^{\infty} \left\{S\left(t_{ij} \mid x_{ij}\right)\right\}^{\alpha_i} \cdot g\left(\alpha_i\right) d\alpha_i, \tag{5}$$

where θ is explained for the frailty variance that identifies the degree of heterogeneity among the observed countries. According to the assumption of Cleves et al. (2004), $g\left(\alpha_i\right)$ denotes the probability density function that has been selected widely for computational application with a gamma distribution. Therefore, the survival function with a gamma distribution is described as below:

$$g\left(\alpha_i\right) = \frac{\alpha_i^{1/\theta - 1} \cdot e^{-1/\theta}}{\Gamma\left(1/\theta\right) \cdot \theta^{1/\theta}}, \tag{6}$$

where Γ is assumed as a gamma function.

Table 1: The Distribution of Survival Function and Hazard Function

Distribution	***Survival Function*** $S(t_{ij} \mid x_{ij})$	***Hazard Function*** $h(t_{ij} \mid x_{ij})$	***Shape***
Weibull	$\exp\left(-(\lambda t_{ij})^{p}\right)$	$\lambda p(\lambda t_{ij})^{p-1}$	Monotonic hazard rate
Exponential	$\exp(-\lambda t_{ij})$	λ	Monotonic hazard rate
Gompertz	$\exp\left((-p/\lambda)(e^{\lambda t}-1)\right)$	$\text{pexp}(\lambda_t)$	Monotonic hazard rate (Exponential increase or decrease)
Log-Normal	$\Phi(-p\cdot\log(\lambda t_{ij}))$	ϕ/Φ	Non-monotonic hazard rate
Log-Logistic	$1/(1+(\lambda t_{ij})^{p})$	$\lambda p(\lambda t_{ij})^{p-1}/(1+(\lambda t_{ij})^{p})$	Non-monotonic hazard rate

Note: Φ represents the standard normal cumulative distribution.

3. Data

According to the developed of Pazarbaşioğlu and Ötker (1997), Gonzalez et al. (1997), Catanach and Perry (2001) and Tudela (2004), this study focuses on the recurrence time for inflation and deflation cycles in different economies as dependent variables. The available quarterly data emanated from the International Financial Statistics (IFS) database published by the International Monetary Fund (IMF) from January 1970 to December 2012. Other data is collected from website: Trading Economics[1] and index mundi[2]. This includes twenty-six countries from the Asia, the Americas, the Australia, Western Europe and Eastern Europe, which were distinguished as inflation and deflation period according to the volatility of consumer price index. The independent variables encompass the effects of macroeconomics variables (such as industrial production index, stock index, GDP per capita, real exchange rate, unemployment and government expenditure) and monetary variables (such as money supply, interest rate, hot money growth rate, reserve assets and M2/reserve ratio). This data is yearly data basis and derived from IFS. These independent variables are classified into two categories that are discussed in this section.

3.1 Macroeconomic variables: (1) Real exchange rate (RER): RER is derived from the nominal exchange rate that deflated the ratio of domestic and foreign currency levels. Celasun (2006) found that determinants of inflation played an important role in inflation dynamics. Arize et al. (2004) explained through eighty-two countries with the current floating exchange-rate era and stated that nominal exchange rate volatility can have a positive and significant effect on the volatility of inflation. Joshua et al. (2010) showed the response to real exchange rates was strongest in these countries following inflation targeting policies that were relatively intensive in exporting basic commodities. This paper expects that the higher appreciation in RER, the greater probability a country can rapidly revive the economy resulting to shorter exit inflation period. The higher appreciation in RER, the less probability a country exits from the deflation period.

[1] http://www.tradingeconomics.com.
[2] http://www.indexmundi.com.

(2) Stock return (SIR): Cagan (1974) and Choudhry (2001) examined the positive relationship between stock returns and inflation and provided the evidence that stock returns acted as a hedge against inflation in high inflation countries. However, Eugene (1981) and Durai and Bhaduri (2009) tested and explained the negative relations between stock return and expected and unexpected inflation rate during the post-1953. Therefore, the influence of stock index return on inflation still continues being as controversial issues. The increasing in stock index return can facilitate a faster recovery time of a country from a recession resulting to shorter exit inflation time. Moreover, the more increase in stock return, the shorter time a country can escape from the deflation period.

(3) Industrial production index (IPI): IPI is an economic indicator that measures the amount of output from the manufacturing, mining, electric and gas industries. Harrison (2000) mentioned that if the new products were substituted for old ones, the inflation would rose. Thus, the paper anticipates that the more continued increase in IPI, the longer likelihood of survival time in inflation period. The signal of IPI index coefficient in deflation period is forecasted to have the positive impact on the deflation recurrence period.

(4) Gross domestic product per capita (GDP): GDP per capita is measured by the value of all the finished goods and services produced within a country which divided for number of people in a specific period of time. Bruno and Easterly (1998) and Nicholas (2004) contended that the inflation and output had causal effects when investigated panel data from high inflation countries and G7 countries. Gruben and McLeod (2002) consolidated the positive correlation between high inflation and economic growth and poverty by looking into 112 countries in data samples. In view of this, a negative relationship between GDP per capita and inflation would be anticipated for inflation period. However, the higher in GDP per capita is assumed to lead to the longer recurrence time in deflation period.

(5) Unemployment rate (UER): The relationship between inflation and unemployment rate has been studied through Philip curve that regarded the negative correlation because of an accurate and reliable guide to future price inflation. But Friedman (1977) and Marika et al. (2005, 2008) addressed the tradeoff between long-run inflation-unemployment and the persistence of inflation and unemployment is related to the slope of the long-run Phillips curve. Nevertheless, Samuelson and Solow (1960) found that changes in nominal wages were positively correlated with general inflation, and then there is an inverse relationship between unemployment and overall price inflation. The Philip curve that trades off between the inflation and unemployment is only maintained in the short run. For the long run, the actual inflation is adjusted by the expected inflation and the short-run Philip curve shifts. As a consequence, the long-run Philip curve shifts to be vertical at the natural unemployment rate. Therefore, a higher likelihood of survival time for contagion is driven by the decreasing unemployment rate associated with high inflation. The increasing in recurrence rate, the greater probability a nation can stay longer in existing time of deflation.

(6) Government expenditure (GE): The structural relationship between inflation, money growth, and government expenditure exploited by Francisco (1999). If there is a stable between inflation and money growth rates, they will have associated with each of the two possible government spending regimes. This paper proposes the greater likelihood of recurrence time for contagion is driven by increasing in the government expenditure related to rising up in inflation rate. The hypothesis also is proposed for the deflation period, with the higher in government expenditure, the shorter an economy staying in a recurrence time.

3.2 Monetary variables: (1) Money supply (MS): The government can decrease the inflation through controlling money supply. If the central bank pushes a large of money quantity into the economy, it leads to the price level will increase. The inflation will maintain in a longer time when the central bank continuing increases the supply of money. Ziya and Süleyman (1990) found the existence of interactions between exchange rate, price level and money supply. According to Akhand (2010), there is a causal relationship between money supply growth and inflation. Gianni and Gabriel (2013) illustrated money supply provides an important early warning indicator for risks to price stability. This study expects that the larger the quantity of money, the greater probability a country in a recession resulting to a longer exist time in inflation. Moreover, for deflation period, the higher money supply, the greater probability a country in a recession resulting to a longer recurrence time.

(2) Interest rate (IR): Interest rate is a long-term 10 year interest rate that a central bank charges from the borrowing depository institutions. Based on the study of Peter (2008), if central bank charges interest rate at high rate, it will increase the marginal costs of production and certainly rise up the inflation. Syed and Sajid (2013) indicated the influences of the interest rate policy in controlling inflation. Both the cost channel and national debt create large challenges to less developed economies. Thus, an increasing ratio of interest rate might facilitate a longer recurrence time of a country from recession resulting to longer exist time in inflation period. For the deflation time, the sign of the interest rate coefficient is assumed has positive impact on the recurrence time.

(3) Hot money growth rate (HMR): Hot money is amount of money that identifies the flow of capital transfer from one country to another through a short-term profit on interest rate differences and/or the shifts of anticipated exchange rate. Hot money is equal to change in foreign exchange reserves minus net exports minus net foreign direct investment. In view of this, this paper predicts that the higher in hot money growth rate, the lower probability of a country can rapidly revise the economy resulting to shorter recurrence period in the inflation period. For the deflation period, a higher likelihood of recurrence time for hot money growth rate is foreseen to represent the opposite signal as in the inflation period.

(4) Reserve assets (RAs): Reserve assets are known as the currency or other store of value that is primarily used by countries for their foreign reserves. Davis and Toma (1995) indicated that when the inflation rate increased the tax on banks, then they are required to hold reserves, and causes banks to lower deposit rates. Frankel and Rose (1996) discussed the problem of a country with less reserve assets and high domestic credit growth might hide the bad sign of economic growth. Therefore, a higher likelihood of recurrence time for contagion is driven by growing inflation rate associated with the large number of reserve assets. Nonetheless, this paper expected that the higher the number of reserve assets, the less probability a country can revive the economy resulting to shorter recurrence time in deflation period.

(5) M2 to reserve ratio (M2R): M2R is calculated by M2 divided by reserve assets. Chen and Chen (2012) have referred the positive impact of M2R on probability of exit time and speculative attacks when studying financial crises leads to the rapid depletion of reserve assets under the expectations of central banks. This study has assumed that the greater ratio of M2 to reserve ratio, the higher probability a nation might swift to revive the economy that leads to longer recurrence period of inflation time. Furthermore, the increasing in the M2 to reserve ratio is forecasted to have positive influence on the recurrence time of

a nation that staying in the deflation recurrence time. The prediction for the signs of all variables is summarized in Table 2 for both inflation and deflation recurrence time.

Table 2: Notation and definitions of variables used

Category	Variables	Notation	Sign in inflation period	Sign in deflation period
Macroeconomic variables	Real exchange rate	RER	-	+
	Stock index return	SIR	+/-	+/-
	Industrial production index	IPI	+	-
	Gross domestic product per capita	GDP	-	+
	Unemployment rate	UER	+/-	+/-
	Government expenditure	GE	-	+
Monetary variables	Money supply	MS	+/-	+/-
	Interest rate	IR	+	-
	Hot money growth rate	HMR	-	+
	Reserve assets	RAs	+	-
	M2 to reserve ratio	M2R	+	-

4. Empirical results

Table 3 illustrates the results of both the inflation and deflation periods that estimated by the parametric shared-frailty models. Cleves et al. (2008) stated two criteria to evaluate the best fitting model based on the highest Log-likelihood value and the lowest Akaike Information Criterion (AIC). The best fitting distributions for both specifications are Gompertz and lognormal distribution among five parametric shared-frailty models. Figure 1 describes the exit time for inflation and deflation period in panel (A) and (B), respectively.

For the inflation period, there are seven variables are significant such as money supply, stock return, industrial production index, real exchange rate, GDP per capita, government expenditure and reserve assets. The stock return is found to have negative significant influence on the increasing of inflation at 5 percent level. The influence of stock return on inflations still is controversial attentions from scholars because of its signal. This finding is consistent with the research of Eugene (1981) and Durai and Bhaduri (2009). They found the negative relations between real stock returns and inflation during the post-1953 period and explained by monetary policy. Choudhry (2001) has exhibited the negative relation between stock returns and inflation in high inflation countries, is inconsistence with Fisher's theory that argued no relation between them. Li et al. (2010) assessed the relation between real stock returns and inflation which depended on different regimes. Moreover, real exchange rates likely present a negative effect on the existing time for the period of inflation and significant at 5 percent level. This empirical result conformed to the hypothesis. It means that constant increase in value of this variable probably leads to shorter inflation recurrence time. This result is explained in many open-economy countries, an appreciation in exchange rate will effect lower inflation since the price to import goods from foreign countries will not increase as rapidly with the appreciation of the currency. An appreciation of the exchange rate may decline the level of output and inflation as mentioned in the study of John (2001). As we expected in the

literature review, the industrial production index proves a significant impact on inflation period at 1 percent level. This influence on inflation is positive and in accordance with the finding of Harrison (2000). The increase in production level can be institutionalized that leads to the excesses produced. Consequently, there is an increase in supply of goods as well as export if well managed and which may thus induce a reduction in inflation. With the higher industrial production index, the exit time of inflation period will likely be longer in controlling inflation of a country. For developed countries, the industrial production index is often much higher than developing countries, thus the period of inflation in these countries is likely longer and more stable than that of developing ones. As this review as shown, the contrasting signs but negligible values of GDP per capita and government expenditure can be related to the study of Bruno and Easterly (1998) in high inflation among thirty-one countries that is further developed by Nicholas (2004) among G7 countries, showing the negative relationships of long-run growth and recurrence the time of inflation. Using panels of annual, 5-year, or even 10-year averages, the evidence indicated that the lower growth rate, the higher inflation. In addition, when the state has budget deficit, the government creates new money to meet the expenditure demand. It induces the increase in money supply leads to inflation in these countries as the regard of Francisco (1999).

Table 3: Test results: The survival model

Variables	Notation	Inflation period		Deflation period	
Real exchange rate	RER	**-0.00164**	**(0.022)****	0.00002	(0.137)
Stock return	SIR	**-0.04775**	**(0.015)****	**-0.00085**	**(0.026)****
Industrial production index	IPI	**0.09186**	**(0.038)****	-0.00250	(0.540)
GDP per capita	GDP	**-0.00002**	**(0.004)*****	**0.000004**	**(0.000)*****
Unemployment rate	UER	-0.56458	(0.207)	-0.00540	(0.771)
Government expenditure	GE	**-0.00003**	**(0.042)****	0.00001	(0.434)
Money supply	MS	**-0.00322**	**(0.008)*****	-0.00003	(0.982)
Interest rate	IR	-0.02784	(0.470)	0.00224	(0.628)
Hot money growth rate	HMR	-0.00008	(0.346)	0.000004	(0.754)
Reserve assets	RAs	**0.00103**	**(0.024)****	**-0.00015**	**(0.000)*****
M2 to reserve ratio	M2R	0.00017	(0.477)	0.00008	(0.230)
Constant		**-14.0408**	**(0.000)*****	**3.5015**	**(0.000)*****
Log Pseudo Likelihood		-117.1532		-137.399	
Best fitting model		Gompertz		Lognormal	

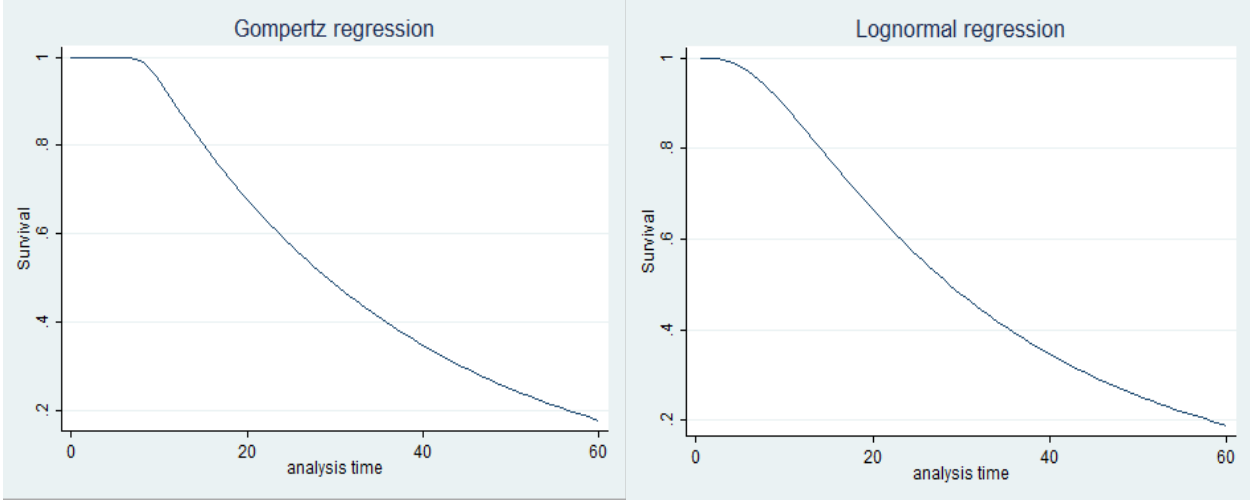
Note: *, ** and *** are significance at 10, 5 and 1% levels, respectively; p-values are in parentheses.

Monetary variables have the impact of significances on inflation period such as money supply and reserve assets. A significance at 1 percent level result for money supply seems make sure its negative impacts on the existing time for inflation which is still debated by researchers. The finding supports the claims of Francisco (1999) and Akhand (2010) about the existence of long-run causal relation between money supply growth and inflation in different countries. The inflation can probably be shifted from the low to high inflation depends on the lagged money growth measurement calculated in the real time. Thus, the money supply growth can represent a warning signal for shifting inflation, and vice versa. This statement is developed by Gianni and Gabriel (2013) when finding the early warning signal of money supply on the consumer price index volatility. The last variable that performs the significant estimation is reserve assets, explained by Davis and Toma (1995) and Frankel and Rose (1996). Among the significant

results, the industrial production index is presented to be the major factors in affecting the inflation recurrence time of twenty-six countries.

Figure 1: Survival times for inflation and deflation period.

Panel (A) Panel (B)

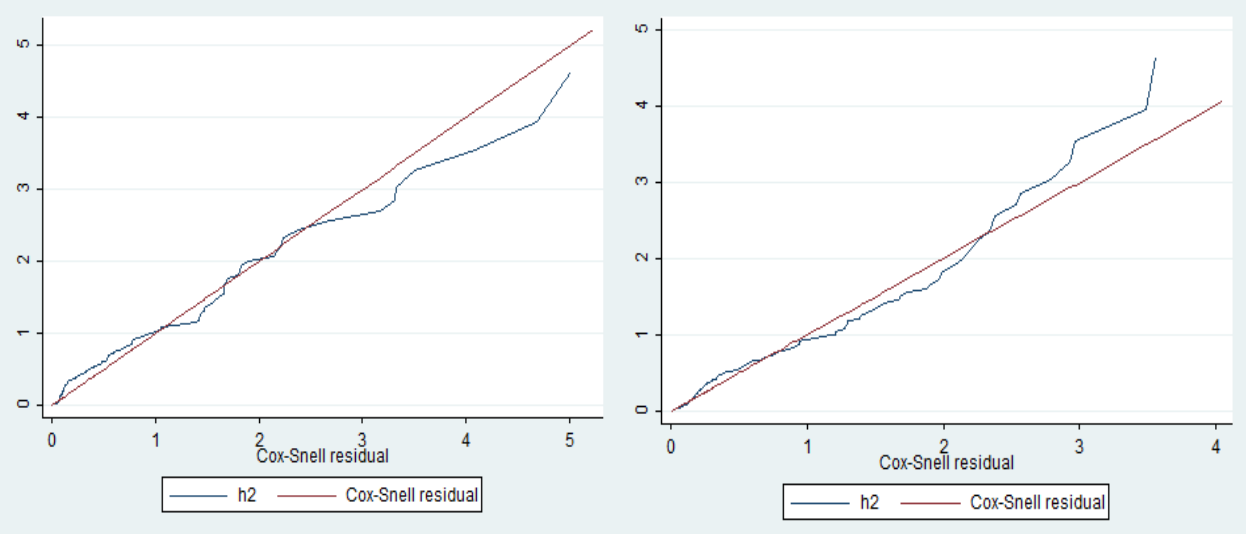


For the deflation period, there are only three variables are significant at 1 and 5 percent levels such as stock return, GDP per capita and reserve assets. Most of macroeconomic variables are observed to be more influent than monetary variables considering the weight of significant variables performed. The stock return in this period is described with a negative signs and the same sign with inflation period which is in line with the previous findings such as Eugene (1981) and Durai and Bhaduri (2009). Interestingly, GDP per capita is likely to have positive coefficient but opposite sign comparing to inflation period. These results have been studied by Nicholas (2004) when looking into the inflation in G7 countries. It reflects the positive relationship between aggregate demand and supply in the economy. Heather and Sophia (2000) developed further that if demand is approaching capacity output and continue to increase, the economy will get inflation pressures. The influence of reserve assets presents a negative sign on deflation recurrence time unlike the findings mentioned on the previous studies of Davis and Toma (1995) and Frankel and Rose (1996), the deflation recovery time will be slower if a country has much reserve assets. This leads to many expected effects on the economy. Comparing to the inflation period, the number of significant variables in deflation period is lower and their coefficients are relatedly small. This means that the deflation recurrence period is less efficient to determine the influenced factors over inflation exiting period.

According to Cox and Snell (1968) and applied study of Chen and Chen (2012), Figure 2 makes the comparison of forecasting precise of the models by applying the Cox-Snell residual method. A straight line is illustrated for the exactly fitted model with an exponential distribution equal to 1. As can be seen from the graph, both inflation and deflation occurrence periods represent the best fitted model among five survival distributions. The plotting line reveals that the parametric survival models perform a comparatively explainable fit to the data for both inflation and deflation survival time. It seems that the inflation period is closer to fit with the data.

Figure 2: Forecasting for Cox-Snell residuals:

Panel (A) Panel (B)



5. Conclusions

This paper applies parametric shared-frailty models to estimate the inflation and deflation recurrence periods. The results underscore several contributions as; firstly, for the inflation period, the industrial production index is the most important determinant of recurrence time. Moreover, other determinants like stock return, real exchange rate, GDP per capita, government expenditure, money supply and reserve assets are proved to have impact on the inflation time. A country wished to maintain the stable inflation can consider the influence of these determinants when combined the fiscal and monetary policies. This study provides additional information to policy makers, with significant determinants and referred to previous literatures to lengthen or shorten the inflation recurrence when controlling the macroeconomic policies. Secondly, for the deflation period, there are only three determinants represented significant results but negligible effect in the study samples. In comparison to inflation period, the stock returns has the same weight in both two periods, but GDP per capita and reserve assets have different signals. As observed in the sample, the policymakers can rely on the negative influence of GDP per capita and positive reserve assets to lengthen or shorten the inflation recurrence time, however, to do that in deflation they have to apply positive impact of GDP per capita and negative reserve assets impact. Thirdly, this study has combined the fiscal and monetary policies in considering the previous literature to evidence the implication of parametric shared-frailty model in macroeconomic issues. These findings point to the considerations should be taken by researchers and policymakers when they make plans and strategies in response to implement inflation policy.

According to the findings, the paper suggests that the determinants which influences the deflation period is more complicated than inflation recurrence time and needs to explore the strength of other variables in affecting deflation period by broaden the data.

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Appendix 1: Sample countries list

	Countries	Period		Countries	Period
1	Canada	1990-2012	14	Belgium	1985-2012
2	Japan	1970-2012	15	Hungary	1985-2012
3	United Kingdom	1989-2012	16	Indonesia	1990-2012
4	United State	1970-2012	17	Malaysia	1975-2012
5	Italy	1990-2012	18	Philippine	1970-2012
6	Germany	1970-2012	19	Singapore	1985-2012
7	France	1990-2012	20	Thailand	1975-2012
8	Australia	1970-2012	21	South Africa	1970-2012
9	Sweden	1970-2012	22	India	1990-2012
10	Austria	1970-2012	23	Brazil	1990-2012
11	Spain	1970-2008	24	Russia	1995-2012
12	Switzerland	1985-2012	25	Turkey	2000-2012
13	Norway	1990-2012	26	Mexico	1975-2012