sciendo

UDK: 338.23:336.74
DOI: 10.2478/jcbtp-2020-0014

Journal of Central Banking Theory and Practice, 2020, 2, pp. 67-85
Received: 5 May 2019.; accepted: 15 March 2020

Borivoje Krušković*

* Email:
bkruskovic@gmail.com

Exchange Rate Targeting Versus Inflation Targeting: Empirical Analysis of the Impact on Employment and Economic Growth

Abstract: This paper analyses the effects of two alternative monetary strategies (exchange rate targeting and inflation targeting) on economic growth and employment. On the panel of 18 countries for the period from 1996 to 2013, I tested the hypothesis that countries in exchange rate targeting have a higher rate of GDP growth and lower inflation rate. In order to test the impact of exchange rate policy on economic growth and prices, I applied dynamic panel two stepwise method of least squares (2SLS method) and they were evaluated by two independent regression equation. In order to allow the comparison of results related to exchange rate targeting, the effects of the introduction of inflation targeting in the unemployment rate were also estimated using the panel method two stepwise least squares (2SLS method). Results of empirical studies show that countries with inflation targeting have a lower rate of economic growth and higher unemployment.

Key words: exchange rate targeting, inflation targeting, monetary strategy, economic growth, employment

JEL: E31, E42, E52, E58, F31.

1. Introduction

The basis for the implementation of monetary policy is the monetary strategy. Each monetary strategy includes the appropriate exchange rate regime and instruments for

achieving the ultimate goal of monetary policy. Monetary policy should act in a predictable and systematic way in order to stabilize expectations and increase the efficiency of macroeconomic policy.

When monetary policy aims at price stability, the optimal rules in an open economy differ considerably from the optimal rules in a closed economy. In a large open economy, price stability is achieved by inflation targeting. Inflation targeting is a monetary policy strategy which uses inflation expectation (Bulut, 2018). Inflation is usually targeted within the range of 1% and 3% (Fabris, 2018).

In the flexible exchange rate regime, monetary policy actions have effects both through the interest rate and through the exchange rate. Changes in the real exchange rate affect economic activity through external competitiveness. Bearing in mind the transmission of monetary mechanisms (interest rate and exchange rate), the central bank must select an operational target in order to achieve the ultimate goal of monetary policy. If a central bank uses an interest rate as an operational target, there is a potential risk of ignoring a very important exchange rate mechanism through which monetary policy operates.

The balance of payments surplus brings the central bank into a dilemma whether to target inflation or exchange rate. Inflation targeting leads to a sharp appreciation of the exchange rate, which adversely affects competitiveness, employment, output and economic growth, while exchange rate targeting can generate inflation. The combination of inflation targeting and exchange rate targeting, with a priority on the exchange rate, is an optimal monetary strategy for developing countries and emerging countries with a large foreign exchange inflow.

If the central bank does not prevent the appreciation of the nominal exchange rate, the real effective exchange rate would be appreciated. The anti-inflationary effect of this policy may be negligible, since the nominal exchange rate indirectly influences inflation, while the real effective exchange rate impacts directly. While foreign exchange-based stabilization can function in the fight against inflation in the initial stages of transition, it becomes an obstacle to economic growth at a later stage and generates the possibility of a currency crisis if the exchange rate is maintained at an overestimated level in the long run.

A central bank cannot influence the interest rate if it adopts the exchange rate targeting in the conditions of free capital mobility. If the central bank would respond to the mounting inflation by tightening monetary conditions, i.e. by increasing the interest rate, capital inflows would hamper an attempt to tighten. If the central bank intervenes in the foreign exchange market to prevent adapting the exchange rate, there will be an increase in money supply and aggregate

demand, as well as inflation. This will continue as long as inflation is insufficient to cause the appreciation of the real exchange rate needed to balance the balance of payments. When a central bank targets the exchange rate, an attempt to influence aggregate demand and inflation by increasing the interest rate, this will be prevented by international capital flows.

The rest of this paper is organized as follows. Section 2 considers a preliminary examination of literature from the relevant scientific field. The hypotheses of interest are given in Section 3 which also describes the econometric model to be used in the analysis of inflation targeting and exchange rate targeting on employment and economic growth. It considers the data, methodologies and variables used in the study. A discussion of the results and implications is given in Section 4.

2. Literature Review

Abu Asab, Cuestas and Montagnoli (2018) investigate and compare the relationship between inflation and inflation uncertainty under inflation targeting and, alternatively, a conventional fixed exchange rate regime, for a group of emerging countries. To do so they estimate GARCH in mean models and they find that there is a bi-directional relationship between inflation and inflation uncertainty under the two monetary strategies. It is also found that the fixed exchange rate regime has no impact on average inflation and inflation inertia, while inflation targeting has been successful at lowering both average inflation and inflation persistence. Maduku and Kaseeram (2018) analyse the impact of inflation, growth and exchange rate on unemployment in South Africa using 1980-2017 annual data spanning. Using the ARDL methodology they find that there is a negative long-run relationship between inflation and unemployment in South Africa and inflation is significant in explaining unemployment. Other variables of interest, economic growth and exchange rate are also significant in explaining unemployment. Fabris and Vujanovic (2017) find that the effect from the financial dollarization shock on the exchange rate is strong in the case of inflation targeting. Svensson (2016) shows that "leaning against the wind" with a higher monetary policy interest rate may have benefits in terms of lower real debt growth and associated lower probability of a financial crisis but has costs in terms of higher unemployment and lower inflation, importantly including a higher cost of a crisis when the economy is weaker. Habib, Mileva and Stracca (2016) investigate the impact of movements in the real exchange rate on economic growth based on five-year average data for a panel of over 150 countries in the post Bretton Woods period. They use external instruments to deal with possible reverse causality

from growth to the real exchange rate. Their country-specific instruments are global capital flows interacted with individual countries' financial openness and the growth rate of foreign exchange reserves. They find that a real appreciation (depreciation) significantly reduces (raises) annual real GDP growth. However, their results confirm this effect only for developing countries and for pegs. Cuestas, Gil-Alana and Taylor (2016) consider inflation rate differentials between seven Central and Eastern European Countries and the Eurozone. Their empirical findings suggest that the majority of countries experience non-linearities in the inflation rate differential. However, there is only evidence of a persistent difference in some countries. Krušković (2016) shows that the exchange rate is a more significant transmission mechanism than the interest rate both in emerging markets and Serbia, and therefore that the exchange rate targeting is more favourable monetary strategy than inflation targeting in these countries. Svensson (2015) shows that if inflation expectations become firmly anchored at the inflation target even when average inflation deviates from the target, the long-run Phillips curve becomes nonvertical. During 1997-2011, average inflation expectations in Sweden were close to the inflation target of 2 percent, whereas average inflation fell short of the target by 0.6 percentage points. The estimates reported suggest that the slope of the long-run Phillips curve was about 0.75. Then the average unemployment rate was about 0.8 percentage points higher than if average inflation was on target. This is a large unemployment cost of undershooting the inflation target. Ehrmann (2015) tests to what extent inflation expectations are anchored in such circumstances, by comparing across periods when inflation is around target, (persistently) high, or (persistently) weak. He finds that under persistently low inflation, inflation expectations are not as well anchored as when inflation is around target: inflation expectations are more dependent on lagged inflation; forecasters tend to disagree more; and inflation expectations get revised down in response to lower-than-expected inflation, but do not respond to higher-than-expected inflation. Andersen, Malchow-Møller and Nordvig (2015) show that countries with inflation targeting weathered the crisis much better than countries with other monetary strategies, particularly countries with fixed exchange rates. Rey (2015) suggests that one of the determinants of the global financial cycle is monetary policy in the centre country, which affects leverage of global banks, capital flows and credit growth in the international financial system. Whenever capital is freely mobile, the global financial cycle constrains national monetary policies regardless of the exchange rate regime. For the past few decades, international macroeconomics has postulated the "trilemma": with free capital mobility, independent monetary policies are feasible if and only if exchange rates are floating. The global financial cycle transforms the trilemma into a "dilemma" or an "irreconcilable duo": independent monetary policies are possible if and only if the capital account is managed. Krušković and Maričić (2014)

examine how the adoption of inflation targeting affects the movement of the risk premium. The hypothesis they want to test is that the adoption of inflation targeting affects the reduction of the country risk premium by affecting the formation of a more stable macroeconomic environment through a more stable and predictable inflation rate in the medium and long term. Bussiere, Lopez and Tille (2014) assess the impact of appreciations, productivity booms and capital flow surges using a propensity-score matching approach to address causality issues. They show that appreciations associated with higher productivity have a larger impact on growth than appreciations associated with capital inflows. Furthermore, the appreciation per se tends to have a negative impact on growth and Fry-McKibbin and Wang (2014) show that inflation targeting tends to insulate developed countries, but is much less conclusive for the emerging countries during downturns. These results are opposite to those found for normal economic periods which are inconclusive for developed countries, but beneficial for emerging countries. Most concerning for emerging countries is that inflation targeters experience lower GDP growth in downturns. Both developed and emerging countries need to evaluate their choice of monetary regime by taking into account the trade-off between low and stable inflation during normal periods with growth during downturns. Ghosh, Ostry and Qureshi (2014) show that macroeconomic and financial vulnerabilities are significantly greater under less flexible intermediate regimes, including hard pegs, as compared to floats. While not especially susceptible to banking or currency crises, hard pegs are significantly more prone to growth collapses, suggesting that the security of the hard end of the prescription is largely illusory. Intermediate regimes as a class are the most susceptible to crises, but "managed floats", a subclass within such regimes, behave much more like pure floats, with significantly lower risks and fewer crises. However, managed floating is a nebulous concept; a characterization of more crisis prone regimes suggests no simple dividing line between safe floats and risky intermediate regimes. Daboussi (2014) investigates the effect of inflation targeting on inflation, output growth and interest rates based on panel data of 53 developing countries, of which 20 that adopted inflation targeting by the end of 2007. The results show that the empirical analysis confirms that the effect of inflation targeting in developing economies will contribute effectively to achieve economic performance. Yamada (2013) applies propensity score matching estimators with multiple outcomes to evaluate the impacts of exchange rate regimes (fixed, intermediate and flexible without inflation targeting) and inflation targeting on inflation rates in emerging and developing countries. Inflation-targeting does better than or at least as good work as a fixed regime in lowering inflation rates when compared with intermediate or flexible regimes and does not observe a clear difference in inflation rates between fixed and inflation-targeting regimes. Intermediate and flexible regimes provide higher inflation than fixed or inflation-targeting regimes

in most cases. Bhar and Mallik (2013) examine the transmission and response of inflation uncertainty and output uncertainty on inflation and output growth in the UK using a bi-variate EGARCH model. Results suggest that inflation uncertainty has positive and significant effects on inflation before the inflation-targeting period, but that the effect is significantly negative after the inflation-targeting period. On the other hand, output uncertainty has a negative and significant effect on inflation and a positive effect on growth, while oil price rise significantly increase inflation for the UK. Results also indicate that inflation uncertainty significantly reduces output growth before and after the inflation-targeting period. Evans (2012) finds that either price-level targeting or temporary above-average inflation is nearly optimal policy to address liquidity trap crisis. Still, central bankers and the public generally question whether even a temporarily higher inflation rate could be beneficial in addressing a liquidity trap or could be consistent with price stability over the longer term. Di Nino, Eichengreen and Sbracia (2011) assume that productivity is higher in the tradeable-goods than in the non-tradeable-goods sector, and examine the roles of market structure, scale economies and wage flexibility in channelling resources from the latter to the former sector, increasing exports and real GDP. They then turn to Italy and verify empirically that undervaluation has positively affected its exports. Undervaluation has been helpful to increase the exports of high-productivity sectors, such as most manufacturing industries. Finally, they describe the misalignments of the lira/euro since 1861, analyse their determinants and draw the implications for Italy`s economic growth. Ncube and Ndou (2011) derive the inflation equation to search for a possible transmission channel between the real interest rate, inflation rate, exchange rates, real output growth rate using a Bayesian VAR sign restriction approach. Their findings show that the real interest rate reacts negatively to inflation rate shocks and the Fisher effect holds in the long run. They show that strict inflation targeting is not compatible with significant real output growth. However, a flexible inflation targeting which attaches a large weight to the role of real effective exchange rates results in a significant real output growth given the central bank desire to accumulate more foreign exchange reserves and high oil price inflation. Thus real effective exchange rate measuring competitiveness against trading partners matters more than domestic currency and nominal effective exchange rate depreciations. Rose (2011) provides a selective survey of the incidence, causes, and consequences of a country's choice of its exchange rate regime. While a fixed exchange rate with capital mobility is a well-defined monetary regime, floating is not; thus, it is unclear whether it is theoretically sensible to compare countries across exchange rate regimes. This comparison is quite difficult to make empirically. It is often hard to figure out what the exchange rate regime of a country is in practice, since there are multiple conflicting regime classifications. More importantly, similar countries choose radically different ex-

change rate regimes without substantive consequences for macroeconomic outcomes like output growth and inflation. Wong, Clifton and Leon (2001) examine the impact of the introduction of inflation targeting on the unemployment-inflation trade-off in OECD countries. Theoretical models suggest that the credibility-enhancing effects of the adoption of inflation targeting should cause an improvement in the unemployment-inflation trade-off, i.e., that reducing inflation by a given amount should occur with a smaller rise in unemployment. Using a smooth transition regression model, it is shown that the improvement in this trade-off does not take place immediately after the adoption of inflation targeting; rather, it improves over time as the credibility of the central bank is established.

3. Empirical Analysis

The panel of 18 countries for the period from 1996 to 2013, we tested the hypothesis that countries in exchange rate targeting (fixed exchange rate regime) have a higher rate of GDP growth and lower inflation rate. Two independent regressions were evaluated: in the first regression, the rate of growth of real gross domestic product per capita (approximated first difference of the logarithm of real GDP per capita) as the dependent variable, while in the second regression, inflation occurs as the dependent variable (approximated as the first difference of the logarithm of the annual consumer price index). Annual data on gross domestic product, inflation, the share of investment in GDP, the share of gross government expenditure in GDP and the share of exports in GDP were collected from the IMF WEO database in October 2013.

Table 1: Definition and description of the variables used in the models

Variable	Description variables
BDP	Real gross domestic product per capita
INF	The annual growth rate of consumer prices (annual inflation)
inv	The share of investment in GDP
exports	The share of exports in GDP
GGE	The share of gross government expenditure in GDP
FX_regime	Artificial variable that takes the value 1 in the case of a fixed exchange rate of the euro or the value 0 in the case of floating exchange rate

Table 2 presents the countries and the exchange rate regime.

Table 2: Countries and the exchange rate regime

Country	Exchange rate regime
Albania	Floating exchange rate
Bosnia and Herzegovina	The currency board
Bulgaria	The currency board
Montenegro	Euro
Czech Republic	Floating exchange rate
Estonia	Euro
Croatia	Managed floating exchange rate
Cyprus	Euro
Latvia	Fixed exchange rate
Lithuania	Fixed exchange rate
Hungary	Floating exchange rate
Macedonia	Fixed exchange rate
Malta	Euro
Poland	Floating exchange rate
Romania	Floating exchange rate
Slovakia	Euro
Slovenia	Euro
Serbia	Floating exchange rate

3.1. Methodology

In order to test the impact of exchange rate policy on economic growth and price was applied dynamic panel two stepwise method of least squares (2SLS method) and were evaluated by two independent regression equation. In evaluating the regression equations are used instrumental variables:

1. correlated with the explanatory variables in the regression;
2. not correlated with the residuals.

The first step in the two stepwise method of least squares estimation involves ordinary least squares regression of each variable in the model on the set of instruments.

The second step involves the original regression equation, where all variables are replaced with values estimated from the regression from the first step. The coefficients of the regression coefficients represent two stepwise least squares.

In regression for economic growth, the first difference of the logarithm of the gross domestic product per capita (growth rate of real GDP) is used as the de-

pendent variable. The independent variables appear artificial variable for the exchange rate regime, the dependent variable lagged first difference of the share of investment in GDP and the first differential share of exports in gross domestic product. The following regression model is estimated:

$$\Delta \log(BDP)_{it} = \beta_1 \Delta \log(BDP)_{it-1} + \beta_2 FX\_regime_{it} + \beta_3 \Delta(inv)_{it} + \beta_4 \Delta(\exp orts)_{it} + \gamma_t + \varepsilon_{it}$$

where γ_t is a fixed time effect.

In regression for inflation, as the dependent variable, the annual inflation rate, as an independent exchange rate regime, the dependent variable lagged first difference of the share of gross government expenditure in GDP in the first differential share of exports in GDP. Estimated the following regression model:

$$\Delta \log(CPI)_{it} = \beta_1 \Delta \log(CPI)_{it-1} + \beta_2 FX\_regime_{it} + \beta_3 \Delta(inv)_{it} + \beta_4 \Delta(\exp orts)_{it} + \beta_5 \Delta(GGE)_{it} + \gamma_t + \varepsilon_{it}$$

where γ_t is a fixed time effect.

For the analysis of the links between exchange rate regimes and economic growth and inflation, it is vital sign and significance of the parameter β_2. This coefficient links? the macroeconomic performance of exchange rate regime. Bearing in mind the theoretical considerations about the fixed exchange rate, it is expected that in the regression coefficient β_2 for economic growth is positive, while the regression of inflation expectations has negative value of this ratio.

Results of regression equations estimated two stepwise method of least squares for economic growth and inflation are shown in Table 3 and Table 4.

Table 3: Results of the estimated regression links between economic growth and the exchange rate regime based on two stepwise method of least squares for a panel of 18 countries for the period from 1980 to 2013

Dependent Variable: Growth rate of real GDP per capita (Δlog (GDP))

Independent Variables	Equation	
Variable	Coefficient	p-value
$\Delta\log(BDP)_{t-1}$	0.45***	0.00
Fx regime	0.03***	0.00
Δ(inv)	0.01***	0.00
Δ(exports)	0.01**	0.03
	$R^2 = 0.62$ Adjusted $R^2 = 0.62$	

Note: *, ** and *** indicate statistical significance at the level of 10%, 5% and 1% respectively.

Results in Table 3 show that in the set of surveyed countries for the period from 1980 to 2013, the exchange rate regime has a statistically significant impact on

economic growth (positive and statistically significant coefficient on the dummy variable FX_REGIME). The value of the coefficient β_2 of 0.03 indicates that for the given set of countries, adopting fixed exchange rate regime leads to an increase in the annual rate of GDP growth by 0.03 percentage points. The estimated coefficient on the lagged dependent variable indicates that the growth rate of real GDP in the sample indicates the level of persistence of 0.45, as well as to increase the share of investment in GDP by one percentage point, leading the growth rate of real GDP by 0.01 percentage point. The growth of the share of exports in GDP by one percentage point, increase the rate of GDP growth by 0.01 percentage point.

Fixed time effects are excluded from the model because they were not statistically significant (p-value greater than 0.10).

All variables are shown in Table 3 are statistically significant, while the variables lagged dependent, FX_regime and the share of investment in GDP, with the probability of 99% can claim to be statistically significantly different from zero (p-value of 0.00 indicates a significance level of 1%), while the variable share of exports in GDP statistically significantly different from zero at a significance level of 5%, from 95% certainty we can say that variable affects the exports growth in real GDP.

The value of R^2 statistic indicates the part of the variation of the dependent variable that is explained by a set of explanatory variables, i.e. that the proposed specification model explains 62% of variation of the dependent variable.

Regression results for inflation and exchange rate regime are shown in Table 4:

Table 4: Results of regression assessed the relationship between inflation and the exchange rate regime based on two stepwise method of least squares for panel of 18 countries for the period from 1980 to 2013

Dependent variable: annual inflation rate

Independent Variables	Equation (1)	
Variable	Coefficient	p-value
C	1.33*	0.07
INF_{t-1}	0.69***	0.00
Fx regime	-0.29***	0.00
Δ(inv)	0.59***	0.00
Δ(exports)	-0.05**	0.04
Δ(GGE)	0.08*	0.10
	$R^2 = 0.55$	
	Adjusted $R^2 = 0.50$	

Note: *, ** and *** indicate statistical significance at the level of 10%, 5% and 1% respectively. Time effects were included in the regression.

The results in Table 4 are consistent with the theoretical assumption that fixing the exchange rate leads to lower inflation. This is indicated by a negative and statistically significant estimated coefficient β_2 (-0.29). This coefficient is significant at a significance level of 1%, and its value indicates that the adoption of inflation targeting leads to a decrease in the annual rate of inflation by 0.29 percentage points.

Annual inflation in the sample expressed a high level of persistence of 0.69. This is indicated by the value of the coefficient β_1. This ratio was also statistically significant at a significance level of 1%. The value of the coefficient β_3 indicates that the increase in the share of investment in GDP by one percentage point leads to an increase in the annual rate of inflation by 0.59 percentage points. In the same direction operates also increase in the share of government expenditure in GDP, whose growth of one percentage point leads to an increase in the annual rate of inflation of 0.08 percentage points. The growth of the share of exports in GDP by one percentage point leads to a decrease in the annual rate of inflation of 0.05 percentage points.

The constant (C) denotes a fixed time effects. P-value of 0.07, which corresponds to the estimated constant, suggests that the fixed effects are not statistically significant at a significance level of 10%, and are therefore retained in the model.

The value of the coefficient of determination of 0.55 indicates that the variables in the model explained 55% of the total variance of the dependent variable.

3.2. Assessment of the effects of the adoption of inflation targeting on the unemployment rate

In the previous section it is shown that a fixed exchange rate (exchange rate targeting) has a positive impact on economic growth, this paper shows that compared to the alternative exchange rate regime (flexible exchange rate regime), fixing the exchange rate leads to higher rates of growth of real GDP of 0.03 percentage points.

Based on the same data we tested the hypothesis that the adoption of inflation targeting has resulted in a higher unemployment rate. New regression was estimated in which the dependent variable is annual unemployment rate. The unemployment rate is approximated as the first difference of the logarithm of the number of unemployed.

Table 5: Definition and description of the variables used in the models

Variable	Description variables
UN_RATE	Annual rate of unemployment
BDP	Real gross domestic product per capita
INV	Share of investment in GDP
IT	Artificial variable that takes the value 1 in the case of the inflation targeting, and the value 0 otherwise
IT*UNEMPLOYMENT	Variable that represents the interaction between inflation targeting and the average unemployment rate in the period before the introduction of inflation targeting

Table 6 gives information on the adoption of inflation targeting countries that make up the panel.

Table 6: Inflation targeting and the date of the adoption of inflation targeting by the country

Country	Inflation targeting
Albania	Since 2009
Bosnia and Herzegovina	No
Bulgaria	No
Montenegro	No
Czech Republic	Since 1997
Estonia	No
Croatia	No
Cyprus	No
Latvia	No
Lithuania	No
Hungary	Since 2001
Macedonia	No
Malta	No
Poland	Since 1998
Romania	Since 2005
Slovakia	No
Slovenia	No
Serbia	Since 2006

3.2.1. Methodology

In order to allow comparison of results from the previous section related to the targeting of the exchange rate, the effects of the adoption of inflation targeting on the unemployment rates were also estimated using the panel method stepwise least squares (2SLS method) as described in the previous section.

The unemployment rate appears as a dependent variable, while artificial variable for inflation targeting, the growth rate of gross domestic product, the first difference of the share of investment in GDP, and the first difference of the share of exports in gross domestic product appear as the independent variable. The following regression model is estimated:

$$\Delta \log(UN\_RATE)_{it} = \beta_1 IT_{it} + \beta_2 \Delta \log(BDP)_{it-1} + \beta_3 \Delta(INV)_{it} + \beta_5 \Delta(INF)_{it} + \gamma_i + \varepsilon_{it}$$

where γ_i is a fixed comparative effect.

$$\Delta \log(UN\_RATE)_{it} = \beta_1 IT_{it} + \beta_2 \Delta \log(BDP)_{it-1} + \beta_3 \Delta(INV)_{it} + \gamma_i + \varepsilon_{it}$$

where γ_i is a fixed comparative effect.

The third equation shown in Table 7 aims to test the hypothesis that the effect of the adoption of inflation targeting on unemployment depends on the initial level of unemployment. For these purposes, a new variable is introduced that represents the interaction between the artificial variables IT and the average unemployment rate in the period before the adoption of inflation targeting.

$$\Delta \log(UN\_RATE)_{it} = \beta_1 IT_{it} * UNEMPLOYMENT + \beta_2 \Delta \log(BDP)_{it-1} + \beta_3 \Delta(INV)_{it} + \gamma_i + \varepsilon_{it}$$

where γ_i is a fixed comparative effect.

For the analysis of the links between targeting the exchange rate and economic growth and inflation, sign and significance of the parameter β_1 are vital. This coefficient links the movement of the unemployment rate with the adoption of inflation targeting. The value of the coefficient indicates how much is going to change the value of the dependent variable in the event that a country adopts inflation targeting in relation to the situation in which the country implements an alternative monetary strategy.

Bearing in mind the theoretical considerations of inflation targeting, it is expected that in the regression of unemployment estimated value of the coefficient β_1 is positive as a result of significantly higher opportunity cost of low inflation rates compared to other monetary policy strategy.

Results of regression equations estimated two stepwise least squares method for the unemployment rate are shown in Table 7.

Table 7: Results of the estimated regression links between unemployment and inflation targeting on the basis of two stepwise method of least squares for a panel of 18 countries for the period from 1980 to 2013

Independent variables	Equation (1)		Equation (2)		Equation (3)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
C	0.12***	0.00	0.10***	0.00	0.10	0.00
IT	0.07*	0.10	0.09**	0.03		
INF_{t-1}	-0.01	0.50				
$\Delta(INV)_{t-1}$	-0.01*	0.10	-0.01**	0.10	-0.01**	0.00
$\Delta(GDP)_{t-1}$	-0.11*	0.10	-0.18*	0.08	-0.15*	0.08
IT*UNEMPLOYMENT					0.10**	0.00
	$R^2 = 0.74$		$R^2 = 0.74$		$R^2=0.76$	
	Adjusted $R^2 = 0.71$		Adjusted $R^2 =0.72$		Adjusted $R^2 = 0.74$	

Note: *, ** and *** indicate statistical significance at the level of 10%, 5% and 1% respectively. Fixed effects relating to the countries included in the regression.

Results in Table 7 are consistent with the hypothesis that the adoption of inflation targeting leads to higher unemployment rate. This is indicated by a positive and statistically significant estimated coefficient β_1 (0.07 in Equation 1 and 0.09 in Equation 2). In the first specification, the coefficient is significant at a significance level of 10%, and its value indicates that the adoption of inflation targeting leads to an increase in the annual rate of unemployment by 0.07 percentage points compared to the alternative strategy of monetary policy.

Albeit the expected negative sign (-0.01), the coefficient of the annual rate of inflation, was not statistically significant (p-value of 0.50) and this variable was excluded from further analysis.

Change in the share of investment in GDP has a negative impact on the unemployment rate and the impact was confirmed through all three specifications of the model in which the coefficient on the share of investment in GDP is negative and statistically significant (in the first two specifications coefficient is significant at the level of significance of 10%, while the specification in the last significant increased up to 1%). The value of this ratio is unchanged in all three specifications, indicating the robustness of the results.

The growth rate of real GDP, as expected, has a negative impact on the unemployment rate. In all three of the estimated specifications, the estimated negative at the level of 10% is statistically significant coefficient on the growth rate of real GDP.

Bearing in mind the coefficient on inflation rate, although its expected sign is not statistically significant, the INF variable is excluded from the analysis and estimated in the equation 2.? All remaining variables in the model are still statistically significant and have the expected sign. Improvement in relation to equation 1 is reflected in the increasing significance of the coefficient with artificial variable IT, as well as the increase in adjusted coefficient of determination (adjusted R^2) increased from 71% in equation 1 to 72% in equation 2, which justifies the exclusion variable inflation from the model.

Equation 3 aims to test the extent to which the adoption of inflation targeting affect the unemployment rate, taking into account the initial level of unemployment. This is indicated with a variable coefficient IT*UNEMPLOYMENT. Rated coefficient is positive (0.10) and statistically significant at a significance level of 1%. The positive value of this ratio indicates that the adoption of inflation targeting has a greater impact on the growth rate of unemployment if the country had a higher unemployment rate in the period before it adopted inflation targeting. Also, the introduction of these variables in the model has increased the coefficient of determination and adjusted coefficient of determination. R^2 is 74%, as it was in the first two specifications, increased to 76%, which indicates that the percentage of the explained variance of the dependent variable increased by 2 percentage points.

4. Conclusion

When targeting a foreign exchange rate, the decisions of the central bank are affected by the "trilemmas" of macroeconomic policies, but the real exchange rate can still be used to encourage employment and economic growth. Therefore, although the stabilization based on open market operations has a tendency to reduce economic activity, the central bank can always target the real exchange rate which, at least partially, compensates for contraction effects of stabilization. Monetary policy instruments can reduce inflation without limiting the “macroeconomic trilemmas.” The long-term balance is stable if nominal wages are flexible and if the central bank maintains a competitive real exchange rate.

Exchange rate targeting with the aim of controlling inflation reflects the fact that although the central bank can control the nominal exchange rate, the market and fiscal policy determine the real exchange rate. If the balance of payments factors require the appreciation of the real exchange rate, it will be achieved through inflation, unless the appreciation of the nominal exchange rate is permitted. The main advantage of a flexible exchange rate target is the ability to absorb and mitigate external shocks (such as changes in oil and food prices) through changing the exchange rate target, rather than through inflation or deflation.

The key question when targeting a foreign exchange rate is on which level the target exchange rate is defined. If the target exchange rate is defined at a level above the equilibrium, the exchange rate will be overestimated, which will inevitably lead to the foreign exchange crisis. If the target exchange rate is defined at a level below the equilibrium, the exchange rate will be understated, which will have positive effects on economic growth and employment, regardless of the slightly higher rate of inflation. A key indicator that needs to determine the level at which the target exchange rate is fixed is the balance of payments and the unemployment rate.

There is a long-term trade-off between the depreciated real exchange rate and inflation, when the real exchange rate is targeted by the policy of accumulation of foreign exchange reserves. Maintaining low inflation in conditions of high unemployment and low economic growth requires a set of adjustments that will further boost recessions and depreciation pressures and deepen the economic cycle.

In achieving the goals of low inflation and maximum economic growth rates, central banks use the interest rate as an instrument of monetary policy. If the sole objective of monetary policy is to reduce inflation fluctuations, then it should respond to economic cycle shocks because the inflation variability partly determined by the variability of output or by a decrease in the yield variability reduces the inflation variability. A higher change in interest rates in response to deviations in output from a potential level reduces variability and output and inflation, but excessive activist monetary policy can increase variability. Trade-off between the variability of output and inflation is convex, i.e. at a relatively high level of inflation variability, the costs of stabilizing the output due to the decrease in inflation variability are small but they grow as variability decreases. Also, a higher credibility of the inflation target reduces the variability of output and inflation.

The central bank seeks to reduce the expected deviation of inflation from target and output from the potential level. Time lag of monetary policy means that the

current level of economic activity is influenced by the interest rate from the previous years. Interest rate correction has little effect on the variability of output and inflation, but it leads to significantly longer cycles and outputs and inflation.

The main monetary policy instrument used by the central bank to target inflation is the interest rate. In the short term, when the outcome of a shock causes openness, the central bank can allow the adjustment process if shocks do not endanger the achievement of inflation targets, or intervene with monetary policy, i.e. adjust the interest rate if the shocks threaten to achieve an inflation target. If the output gap is generating inflation pressure, the central bank will intervene to keep the output close to the potential level (trend) and inflation within the target or range of targets. Positive shocks will be suppressed by contraction, and negative by expansive monetary policy.

The analysis of the effects of inflation targeting is controversial because the adoption of this monetary strategy has occurred in fairly favourable macroeconomic circumstances characterized by the absence of supply shocks, low budget deficits, and the availability of foreign exchange. The nineties of the last century were generally a stable macroeconomic environment, a "price-prone period" and inflation had a downward trend in many countries, especially developed ones, even before the introduction of inflation targeting. This could have contributed to the effectiveness of inflation targeting in relation to other monetary strategies. In addition, the question is whether systemic risks, volatility and inflation are really reduced by adopting inflation targeting or by a set of "exogenously favourable" factors. Essentially, inflation targeting is not superior to other monetary strategies and is also vulnerable to shocks, as well as exchange rate targeting, in the presence of fiscal domination and imbalance. Numerous empirical results on the performance of inflation targeting occur in a situation where inflation is relatively overwhelming in the whole world. The question is how inflation targeting will progress if world inflation increases considerably. Central banks that do not target inflation have also been successful in achieving and maintaining low inflation. This clearly implies that central banks do not need to adopt inflation targeting to achieve and maintain low inflation.

References

1. Abu Asab, N., Cuestas, J.,C. and Montagnoli, A. (2018). Inflation targeting or exchange rate targeting: Which framework supports the goal of price stability in emerging market economies? *Sheffield Economic Research Paper Series*.
2. Barnebeck Andersen, T., Malchow-Møller, N. and Nordvig, J. (2015). Inflation targeting and macroeconomic performance since the Great Recession. *Oxford Economic Papers*.
3. Bhar, R. and Mallik, G. (2013). Inflation uncertainty, growth uncertainty, oil prices, and output growth in the UK. *Empirical Economics*.
4. Buut, U. (2018) Inflation Expectations in Turkey: Determinants and Roles in Missing Inflation Targets, *Journal of Central Banking Theory and Practice*, vol 7, no 3, pp 73-90.
5. Bussiere, M., Lopez, C. and Tille, C. (2014). Do real exchange rate appreciations matter for growth? Graduate Institute of International and Development Studies, *Working Paper No. 6*., Munich Personal REPEC Arhive.
6. Cuestas J.C., Gil-Alana L.A., Taylor K. Inflation convergence in Central and Eastern Europe vs the Eurozone: non-linearities and long memory. (2016). *Scottish Journal of Political Economy*.
7. Daboussi, M. O. (2014). Economic performance and inflation targeting in developing economies. *Journal of World Economic Research*.
8. Di Nino, V., Eichengreen, B. and Sbracia, M. (2011). Real Exchange Rates, Trade, and Growth: Italy 1861-2011. Bank of Italy Economic History, *Working Papers No. 10*.
9. Ehrmann, M. (2015). Targeting Inflation from Below: How Do Inflation Expectations Behave?. *International Journal of Central Banking*, 11 (4)..
10. Evans, C.L. (2012). Monetary Policy in a Low Inflation Environment: Developing a State Contingent Price Level Target. *Journal of Money, Credit and Banking*, Vol. 44, No. 2.
11. Fabris, N. (2018) Challenges for Modern Monetary Policy, *Journal of Central Banking Theory and Practice*, vol 7, no 2, pp 5-24.
12. Fabris, N and Vujanovic, N. (2017) The Impact of Financial Dollarization on Inflation Targeting: Empirical Evidence from Serbia, *Journal of Central Banking Theory and Practice*, vol 6, no 2, pp 23-43.
13. Fry-McKibbin, R.A. and Wang, C. (2014). Does Inflation Targeting Outperform Alternative Policies during Global Downturns? *CAMA Working Paper No. 64*.

14. Ghosh, A.R., Ostry, J.D. and Qureshi, M.S. (2014). Exchange rate management and crisis susceptibility: A reassessment. *IMF Working Paper Series, WP/14/11*.
15. Habib, M.M., Mileva, E. and Stracca, L. (2016). The real exchange rate and economic growth: revisiting the case using external instruments. *Working Paper Series ECB*.
16. Krušković, B.D. (2014). "Monetary Strategies, Exchange Rate and Foreign Exchange Reserves". Economics Faculty in Banjaluka.
17. Krušković, B.D., Maričić, T. (2014). "Empirical Analysis of the Impact of Inflation Targeting on the Risk Premium". *Journal of Central Banking Theory and Practice*.
18. Maduku, H. and Kaseeram, I. (2018). Inflation Targeting Monetary Policy and Unemployment in South Africa. *Journal of Economics and Behavioral Studies*, Vol. 10, No. 4.
19. Ncube, M. and Ndou, E. (2011). Inflation Targeting, Exchange Rate Shocks and 0utput: Evidence from South Africa. African Development Bank Group, *Working Paper No. 134*.
20. Rey, H. (2015). Dilemma not trilemma: The global financial cycle and monetary policy independence. *NBER Working Paper No. 21162*.
21. Rose, A. K. (2011). Exchange rate regimes in the modern era: Fixed, floating and flaky. *Journal of Economic Literature*, 49(3).
22. Svensson, L.E O. (2016a). Cost-Benefit Analysis of Leaning Against the Wind: Are Costs Larger Also with Less Effective Macroprudential Policy? *Working Paper No. 21902*, National Bureau of Economic Research.
23. Svensson, L. (2015). The Possible Unemployment Cost of Average Inflation below a Credible Target. *American Economic Journal*.
24. Yamada, H. (2013). Does the exchange rate regime make a difference in inflation performance in developing and emerging countries? The role of inflation targeting. *Journal of International Money and Finance*.
25. Wong, C-H., Clifton, E.V. and Leon, G.L. (2001). Inflation Targeting and the Unemployment-Inflation Trade-off. *IMF Working Paper No. 01/166. 2-546*.