Peer-reviewed and Open access journal **BEH - Business and Economic Horizons**
ISSN: 1804-5006 | www.academicpublishingplatforms.com Volume 15 | Issue 1 | 2019 | pp.126-136
The primary version of the journal is the on-line version DOI: http://dx.doi.org/10.15208/beh.2019.8

The new Keynesian trade-off between output and inflation: Time series based evidence from Russia

***Chin-Hong Puah,*[1] *Chong-Yang Sim,*[1] *Mui-Yin Chin,*[2] *M. Affendy Arip*[1]**

[1] *Faculty of Economics and Business, Universiti Malaysia Sarawak, Malaysia*
[2] *Faculty of Accountancy, Finance and Business, Tunku Abdul Rahman University College, Malaysia*

corresponding e-mail: chpuah[at]unimas(dot)my
address: Faculty of Economics and Business, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, 94300 Kota Samarahan, Sarawak, Malaysia

Abstract: As oil exports remain the main source of income for the Russian economy, the ongoing plunging of global oil prices is causing severe adverse supply shock and cost-push inflation in the country. The recent attempts at stabilisation policies by the policymakers have not been very successful in stabilising both national output and inflation. This has brought about concern over the relevance of policymaker interventions in the Russian economy. We investigate this matter by applying Asai's (1999) model. Our empirical results indicated that the trade-off between output and inflation in the short run in Russia is inversely associated with the mean rate of inflation, which supports the new Keynesian view. As such, stabilisation policies, particularly monetary policies adopted by policymakers, are extremely crucial in moderating the short-run trade-off between output and inflation with respect to the recent financial crisis.

JEL Classifications: E31, E61, C22

Keywords: Output-inflation trade-off, new Keynesian, new classical, nominal rigidity
Citation: Puah, C. H., Sim, C. Y., Chin, M. Y., Arip, M. A. (2019). The new Keynesian trade-off between output and inflation: Time series based evidence from Russia. *Business and Economic Horizons, 15*(1), 126-136. http://dx.doi.org/10.15208/beh.2019.8

1. Introduction

The severe balance of payment shock since the fourth quarter of 2014 has caused the Russian economy to enter a major financial crisis. The crisis is partly attributable to monetary policy normalisation and geopolitical tensions followed by economic sanctions, which caused capital outflow from the country, but the primary cause is attributable to the declining global oil price (Sinyakov & Yudaeva, 2016). The Russian economy is a resource-dependent economy in which the growth of the economy is largely dependent on global oil prices. Thus, plummeting global oil prices have exposed the Russian economy to severe external shocks.

The abovementioned events in Russia following the global oil price drop have been documented (see for example, Idrisov, Ponomarev, & Sinelnikov-Murylev, 2016; Ilyashenko & Kuklina, 2017). The reduction in oil export duties has led to the depreciation of the ruble and worsening of the terms of trade of the Russian economy, which has resulted in cost-push inflation and adverse supply shocks in the country. The recent studies of Ivanova (2016) and Bhattarai (2016) have provided evidence towards the existence of cost-push inflation in the Russian economy in the current crisis. The former

study has discovered that labour wage influences the general price level, while the latter study revealed that unemployment rate is positively related to the inflation rate.

In addition, rising food and energy prices and external sanctions have caused high inflation in the country, while rising imported raw material costs and wages have caused the national output to slow down. This has led to high unemployment. Subsequently, the Russian economy is on the brink of stagflation.

The trade-off between output and inflation in the short run is a pivotal issue when a country is facing both high unemployment and high inflation (McCaw & Morka, 2005). Although adverse supply shocks are beyond the control of policymakers, they can adopt monetary policies to influence aggregate demand in the short run, thus affecting output, unemployment and inflation. However, as both inflation stability and output stability are mutually exclusive, cost-push inflation and adverse supply shocks create a difficult policy trade-off for the policymakers - raising the interest rate to reduce cost-push inflation will result in a larger output loss at each inflation rate, and vice versa. In any case, policymakers cannot achieve the dual objectives of stabilising both general prices and unemployment at their respective levels before the shock.

In an attempt to reduce the inflation rate following a cost-push shock, the Central Bank of Russia (CBR) implemented a contractionary monetary policy in 2015. Although the measure brought the inflation rate down to a certain degree, it caused severe negative consequences for the Russian economy - stagnated government spending and decreased household spending as well as investment that led to a sharp decline in national output (Mironov, 2015; Ilyashenko & Kuklina, 2017). In that year, investments decreased by 10% due to the significant reduction in lending opportunities following a sudden increase in the CBR monetary policy rate (Fal'tsman, 2016). This has brought about a debate over the effectiveness of monetary policy and the relevance of policymaker interventions in managing the current financial crisis in Russia. On this basis, the current study aims to revisit the short-run trade-off between output and inflation in Russia under the new classical and new Keynesian theories to resolve the ambiguity regarding the relevance of policymaker interventions.

Introduced by Lucas (1973) in the 1970s, the new classical theory is built upon the concepts of rational expectation and the market-clearing system. This theory believes that the product and labour markets are continuously self-clearing and that the self-correcting mechanism in the markets will work swiftly and efficiently. Since the market is able to clear by itself, policymaker's intervention as in monetary policies, have no effect on real output. Thus, the intervention of policymakers in the economy is not necessary because the aggregate demand and supply in the market are always self-regulating and able to self-equate. However, there is a possibility of the emergence of the trade-off between output and inflation in the short run, as market information imperfection has caused economic agents to be confused between the nominal and real shocks that affect aggregate prices and relative prices, respectively. Based on this notion, the new classical theory contends that the parameters of the short-run trade-off between output and inflation are associated inversely to the variances of nominal aggregate demand and the inflation rate.

On the other hand, the new Keynesian school is different from the new classical school in a number of important fundamental ways. The new Keynesian theory believes in menu cost and competition imperfection of product and labour markets, in which nominal rigidities, sluggish aggregate demand and market distortions exist in the workings of the

economy. In the view of the new Keynesian school, price and wage stickiness are the main factors that cause the sluggishness of the self-correction mechanism in the economy - which is very different from the new classical school. As such, policymaker interventions in terms of activist policies, such as monetary policies, are required to smooth out business cycles since general prices and labour wages are unable to adjust themselves autonomously and instantly to replicate such sudden shocks in the economy. As a result, the real effects of nominal shocks are largely dependent on the speed of adjustment of individual prices, whereby the higher unpredictability of relative general prices and labour wages shall bring about lesser effects of such shocks because they are determined for a shorter period and are modified regularly. Consequently, the new Keynesian theory argues that the parameters of the trade-off in the short run are associated inversely to the mean of nominal aggregate demand and the inflation rate.

By adopting Asai's (1999) model, this study aims to explore empirically whether the trade-off between output and inflation in the short run in Russia is inversely associated with the variance of the inflation rate as hypothesised by the new classical theory, or by the mean rate of inflation as hypothesised by the new Keynesian theory. If the former proposition holds, we may infer that policymaker interventions in the Russian economy are unnecessary. Otherwise, we may suggest that policymaker interventions are crucial if the latter proposition holds in the case of Russia.

This paper is organized into five sections. Section 1 introduces the motivation and the purpose of the study. Section 2 discusses the empirical literature on output-inflation trade-off. Section 3 describes the methodology and data sources used in this study. Section 4 presents the empirical results and discussion of this study. Section 5 provides the conclusion of this study and suggests policy implications to the policymakers.

2. Review of literature

Following the seminal work of Lucas (1973), voluminous studies have been carried out in attempts to discover the presence of nominal rigidities and the relevance of policymaker interventions in the economy under the settings of the new classical theory and new Keynesian theory. There have also been studies that propose various methodologies that are built upon the weaknesses of the methodologies available in the literature to discriminate between these two contending theories. However, to date, despite various methodologies and approaches that have been utilised in prior literature, the empirical evidence regarding the trade-off is somewhat mixed.

Lucas (1973) was the first to find empirical evidence for the output-inflation trade-off within the new classical framework, by taking the existence of the natural rate of real output and rational expectations into account. His findings indicated an inverse association between the trade-off parameter and the variance of the inflation rate, which was later supported by the empirical studies of Addison, Chappell, & Castro (1986), Asirim (1995), Holmes (2000) and Fendel & Rulke (2012). However, Froyen & Waud (1985), Avsar & Gur (2004), Puah, Habibullah, & Ong (2005), Liew, Lim, & Puah (2006), Benigno & Ricci (2011), Sun (2014) and Sim, Puah, Chin, & Wong (2015) could not find empirical support for the new classical theory. They found that the variance of the inflation rate does not provide sufficient explanation for the trade-off between output and inflation in the short run as hypothesised by the new classical theory.

Under the new Keynesian school of thought, Ball, Mankiw, & Romer (1988) challenged Lucas's (1973) new classical theory by providing an alternative. By including the effects of menu cost on price adjustment, Ball et al. (1988) concluded that the variance of aggregate demand was inversely associated with the output-inflation trade-off and that this trade-off was inversely correlated to the mean rate of inflation. The research of Greenwald & Stiglitz (1987), Avsar & Gur (2004), Puah et al. (2005), Liew et al. (2006), Brissimis & Magginas (2008), Benigno & Ricci (2011), Sun (2014), Sim et al. (2015) and Bakas & Chortareas (2018) discovered strong empirical evidence of the new Keynesian theory in explaining the short-run trade-off between output and inflation. As such, Puah et al. (2005), Liew et al. (2006) and Sim et al. (2015) suggested that the intervention of policymakers and policy effectiveness were important determinants of nominal rigidity while Benigno & Ricci (2011) states that policymaker's stabilisation policy can improve the output-inflation trade-off.

Furthermore, there have also been studies that use different econometric techniques by employing variants of the original Lucas (1973) and Ball et al. (1988) models to rectify their shortcomings. For instance, Katsimbris & Miller (1996) restudied the test proposed by Ball et al. (1988) by using pooled and country-to-country regressions. Their methodology reflected the two-step procedures of Ball et al. (1988), except that the slopes of the estimated trade-off between output and inflation, the variance of the inflation rate, and the average inflation rate were allowed to vary over time for each country. A Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model was used to remodel the time-dependent variance of the inflation rate, but the stationary properties of the data were not taken into account. They found no empirical evidence to support the new Keynesian theory; instead, they discovered weak evidence for both the new classical and new Keynesian theories on the basis of individual country tests. The study of Giorgioni (2001) had similar findings to Katsimbris & Miller (1996).

Asai (1999) re-examined the empirical test of Ball et al. (1988) using a one-stage simple and straightforward testing procedure with country-by-country data. Taking the stationarity of real output into account and modelling the time-dependent variance of the inflation rate using the GARCH model, his finding indicated strong evidence for the new Keynesian theory in Germany, Japan and Canada and weak evidence in Italy and France. However, his finding did not produce sufficient evidence to support the new classical theory that the trade-off between output and inflation in the short run is inversely associated with the variance of inflation. The use of the one-step testing procedure as in Asai (1999) was deemed superior by Sun (2014) after the latter author empirically evaluated four different estimation approaches that had been applied in prior literature to examine the short-run trade-off between output and inflation.

3. Methodology and data description

We adopted Asai's (1999) one-step version of the Ball et al. (1988) two-step model in this paper to empirically examine the trade-off between output and inflation in the short run in Russia.

The Lucas function as proposed by Asai (1999) is denoted as:

$$y_t = \alpha + \tau_t \Delta x_t + \sum_{i=1}^{p+m} \lambda_i y_{t-i} + \gamma t + \varepsilon_{t\,,\ldots t=1,\ldots,T} \quad (1)$$

Where, y is logarithm of real GDP; x is logarithm of nominal GDP; τ is time-dependent coefficient of trade-off; Δ is differencing operator; p is lag length; m is integration order of y; T is sample size.

According to Ball et al. (1988), the functional form used to test the coefficient of trade-off and the inflation rate is denoted as:

$$\tau_t = a_1 + b_1 \pi_t + c_1 \sigma_t \quad (2)$$

Where, τ_t is trade-off coefficient; π_t is inflation rate; σ_t is time-dependent standard deviation of the inflation rate.

We obtain Asai's (1999) one-step version of the Ball et al. (1988) two-step model by replacing the time-dependent coefficient of the trade-off (τ_t) in Equation (2) into Equation (1). Hence the final model is as below:

$$y_t = \alpha + a_1 \Delta x_t + b_1 \pi_t \Delta x_t + c_1 \sigma_t \Delta x_t + \sum_{i=1}^{p+m} \lambda_i\, y_{t-i} + \gamma_t + \varepsilon_t \quad (3)$$

Similar to the interpretation of Asai (1999), Katsimbris & Miller (1996) and Sim et al. (2015), we assume that a negative and significant coefficient on the inflation term b_1 supports the view of the new Keynesian theory. On the other hand, a negative and significant coefficient on the time-dependent standard deviation of inflation c_1 and a negative but insignificant coefficient of inflation term b_1 supports the view of the new classical theory.

Prior to the Equation (3) estimation, the time series properties of all of the variables are examined by utilising the Augmented Dickey-Fuller (ADF) unit root test (Dickey & Fuller, 1979; Dickey & Fuller, 1981; Said & Dickey, 1984). Engle's (1982) lagrange multiplier autoregressive conditional heteroscedasticity (ARCH-LM) test is used to detect a time-dependent phenomenon in the conditional volatility of the inflation rate. If the ARCH effect is present in the inflation rate, the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model by Bollerslev (1986) will be utilised to model the σ_t and to capture this ARCH effect simultaneously. It is important to note that the inflation rate should not exhibit the ARCH effect, because conditional heteroscedasticity may cause standard estimation methods to be inconsistent. On the contrary, the σ_t may instead be

modelled by calculating the standard deviation of the inflation rate after taking into account the time factor if the inflation rate is unrestricted to the ARCH effect (Liew et al., 2006).

Since the interpretation of the model is solely based on *t*-statistics, it is important to note that the interpretation of *t*-statistics might not be robust if the model's residuals exhibit autocorrelation and heteroscedasticity problems (Liew et al., 2006). Hence, we examined the model's residuals for autocorrelation and heteroscedasticity problems. Furthermore, to further strengthen the robustness of the estimation results, a series of diagnostic tests i.e. Jacque-Bera test, Ramsey Regression Equation Specification Error (RESET) test, cumulative sum (CUSUM) test and cumulative sum-of-squares (CUSUM2) test were performed.

Quarterly time series data over the period of 2008:Q1 to 2016:Q4 were utilised in this study, which sufficiently covers two episodes of crises that affected the Russian economy - the global financial crisis in 2008-2009 and the recent Russian financial crisis starting in 2014. The data of the nominal Gross Domestic Product (GDP) and the GDP deflator were retrieved from Datastream, while the consumer price index (CPI) data were accessed from the CEIC database. Nominal GDP was deflated with the GDP deflator to acquire the real GDP data, while the inflation rate data were obtained by computation from the consumer price indexes (CPI). All data except the inflation rate were transformed into a natural logarithm form prior to the empirical estimations.

4. Results and discussion

The ADF unit root test was applied to examine the time series properties of the variables and the results are presented in Table 1. Based on the results, the null hypotheses of non-stationarity of the variables cannot be rejected in their level form but are rejected after the first differentiation. In other words, the results have shown that the variables are not stationary in the level form but are stationary after first differencing. Therefore, it can be inferred that all of the variables are integrated of order one or *I*(1).

TABLE 1. ADF UNIT ROOT TEST RESULTS

VARIABLES	μ	Δ_η
Nominal GDP	-1.897 (3)	-4.853 (3) **
Real GDP	-1.427 (3)	-4.209 (3) **
Inflation	-2.129 (3)	-3.473 (3) **

Source: Own calculations.
Note: Δ denotes the differencing operator. The subscript μ is trend and intercept. The subscript η is intercept only. Figures in parentheses are the lag length. Asterisk (**) denotes the significance at the 5 percent significance level. The lag length is selected according to Schwert's (1987) method.

Once the time series properties of the variables had been considered, the ARCH-LM test was employed to detect the presence of ARCH effects in the inflation rate. The results of the ARCH-LM test are presented in Table 2. Based on the results, ARCH effects are not present in the inflation rate for up to 4-lags. Consequently, we followed the approach of Liew et al. (2006) and Sim et al. (2015) to estimate the time-dependent standard deviation

of the inflation rate by calculating the standard deviation of the inflation rate after taking into account the time factor in the data.

TABLE 2. ARCH-LM TEST RESULTS FOR CONDITIONAL VARIANCE OF THE INFLATION RATE

LAG 1	LAG 2	LAG 3	LAG 4
0.138 (0.711)	0.336 (0.845)	0.486 (0.922)	0.720 (0.949)

Source: Own calculations.
Note: Figures in parentheses are the *p*-value.

TABLE 3. LINEAR LEAST SQUARE ESTIMATE FOR ASAI (1999) MODEL

m	p	b_1	c_1	Supported Theory
1	3	-0.083 (0.047) **	-0.025 (0.743)	New Keynesian

Source: Own calculations.
Note: Asterisk (**) denote the significance at the 5 percent significance level. Figures in parentheses are the *p*-values.

TABLE 4. DIAGNOSTIC TEST RESULTS OF LINEAR LEAST SQUARE ESTIMATE FOR ASAI (1999) MODEL

SERIAL CORRELATION LM TEST	
Lag 1	2.305 (0.129)
Lag 2	3.096 (0.213)
Lag 3	5.617 (0.132)
Lag 4	5.633 (0.228)
HETEROSCEDASTICITY TEST	
Lag 1	1.202 (0.273)
Lag 2	2.078 (0.354)
Lag 3	2.137 (0.545)
Lag 4	2.023 (0.732)
JARQUE-BERA TEST	2.227 (0.328)
RAMSEY REGRESSION EQUATION SPECIFICATION ERROR TEST	2.451 (0.132)
CUMULATIVE SUM TEST	Stable
CUMULATIVE SUM-OF-SQUARES TEST	Stable
R-squared	0.988
Adjusted R-squared	0.984

Source: Own calculations..
Note: Figures in parentheses are the *p*-value

After obtaining the time-dependent standard deviation of the inflation rate, we proceeded to the estimation of Equation (3) and the results are presented in Table 3. As the real GDP was integrated at order one, it was concluded that the parameter m in Equation (3) took the value of 1. The parameter p had a value of 3 indicating 3-lags, chosen on the basis of no autocorrelation remaining in the error term of Asai (1999) model. Most

importantly, the coefficient of inflation term b_1 was empirically proven to be negative and significant at the 5 percent level of significance. In accordance with the interpretations of Asai (1999), Katsimbris & Miller (1999) and Sim et al. (2015), we concluded that the trade-off between output and inflation in the short run in Russia is inversely associated with the mean rate of inflation, which is in line with the proposition hypothesised by the new Keynesian theory. In addition, the insignificance of c_1 further implied the irrelevance of the new classical theory in the case of the Russian economy.

Moreoever, a series of diagnostic tests were carried out to check for the robustness of the empirical results. Based on the results in Table 4, the Lagrange multiplier test for autocorrelation and heteroscedasticity reveals that the error terms of the model have constant variance and are not correlated with their previous values. Furthermore, the Jarque-Bera normality test result posits that the error terms of the model are normally distributed, while the Ramsey RESET test result implies that the model is correctly specified. Likewise, the CUSUM and CUSUM2 test results also suggest that the model is relatively stable. As all of the diagnostic tests results are insignificant, we can confidently conclude that our empirical results are robust.

5. Conclusions

This study aims to examine the relevance of policymaker interventions in managing the current financial crisis that has taken place in Russia since 2014 following the adverse supply shocks and cost-push inflation attributable to a series of dramatic falls in the global crude oil price and economic sanctions. Although the tightening of monetary policy by the CBR in 2015 in response to the cost-push inflation had managed to reduce the general price level, it has severely impeded the economic growth in the country. This incidence has cast doubts regarding the efficiency and relevance of Russian policymaker interventions in response to the financial crisis.

By using the one-step estimation procedure as in Asai (1999) model, which is deemed superior than other two-stage estimation procedures available in the literature as documented by Sun (2014), our empirical results suggest that the new Keynesian theory best explains the trade-off pattern between output and inflation in the short run in Russia. Based on this notion, we can imply that nominal rigidities are present in the works of the Russian economy. Although conventional macroeconomic theory posits that an economy will return to the equilibrium state in the long run even without policymaker intervention, the new Keynesian theory argues that nominal rigidity in the economy due to competition imperfection and menu costs may distort such adjustment process. Given this situation, macroeconomic stabilisation policies especially monetary policies, have real effects and should be effectively used to achieve a more efficient macroeconomic outcome, in contrast to the laissez-faire policy as postulated by the new classical theory. Taken together, this posits that the Russian policymakers play a significant role in managing the financial crisis currently present in the country through effective implementation of demand management policies.

We suggest several courses of action to be considered by the policymakers. Within the monetary policy context, it is not possible to purge the inflationary pressure by contracting

the monetary policy stance*, at least for the case of the Russian economy. That is because inflation in Russia is largely monetary in nature, which is primarily associated with high production costs† and natural monopolies (Akaev, Ziyadullaev, Sarygulov, & Sokolov, 2016). Instead, the CBR should consider adopting the opposite approach by expanding monetary policy to gradually stimulate aggregate supply instead of suppressing aggregate demand through contractionary monetary policy. As such, the stimulation of supply should begin from the development of mass financing, which in the medium term should rely on bank loans, through lending rates realignment between economic sectors towards lower rates (Ivanter, et al., 2018). Only with lower lending rates, expansion of loans and incremental increase of projects - especially to the small and medium enterprises (SMEs) - can this be made possible. With sufficient amount of loans available to the SMEs, they will be able to invest in advanced production technologies and realise economies of scale, and that subsequently lowers production costs. At the same time, this may reduce natural monopolies that currently exist in the Russian economy. Furthermore, through expanding loans and increasing number of projects, Russia's move towards import substitution and export promotion to cushion the impact of depreciation of the ruble and economic sanctions can be made even more promising.

In addition, the CBR has transited to a full-fledged inflation-targeting regime in 2015 in response to the deterioration of external economic conditions caused by economic sanctions and falling global oil prices (Akaev et al., 2016). As such, inflation expectations, the level of transparency and public confidence in the policymakers' commitment towards an inflation target play a significant role in achieving the inflation target, which in turn determines the effectiveness of the regime in tackling the current crisis in the Russian economy. Given transparent and well-communicated strategies of monetary policy, empirical evidence has shown that policymakers can reduce the costs of minimising the output-inflation trade-off under a cost-push shock (Baeriswyl & Cornand, 2010). Based on these notions, the Russian policymakers should consider improving their level of transparency and provide proper communication to the public regarding their monetary policy strategies in order to achieve a favourable outcome with minimal cost in tackling the cost-push shock and adverse supply shock issues in the Russian economy.

The methdology used in the study generates robust empirical results for the purpose of the study. Nonetheless, more empirical studies should be conducted on other countries that shares similiar economic characteristics as Russia to test for the robustness of the methodology. Furthermore, recent empirical studies (see for example, Kobbi & Gabsi, 2017; Bildirici & Sonustun, 2018) have discovered the non-linearity of the Philips curve. Newer and more advanced methodologies that allow for non-linearity can be considered to better capture the short-run output inflation-trade off.

* This has been evidenced by the mis-steps of the CBR in tightening the monetary policy stance to combat inflationary pressure in the Russian economy in 2015, which was evidently ineffective and has caused the Russian economic growth to worsen.

† Again, this has provided support towards the existence of cost-push shocks in the Russia economy as higher production costs leads to higher inflationary pressure.

References

Addison, J. T., Chappell, H. W., & Castro, A. C. (1986). Output-inflation tradeoffs in 34 countries. *Journal of Economics and Business, 38*(4), 353-360.

Akaev, A. A., Ziyadullaev, N. S., Sarygulov, A. I., & Sokolov, V. N. (2016). Medium-term forecast of the dynamics of the development of the Russian economy. *Studies on Russian Economic Development, 27*(5), 510-517.

Asai, M. (1999). Time series evidence on a new Keynesian theory of the output-inflation trade-off. *Applied Economic Letters, 6*(9), 539-541.

Asirim, O. (1995). Output inflation tradeoff: Evidence from Turkey (Discussion Paper No. 9506). Turkey: The Central Bank of the Republic of Turkey.

Avsar, R. B., & Gur, T. H. (2004). How relevant is the new (Keynesian) Philips curve?The case of Turkey. *Journal of Economic Cooperation, 25*(4), 89-104.

Baeriswyl, R., & Cornand, C. (2010). Optimal monetary policy in response to cost-push shocks: The impact of central bank communication. *International Journal of Central Banking, 6*(2), 31-52.

Bakas, D., & Chortareas, G. (2018). *Inflation dynamics and the output-inflation trade-off: International panel data evidence* (Working Paper No. 2018/3). Data Analytics for Finance & Macro Research Centre.

Ball, L., Mankiw, N. G., & Romer, D. (1988). The new Keynesian economics and the output-inflation tradeoff. *Brookings Papers on Economic Activity, 19*(1), 1-82.

Benigno, P., & Ricci, L. A. (2011). The inflation-output trade-off with downward wage rigidities. *American Economic Review, 101*(4), 1436-1466.

Bhattarai, K. (2016). Unemployment-inflation trade-offs in OECD countries. *Economic Modelling, 58*, 93-103.

Bildirici, M. E., & Sonustun, F. O. (2018). Backward bending structure of Phillips curve in Japan, France, Turkey and the U.S.A. *Economic Research-Ekonomska Istraživanja, 31*(1), 537-549.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedascity. *Journal of Econometrics, 31*(3), 307-327.

Brissimis, S. N., & Magginas, N. S. (2008). Inflation forecasts and the new Keynesian Philips curve. *International Journal of Central Banking, 4*(2), 1-22.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*(366), 427-431.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica, 49*(4), 1057-1072.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica, 50*(4), 987-1007.

Fal'tsman, V. K. (2016). Problems of structural, investment and innovation policy in the crisis period. *Studies on Russian Economic Development, 27*(4), 367-373.

Fendel, R., & Rulke, J. C. (2012). Some international evidence on the Lucas supply function. *Economics Letters, 114*(2), 157-160.

Froyen, R. T., & Waud, R. N. (1985). Demand variablility, supply shocks and the output-inflation tradeoff. *The Review of Economics and Statistics, 67*(1), 9-15.

Giorgioni, G. (2001). New evidence on the output-inflation trade-off from developing economies: The case of the CFA Franc zone. *Applied Economics, 33*(8), 1077-1082.

Greenwald, B., & Stiglitz, J. E. (1987). Keynesian, new Keynesian and new classical economics. *Oxford Economic Papers, 39*(1), 119-133.

Holmes, M. J. (2000). The output-inflation trade-off in African less developed countries. *Journal of Economic Development, 25*(1), 41-55.

Idrisov, G., Ponomarev, Y., & Sinelnikov-Murylev, S. (2016). Terms of trade and Russian economic development. *Russian Journal of Economics, 2*(3), 279-301.

Ilyashenko, V. V., & Kuklina, L. N. (2017). Inflation in modern Russia: Theoretical foundations, specific features of manifestation and regional dimension. *Ekonomika Regiona, 13*(2), 434-445.

Ivanova, M. A. (2016). Analysis of the nature of cause-and-effect relationship between inflation and wage in Russia. *Studies on Russian Economic Development, 27*(5), 575-584.

Ivanter, V. V., Dzh. Govtvan', O., Gusev, M. S., Yu. Ksenofontov, M., Kuvalin, D. B., Moiseev, A. K., . . . Shirov, A. A. (2018). System of measures to recovery of economic growth in Russia. *Studies on Russian Economic Development, 29*(1), 1-5.

Katsimbris, G. M., & Miller, S. (1996). The new Keynesian economics and the output-inflation trade-off. *Applied Economics Letters, 3*(9), 599-602.

Kobbi, I., & Gabsi, F. (2017). The nonlinearity of the new Keynesian Phillips curve: The case of Tunisia. *Economies, 5*(3), 1-12.

Liew, V. K., Lim, K. P., & Puah, C. H. (2006). New evidence on the output-inflation trade-off from ASEAN-5 economies. *The ICFAI Journal of Applied Economics, 5*(2), 16-25.

Lucas, R. E. (1973). Some international evidence on output-inflation tradeoffs. *The American Economic Review, 63*(3), 326-334.

McCaw, S., & Morka, K. H. (2005). Monetary policy and the trade-off between inflation and output variability. In S. Gjedrem, & H. Snellingen, *Economic Bulletin 1/2005* (pp. 42-49). Norway: Norges Bank.

Mironov, V. (2015). Falling into the abyss or a window of opportunity? *Russian Journal of Economics, 1*(3), 217-239.

Puah, C. H., Habibullah, M. S., & Ong, H. B. (2005). Output-inflation trade-off in the Asian countries. In A. Z. Baharumshah, *Open Economy Macroeconomics in East Asia* (pp. 49-57). England: Ashgate Publishing Limited.

Said, S. E., & Dickey, D. A. (1984). Testing for unit roots in autoregressive-moving average models of unknown order. *Biometrika, 71*(3), 599-607.

Schwert, G. W. (1987). Effects of model specification tests for unit roots in macroeconomic data. *Journal of Monetary Economics, 20*, 73-103.

Sim, C. Y., Puah, C. H., Chin, M. Y., & Wong, H. N. (2015). Assessing the output-inflation trade-off for the case of Brazil. *Journal of Academy of Business and Economics, 15*(3), 107-112.

Sinyakov, A., & Yudaeva, K. (2016). Central bank policy under significant balance-of-payment shocks and structural shifts. *Russian Journal of Economics, 2*(3), 246-278.

Sun, R. (2014). Nominal rigidity and some new evidence on the new Keynesian theory of the output-inflation tradeoff. *International Economics and Economic Policy, 11*(4), 575-597.