NONLINEARITY IN THE IMPACT OF INFLATION TARGETING ON UNEMPLOYMENT

By

Maleka Chirwa Thula

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfilment of the requirements

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Professor Lin, Shu-Chin

EFFECT OF TRADE OPENNESS ON FEMALE UNEMPLOYMENT RATE IN DEVELOPING COUNTRIES

By

Ligia Elizabeth Ventura Gutierrez

THESIS

Submitted to
KDI School of Public Policy and Management
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ABSTRACT

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Motivated by the controversy surrounding the effects of inflation targeting on economic performance, this paper assesses the impact of inflation targeting on unemployment and further explores whether the level of unemployment and financial development matter in determining the impact of inflation targeting on unemployment. To approach this issue, we utilise cross sectional data covering the period of 1990 to 2010 from 68 inflation targeting and non-targeting countries.

The results show that inflation targeting has nonlinear effects on unemployment. On one hand, inflation targeting reduces unemployment, particularly for countries with higher unemployment rates. On the other hand, the beneficial effect of inflation targeting on unemployment is moderated by financial deepening.

DEDICATION

To my family.

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List of Abbreviations

EU	European Union
GDP	Gross Domestic Product
GDPrate	Gross Domestic Product Growth Rate
Govt	Government
M2	Money Supply
OECD	Organization of Economic Cooperation and Development
OLS	Ordinary Least Squares
PSM	Propensity Score Matching
Pop_growth	Population Growth Rate
UK	The United Kingdom
Unemp	Unemployment
Urban_pop	Urban Population

1.0 Introduction

Inflation targeting has become popular and dominant monetary policy framework being utilised in over 27 developed as well as developing countries. Generally, economists and central bankers agree that necessary requisites are important for adoption and successful implementation of inflation targeting framework. Bernanke, et al. (1999), Mishkin (2004), Aliyu and Englama (2009) put forward some key preconditions for determination and successful implementation of inflation targeting which include: the public pronouncement of medium-term inflation target; central bank primary objective being price stability; high degree of transparency in the conduct of monetary policy; and accountability of central bank in achieving the primary objective price stability. It is widely agreed that the primary goal of monetary policy is to achieve price stability (Batini, Laxton and Yates, 2003; Pianalto, 2005). Thus, inflation targeting is seen as a useful monetary policy framework that fulfils the goal of price stability. Unlike other targeting regimes such as money and exchange rate targeting that aim at achieving low and stable inflation by targeting intermediate variables, such as the growth rate of money aggregates or the level of the exchange rate of an "anchor" currency, inflation targeting involves targeting inflation directly (Batini and Laxton, 2007). The two major features of inflation targeting include: public announcement and commitment to a specific or a range of numerical inflation target and the second one is forecasting inflation over some horizon which becomes the de facto intermediate target of policy.

Despite the popularity of inflation targeting among central bankers and economists, its role on economic performance has been debatable. The proponents of inflation targeting argue that adoption of inflation targeting leads to lower and stable inflation (Svensson, 1997; Bernanke, Launach, Mishkin and Posen, 1999 and Mishkin, 1999), hence anchoring inflation expectation more durably and permanently. On the other hand, inflation targeting is viewed as unimportant

factor for achieving price stability as well as boosting economic growth (Mishkin, 2000, 2004; Bernanke and Woodford, 2005 and Caballero and Krishnamurthy, 2005).

In spite of the unresolved controversy, inflation targeting since its adoption in New Zealand in 1990 has been widely regarded as a popular monetary policy framework in both advanced and emerging economies. In this paper, we shift the focus toward unemployment. We check whether inflation targeting has influence on unemployment. If inflation targeting leads to lower macroeconomic uncertainty and hence better business climate, it should increase the incentive to invest and hence more job creation. Unemployment would be lower in inflation targeting countries. However, studies on the impact of inflation targeting on unemployment have been few and also have yielded mixed results. For instance, Yeh and Huang (2014) and Balli and Louis (2013) which focus directly on the impact of inflation targeting on unemployment. Rather than focussing directly on unemployment, most scholarly research such as those of Carneiro et.al, 2011, Belasen et.al, 2012, Bysetedt & Brito, 2009, Lin and Yeh, 2007, Mendonca and Souza 2011, and Reschreiter, 2010, have emphasised on the impact of inflation targeting on other macroeconomic aggregates. Unlike the previous studies, this paper tries to contribute to literature in three ways: firstly, by focussing directly on the impact of inflation targeting on unemployment it is expected therefore that this study will augment literature by further uncovering the unemployment-inflation targeting relationship. Secondly, by investigating on whether the impact of inflation targeting on unemployment depends on the level of unemployment itself constitutes a new contribution to literature since there have been few previous studies that have focused on this relationship. Finally, using interaction methodology to explore whether the impact of inflation targeting on unemployment; is a new contribution in literature.

It is expected that countries that are more developed are likely to have less macroeconomic uncertainties, higher financial development, higher investment, more stable inflation and subsequently higher levels of job creation. Following this argument it is implied that less developed countries are more likely to have higher levels of unemployment, lower level of

financial development, more macroeconomic uncertainties and volatile inflation, just to mention but a few. Consequently, the level of unemployment and financial development could be important in determining the impact of inflation targeting on unemployment. Hence it is important to check whether the impact of inflation targeting depends on the level of unemployment and level of financial development. The main objective of the paper is therefore to investigate the nonlinearity in the impact of inflation targeting on unemployment. With this in mind, we have the following specific objectives which are set as hypothesis to be tested;

a) Inflation targeting does not have any impact on unemployment;

b) Impact of inflation targeting does not depend on level of unemployment;

and c) Impact of inflation targeting on unemployment does not depend on the level of financial development.

In order to conduct this study, quantile regression approach as well as interaction methodology are employed[1].

By using cross-sectional data averaged over the period of 1990 to 2010 obtained from 68 inflation targeting and non-inflation targeting countries, the findings reveal that inflation targeting has nonlinear negative effects on unemployment. Quantile results show that inflation targeting is negatively correlated with unemployment. In particular, adoption of inflation targeting in high unemployment countries reduces unemployment rate. However, interaction methodology results show that the beneficial effects of inflation targeting on unemployment is weakened by improvement in financial development.

The rest of this paper is organized as follows: Chapter 2 reviews the relevant literature on inflation targeting. Chapter 3 describes the data and their sources as well as presents the methodology used. In Chapter 4, main results for quantile regression approach and interaction methodology are presented. Finally, chapter 5 provides conclusion and policy recommendations on the main findings of this study as well as suggest areas for future research.

[1] Details on choice of methodology are discussed in Chapter 3, under methodology.

2.0 Literature Review

Generally economists and central bankers agree that necessary requisites are important for adoption and successful implementation of inflation targeting framework. Bernanke, et al. (1999), Mishkin (2004), Aliyu and Englama (2009) put forward some key preconditions for determination and successful implementation of inflation targeting which include: the public pronouncement of medium-term inflation target; central bank primary objective being price stability; high degree of transparency in the conduct of monetary policy; and accountability of central bank in achieving the primary objective price stability. Arising from the foregoing requisites for inflation targeting is the need for the public to have access to information from central bank through enhanced communication channels as well as increased accountability of the monetary authorities regarding the inflation target. If the objective of price stability and specific inflation target are properly communicated to the public and all other preconditions are satisfied, then inflation targeting is more likely to be a success.

However, since the adoption of inflation targeting in the 1990s as a monetary policy framework, its efficacy on the overall performance of the economy has ignited a heated debate. Theoretically, proponents of inflation targeting as an approach of monetary policy have argued that adoption of inflation targeting is associated with considerable benefits (Svensson, 1997, Bernanke, Launach, Mishkin and Posen, 1999 and Mishkin, 1999). Principal gains put forward by its proponents are lower and less variable inflation and interest rates, more stable growth and enhanced ability to respond to shocks without losing credibility (Salles and Gonçalves, 2006). The implication of this view is that attainment of low and stable inflation would result into economic growth, employment and poverty reduction, just to mention a few anticipated positive economic gains. On the other hand, inflation targeting is viewed as unimportant factor for achieving price stability as well as boosting economic growth (Romer, 2006, Mishkin, 2000, 2004; Bernanke and

Woodford, 2005 and Caballero and Krishnamurthy, 2005). Romer (2006) calls this a "window dressing view" meaning that lower and stable inflation observed during the period of inflation targeting cannot be attributed to the effectiveness of inflation targeting but rather to the decision and efforts of authorities in the targeting countries to lower inflation. Besides, even in non-inflation targeting countries inflation had been observed to be low during the same period. With respect to economic growth, it is argued that by obliging central banks to commit to low and stable inflation so restrictively reduces output and restrains growth.

Empirically, there are several studies that look at the effectiveness of inflation targeting on various key economic variables. Salles et.al (2006), Batini and Laxton (2007), Lin and Ye (2007) find that adoption of inflation targeting is associated with lower inflation and more stable growth. Salles et.al (2006) show that 13 countries that adopted inflation targeting experienced lower and stable inflation compared to non-targeters in a sample of 36 emerging countries. Similarly, Batini and Laxton (2007) establish that adoption of inflation targeting in developing countries lowers average inflation and real output growth volatility.

Mendonca and Souza (2011) find that the adoption of inflation targeting is an ideal monetary regime for developing economies as it plays a crucial role in reducing inflation volatility as well as driving inflation down to internationally acceptable levels. However, their results further show that inflation targeting does not have significant impact on the developed economies. Johnson (2001) looks at the impact of inflation targeting on reducing expected inflation, the results show that inflation targeting is associated with the reduction in expected inflation after announcement of the inflation targets.

Reschreiter (2011) investigates the impact of monetary policy regime shift to inflation targeting on the UK's real interest rate. The findings of the study show that inflation targeting has the ability to reduce the volatility of real interest rate; the implication of these findings is that central banks can influence the stochastic properties of real interest rate through the choice of monetary regime (such as inflation targeting) in the long run.

Emirmahmutoglu, Aksoy, Kose (2012) look at the relationship between nominal interest rate and inflation expectation in Turkish economy during the period of inflation targeting. The results of this study indicate that monetary policy rates depend on inflationary expectations. The findings of the study also reveal that long-term interest rates are affected by monetary policy and that the actual inflation was close to targeted level, meaning that inflation targeting is crucial in bringing inflation to targeted level.

In contrast, Bysetedt and Brito (2009) find no evidence to support the claim that inflation targeting leads to improved economic performance as measured by the behaviour of inflation and output growth in developing countries, rather results show unequivocal evidence of output reduction during the period of inflation targeting adoption. In addition, Ball and Sheridan (2005) find no any significant impact of inflation targeting on reducing inflation and inflation variability in developed countries. Lin and Ye (2009) also find no evidence to support that inflation targeting results in lower inflation and reduced inflation variability; rather their findings confirm the window dressing view of inflation targeting.

Fouejieu (2013) investigates whether inflation targeting countries are more resilient and perform better than non-targeting countries when exposed to financial crisis. However, the results show that there is no significant difference in terms of inflation rate and growth rate between inflation targeters and non-targeters when exposed to financial crisis. Honig and Alpanda (2014) investigate the impact of central bank independence on performance of inflation targeting regimes, their findings show no significant impact of inflation targeting on reducing inflation in developed countries but show small benefits of inflation targeting in the developing countries. More baffling is their finding of large beneficial effects of inflation targeting in developing countries with lower level of central bank independence, this finding suggests that central bank independence is not the major requisite for countries to experience major decline in inflation.

Choi, Kim, Osullivan (2011) investigate the effects of inflation targeting on relative variability of price variability and find no significant impact of decline in inflation after adoption

of inflation targeting on relative price variability. However, the results suggest that what is important for structural changes in relative price variability is not the adoption of inflation targeting per se but rather initial inflation regime prior to adoption of inflation targeting.

Given that some studies have identified existence of relationship between inflation targeting and economic performance, now we review few studies that directly investigate the impact of inflation targeting on unemployment. The study by Yeh and Huang (2014) uses Propensity Score Matching (PSM) to identify the effect of inflation targeting on unemployment, and find no significant impact of inflation targeting on unemployment in a panel of 74 countries. However, when these countries are segregated to developing and developed countries, adoption of inflation targeting is found to be associated with higher (lower) unemployment in developed (developing) countries. The implication of these findings could be that adoption of inflation targeting is more likely to be effective in reducing unemployment in countries where unemployment is high compared to countries where unemployment is already low. Balli & Louis (2012) investigate whether targeting inflation rate too low is responsible for the differential unemployment rate observed between major Organisation of Economic Cooperation and Development (OECD) countries and the US. The findings show that targeting inflation rate too low does not have effects on unemployment in the short run. However, in the long-run the results reveal show high and persistent cost for OECD inflation targeting countries. And also those OECD inflation targeting countries are even worse off in terms of level of unemployment when compared with OECD non-targeting countries.

Based on the reviewed literature, it is clear that there are differences in both theory and empirical findings on the role of inflation targeting on overall economic performance including unemployment; therefore further research on the subject matter is justified.

3.0 Data and Methodology

3.1 Data

Cross sectional data averaged over the period of 1990 to 2010 obtained from 68 inflation targeting and non-inflation targeting countries is used. The data is sourced from the World Bank's World Development Indicators (2014) and International Monetary Fund's World Economic Outlook. Inflation targeting countries includes all countries in the EU that use euro currency and all countries that officially adopted inflation targeting framework.

Identification strategy of targeting country follows Lin and Ye (2007), Ball and Sheridan (2003), where each country's starting time of inflation targeting is defined as the first year in which a specific target or range of target was adopted. Furthermore, this paper attaches weights depending on the period each country adopted inflation targeting. For instance, a country that adopted inflation targeting in 1990 takes the value 1 while a country that adopted inflation targeting later than 1990 takes a value less than 1 but greater than 0. Weighting allows to capture the true impact of inflation targeting on unemployment.

Another key variable included is liquid liabilities (M2), an indicator for financial development and also other variables to control for their effects on unemployment. Variables reported in Table 1 below are defined as follows: unemployment measured as a percentage of total labour force, it-share represents countries that adopted inflation targeting ($0<it\_share \leq 1$), otherwise equals 0, m2 is liquid liabilities, captures the level of financial development and is measured as money supply and quasi money as a percentage of GDP, rgdprate represents real GDP per capita growth rate, trade expressed as percentage of GDP is a measure of trade openness, government expenditure measured as percentage of GDP controls for policy effects on unemployment, pop_growth measured as a percentage of GDP accounts for impact of increase on

labour force on unemployment, urban_pop measured as a percentage of total urban population captures the impact of growth in urban population, inflation accounts for policy effects on economic growth.

Table 1 and 2 show summary statistics for the data used in this paper. Table 1 shows descriptive statistics. Table 2 reports pair wise correlation for all variables used in contemporaneous regression model (panel A) and initial regression model (panel B).

Table 1: Descriptive statistics for panel data

VARIABLES	Obs	Mean	Std dev	Min	Max
Panel A: Contemporaneous values					
unemp	60	8.204467	4.225559	1.486	23.135
it_share	68	0.2661471	0.2936845	0	1
inflation	67	173.832	494.3666	2.119	4031.543
M2	68	77.94651	79.43588	18.88553	619.1556
rgdprate	68	3.450235	1.803231	.249	10.16
trade	68	82.14326	52.54461	22.453	363.961
govt	68	17.66676	10.05139	4.896	86.582
pop_growth	68	2.335162	10.17004	-1.157	84.534
urbanpop	67	65.40152	20.63671	14.093	100
Panel B: Initial regressors					
It_share	68	0.1531912	0.2853408	0	1
Inflation	68	130.1837	378.9366	0.093	3039.444
M2	68	64.74924	78.94548	11.481	618.945
Rgdprate	68	1.956618	6.822473	-26.229	12.766
Trade	68	70.87974	50.31134	14.991	344.83
Govt	68	16.27615	6.829587	3.135	38.749
pop_growth	68	1.282897	1.210651	-1.804	3.881
urbanpop	68	62.27699	21.54331	11.56	100

Table 2 shows that most of the variables used are significantly correlated at 5 percent level and that there is no problem of perfect multicolinearity.

Table 2: Correlation Matrix for cross-sectional data

Panel A: Correlation for variables in Contemporaneous Model

Variables	unempr~e	it_share	M2	inflation	rgdprate	trade	govt	pop_grwth	urbanpop
unempr~e	1.0000								
it_share	-0.0267	1.0000							
M2	-0.3237**	0.2217**	1.0000						
Inflation	0.4763**	0.0630	-0.0614	1.0000					
rgdprate	-0.2015	-0.3087**	-0.0389	-0.0058	1.0000				
trade	-0.2579**	-0.1448	0.4014**	-0.1115	0.1526	1.0000			
govt	-0.0442	0.2444**	0.1124	0.0103	-0.3821**	-0.0142	1.0000		
pop_growth	-0.1146	0.0897	0.0653	0.1631	-0.0980	-0.0539	0.8211**	1.0000	
urbanpop	-0.1823	0.3651**	0.2659**	-0.1409	-0.3952**	0.2106**	0.4811**	-0.2039**	1.0000

Panel B: Correlation for variables initial values of regressors

Variables	unempr~e	it_share	M2	Inflation	rgdp	trade	govt	pop_grwth	urbanpop
unempr~e	1.0000								
it_share	-0.1669	1.0000							
M2	-0.2983*	0.1791	1.0000						
inflation	0.1724	0.1521	0.1652	1.0000					
rgdp	-0.1230	0.0049	-0.3197*	-0.0511	1.0000				
Trade	0.2404*	-0.0146	0.1013	-0.0530	0.0696	1.0000			
Govt	0.0808	0.0766	0.1220	0.0892	-0.3232*	0.1511	1.0000		
pop_growth	0.0728	-0.1221	-0.1729	0.1132	0.5371*	0.0833	-0.3080*	1.0000	
urbanpop	0.2224*	-0.0862	0.0559	-0.1507	-0.2065*	0.2735*	0.3166*	-0.3418*	1.0000

Notes: ** and * indicate significance at 5% and 10%, respectively

3.2 Methodology

3.2.1 Quantile Regression

In order to estimate the long run relationship between unemployment and inflation targeting as well as to explore whether the effect of inflation targeting depends on the level of unemployment, quantile regression estimation method is utilised. The major reason for using quantile regression is that it allows us to examine whether the relationship between unemployment and inflation targeting depends on the dependent variable itself (unemployment). This technique follows seminal works of Koeker and Bassett (1970s). Quantile regression model can be specified as:

$$Q_y(q|X)=\beta_0(q)X_0+ C_1(q)X_1+ \beta_2(q)X_2+...+ \beta_n(q)X_n +u_i \qquad (1)$$

where Q_y is dependent variable in qth quantile, (q) means that the parameters are for a particular q quantile (q ϵ [0, 1), X represents all explanatory variables and β captures the marginal effects of explanatory variables in each quantile. In general the conditional linear quantile can be written as:

$$Q_q(Y_i|X_i)= X'_i\beta_i \qquad (2)$$

The qth quantile estimator of β_q minimises the objective function given as:

$$Q(\beta_q) = \sum_{i=y\geq X_i'\beta}^{N} q\ |y_i - X_i'\beta_q| + \sum_{i=y\leq X_i'\beta}^{N}(1-q)\,|y_i - X_i'\beta_q| \qquad (3)$$

where 0<q<1, and we use β_q instead of β to make clear different choices of q to estimate various values of β. For instance, if q=.75, then more weight is placed on estimation of values greater than $y \geq X_i'\beta$ than for observations with $y \leq X_i'\beta$.

There are many other reasons why quantile regression is preferred. Firstly, quantile regression is robust even in the presence of heterogeneity (Cade &Noon, 2003). Terrell et.al, 1996, argue that use of regression quantile in linear model with unequal variance helps us to detect the relationship between and among variables that might have been deemed statistically insignificant based on the estimates of means. In addition, unlike OLS which is sensitive to outliers and becomes inefficient when the dependent variable has highly non-normal distribution, quantile regression is more robust (Cameron and Trivedi, 2009). Quantile regression also helps us to

picture a wider characterisation of data by allowing us to study the impact of the covariate on the full distribution or a particular quantile, and not just the conditional mean. Finally, quantile regression does not require the assumption of zero conditional mean which is the major assumption for consistency in OLS.

3.2. 2 Interaction Methodology

To investigate whether the impact of inflation targeting on unemployment depends on the level of financial development, two equations are estimated following interaction approach. Regression models can be summarised[2] as:

$$Unemp_i = a_0 + \beta_1 it_{share_i} + B_2 findev_i + B_3 it * findev_i$$
$$+\theta' control_i + \varepsilon_i \quad (4)$$

$$Unemp_i = a_0 + \beta_1 initial\_itshare_i + B_2 initialfindev_i + B_3 it * initialfindev_i +$$
$$\theta' initial\ control_i + \varepsilon_i \quad (5)$$

Where Un_i=unemployment for country i, it_share_i=share for inflation targeting for country i weighted depending on the time of adoption of inflation targeting, *findevi*=indicator for financial development (m2) for country *i*, *it*findev*=captures interaction effects between inflation targeting and financial development, $control_i$=all control variables included in the model, where β_1=coefficient for *it_share*, β_2=coefficient for financial development, β_3=coefficient for interaction term, θ'=coefficient for all explanatory variables, εit=error term

The equation 4 estimates the impact of inflation targeting on unemployment using contemporaneous values, where we assume that there is no reverse causality between the dependent variable and the independent variable. However, being mindful that financial

[2] Definition of Variables used in this paper (see Appendix 1)

development and other independent variables may be endogenous, hence this paper follows Levine R. (1997) where initial values of independent variables are used instead of contemporaneous values, thus we specify equation 5. By utilising initial values we are able to remedy any spurious relationship between unemployment and inflation targeting that may be influenced by reverse causality. By regressing unemployment on initial values of the regressors, we assume that the current unemployment cannot influence initial values of the regressors; however initial values can influence the current average unemployment, thereby dealing with the problem of reverse causality. If the actual time period in which the improvement in financial development lowers or increases unemployment is shorter than our sample period, then initial values are expected to reduce the bias arising from reverse causality.

4.0 Results

4.1 Estimation results for unemployment and inflation targeting impact

4.1.1 Results for Contemporaneous Model

This section reports estimation results for the impact of inflation targeting on unemployment. We begin by reporting quantile estimation results for contemporaneous model while results for initial regression model are presented in the latter section. Table 3 presents results for the relationship between inflation targeting and unemployment, without including control variables. Column 1 shows OLS results while column 2 to column 6 display results for 10th quantile, 25th quantile, 50th quantile, 75th quantile and 90th quantile, respectively.

Table 3: Contemporaneous quantile results without controls

		Quantile regression estimates				
	OLS	q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	(6)
it_share	-0.377	0.634	2.352	-1.138	-4.574*	-2.147
	(1.566)	(2.352)	(2.012)	(2.187)	(2.523)	(6.291)
_cons	8.316***	3.207***	4.106***	8.335***	12.420***	14.553***
	(0.760)	(0.622)	(0.872)	(1.097)	(1.334)	(0.817)
N	0.00	60	60	60	60	60
R^2	60	0.0064	0.0309	0.0034	0.0640	0.0209

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

In column 1, OLS results show negative but insignificant relationship between inflation targeting and unemployment. From 10th quantile to 20th quantile (column 2 to 3), inflation targeting enters positively but the relationship is statistically insignificant. While from 50th quantile to 90th quantile, inflation targeting enters negatively and is marginally statistically significant in 75th quantile only.

Table 4 presents quantile results for the unemployment-inflation targeting relationship, controlling for financial development. Column 1 shows OLS results, column 2 to column 6 reports results for 10th quantile, 25th quantile, 50th quantile, 75th quantile and 90th quantile, respectively.

Table 4: Contemporaneous quantile results with financial development as a control variable

	OLS	Quantile regression estimates				
		q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	
it_share	0.457	2.763	1.050	0.300	-4.009	-1.605
	(1.511)	(2.799)	(1.287)	(1.773)	(2.398)	(5.190)
m2	-0.017***	-0.001	-0.024*	-0.014	-0.013	-0.018
	(0.006)	(0.033)	(0.014)	(0.012)	(0.012)	(0.018)
_cons	9.478***	2.536	7.532***	8.763***	13.025***	14.958***
	(0.831)	(2.832)	(1.893)	(1.570)	(1.700)	(1.631)
N	0.11	60	60	60	60	60
R^2	60	0.0221	0.1094	0.0623	0.1225	0.0645

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

After including financial development as a control variable, OLS estimated results indicate that inflation targeting becomes positive but still remains insignificant. Quantile results show that inflation targeting still enters positively and remains statistically insignificant in 10^{th} and 25^{th} quantiles, while becomes negatively correlated with unemployment in 75^{th} quantile and 90^{th} quantile but the relationship is statistically insignificant.

Table 5 reports quantile results for the unemployment-inflation targeting relationship with more control variables. Column 1 shows OLS results while column 2 to column 6 display results for 10^{th} quantile, 25^{th} quantile, 50^{th} quantile, 75^{th} quantile and 90^{th} quantile, respectively.

Table 5: Contemporaneous quantile results with more controls

		Quantile regression estimates				
	OLS	q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	(6)
it_share	-0.807	2.162	0.830	-0.715	-3.775*	-6.524*
	(1.454)	(1.536)	(1.573)	(2.448)	(2.018)	(3.649)
m2	-0.014**	-0.003	-0.019	-0.008	-0.011	-0.013
	(0.006)	(0.011)	(0.017)	(0.013)	(0.016)	(0.021)
inflation	0.004***	0.005	0.004	0.003	0.003	0.003
	(0.000)	(0.012)	(0.005)	(0.009)	(0.009)	(0.007)
rgdprate	-0.516*	-0.170	-0.419	-0.738	-0.193	0.528
	(0.265)	(0.417)	(0.384)	(0.460)	(0.584)	(0.675)
govt	-0.000	-0.005	0.008	-0.144	0.131*	0.382
	(0.114)	(0.127)	(0.162)	(0.153)	(0.221)	0.253
_cons	10.768***	3.446	7.742*	13.326***	10.464*	6.559
	(2.444)	(3.421)	(4.317)	(3.699)	(4.294)	(4.821)
N	0.36	59	59	59	59	59
R^2	59	0.1117	0.204	0.184	0.276	0.314

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

Despite including more explanatory variables, OLS results (column 1) indicate that the impact of inflation targeting on unemployment remains statistically insignificant. With more

controls, quantile results show that inflation targeting has positive but statistically insignificant impact on unemployment (quantile 10 and quantile 25). While at a higher level of unemployment (quantile 50 to quantile 90), inflation targeting becomes negative and is marginally statistically significant from 75th quantile and upwards.

Finally, we report quantile estimation results with all control variables in Table 6. Column 1 shows estimation results for OLS, while columns 2 to 6 display estimation results for quantile regression. Column 2, 3, 4 and 6 report results for 10th quantile, 25th quantile, 50th quantile, 75th quantile and 90th quantile, respectively.

Table 6: Main results for unemployment and inflation targeting impacts for contemporaneous model

	OLS	Quantile regression estimates				
		q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	(6)
it_share	-0.872	-1.33	0.766	-1.878	-3.832*	-6.362**
	(1.599)	(2.43)	(1.991)	(2.574)	(2.205)	(2.801)
m2	-0.012*	-0.015	-0.016	-0.010	-0.003	-0.003
	(0.007)	(0.015)	(0.012)	(0.019)	(0.019)	(0.030)
inflation	0.004***	0.005	0.005	0.004	0.003	0.003
	(0.000)	(0.006)	(0.008)	(0.008)	(0.004)	(0.006)
rgdprate	-0.234	-0.221	-0.181	-0.677	-0.303	0.548
	(0.403)	(0.2937)	(0.365)	(0.589)	(1.022)	(0.872)
trade	-0.007	0.006	0.003	-0.010	-0.022	-0.029
	(0.009)	(0.011)	(0.016)	(0.023)	(0.015)	(0.032)
govt	0.022	0.063	0.044	-0.149	0.057	0.268
	(0.113)	(0.160)	(0.210)	(0.262)	(0.159)	(0.218)
pop_growth	-0.831	-1.307*	-1.190	-1.087	-0.315	-1.327
	(0.612)	(0.734)	(0.754)	(1.100)	(1.318)	(1.212)
urbanpop	-0.019	-0.017	-0.006	0.002	-0.022	-0.040
	(0.038)	(0.046)	(0.058)	(0.095)	(0.055)	(0.064)
_cons	11.951***	7.175	6.945	15.485***	15.109***	14.167**
	(3.021)	(4.285)	(4.182)	(4.591)	(4.306)	(5.549)
N	59	59	59	59	59	59
R^2	0.40	0.2130	0.2490	0.2210	0.2933	0.3968

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

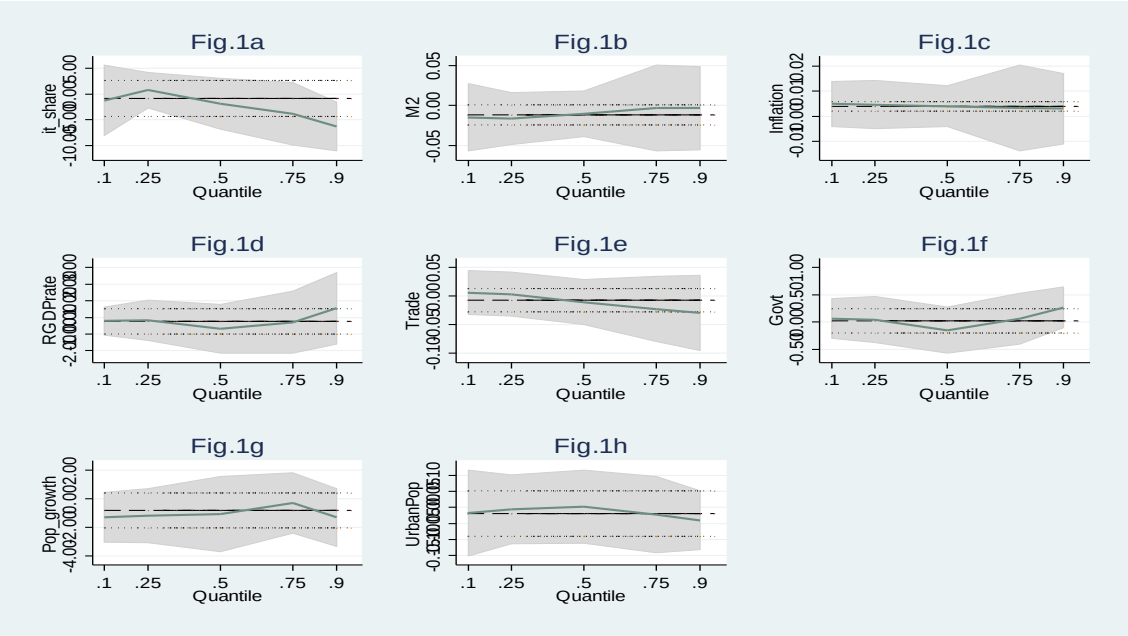
In Table 6 (column 1) OLS regression results show that inflation targeting has negative and statistically insignificant impact on unemployment. Financial development (m2) is negatively correlated with unemployment and statistically significant at 10 percent level. All other control variables in column 1 are insignificant except inflation which is significant at 1 percent level but displaying unexpected sign.

In 10^{th} quantile (column 2), inflation targeting enters negatively and is statistically insignificant. All other explanatory variables are statistically insignificant except population growth rate which is statistically significant at 10 percent level and is negatively correlated with unemployment. In 25^{th} quantile (column 3), coefficient for inflation targeting is positive but statistically insignificant. All other variables in column 2 are also insignificant. In 50^{th} quantile (column 4), the impact of inflation targeting remains statistically insignificant and enters negatively as in 10^{th} quantile. Estimation results for all other control variables remain insignificant. In 75^{th} quantile (column 5), inflation targeting remains negative and becomes statistically significant at 10 percent level. This implies that adoption of inflation targeting in countries with higher unemployment would decrease unemployment. All other control variables are insignificant. In 90^{th} quantile (column 6) coefficient for inflation targeting remains negative and statically significant at 5 percent level, while all other variables remain insignificant.

OLS results for contemporaneous model (Table 3- 6) reveal that inflation targeting has no significant impact on unemployment. However, quantile regression results show that, at lower levels of unemployment, inflation targeting has positive and insignificant impact on unemployment. While at higher level of unemployment, inflation targeting has negative impact on unemployment. Coefficient of determination (R^2) is large enough in all columns, implying that variations in unemployment are largely explained by the variations in the independent variables.

Figure 1 below depicts quantile regression results presented in Table 6 (column 2 to 6). Figures 1a to 1h show coefficient for each contemporaneous independent variable and indicates whether a particular regressor is statistically significant in a particular quantile or not. It is evident that inflation targeting is significant from 75th quantile to 90th quantile as depicted by Figure 1a; and this is in line with results in table 3.

Figure 1: Coefficient for each regressor in contemporaneous model



4.1.2 Results for Initial Model

We now report initial regression results on impact of inflation targeting on unemployment. Table 7 presents results for the relationship between inflation targeting and unemployment, without including control variables. Column 1 shows OLS results while column 2 to column 6 represent 10th quantile, 25th quantile, 50th quantile, 75th quantile and 90th quantile, respectively.

Table 7: initial quantile results without controls

		Quantile regression estimates				
	OLS	q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	(6)
it_share	-2.366**	3.373***	2.537	-1.841**	-4.727***	-6.990***
	(1.073)	(1.264)	(1.520)	(0 .751)	(1.384)	(0 .874)
_cons	8.615***	2.831***	4.106***	8.479***	11.582***	14.555
	(0.695)	(0 .583)	(0 .904)	(0 .615)	(1.096)	(0.732)
N	0.03	60	60	60	60	60
R^2	60	0.0361	0.0348	0.0419	0.0860	0.1267

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

Without including controls, OLS results (column 1) show negative and significant relationship between inflation targeting and unemployment. Inflation targeting enters positively in 10^{th} quantile (column 2) and is statistically significant at 1 percent level. In 25^{th} quantile inflation remains positive but becomes statistically significant. From 50^{th} quantile to 90^{th} quantile, inflation targeting is negative and statistically significant. Without including control variables, inflation targeting is significant in all quantiles except in 25^{th} quantile.

Table 8 shows quantile results for the relationship between unemployment and inflation targeting for initial regression model, with only financial development included as a control variable. Column 1 shows OLS results, column 2 to 6 reports quantile results representing 10^{th} quantile, 25^{th} quantile, 50^{th} quantile, 75^{th} quantile and 90^{th} quantile, respectively.

Table 8: Initial quantile results including financial development

		Quantile regression estimates				
	OLS	q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	(6)
it_share	-2.426**	3.058	1.169	-1.907	-4.353***	-7.027***
	(1.065)	(2.265)	(2.038)	(1.164)	(1.035)	(1.089)
m2	-0.015***	-0.010	-0.015	-0.009	-0.014	-0.019
	(0.005)	(0.009)	(0.018)	(0.014)	(0.015)	0.028
_cons	9.704***	3.555	6.046***	9.009***	12.476***	15.610***
	(0.775)	(1.302)	(1.771)	(0.937)	(1.393)	(1.576)
N	0.12	60	60	60	60	60
R^2	60	0.0535	0.0763	0.0825	0.1396	0.1592

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

OLS results in column 1, inflation targeting still enters negatively and is significant at 5 percent level. While quantile results show that inflation targeting is positively correlated with unemployment from 10^{th} quantile (column 1) to 25^{th} quantile and is statistically insignificant. From 50^{th} quantile to 90^{th} quantile, inflation targeting enters negatively and statistically significant, with exception of 50th quantile where inflation targeting is statistically insignificant.

Table 9 shows results for the unemployment-inflation targeting relationship, with more control variables included. OLS results are displayed in column 1. Column 2 to column 6 show results for 10^{th} quantile, 25^{th} quantile, 50^{th} quantile, 75^{th} quantile and 90^{th} quantile, respectively.

Table 9: Initial quantile regression results with more controls

		Quantile regression estimates				
	OLS	q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	(6)
it_share	-2.108*	2.402	0.206	-1.312	-3.425**	-6.253**
	(1.135)	(2.812)	(1.574)	(1.612)	(1.510)	(2.610)
m2	-0.021***	-0.008	-0.0153	-0.016	-0.0168	-0.017
	(0.005)	(0.023)	(0.011)	(0.017)	(0.020)	(0.017)
inflation	0.002***	0.002	0.003	0.003	.002	.001
	(0.001)	(0.006)	(0.004)	(0.004)	(.003)	(0.003)
rgdprate	-0.130	-0.115	(-0.207)	-0.151	-0.053	0.071
	(0.078)	(0.158)	0.172	(0.162)	(0.138)	(0.208)
govt	0.010	0.0267	0.026	-0.011	-0.022	0.053
	(0.041)	(0.102)	(0.118)	(0.111)	(0.092)	(0.095)
_cons	9.719***	3.744**	6.344**	9.389***	12.445***	14.179***
	(1.019)	(1.394)	(2.479)	(2.292)	(1.831)	(1.471)
N	0.21	60	60	60	60	60
R^2	60	0.0921	0.1533	0.1475	0.2052	0.2248

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

After including more controls, OLS results (column 1) show that inflation targeting remains negatively correlated with unemployment but becomes marginally statistically significant. Quantile results show that inflation targeting has positive but statistically insignificant impact on unemployment, at lower levels of unemployment (quantile 10 and quantile 25). While at a higher level of unemployment (quantile 50 to quantile 90), inflation targeting becomes negative and is statistically significant in 75^{th} quantile and 90^{th} quantile.

Finally, we include all explanatory variables in the initial model, results are shown in Table 10. Column 1 displays OLS results, column 2 to 6 show estimation results for quantile regression. Column 2, 3, 4, 5 and 6 represent results for 10th quantile, 25^{th} quantile, 50^{th} quantile, 75^{th} quantile and 90^{th} quantile, respectively.

Table 10: Main results for unemployment and inflation targeting impacts for initial regression model

	OLS	Quantile regression estimates				
		q10	q25	q50	q75	q90
unemp	(1)	(2)	(3)	(4)	(5)	(6)
it_share	0.920	1.000	1.167	-0.546	-3.428**	-4.128**
	(1.374)	(3.412)	(2.846)	(1.111)	(1.307)	(1.781)
m2	-0.023***	-0.0224	-0.022	-0.017**	-0.016	-0.033***
	(0.005)	(0.0181)	(0.016)	(0.007)	(0.011)	(0.011)
inflation	0.003***	0.003	0.004	0.003	0.002	0.002
	(0.000)	(0.006)	(0.003)	(0.003)	(0.004)	(0.003)
rgdprate	-0.201**	0.0363	-0.156*	-0.180*	-0.024	-0.263
	(0.080)	0.118	(0.078)	(0.099)	(0.187)	(0.225)
trade	0.022	-0.0283	0.016	0.011	0.013	0.062*
	(0.015)	(0.025)	(0.016)	(0.013)	(0.035)	(0.037)
govt	-0.030	0.101	-0.021	-0.122	-0.024	0.021
	(0.078)	(0.141)	(0.108)	(0.112)	(0.173)	(0.223)
pop_growth	0.635	0.360	0.905	0.689	-0.173	0.905
	(0.536)	(0.588)	(0.784)	(0.724)	(0.816)	(1.240)
urbanpop	0.044	0.047	0.080**	0.067***	0.019	0.030
	(0.029)	(0.029)	(0.033)	(0.023)	(0.045)	(0.044)
_cons	4.895**	1.938	0.196	5.222**	10.086**	8.207
	(2.273)	(2.550)	(3.109)	(2.563)	(4.109)	(6.250)
N	60	60	60	60	60	60
R^2	0.34	0.1687	0.2467	0.2640	0.2697	0.3781

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

In Table 10 above (column 1), OLS regression results show that inflation targeting is positively correlated with unemployment but the relationship is statistically insignificant, implying that inflation targeting has no impact on unemployment. Unlike in contemporaneous model, financial development (m2) is strongly correlated with unemployment, as it now becomes significant at 1 percent level and also coefficient for financial development remains negative. Inflation and GDP growth rate are significant at 1 percent level and 5 percent level respectively; however the sign for inflation is unexpected. All other control variables for OLS estimation results in column 1 remain insignificant.

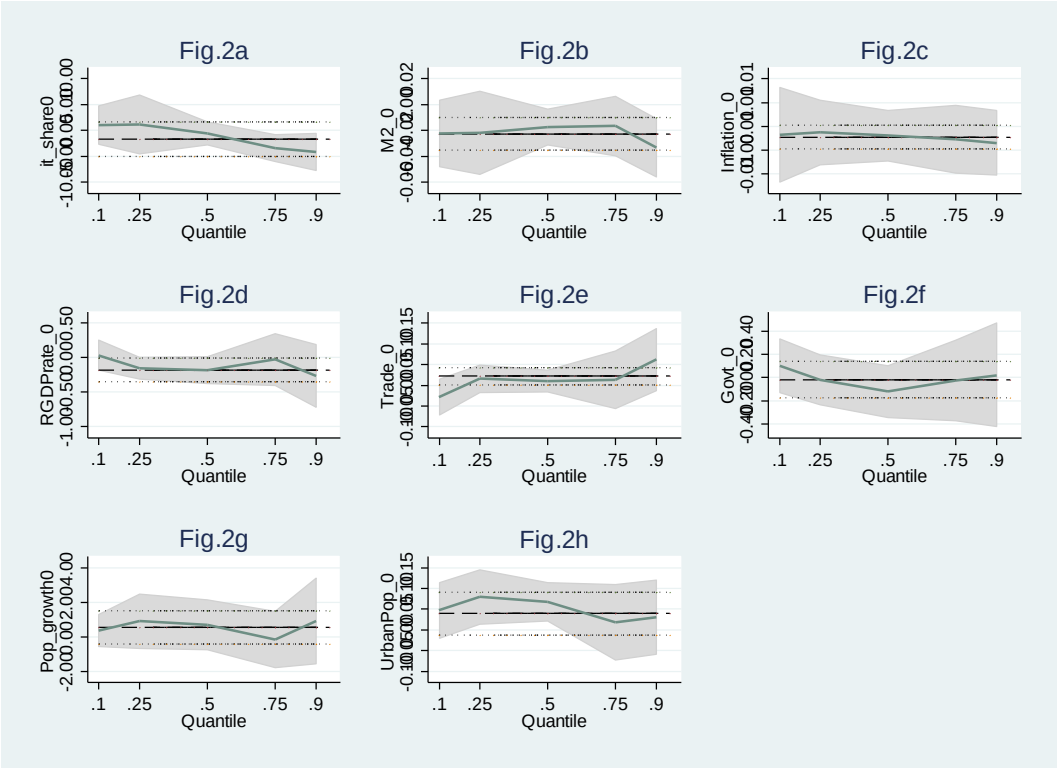
In 10^{th} quantile (column 2), inflation targeting enters positively and is statistically insignificant. All other explanatory variables are statistically insignificant. In column 3, coefficient for inflation targeting is positive and statistically insignificant, consistent with contemporaneous results in Table 6. GDP growth rate and urban population growth rate are statistically significant at 10 percent level and 5 percent level, respectively and display expected signs. All other variables in

column 2 are also insignificant. In 50^{th} quantile (column 4) the impact of inflation targeting remains statistically insignificant and enters negatively. Coefficient estimates for financial development, GDP growth rate and urban population growth rate are negative and statistically significant at 5 percent level, 10 percent level and 1 percent level, correspondingly. However, results for other control variables are insignificant. In 75^{th} quantile (column 5), inflation targeting remains negative and becomes statistically significant at 5 percent level, meanwhile all other control variables are insignificant. In 90^{th} quantile (column 6) coefficient for inflation targeting remains negative and statically significant at 5 percent level. While financial development and trade are significant at 1 percent level and 10 percent level, respectively.

According to OLS results, inflation targeting becomes statistically insignificant after controlling for more relevant variables. Table 10 (column 1) provides more reliable OLS results as all necessary explanatory variables are taken into account, and shows that inflation targeting does not have significant impact on unemployment. Quantile estimation results (from Table 7-10) reveal that the impact of inflation targeting on unemployment depends on the level of unemployment. After controlling for the possibility of reverse causality, results for initial quantile regression model indicate that, at lower levels of unemployment, inflation targeting does not have significant impact on unemployment. However, at higher level of unemployment, from 75th quantile to 90^{th} quantile, inflation targeting has negative and significant impact on unemployment. Results in column 5 and 6 are not only statistically significant but also economically significant as indicated by the magnitude of the coefficient estimates. Turning to statistical significance pattern of control variables, some variables become significant when they are estimated in different quantiles, implying that their impact at mean or median point of unemployment may not be significant but become significant either below (lower quantile) the mean or above (higher quantile) the mean. From column 1 to 6, R^2 is large enough implying that our model is good and has power to explain that variations in unemployment are due to variations in changes in explanatory variables.

The Figure 2 below displays quantile regression results in Table 10 (column 2 to 6). The Figure 1a to 1h shows whether coefficient for each contemporaneous independent variable is statistically significant in a particular quantile or not. For instance, it is clear from Figure 2a that inflation targeting becomes statistically significant at higher levels of unemployment (75th quantile to 90th quantile).

Figure 2: Coefficients for each regressor in initial regression model



4.2 Estimation results for inflation targeting impact and financial development

4.2.1 Results for Contemporaneous Regression Model

Table 11 reports OLS estimated results for contemporaneous model in column 1 to 4. Column 1 shows the impact of inflation targeting on unemployment without controlling for level of financial development, column 2 controls for financial development and includes interaction term, column 3 includes more variables and interaction term, and finally column 4 includes all variables and interaction term.

Table 11: Main results for inflation targeting and financial development impacts for contemporaneous regression model

unemp	(1)	(2)	(3)	(4)
it_share	-0.377	-6.386**	-7.439***	-7.882***
	(1.566)	(2.440)	(2.234)	(2.309)
m2		-0.055***	-0.052***	-0.049***
		(0.011)	(0.010)	(0.009)
it_m2		0.088***	0.086***	0.087***
		(0.022)	(0.019)	(0.018)
inflation			0.004***	0.004***
			(0.000)	(0.000)
rgdprate			-0.411*	-0.059
			(0.224)	(0.322)
govt			0.024	0.033
			(0.109)	(0.101)
trade				-0.010
				(0.007)
pop_growth				-0.926
				(0.590)
urbanpop				-0.004
				(0.034)
_cons	8.316***	12.152***	12.607***	13.176***
	(0.760)	(1.046)	(2.187)	(2.780)
R^2	0.00	0.21	0.46	0.50
N	60	60	59	59

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

Without controlling for other factors, inflation targeting in column 1 enters negatively but the relationship is statistically insignificant. While in column 2 when financial development and interaction term are included, inflation targeting remains negatively correlated with unemployment but the relationship now becomes statistically significant. Financial development is also negative and significant, while the interaction term enters positively and is statistically significant. In

column 4 when more variables are included, inflation targeting still enters negatively and becomes highly significant at 1 percent level. Meanwhile inflation targeting coefficient has improved in absolute terms when more variables are included. Financial development remains negative and significant in column 3, and coefficient for interaction term also remains positively correlated with unemployment and significant. Inflation and GDP growth rate results are also significant while government expenditure is statistically insignificant. After including all control variables, inflation targeting is still significant at 1 percent level and remains negative in column 4, however, the coefficient for inflation targeting further improves. Financial development and the interaction term remain highly significant in column 4. Inflation rate is also statistically significant, however with unexpected sign. All other control variables are not significant in column 4.

4.2.2 Results for Initial Regression Model

However, being mindful that results in contemporaneous model may be driven by endogeneity problem (reverse causality), now we turn to results from the initial regression model. Table 12 reports OLS estimated results for initial regression model. Column 1 shows the impact of inflation targeting on unemployment without controlling for level of financial development, column 2 controls for financial development and includes interaction term, column 3 includes more variables and interaction term, and finally column 4 includes all variables and interaction term.

Table 12: Main results for inflation targeting and financial development impacts for initial regression model

Unemp	(1)	(2)	(3)	(4)
it_share	-2.366**	-11.731***	-11.180***	-9.472**
	(1.073)	(3.890)	(3.553)	(4.000)
m2		-0.029***	-0.033***	-0.033***
		(0.007)	(0.006)	(0.006)
it_m2		0.143***	0.139***	0.119**
		(0.052)	(0.047)	(0.053)
inflation			0.002***	0.003***
			(0.000)	(0.000)
rgdprate			-0.105	-0.161**
			(0.084)	(0.078)
govt			0.039	-0.008
			(0.074)	(0.076)
trade				0.021
				(0.014)
pop_growth				0.482
				(0.538)
urbanpop				0.037
				(0.030)
_cons	8.615***	10.552***	10.028***	6.347**
	(0.695)	(0.840)	(1.534)	(2.378)
R^2	0.03	0.18	0.26	0.39
N	60	60	60	60

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

Inflation targeting in column 1 enters negatively and is significant. In column 2, after controlling for financial development and the interaction effects, inflation targeting remains negatively correlated with unemployment and becomes highly statistically significant. Inflation targeting coefficient improves substantially after including level financial development and the interaction term. Financial development also enters negatively and is statistically significant. The interaction term is positive and highly significant. In column 3, inflation targeting enters negatively and is significant, while the inflation targeting coefficient drops after including more variables. Financial development and the interaction term are still significant. Inflation is significant and displays unexpected sign[3], while all other variables are insignificant. Turning to column 6, after accounting for all control variables, inflation targeting is still negative and remains significant. Coefficient for interaction term is statistically significant and positive, implying that

[3] Coefficient estimates for inflation display unexpected sign contrary to our economic a prior. Economic theory assumes negative relationship between inflation and unemployment, contrary to the findings of this paper; this could be due to problems in our data.

adoption of inflation targeting where the level of financial development is higher would exacerbate unemployment levels. GDP growth rate enters negatively and is statistically significant, meaning that increase in GDP reduces unemployment.

Our findings are robust to use of different estimation techniques, different models as well as use of different controls. The results show that inflation targeting has nonlinear effects on unemployment. In countries with higher unemployment rates, adoption of inflation targeting reduces unemployment. However, while inflation targeting reduces unemployment, this beneficial effect is watered-down by improvement in financial development.

In particular, quantile regression results reveal that inflation targeting has no impact at lower levels of unemployment, while becomes negative at higher levels of unemployment. While results for interaction methodology, show that the impact of inflation targeting on unemployment becomes highly significant and negative, after controlling for the level of financial development. However, the interaction effects of inflation targeting and unemployment is significant and positive, consequently moderating the beneficial impact of inflation targeting on unemployment. The intuition from positive coefficient for the interaction effect of financial development and inflation targeting could partly imply that the more the financial sector is developed the more likely it would be associated with reduced financial risks (exchange risk, default risks) as a result interest rates are lower and this lowers savings leading to decline in funds available for investment and hence lower job creation. In addition, countries that are financially developed are also more developed and are more likely to have lower inflation hence lower prices, and this in turn reduces incentives for production thereby increasing unemployment.

5.0 Conclusion

This paper investigated the nonlinearity in the impact of inflation targeting on unemployment. In particular, the paper examined whether the impact of inflation targeting on unemployment depends on the level of unemployment itself and also whether the level of financial development matters in determining unemployment-inflation targeting relationship. This study uses cross-sectional data averaged over the period of 1990 to 2010 obtained from 68 inflation targeting and non-inflation targeting countries. The results show that inflation targeting has nonlinear effects on unemployment. In countries with higher unemployment rates, adoption of inflation targeting reduces unemployment. However, while inflation targeting reduces unemployment, this beneficial effect is moderated by financial deepening.

The findings of this study are in tandem with the prediction of this paper that inflation targeting should be associated with lower unemployment in less developed countries as it lowers macroeconomic uncertainty hence more incentives to invest leading to more job creation. In addition, these results also support the findings of prior studies such as Yeh and Huang (2014) that find no significant impact of inflation targeting on unemployment in a panel of 74 countries. Yeh and Huang (2014), however, after segregating those countries to developing and developed, they find that adoption of inflation targeting is associated with higher (lower) unemployment in developed (developing) countries.

It is clear from our findings that countries with high levels of unemployment are more likely to gain from adopting inflation targeting than those with lower unemployment, therefore it would be important for high unemployment countries to consider adopting inflation targeting as a monetary policy framework. However, apart from other necessary preconditions for implementing inflation targeting being met, monetary authorities and government also need to consider the level of financial development in order to gauge the likely impacts on unemployment of monetary

policy shift to inflation targeting. This is because the level of financial development also affects the transmission mechanism of monetary policy since for monetary policy to work there is a need to exist significant relationship between the monetary policy and financial sector. The findings also reflect that adoption of inflation targeting is beneficial to countries with lower level of financial development. This is because those countries are more likely to have more unstable inflation, less investment and higher unemployment as a result adoption of inflation targeting improves economic certainty and confidence thereby leading to higher investment and more job creation.

Given this study takes into account cross country heterogeneity and long run relationship between unemployment and inflation targeting; however it does not give us the complete picture of cross country heterogeneity. Therefore, future studies may consider utilising panel heterogeneity co-integration methodology in order to capture the whole picture of cross country heterogeneity as panel heterogeneity co-integration methodology takes into account cross country commonalities and differences arising from large movements of macroeconomic aggregates across countries due to ever increasing globalisation.

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Appendices

Appendix 1: Definition of Variables

Variable Name	Definition
Unemployment	Unemployment refers to the share of the labor force that is without work but available for and seeking employment (% of total labor force)
it_share	Equals greater than 0 or equal to 1 when a country adopted inflation targeting, 0 otherwise
Financial development (M2)	Represents liquid liabilities measured as money supply plus quasi money as a percentage of GDP
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency (annual %)). Aggregates are based on constant 2005 U.S. dollars.
Government	General government final consumption expenditure measured as a percentage of GDP
Trade	Trade is the sum of exports and imports of goods and services measured as a percentage share of gross domestic product.
Population growth	Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage.
Urban population	Urban population refers to people living in urban areas as defined by national statistical offices, % of total population. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects.
Inflation	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly (annual %)). The Laspeyres formula is generally used.

Appendix 2: List of countries

Country List			
1	Argentina	44	New Zealand
2	Australia	45	Nigeria
3	Austria	46	Norway
4	Bangladesh	47	Peru
5	Belgium	48	Philippines
6	Botswana	49	Poland
7	Bulgaria	50	Romania
8	Canada	51	Russia
9	Chile	52	Saudi Arabia
10	China	53	Serbia
11	Colombia	54	Singapore
12	Croatia	55	Slovak Republic
13	Cyprus	56	Slovenia
14	Czech Republic	57	South Africa
15	Denmark	58	Spain
16	Ecuador	59	Sweden
17	Estonia	60	Switzerland
18	Finland	61	Syria
19	France	62	Thailand
20	Germany	63	Tunisia
21	Ghana	64	Turkey
22	Greece	65	United Kingdom
23	Guatemala	66	United States
24	Honduras	67	Venezuela, RB
25	Hungary	68	Vietnam
26	Iceland		
27	India		
28	Indonesia		
29	Ireland		
30	Israel		
31	Italy		
32	Japan		
33	Kenya		
34	Korea		
35	Kuwait		
36	Latvia		
37	Lithuania		
38	Luxembourg		
39	Malawi		
40	Malaysia		
41	Malta		
42	Mexico		
43	Mozambique		