Preconditions for Adopting Inflation Targeting Framework: *An Empirical Evidence for Small Economies*

By

GATHONI, Anthony Gathogo

THESIS

Submitted to
KDI School of Public Policy and Management
In partial fulfillment of the requirements
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Professor Sohn, Wook

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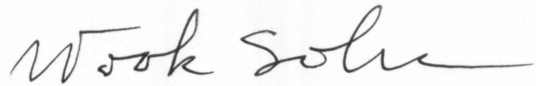## GATHONI, Anthony Gathogo

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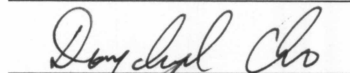for the degree of

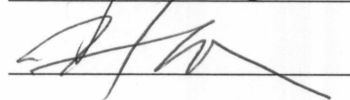MASTER OF PUBLIC POLICY

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ABSTRACT

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In the past decades, the monetary policy encountered by most of the low-income economies has been depressing, this has resulted to extreme periods of monetary instability, vacillating from high inflation, to colossal capital flight, and thereby leading to the downfall of many financial systems. However, the forecast for successful monetary policy transformation in the majority of these countries has been remarkable in forecasting future inflation expectations. This paper provides a theoretical and empirical framework analyzing preconditions that relate to low-income countries and emerging markets likelihood of adopting inflation targeting framework in a sample that comprises both inflation targeters and non-targeters countries covering a period of 1990-2009. The panel data model protracted for analysis will comprise both macro-economic variables and institutional arrangements plausible for the adoption of inflation-targeting framework for these countries. The findings have indicated that, the decision to forge towards IT-framework requires resolute efforts and support in addressing the main drawbacks that may hinder successful implementation of IT-framework to a larger extent on the technical aspects and capability of most of low-income as well as emerging countries, which are limited or lacking.

Dedicated to Gathogo, Kien Kimani

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LIST OF ABBREVIATIONS

BOG- Board of Governors

CBI- Central Bank Independence

CBK- Central Bank of Kenya

CBN- Central Bank of Nigeria

CBE- Central Bank of Egypt

CPI- Consumer Price Indices

DPFB -Deposit Protection Fund Board

EAC- East Africa Community

ECB- European Central Banks

ERM-Exchange Rate Mechanism

GDP- Growth Domestic Product

DPI-Political Institutions

IT-Framework- Inflation Targeting Framework

IMF- International Monetary Fund

IFS- International Financial Statistics

MPC- Monetary Policy Committee

SDR-Special Drawing Rights

TOR-Governor's Turnover Rate

VAR- vector auto regression

VIF- Variance Inflation Factor

WDI-World Development Indicators

CHARPTER 1

INTRODUCTION

An aura of cynicism has demonized most government authorities' efforts to cut down prices of major commodities, which has a negative influence over majority of small economies. Indeed, the price levels have skyrocketed in the recent past coupled with dwindling wage levels, weakening of national currency against other major currencies and declining growth rate in Low-income countries. In spite of concerted efforts instituted by majority of these countries governments', only a few have been able to achieve their inflation target or close to the target, though, others are following the same progress in achieving price stability and increasing economic growth rate. In contrast, inflation volatilities have declined dramatically since early 1990s in high income countries as well in the middle upper countries.

Indeed most governments' have embarked on instituting fundamental reforms through the introduction of avant-garde monetary policy regimes, which forge the way forward through, which the monetary authority are supposed to re-design their policy, thereby, focusing primarily on numerically anchoring inflation to a band or target. One of the major reforms that authorities in most of the upper-income level countries and few middle upper-income countries focused on in early 1990's was, the introduction of Inflation Targeting Framework (henceforth "IT-framework")-a monetary policy framework aimed at monitoring and controlling price stability after a prolonged period of disinflation. Nevertheless, Masson et al. (1997), and Cukierman et al (1992); have pointed out that, for an effective and successful implementation of IT-framework, there should be other overriding reforms, for example, the

level of independence from political interference i.e. Central bank autonomy[1], and other monetary policy designs (exchange rate framework, monetary aggregate and credit control). They caution against the central bank emphasizing on any other monetary policy design, but instead focus on explicitly anchoring inflation. Other nominal anchor strategies instituted in the past comprises of monetary aggregate targeting, exchange rate targeting, and implicit form of nominal anchor rather than explicit nominal anchor, (Mishkin, 1999a). Notably, majority of these countries that anchor their inflation have perceived IT-framework as their best choice in conducting monetary policy, with none abandoning the regime, save for Finland and Spain, that have already joined the European Monetary Union (EMU) since late 90's. [2]

In the past, majority of these countries mainly from Latin America countries, East Asia countries and some parts of Europe had experienced high bout of inflation and financial crises exacerbated by their former monetary policy regimes. These not only resulted to sacrificing output and employment but also resulted to severe increase in international capital flow leading to a switch to floating exchange rate and also redesigning there monetary policy approach.[3]

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[1] Note the paper will use the following words interchangeably to refer to the same things- central bank autonomy and central bank independence, central bank and authority, and monetary policy stance/strategy/regime.

[2] In their study, Mishkin and Schmidt-Hebbel (2000), argues that the regime had proved to most authorities as the best choice in the 21st century. Arguably, Freedman (2001) has made similar findings on the case for Canada that adopted inflation targeting after New Zealand in 1990. Notably, the EMU uses hybrid strategy characterized by either moving or multiple targets in order to meet its mandate of price stability.

[3] However, Pétursson (2000) state that, the inverse relatioship between inflation and unemployment is not different in both inflation targeting and non-inflation targerting countries, since price stability is the main goal of IT-framework.

1.1 Definition, General Salient Features, and Critics of IT-Framework

IT-framework; an approach to management of monetary policy[4] was first pioneered by the New Zealand Government in 1990 after it abandoned its pegged exchange rate five years later. By the year 2009, over twenty-five countries comprised of developed, emerging, and developing countries around the world had explicitly espoused an inflation target as their nominal anchor, and have reported greater achievement of low inflation rate.

Most policy makers and economists have given slightly different views as to what constitutes the definition of IT-Framework. However, there is an agreement of the major aspects of IT-framework revolves around an explicit inflation targets objective, free from fiscal control and other overriding central bank objectives; central bank independence and transparency to its public (Aliyu & Englama, 2009). IT-framework is also exemplified; "by the public announcement of official quantitative targets (or target range) for the inflation rate, over one or more time horizons, and by explicit acknowledgment, that low, stable inflation is the monetary policy's primary long-run goal." (Ghalwash, 2010). Nonetheless, all literatures converge into what Bernanke, et al. (1999) and Mishkin (2004) have summarized as the main elements that form a surmise of pre-requisites for long lasting implementation of IT-framework. That is: (i) the public pronouncement of medium-term inflation target; (ii) central bank primary objective is price stability; (iii) a comprehensive approach of setting monetary policy instruments; (iv) high degree of transparency in the conduct of monetary policy; (v) accountable central bank in achieving her primary objective in this case price stability.

In their literatures, Svensson (1997); Friedman, (1990); McCallum, (1990) comprehensively

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[4] The work of Svensson (1997a) alludes to "degree of transparency, credibility, and accountability" are requirements for central banks to switch to IT-framework.

argues their case on what constituted IT-framework by indicating that the framework is supposed to be highly correlated with the goal itself. Similarly, both the public and the central bank should comply with it resourcefully. They also saw transparency of the authority to be part of an efficient and effective central bank in communicating to the public its objectives and procedure of conducting its monetary stance.

Bernanke, et al. (1999); and Svensson (1997) in support of the above elements have indicated that price stability is a key component of the authority's performance based appraisal. Indeed, they elucidate the authority should issue a declaration, which states the inflation nominal target/band within a definite time horizon in order to curb instances of falling into time-inconsistency trap in carrying out its primary goal. Consequently, the government can opt to choose the target independently or collectively with the central bank, which is associated with appropriate changes in the authority's governing laws thus enhancing its degree of autonomy.

The public should also access information from the bank with much ease through enhanced communication channels and increased accountability of the authority. More often, the authority should be in the forefront of periodically publishing inflation reports to inform the public of the future inflation expectations and any other adjustments that the central bank would undertake incase there are pronounced deviations of inflation targets. Work by Bernanke, et al. (1999) depicts the notion of "constrained discretion" that this framework of monetary policy proposes.[5]

Svensson (1997) state that, when the authority anticipate the policy target deviation, the strategy should be attuned in such a way that it is neither contractionary nor is it expansionary

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[5] Note: The "constraint" is the official targets enforced by the authority; while authority takes actions through "discretion" in order to cater for any economic disturbances, in particular, output or financial stability disturbance

in accordance with keeping the policy on target. On this background, the IT-framework work best in forecasting future inflation, that is, the relevant information for forecasting monetary policy is of greater importance in predicting future inflation. Indeed, this transparency of inflation targeting forms a better juncture in terms of motivating and forecasting the activities inside the central bank. More so, reinforcement of central bank accountability and credibility is of greater importance in case of breach of inflation target, through clarification of the authority's capability.

Work by Mishkin, (2000) has showed positive contribution of the IT-framework in industrialized countries. He argues that, IT-framework has successfully enabled these countries to control inflation even during economic downturn. Accordingly, there has been remarkable monitoring and weakening of inflationary shocks, and reduced output variations in these countries. Likewise, IT-framework is also advantageous over other nominal anchor, in that, it make it possible for the authority to emphasis on domestic considerations and effectively and efficiently offset inflationary shocks that may be of domestic or foreign sources respectively. It also uses all available information that enables the authority to make a decisive move in the monetary policy transmission mechanism and it offset money and inflation relationship effects.

Although, inflation targeting has proved to be the best monetary policy for the last decade it does not lack some criticism that characterizes it in terms of implementation and monitoring. Svensson (1997) has described some of the inherent problems that makes this strategy ineffective, which includes: central bank's inability to restrain inflation due to the fact that, previous decisions and contracts determine current inflation. In other words, the authority can only forecast future inflation. Another setback is lack of proper mechanism for monitoring

and evaluation of this strategy by public due to inadequate public awareness of immediate inflation deviations from the stated inflation targets. Mishkin and Savastano, (2000) have disparaged IT-framework as, too rigid; indistinguishable to full discretion; swells output unsteadiness; hurts economic expansion in terms of growth; is likely to generate weakness in the accountability of central bank; it lack structures tenable for keeping check on fiscal dominance; and requires exchange rate flexibility which could impact negatively on the financial system. Indeed, controlling inflation pause a major blow to majority of low-income countries, and that there are pronounced lags emanating from monetary instruments to the inflation outcome.

1.2 Research questions and objectives of the study

This paper depicts lessons learned by countries that have already adopted the strict IT-framework since 1990's. What becomes apparently evident in the process of this review, however, is the need to explore several contributory situations before making an informed judgment on the likelihood of low-income countries embracing the framework. The first of these situations is whether there are incentives and aspects linked with decisions to move from a specific monetary practice to another. Second situation revolves around the feasibility of other policy designs of monetary policy. Third situations will address chief pitfalls that hamper low-income countries from embracing this policy design. The study objective is to investigate the relationship between preconditions that lead to adoption of IT-framework in developed and emerging economies and to examine if these preconditions have a replicate effect in low-income countries.

The other body structure of the paper follows the following sequence. Chapter 2; reviews various literatures that pay attention to the main pre-conditions for embracing IT-framework and other institutional arrangements. Chapter 3; reviews the methodological propositions, data and statistical findings acceptable to low-income countries adopting IT-framework. My

findings have indicated that countries under consideration can only have a partial IT-framework rather than a full–fledged one. However, there is huge discrepancy for countries to adopt IT-framework due to underdeveloped financial institutions, poor macroeconomic performance, and lack of central banks autonomy. The findings have also indicated that the decision to forge towards IT-framework requires resolute efforts and support in addressing the main drawbacks that may hinder successful implementation of IT-framework to a larger extent on the technical aspects and capability of most of low-income as well as emerging countries which are limited or lacking.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Major studies have analyzed the preconditions and effectiveness of IT-framework since its inception in the early 1990s. Indeed, there exist a large number of literatures on major developments of the IT-framework since its inception in developed countries and emerging economies. However, there is little development in low-income countries in regards to adoption and implementation of IT-framework. This is because there are greater variations in most of these countries due to under-developed financial markets, inadequate fiscal position, increased fiscal dominance, and lack of market integration. Therefore, these countries are only eligible in adopting partial IT-framework rather than full-fledged IT-framework (Stone, 2002). Further analysis by Hazirolan (1999) alleges that increased accountability is indistinguishable to the effectiveness of the authority in monitoring inflationary expectations

2.1 Review of alternative studies across the globe

In the past decades, the monetary policy encountered by most of the low-income economies has been depressing, this has resulted to extreme periods of monetary instability, vacillating from high inflation, to colossal capital flight, and thereby leading to downfall of many financial systems. However, the forecast for successful monetary policy transformation in the majority of these countries is remarkable in forecasting future inflation expectations. This enables the central bank to be more accountable by explicitly announcing a multi-year target for inflation. Downes and V.aez-Zadeh (1990) declares that "during the transition it is not possible to forecast market behavior…..[s]ince the old money-model is bound to be obsolete and perhaps of little use" (318). Indeed, the 'old fashioned' regime of money growth

targeting framework in the majority of low-income countries has of late proved inefficient, although these countries have managed to maintain inflation rate as low as possible. Using a time-varying parameter model with GARCH specification, Erturk and Ozlale (2004) finds a positive impact of the IT-framework in controlling average expected inflation, although, they fail to find a robust significance of post-inflation targeting implementation in controlling inflation uncertainties for a sample of five industrialized countries. Nevertheless, they conclude by finding a structural break for these countries once they switch to IT-framework.

In his analysis of impulse- response functions, Parrado (2004) argues the case for countries with stricter *vs.* flexible form of IT-framework under floating exchange rate.[6] His outcome shows remarkable reduction in output volatility under flexible IT-framework than in a stricter one, whereas inflation stability solely depends on the type of shock.[7] Seyfried and Bremmer (2003) in a cross-country analysis using dynamic Taylor-type model examine reasons for countries switching to IT-framework in order to keep inflation in check and they find a situation where these countries tend to emphasis more on restraining future inflationary pressures than the current inflation. Debelle (1997) takes the same position of a flexible IT-framework where they urge countries to embrace such a strategy in order to deliver other objectives such as output and employment growth since they have a bearing in determining future inflation and that in totality a flexible IT-framework should not be indifferent in other mandates of monetary policy goals. Accordingly, in support of successful implementation of IT-framework in East Asian countries, Taguchi and Kato (2010) offers an opinion based on the error-correction estimates and they exposition that these countries have remarkably

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[6]Svensson (1999a) defines stricter IT-framework as a framework through which the central bank seeks to minimize any deviations in inflation from its target without including any other indicator in the response function. While the flexible form of IT-framework includes other indicators in the response function.

[7] Aliyu and Abwaku (2009) "An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables"

reported reduced inflation rates in the aftermath of crisis and later adoption of IT-framework due to speeding-up adjustment against other monetary aggregates such as money supply. They also claim that the speeding-up adjustment arises due to central bank emphasis on pursuing other goals instead of focusing primarily to stable price stability; re-modification of exchange rate regime as witnessed in the aftermath of the crisis; and the resulting increase in monetary independence. Conversely, they conclude by finding a robust relationship between money and inflation that is crosscutting across all other monetary policy strategies.[8]

On the macroeconomic activities platform most of the countries targeting inflation have reported remarkable performance during post-inflation targeting. For instance, inflation-targeting countries have experienced greater reduction in inflation volatility and interest rates; significant improvement in output volatility, which is contrary to other monetary policy framework where it has deteriorated; and parallel to exchange rate pass-through (Mishkin & Schmidt-Hebbel, 2006). On the other hand, Walsh (2005) has offered an insightful analysis of IT-framework success, where he finds a reduction of average inflation in countries examined as a group, as well as individual country within such groups and that such effect is because of reduction in inflation volatility. Some theoretical underpinning argues that countries with multiple targets such as inflation targeting and exchange rate targeting are likely to switch to a dominant regime in the near future. This is because such countries faces challenges of choosing between the two regimes in order to avoid them conflicting in future and that authorities may lack focus in communicating their main target within a specified time horizons (Freedman and Ö tker-Robe, 2009).

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[8] Speeding-up adjustment entails the rapidness of the authority in modifying short-term inflation rates according to targeted levels, (Seyfried and Bremmer, 2003).

See Stone (2002) and Carare and Stone (2006) for further definition of Inflation Targeting Lite (ITL).

In contrast, Aizenman and Hutchison (2008) argue that non IT-framework targeters tend to pursue both IT-framework and exchange rate strategies, hence tend to conflict and result in an ambiguous policy stance. However, Hu (2006) provides divergent view of IT-framework based on Taylor curve and the results indicates incoherent credibility of the framework in the tradeoff between inflation and output variability. Overall, McCallum (2003) foresees a monetary policy strategy that is beneficial to the economic expansion and a steady inflation environment. Literature from IMF, (1997) and Ghosh et al, (1997) revealed that inflation declined in a fixed exchange rate regime, however, the regime impact to other macroeconomic indicators such as economic growth was not robust.

Woodford (2003) perceive IT-framework as a global trend that crosscut across the board in the way the authority set its policy rule, and that neither involves any alternation of the monetary policy stance conducted by the authority. The author justify this as the move by the authority to announce its inflation targets, often specified within a specific inflation rate range or band i.e. 2%-4%; and by publicly announcing any deviation from the stated inflation targets, thereby, compelling the authority to   increase accountability and transparency of the monetary policy goal. Carare and Stone (2006) suggest that the central bank can boost transparency to higher levels if it periodically releases detailed reports, perfomance related reviews and alteration of monetary policy stance, and publication of inflation projections.

Walsh (2005) mention that, declaration of an official inflation target is advantageous in that the public perceive inflation targets to be in line with the goal of the authority without incurring any cost of reducing average inflation rates. Indeed, Most of the countries that have switched to IT-framework have also positioned their exchange rate regime in such a way it is flexible enough to avoid unwanted response of exchange rate and to increase credibility of

the authority in terms of independence (Carare and Stone 2006). Mishkin and Schmidt-Hebbel (2007) in their panel data analysis comprising of industrial countries argues that in the long-run IT-framework is important in achieving stable inflation rates, especially in countries where oil-prices and exchange rate shocks are erratic. Similarly, Aizenman and Hutchison (2008) using a simple empirical model for 17 emerging markets concludes that stable inflation has greater effect on interests for inflation targeters in emerging markets than in non-inflation targeters whose central banks respond less in such markets.

2.2 IT-framework in Sub-Saharan Africa

In the African continent, only South Africa and Ghana have officially embraced IT-framework in the conduct of their monetary policy, the rest of the countries in the continent are still searching for the avenues, in particular, fulfilling the main preconditions that characterizes this framework. To date South Africa has now over 10 years experience of IT-framework having adopted it in the year 2000, whereas, Ghana's experience with this framework spans from year 2007 after the Bank of Ghana announced officially it has adopted IT-framework. However, even after these two countries adopted IT-framework the inflation volatility, output volatility have not improved, and that the inflationary shocks (supply-side shocks) are not internally imposed but rather external in nature, (McKinley, 2008).

The other prospective African countries that have a high chance of implementing IT-framework in the near future are Egypt and Nigeria. Aliyu and Abwaku (2009) in their work recommend Nigeria to adopt an inflation targeting Lite (ITL) instead of full-fledged IT-framework- they find "no strong quantitative link between monetary aggregates and prices." This is because Nigeria has not yet met the preconditions necessary for it framework. On the other hand, Ghalwash (2010) states that the Central Bank of Egypt though a potential inflation targeting is characterized by huge fiscal dominance, conflicting policy instruments

and goals of monetary policy, underdeveloped technical infrastructure and lack of technical capacity in forecasting future inflation rates. In testing this policy conflict using Granger causality test, the author find fiscal policy having a transitory role of controlling inflation as well as in achieving economic growth. Porter and Yao (2005) on the institutional front in Mauritius indicate that the central bank has in the past reduced government borrowing, external debt has declined, while financial depth has improved, which are prerequisite necessary for inflation targeting Lite adoption.

In the case of Malawi, Simwaka (2004) and Tutar (2002) in Turkey find an inflationary inertia phenomenon using vector auto regression (VAR) after analyzing the variables of interest. On the degree of openness, Al Nasser, et al, (2009) has sampled 152 countries, where he finds an inverse association between inflation and trade openness since 1952 to 1992. Consequently, the correlation between inflation and the degree of trade openness is unrestrictive within a group neither of countries nor to a precise time horizon. Ndung'u (2000) has done comprehensive study on the dynamics of the inflationary process in Kenya since 1970-1991. Accordingly, the results indicate that monetary growth, interest rates changes, real income growth and excess money printing as the main determinants of inflation in Kenya. Moreover, inappropriate government policies (monetary and fiscal) were the main cause of inflationary shocks experienced in 1980 and early 1990.

2.2.1 An overview of the exchange rate transition and its role in ITF

Guillermo and Reinhart (2002) have expressed their fear of emerging countries not being in full capacity of managing their nominal exchange rate. This is often pegged external debts against other international currencies, thus IT-framework becomes unrealizable due to too

much concern towards exchange rate volatility.[9] In support of this, Lucotte (2010) foresee implementation of IT-framework to work best in those countries that have already switched to floating exchange rate strategy. In other words, countries operating under fixed exchange rate strategy may end up not fixing forever. Indeed, "monetary target, multiple targets, or hybrid" strategies are habitually for a short-term period or are unrealized at all (Rose, 2007).

In recent times, countries with fixed exchange rate have a tendency to fix their domestic currency value to countries whose main objective is to anchor their inflation in readiness to keep inflation rate in check. Most of the countries that have adopted an intermediate currency tend to devalue their currency at a firm rate in order to keep their inflation rate low contrary to anchoring countries. For instance, France and the United Kingdom have had success in their strategy of devaluing their currency against the German Mark. These clearly indicated a trend in which France followed in 1987. At this time, the German inflation rate was 1% while France's was two percentage points higher; by 1992, France's inflation rate was 2%. The United Kingdom also experienced enormous success with this strategy; pegging to the German Mark in 1990 when her inflation rate was at 10% and by 1992, it had fallen to 2%, (Mishkin & Posen (1997), after abandoning the Exchange Rate Mechanism (ERM).

These periods marked milestones that resulted in speeding-up adjustment process of money supply, reduction of inflation rate as well as re-organization of other economic performances. Accordingly, the exchange rate strategy in place affects authority's accountability positively by clearly defining its goals, while it can influence the same accountability negatively if the economy is overheating (Blejer, & Šcreb, 1999, p.41). Similarly, Mishkin (1999a) states that

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[9] However, majority of emerging market economies and low-income countries panic in floating their currencies against other foreign currencies this is because they lack credibility toward currency value Guillermo and Reinhart (2002).

the exchange rate regime may weaken financial sector and as a result cause financial crises. Hence, a continuous adherence of exchange rate regime is probable to have a far-reaching impact of economic sluggishness and exacerbate redundancy in the economy.

2.3 Brief literature review of institutional alignment

The literatures on IT-framework in both middle-income and upper-income levels countries have suggested that this monetary policy strategy is tenable if and only if some institutional preconditions are in place. One such precondition to the adoption and implementation of IT-framework is Central Bank Independence. Indeed, Kydland and Prescott (1977) literature on the time-inconsistency theory in monetary and later extended by Barro and Gordon (1983) offers an intuitive message to most central bank around the globe. The idea behind this conjecture is that the economic agents such as private agents are rational in forming expectations about inflation that are higher than optimal level, whereas unemployment remains static. Rogoff, (1985) extend this dynamic inconsistency analogy and argue that a "conservative" and independent authority that emphasis on low inflation and output stabilization fundamentals is likely to command greater credibility in mitigating this problem of dynamic inconsistency. Most studies have vehemently metioned and differentiated variuos multifacets that could,arguably, give a definite definition of what constitute to central bank independence. In their work (Debelle and Fischer 2004) define *goal independent* as a joint decision between the authority and the government as embedded in the government legislations to set inflation targets in specifying price stability as the fundamental objective of monetary policy. That is, in a democratic system, the government has the tendency of retaining the possession of the monetary policy objective, that is, the authority is committal in setting inflation targets.

Instrument independence is the freedom of central bank in selecting appropriate monetary policy tools in order to achieve the stated policy objectives. However, this freedom requires an authority that command greater accountability in order to avoid situations where the central bank finances government deficit through printing more money. Indeed, where central bank is independent from government interference it is likely to insulate itself from political pressures to finance government fiscal deficits, which can result to over-expansionary monetary policies.[10] The central bank should also exercise greater independence of either legal instruments or goal instruments, (Cukierman, Webb & Neyapti, 1992). While *economic independence* entails the capability of the central bank in determining the rules revolving around the lending policy of the government and the major supervisory measures instituted in the banking sector.

The *political independence* emanates from political influence in appointments of the senior most personel of the aouthority and other overiding features such as primary objective of the authority, (Grilli, Masciandaro and Tabellini (1991); and Loungani and Sheets (1997)). However, the instrument independence is improved if there is continued interaction between the central bank and the government in key decision making regarding execution of the monetary policy conduct, (Obben 2006, pp. 3).

Above all, a large body of studies has primarily focused on indices enshrined in most central bank's laws. Cukierman, (1994) and Eijffinger and De Haan (1996) have categorically contended that the CBI indices in majority of high income countries arise from central bank's laws interpretation and are of great concern to legal independence indicator, whereas, in developing countries *de facto independence* indicators form the main measure of Central Bank Independence. The argument is that low-income countries have weak rule of law

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[10] See Debelle and Fischer (2004)

entrenched in their political customs and as a result, the legal central bank independence is not a good indicator of CBI in such countries but rather the *de facto independence* indicators (that is, turnover rate of central bank governors), (Mangano, 1998). In support to this proposition Cukierman(1992) and Cukierman et al. (1992) in their work, report that TOR is a good indicator of CBI in developing countries, whereas, the legal CBI forms a better proxy of CBI in industrial countries.

The assumption on TOR is that, the frequency at which the central bank governor removal from office is inversely associated with the level of central bank independence. This association as exhibited by the work of Dreher, et al.(2007) and Cukierman(1992) who finds a robust inverse relationship between TOR and inflation in developing countries. However, De Haan and Kooi (2000) find a strong relationship between inflation and TOR after including countries with high inflation rate in their sample. In other words, the causal relationship between inflation and TOR may arise from other inflationary shocks due to past crisis and public preference for either a more goal oriented central bank or a more independent authority free from any political interferences (De Sousa, 2001). Therefore, causal effect is only way link that emanate from inflation to TOR, (Dreher, Sturm & De Haan, 2007).

Studies of Cukierman et al. (1992) states that the average and variance of inflation has a negative correlation to governor's turnover rate in most of the developing countries. This is because most studies have expressed doubts over the reliability of most of indicators used to construct Central Bank Independence indices. Indeed, there exists a greater divergence when it comes to categorization of indicators used to measure CBI incase of high income countries, emerging countries and low-income countries. After instituting control for foreign inflation,

crisis emanating from banks, and exchange rate framework, Jácome and Vázquez (2005) finds a negative link between CBI and Inflation resulting from structural reforms in Latin America.

Dreher et al. (2010) used a data set comprising of eighty-eight countries' term of office of central banks governors since 1975-2005. They used logit model to test the likelihood of central bank governor's tenure geting terminated before their legal term in office expires. According to their results, the probability of a TOR as a measure of CBI tend to soar under certain conditions which includes: unstable political system, undue elapse of governor term of service in office and during elections period in self-governing countries. Accordingly, they indicated in their hypothesis that there was a higher chance of the governors getting replaced if there was huge drop out of veto players from the government.

Cukierman et al. (1992) have developed legal independence indices focusing on the extent of the autonomy and reliance to the legal element of the authoriy in conducting monetary policy that is free from any external interfereneces. The results for legal independence index are significant in ascertaining inflation rate in developed economies and insignificant in Low-income or emerging countries. Under this measure of CBI, they concentrated on such areas such as the governor of the bank, policy formulation, the objectives of the central bank, and the lending practices. However, Ja'come and Va'zquez (2005) extends Cukierman et al (1992) legal independence indices by adding new indicators, which are, the degree of exchange rate conduct by the authority; the rules governing the lender of the last resort; and accountability and transparency legal requirements.

Actual turnover rate of governors forms a better turning point of inflation determination in

developing countries. Cukierman et al (1992) argues that in cases where governor legal term of office is shorter than that of government there are chances the CBI will be compromised by the government, thereby, resulting to increased turnover rate of governor. More over, the governor is likely to be susceptible to government influence thereby derailing long-term objective of policy formation and implementation under the pretext of political pressure especially during election periods. They gave an example of Argentina where the legal term of office of the governor is four years but the actual term of office is one year because the governor has either resigned at will or his/her term get terminated once the government or Finance Minister changes. They went further with their research and administered questionnaires to the personnel of various central banks (twenty three in total).

Kuttner and Posen, (2010), takes the same direction and indicate that undue appointment of governor in office result to construed information to the authority in meeting its goal of price stability. For instance, unjustifiable appointment of governor under low inflation periods may reinforce the exchange rate, while the opposite is always true. Given that governor's appointment seem to contain valuable information regarding the exchange rate and inflation rate. Gutierrez, (2003) point out that CBI has a positive impact in reducing the chances of governments incurring budget deficits through quasi-fiscal activities. In that, such activities can be understood on their inflationary impacts. The effect of legal appointment of governor to office determines the scope to which markets observe that the next governor will bring a swing in policy stance, in that, the governor is expected to determine the bearing of such swing, Posen and Kuttner (2010). This is also in conformity with the fact that, the news conveyed may favor either one side due to markets' reaction after such appointment.

Another important prerequisite for successful IT-framework stressed by the literature is a healthy financial and banking system. A sound financial system is essential to guarantee an efficient transmission mechanism of monetary policy (interest rate channel) and more specifically forms an enabling environment of smooth exchange and provision of credit. In support to these, Lucotte, (2010) suggest that the authority should have a credible financial system for an effective monetary policy transmission mechanism and a sound financial intermediation. In contrast, a weak banking sector is potentially problematic to achieve inflation target, especially in the short-run where central bank tend to relax its stance of raising interest rates since it might depress commercial banks profits leading to downfall of financial system.

Inadequate domestic capital markets and the resulting effect of a domestic currency dollarization make the financial system more vulnerable to domestic currency depreciating by reducing the net worth of borrowers through a balance sheets effect. As outlined in Woo (2003), a well-developed domestic capital market enables the public treasury to diversify its sources of funds (e.g. by issuing bonds), and by reducing incentive to finance public deficits through inflation. Moreover, Cukierman (1992) argues that the degree of financial depth has positive correlation with the level of CBI, that is, broad financial markets are more likely to grant their central bank more independence in order to avoid potential disruptions in the process of financial intermediation. Mishkin, (2004) declared that unhealthy financial system can result to problems in case of embracing the IT-framework since central bank tend to raise interest in the short-term for fear of collapse of financial systems. He also argues that exchange rate sharply depreciate due to huge capital outflow thus exacerbating upward pressure on the inflation rate.

The work by Eijffinger and De Haan (1996) shows a positive relationship between party

political instability and CBI. Their results indicate scenarios where current politicians in office anticipates a greater downfall in the next election and instead they tend to delegate power to authority to restrain the future government, thus restricts the range of policy actions available. Similarly, according to findings of Cukierman (1992) where political institutions are fully established and stable central bank also tend to be more independent. The results showed that political parties' stabilities have a positive relation with CBI, whereas a high-level political party instability has a negative relationship with CBI. The political arena is of greater importance in arriving to the conclusion as to why most countries experiencing high inflation have also high level of political instability. The exposition to this is the main contribution of political institutions in strengthening and supporting the democratic space in terms of political participation, democracy, accountability and openness in government.

CHAPTER 3

METHODOLOGY

This paper will focus more specifically on various institutional arrangements focusing primarily on the central bank autonomy, financial institutions, fiscal position, political institutions and also macro-economic variables. Given the effect of IT-Framework toward inflation, it is important to note that, most of the emerging economies that have already anchored their monetary strategy using this framework have a very short experience with regard to its implementation; therefore, the analysis will focus on those countries with over three years of operational experience by the end of 2010. Similarly, since the data used in this paper is largely secondary data it varies greatly due to various factors associated to country specific, for example, political upheavals that may have derailed data collection as witnessed in most African countries; re-organization and resurgence of governments from former regimes this is mainly the case in former Soviet Union countries which disintegrated in the 1990's.

3.1 Data coverage and sources

The panel dataset covers sample of low-income levels and upper income-levels (emerging markets) countries[11] comprised of both inflation targeters and non-inflation targeters since 1990 to 2009. However, the countries sample size chosen is heterogeneous because these countries are dynamic in the way they are classified.[12] Next, I include countries with a population greater than one million and real GDP per capita equal or greater than one thousand dollars on annual basis (all based on 2010 dataset of IMF) and almost the same size

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[11] Low-Income and Upper Income-level country classifications is according to World Bank countries income levels classifications

[12] Heterogeneity in the sense that countries such as South Korea, Czech Republic, and Israel are in the same level of macroeconomic performance with high income countries yet they fall under emerging markets category.

with Kenya economy. Moreover, the rationale of data selection is on the need to ascertain the success of the framework (fully or partially adopted) since the first emerging country anchored its monetary policy in early1991, as well as capturing small economies.[13]

Conversely, the inflation targeting countries samples are drawn from Leyva (2008) and consist of Brazil, Chile, Colombia, Czech Republic, Ghana, Guatemala, Hungary, Indonesia, Israel, South Korea, Mexico, Peru, Philippines, Poland, Romania, South Africa, Thailand, and Turkey. While, part of the control group (non- inflation targeting countries) sample as described by (Gonçalves and Salles 2008) consists of such countries such as: Algeria, Argentina, Bolivia, China, Costa Rica, Cote d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Honduras, India, Kenya, Malaysia, Mauritius, Morocco, Nicaragua, Nigeria, Paraguay, Singapore, Sri Lanka, Tunisia, Uruguay, Venezuela, and Zambia. The table below shows the inflation targeting countries assessed in this paper, which are fourteen emerging economies and five low-income countries; the date they adopted the IT-framework, and the corresponding description of inflation target levels.

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[13] *Data sources:*
The datasets are drawn from institutions such as, International Financial Statistics-International Monetary Fund, World Bank-World Development Indicators (WDI), and Polity IV Project (polity2) databases. Central Bank's various Legislations, legal Independence and Governor's Turnover Rate data sets are derived from various databases of Eijffinger and De Haan (1996);Cukierman et al. (1992); Crowe and Meade (2007) databases; and country specific central bank's websites.

Table 1: Inflation targeting countries

Country	Pre-targeting dates	Post-targeting dates	Numerical inflation target	Former Regimes	Commit to inflation	Exchange rate regime
Chile	1991	*2000*	3(±1%)	*Exchange rate target*	Yes	*Independent floating*
Israel	1992	*1997*	2(±1%)	*Exchange rate target*	Yes	*Exchange rate (crawling bands)*
Peru	1994	*2002*	2(±1%)	*Monetary aggregates*	No	*Independent floating*
Czech Republic	1998	*1998*	3(±1%)	*Dual regime*	Yes	*Managed float*
South Korea	1998	*1998*	3(±1%)	*Monetary aggregates*	Yes	*Independent floating*
Brazil	1999	*1999*	4.5(±2%)	*Exchange rate target*	Yes	*Independent floating*
Mexico	1999	*2001*	3.5(±1%)	*Monetary aggregates*	Yes	*Independent floating*
Poland	1999	*1999*	2.5(±1%)	*Exchange rate target*	Yes	*Independent floating*
Colombia	2000	*2000*	2-4(%)	*Exchange rate target*	Yes	*Independent floating*
South Africa	2000	*2000*	3-6(%)	*Monetary aggregates*	Yes	*Independent floating*
Hungary	2001	*2001*	3(±1%)	*Exchange rate target*	Yes	*Exchange rate within crawling bands*
Philippines	2002	*2002*	4.5(±1%)	*Dual regime*	No	*Independent floating*
Thailand	2000	*2000*	0.5-3(%)	*Monetary aggregates*	Yes	*Independent floating*
Guatemala	2005	*2005*	5(±1%)	*Monetary aggregates*	No	*Managed float*
Indonesia	2005	*2005*	4-6(%)	*Monetary aggregates*	No	*Independent floating*
Romania	2005	*2005*	3.5(±1%)	*Monetary aggregates*	No	*Managed floating*
Turkey	2001	*2006*	6.5(±2%)	*Exchange rate target*	Yes	*Independent floating*
Ghana	2007	*2007*	14.5(±1%)	*Monetary aggregates*	No	*Managed floating*

Sources: Authors collection based on Levya (2008), Roger, (2010), and country-specific central bank websites.

i.   Inflation targets alongside deviation bands are as of 2009.

3.2 Variable specification

The *endogenous variable* equals to one if a country specific has formally adopted IT-

framework at time *t,* and zero if absent. However, the presumption of "half year rule" (Leyva, 2008) will be the guiding principle in choosing the actual year of IT-framework as a formal monetary strategy for inflation targeting countries. That is, I acknowledge the first six months of the year as the actual year of IT-framework adoption, while the other portion of six months are selected in the year that follows and therefore recognized as the year of IT-framework adoption.[14]

The *exogenous variables* comprising of aforementioned preconditions are as follows and there summary statistic are indicated in Table 4: First, *institutional indicators* have been highly used by various scholars and countries targeting inflation in determining the preference or probability of shifting their former monetary stance to IT-framework. The variables of importance are in four broad indicators that are:

Central Bank Independence Indices proxy of both legal independence and governor's turnover rate indices forms the first institutional indicator of interest. This paper relies on the indices of Cukierman et al. (1992), Crowe and Meade (2007); Kuttner and Posen (2001); Grilli et al, (1992) but takes a different approach since my interest transcends to impact of the Legal CBI index toward IT-framework adoption. I use there more or less methodology of arriving at the legal independence index by constructing a dummy variable of Legal CBI guided by the following four broad questions constructed by Cukierman et al. (1992) first question revolves around the authority's primary objective(=1 if price stability is the primary objective, zero otherwise. Second question revolves around the senior most personnel's of the central bank appointment and tenure of service in office(=1 if appointment is done by highly

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[14] See the work reported by Mishkin and Schmidt-Hebbel (2001), Kuttner and Posen (2001) slightly differs in what constitute the actual year and dates of IT-framework adoption in Peru.

rank central bank officials, zero otherwise. [15] Next, rest on the formulation and implementation of the monetary policy(=1 if the central bank formulates and implement inflation targets independently and set monetary policy independently, zero otherwise. And last one rest on the authority's lending policy(=1 if government does not finance government fiscal budgets, zero otherwise. The overall measure is then scaled accordingly and the average mean score is used to arrive at Legal CBI dummy variable (**LCBI**). This variable is expected to have positive association with IT-framework. The other measure of central bank independence is the turnover rate of central bank Governors (**TOR**), which has an inverse relationship with inflation. Accordingly, the presumption is that, a high turnover rate indicates fragile authority sovereignty. Since this measure of central bank independence, is of great importance, the Cukierman et al.(1992) and Crowe and Meade (2007) derivation of the TOR data since 1990-2003. Arguably, I extend the variable after 2003 for the remaining years of estimation.

Political stability variable forms a larger part in determining the probability of countries anchoring their inflation rate in a more democratic environment, and in particular, the low-income countries where democracy is highly undermined by few political elite.[16] I use polity2 index from databases of Marshall and Jaggers (2010) to measure political stability. The corresponding (**polity2**) coefficients measure the overall influence of democratic score towards adopting IT-framework.

The exchange rate regime forms the third institutional indicator variable. Many proponent of international finance have classified exchange rate regime into two segments: First, "*de jure*" exchange rate (according to law) that captures central bank's official commitment to policy.

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[15] Note the senior most personnel's refers to the Central Bank Governor and Her/his deputy governor
[16]Beck and Demirgüç-Kunt (2009) have constructed a dataset called Polity IV project to measure institutional political stability using databases of (Marshall and Jaggers 2010). They have gone further to deduct Democratic score from Autocratic Score in order to arrive at polity2 index, where it ranges from +10 (very strong) democratic score to -10(very strong) autocratic score.

Nonetheless, it requires proper mechanism for actual policy control for implementation to be effective. Second, the "*de facto*" exchange rate arrangement (by existence) monitors the exchange rate movement; however, it also lacks the intended compositional characteristics.

All member states under the World Bank and the IMF umbrella uses floating exchange rate or fixed exchange rate regimes as there official nominal anchor for monetary policy strategy. Indeed, the IMF (2010) has classified the exchange rate regime into nine categories and further re-classified the same into:[17] First, floating exchange rate system, which could be either free or managed floating system. Next, an intermediate exchange system, that is, it could be either pegged, crawling or a band arrangement system and; fixed exchange rate system- hard peg or currency board. The rationale is on whether the exchange rate system in place is plausible towards country specific shifting to another monetary policy strategy. The "de jure" exchange rate arrangement dummy(**FLXTR**) will equal to one if a country has a floating exchange system in place and equals to zero if floating exchange system is absent.

Macro-economic Structure variables

The Financial Development indicators- a well-developed financial base is reasonable for countries forging the way forward in case of adopting this strategy since it gives authority credibility to meet their intended objectives. Although, there are many indicators used in the past to test financial depth of various countries-broad money growth, money and quasi money(**GM2**), liquid liabilities to GDP (**LLGDP**), domestic private credit percentage of GDP(**DPCGDP**), central bank assets to GDP(**CBAGDP**) and private credit by deposit money banks to GDP (**PCDMB**) are highly associated with IT-framework adoption. Thus, the

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[17] Reinhart and Rogoff (2004) have classified exchange rate into fine classification comprising of numbers ranging from one(less flexible) to fourteen (less rigid).

presumption is that a strong financial depth provides high probability of countries adopting this framework. Similarly, *trade openness (***OPENC***),* forms an alternative to evaluate the extent of exposure to external shocks. This is because it has a direct relationship with the exchange rate system; predetermined exchange rate makes a country to be vulnerable to external shocks due to pressure of sustaining such regime. The expected sign for this variable is supposed to be negative.[18]

Moreover, a weak fiscal position is a major shortcoming of many low-income countries toward switching to IT-framework. This is because their governments normally finance their huge deficit through seigniorage revenues. Therefore, the presumption is that, countries that are highly characterized by government fiscal imbalances have low levels of reliability and lack of credibility of keeping inflation at low levels. Hence, current account relative to GDP (**CAGDP**) measures the extent of fiscal dominance and external government debt to nominal GDP (**DEBT**) in order to draw conclusion of my hypothesis. The control variables will include the log of real GDP per capita (**LNRGDP**), and normalized inflation rate (**INFL_N**).[19]

CHAPTER 4

ECONOMETRIC METHODOLOGY

This paper aims to depict a logit model of estimation in order to arrive at a conclusive evidence of the aforementioned preconditions necessary before countries shifts their monetary stance by anchoring their inflation to a predetermined target range or band. Nevertheless, the logit model is suitable if the response variable takes a value of (=1 if IT-

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[18] Trade openness is the ratio of sum of exports and imports to nominal GDP, all at current US dollars.
[19] The normalized inflation given as $(\pi/100)/((100 + \pi)$ is important in controlling hyperinflation episodes and in avoiding a potential simultaneity between IT-framework and inflation level.

framework is present, zero if IT-framework is absent). The type of research question that I will seek to address in this section is the extent to which the relationship between IT-framework and inflation is influenced by aforementioned preconditions and that the authorities prefers IT-framework than any other monetary policy regime. Then, I will display the likelihood test for testing my hypotheses that also captures the marginal effects of the selected preconditions.

4.1 Logit model derivation

The work of Cameron and Trivedi (2005), Agresti (2003), and Pregibon (1981) has covered categorical models in details. However, I compare and contrast the Logit model alongside other commonly used models for estimating categorical models. More precisely, the Linear Probability Model (henceforth, LPM) and Probit model[20] are widely used in the analysis of categorical data where the dependent variable is dichotomous in nature. As an example, the depiction of LPM expressed in the form of a linear equation is give below:

$\Pi_i = P(Y=1|X_i) = \beta_0 + \beta_1 X_i$……………………………….. …………………….(i)

Where the Y is the response variable (IT-framework = one, zero otherwise), while X is the predictor variables under consideration. LPM is disadvantageous in two ways: First, it is unreasonable to assume that $\Pi_i = P(Y=1|X_i)$ is an increasing factor of X, that is, the marginal effect of X remains constant. Second, the LPM assumes the variance of $\Pi_i = P(Y=1|X_i)$ is constant across values of X, (Homoscedasticity), so that as Π_i approaches 1or zero, the corresponding variance approaches zero, hence heteroscedasticity variances of the disturbance term. The other serious problem with this form of estimating binary choice models is that the response variable, $\Pi_i = P(Y=1|X_i)$ on the left-hand side can only take two

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[20]Logit and Probit model are almost the same since they yield the same results. However, the difference arises in the distribution. Logit reports Cumulative Standards Logistic distribution, whereas Probit model reports Cumulative Standard Normal distribution (Φ) and $\square_i$ function is the index of the Probit model i.e. Probit model is given by, $\square_i = \beta_0 + \beta_1 X_i$; $\Pi_i = E(Y=1|X_i) = \Phi(\beta_0 + \beta_1 X_i)$ and $\square_i = \beta_0 + \beta_1 X_i$, (Cameron and Trivedi ,2005 pp.466)

values [1,0], while the linear parameters on the right-hand side (RHS) can assume values ranging from negative infinity to positive infinity thus making LPM untenable. Therefore, it is appropriate to transform the probability (Π_i) by eliminating [1, 0] restriction. In order to do this; I will evaluate a nonlinear functional form of estimation that satisfies the following assumptions. i) X increases $\Pi_i = P(Y=1|X_i)$ within the range of [1, 0] and does not go to the extreme values. ii) and the non-linearity association between Π_i and X_i holds, such that $\Pi_i = P(Y=1|X_i)$ to be increasing in X_i for ($\beta_1 > 0$), (Cameron & Trivedi, 2005 pp.471). Since Logit model reports Cumulative standards logistic distribution function, it follows that:

$\square_i = \beta_0 + \beta_1 X_i$:

$\Pi_i = P(Y=1|X_i) = (\beta_0 + \beta_1 Xi)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ (ii)

Therefore, eq. (ii) transformed results to eq. (iii);

$$\Pi i = P(Y = 1|Xt - 1) = \frac{1}{1+e^{-(\beta 0+\beta 1 Xi)}} = \frac{1}{1+e^{i}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{....... (iii)}$$

Consequently, $\square_i$ assumes a negative infinity (-∞) to positive infinity (+∞); while Π_i ranges between [1, 0]; and that there is no linear relationship between Π_i and $\square_i$ (e.g. X_i). Hence, under this threshold the LPM both conditions are satisfied. This means that we cannot use LPM in estimating the explanatory variables under consideration since Π_i is nonlinear to both X_i and β.

4.2. Logit model estimation

Thus, the overall Logit distribution function and the likelihood of a country adopting IT-framework over time t is derived from eq. (i) and eq. (ii) respectively:

$$Pr(ITt = 1|Xt - 1) = \frac{1}{Xt-1} = \frac{e^{(t)}}{1+e^{(-t)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. \text{(iv)}$$

On the other hand, eq. (v) is the probability of a country not adopting IT-framework over time t given as:

$$Pr(\text{IT}t = 0|\text{X}t-1) = \frac{1}{1 + e^{(-t)}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. \text{(v)}$$

Where, eq. (iv) and eq. (v) yields $\frac{1}{\text{X}t-1}$ which is the odds ratio in support of countries adopting IT-framework- the ratio of the probability of adopting IT-framework against the probability of not adopting IT-framework. After transforming the odds ratio into natural logs, it is obvious the log odds ratio has a linear relation to X_{t-1} as well as to the parameters β under estimation. In this case, parameter β measures a change in the log-odds ratio for a unit change in X_{t-1}. The Logit model indicating the log of the odds ratio estimation as a linear function of the predictor variables is derived from eq. (iv) and eq. (v):

$$Ln\frac{Pr(\text{IT}t=1|\text{X}t-1)}{Pr(\text{IT}t=0|\text{X}t-1)} = t = \beta 0 + \beta 1 \text{X}t - 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(vi)}$$

Estimation of the Logit model requires information regarding the values of X_{t-1} and L_t. [21] Therefore, the maximum likelihood estimation (MLE) of the model parameter is widely used in logistic estimation (Cameron and Trivedi (2005) pp.467) and (Agresti 2003)).[22] Indeed, to test the hypotheses, that is, the null and alternative hypotheses and the log ratio of the maximum likelihood of the two hypotheses are related asymptotically to the chi-square distribution, I maximize the logistic function to give the log likelihood ratio verified as,

$$\lambda^2 \approx {}_i(\ln(\text{H}_0) - \ln L(\text{H}_1)) = {}_i\ln\frac{L(\text{H}_0)}{L(\text{H}_1)}$$

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[21] Hence, LPM becomes invalid in such scenarios where we are dealing with data resulting from individual or group variables.

[22] The marginal effect model is given by:

$$\boldsymbol{Pr(\text{IT}t = 1|\text{X}t - 1) = [1 - \Phi(\beta'\text{X}_{t-1}]} \quad \textbf{Thus,} \quad \frac{\boldsymbol{\delta Pr(\text{IT}t = 1|\text{X}t - 1)}}{\boldsymbol{\delta X_{t-1}}} = \boldsymbol{\beta'\Phi(\beta'\text{X}_{t-1})}$$

The above partial derivative bring us to marginal effect of $\boldsymbol{X_{t-1}}$ on the dichotomous variable IT_t that is given as,

$$\frac{\delta Pr(\text{IT}t = 1|\text{X}t - 1)}{\delta X_{t-1}}$$

In order to derive the marginal effect, there is a need to multiply β estimate by the density of ε that differ with the level of X. (Cameron and Trivedi (2005) pp.467).

4.3 Estimation results

In this paper, I use Levya, (2008) methodology of differentiating between the two sub-periods (Pre-targeting and Post-targeting dates) of IT-framework adoption as shown in Table 1. Thus, my estimates revolve around these two sub-periods of IT-framework adoption for inflation targeting countries. On the contrary, the periods between 1990-2009 and 1997-2009 forms the selection periods for non-inflation targeting countries.

4.4 Tests for Model specification errors and multicollinearity

In testing for the model specification errors, the linearly predicted values are significant predictor for the model, whereas, the squares of linearly predicted values are insignificant, table 2 portrays the corresponding p-values. This means that the preconditions variables under investigation are influential predictor for the likelihood of adopting IT-framework. Similarly, the likelihood chi2's and pseudo-R^2 reported in table 2 indicates all models under investigations as a whole fits significantly better than empty models.[23] However, the disadvantage of the Hosmer and Lemeshow (2000) goodness of fit results need greater precision in interpretation in order to leave no room for doubts, hence, need to go further and estimate the model for any other misspecifications. Therefore, in curbing the problem of *multicollinearity*, I use both the Variance Inflation Factor (VIF) and Tolerance Level to test any instances of the correlation between the variables themselves ad to avoid any biasness in estimations. Accordingly, the mean VIFs for all corresponding estimations have the right values of one.[24] That is, the tolerance does not go to a value of less than one in all estimations, while none of the VIFs goes to extremes of more than ten. *"See Table 2"*

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[23] The goodness of fit proposed by Hosmer and Lemeshow (2000) is statistically insignificant for all models in Table 2 indicating the models are well fit for investigations.
[24] See Long and Freese (2006)

4.5 Summary Statistics

The summary statistics reported in Table 4 comprise all variables under estimation. Table 4 indicates that the LCBI has a slight magnitude effect in these countries, especially, in non-inflation targeting countries. The governor TOR is significantly important in non-inflation targeting countries than in post inflation-targeting period, where on average it is higher in non-inflation targeting countries (0.32) than in the inflation targeting ones (0.25). Flexible exchange rate is favorable in inflation targeting countries than in non-inflation targeting ones.

The overall financial development on average, has improved tremendously in inflation targeting countries than in their counterpart non-targeters, indicating formidable development in financial systems. The fiscal position is highly weakened by huge government's deficits and external debts in both countries though seem to improve greatly in inflation targeting countries. The macroeconomic performance: log of real GDP per capita measures the variation of the country's extent of economic activities and increases on average of 7.42 (non-targeters) to 8.18 (inflation targeting countries) though the difference is minimal between them. On the other hand, the normalized inflation rate is higher in inflation targeting countries (0.17) than in inflation targeting countries (0.14), this is contrary to the presumption of IT-framework adoption in countries experiencing disinflation. However, this difference can be because of various economic shocks experienced during the post inflation-targeting period.

4.6 Interpretation of the findings

Table 2 shows the logit estimation results for low-incomes and emerging economies. In Model 1 and Model 1, the results are inclusive of hyperinflation periods. While, Model 3 and Model 4 the results are for periods with less than 50% inflation rate. However, the results reported in both tables are slightly different from each other with almost similar coefficients and significant levels. Similarly, all the preconditions necessary for IT-framework adoption

exhibit the expected sign as hypothesized in Table 3, although some are statistically significant and others are not. This overall result indicates that real GDP per capita, declining inflation rate, floating exchange rate regime, trade openness, and fiscal position are considerable determinants for IT-framework adoption.

On the individual variable specification reported in Table 2 and Table 3: The economic performance measured by the log of real GDP per capita is highly significant and positively related to IT-framework in all models of estimation. This clearly indicates the significance attached to the output levels in determining the likelihood of countries shifting to IT-framework, that is, one point increase in log of GDP per capita, increases the log-odds of adopting IT-framework by coefficients reported in Model 1 to Model 3. However, in Model (1)-(3) real GDP per capita has improve less than in Model (2)-(4), which are inclusive of the debt component and financial development indicators. This is in conformity with Debelle (1997) who state that "output should always feature in the reaction function of the central bank" meaning that output levels have a greater effect in forecasting expected inflation. Similarly, inflation has an inverse relationship and significant as indicated by the coefficients though fail to produce robust results. Arguably, countries reporting low inflation rates stand a high chance of adopting IT-framework. Trade openess has a negative sign (Table 3) and is statistically significant in all model of estimation in Table 2. Similarly, in Model (1)-(3) the results are highly robust due to exclusion of debt component from estimation. Thus, leading to the conclusion that country differs in the magnitude of debt levels. Conversely, the inclusion of broad money growth in Model 2 of Table 2 has a direct relationship with the degree of openness. Romer, 1993) argues that increasing money growth causes depreciation of exchange rate in an open economy leading to overheating of the economy. Due to high correlation for broad money growth with various financial development indicators the

variable is drop in the subsequent estimations.

The floating exchange rate dummy is statistically significant and positively related to IT-framework dummy throughout the estimation period, thus the presumption of the importance attached towards flexible exchange rate and likelihood of embracing IT-framework is tenable. It should be noted that most developing countries exchange rate regime though freely determined by forces of demand and supply (for floating countries) majority of these governments tend to intervene in determinination of exchange rate in order to maintain exchange rate steadiness. As noted by Rose (2007) that "Inflation targeters let their exchange rates float, usually without controls on capital flows and often without intervention."

The TOR as the measure of central bank independence is statistically significant and negatively associated with the IT-framework adoption in all models of estimation, with a greater reduction of turnover rate of central banks governors in post-inflation targeting in Model having with a coefficient of (-3.64). This is in agreement with most of literatures on CBI such as, Dreher, et al.(2007) and Cukierman(1992). However, the results differs with De Haan and Kooi (2000) who finds a strong relationship between inflation and TOR after including countries with high inflation rate in their sample, unlike the robustness results reported in Model 4 in a sample of low inflation countries. On the otherhand, LCBI though positively related to IT-framework is not a good measure of central bank independence in low-income and emerging countries as it not statistically different from zero. Indeed, the Polity2 indicator for political stability has the expected sign and is statistically significant throughout the estimation period. Hence indicating that countries need to have stable political environment before they switch there monetary policy's regimes. Financial development indicators illustrated by: BMG, LLGDP, and PCDB are not statistically important in all levels

of estimations, while both CBAGDP and PCDMB are not significant in Model 3 but after re-estimation CBAGDP is weakly significant at 0.01 level of confidence and PCDMB is robust in Model 4 with t-statistic of 3.58. Fiscal position (Debt and CAGDP) though negatively related with IT-framework are insignificant at all models of estimation.

4.6 Marginal effects of Logit estimation

Table 5 reports the marginal effects at the mean value of independent variables. The predicted likelihood of adopting IT-framework by various countries is 0.063, 0.114, 0.076, and 0.124 respectively. For instance, in Model 1 one point decrease in inflation increases the probability countries with inflation that decrease at an average of 11 percent and every additional increase in real GDP per capita increases the probability by 77%. On the other hand, trade openness has a high degree of marginal effect. The marginal effects of financial development are negligible, while political stability variables are marginally significant with IT-framework adoption.

CHAPTER 5

CONCLUSION

The main analysis of this study has exhausted major avenues that have led to many countries shifting their former monetary strategy to IT-framework paying attention to emerging markets and low-income countries. The result indicates that countries characterized by low inflation rates stand a high chance of adopting IT-framework. The fiscal surplus measured by the current account to nominal GDP ratio impact negatively (though not significant) in determining countries shifting to IT-framework indicates that non-inflation targeting

countries need to have a sound fiscal balance that can ameliorate instances of high inflation shocks resulting from high interest rates and tightening of monetary policy. Moreover, countries characterized by improved macroeconomic performance and stronger institutional developments have a high chance of switching to IT-framework.

The results also suggest that, overall, institutional development though necessary is not an important prerequisite in the initial periods of IT-framework adoption. Central bank independence measured by TOR affect negatively the choice of moving to IT-framework. This means that high turnover rate of central bank governor results to low credibility and accountability in the conduct of monetary policy and that the public may lack confidence with the authority. Similarly, financial depth is one of the indicators of financial development of a country hence it is clear that, countries need to have strong financial institutions before switching to this framework once again not a prerequisite in prior to IT-framework adoption. The Log of GDP per capita and floating exchange rate are highly associated with the choice of inflation. In conclusion, the decision to forge towards IT-framework requires resolute efforts and support in addressing the main drawbacks that may hinder successful implementation of IT-framework especially on the technical aspects and capability of most of low-income and emerging countries, which are limited or lacking. The technical aspects in this case involve the modalities or indices used to measure inflation (majority of countries use consumer price index), the quality and timely data collection and the expertise that are well knowledgeable about the monetary policy.

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APPENDICES

Table 2: Logit Estimation Results

	(A)	(B)	(C)	(D)
			|Inflation<50%|	
VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL4
OPENC	-0.0134***	-0.0202***	-0.0118**	-0.0176***
	(-4.78)	(-4.49)	(-3.09)	(-3.53)
CAGDP	-0.230	-0.372		
	(-0.40)	(-0.57)		
FLXTR	1.910***	1.901***	1.874***	2.257***
	(4.90)	(4.15)	(4.65)	(4.15)
POLITY2	0.164***	0.194***	0.157***	0.172**
	(4.42)	(3.78)	(4.06)	(3.29)
TOR	-4.448***	-4.714***	-4.093***	-3.639**
	(-4.82)	(-3.95)	(-4.31)	(-2.91)
LNRGDP	1.471***	1.996***	1.303***	1.809***
	(8.60)	(6.81)	(7.16)	(6.03)
INFL_N	-14.35***	-19.98***	-14.31***	-20.81***
	(-5.57)	(-3.62)	(-4.55)	(-3.30)
DPCGDP		0.0130		
		(1.38)		
BMG		0.00831		
		(0.65)		
DEBT		-0.00547		
		(-0.78)		
LCBI		0.549		0.816
		(1.31)		(1.78)
CBAGDP			-2.822	-9.734**
			(-1.39)	(-2.74)
LLGDP			-1.761	-3.464
			(-1.35)	(-1.86)
PCDMB			1.832	5.350***
			(1.88)	(3.58)
CONSTANT	-12.74***	-17.21***	-11.40***	-16.21***
	(-9.17)	(-6.96)	(-7.62)	(-6.47)
LR chi2 (*df_m*)	**336.4 (7)**	**299.9 (11)**	**304.8 (9)**	**293.0 (10)**
r2_p	*0.435*	*0.546*	*0.423*	*0.564*
N	**809**	**488**	**708**	**449**
Mean VIF	**1.29**	**1.95**	**2.37**	**2.58**
Specification errors	0.000(0.33)	0.000(0.87)	0.000(0.99)	0.000(0.95)
HLchi2	**8.34(0.40)**	**7.30(0.50)**	**8.05(0.43)**	**7.95(0.44)**

Note: t statistics in parentheses *p < 0.05, **p < 0.01, ***p < 0.001

1. *Letter A and C are coefficients for pre-inflation targeting framework, while Letter B and D are coefficients for post-inflation targeting framework.*
2. *LR chi2 (df_m)-Log likelihood chi2; r2_p- Pseudo-R^2; df_m; N- number of observations, HLchi2-*Hosmer-Lemeshow chi2

Appendix 1B
Table 3: Hypothesis Estimation Results

| | *SIGNS* | | | |
	Model 1	Model 2	Model 3	Model 4
OPENC	-	-	-	-
CAGDP	-	-		
FLXTR	+	+	+	+
POLITY2	+	+	+	+
TOR	-	-	-	-
LNRGDP	+	+	+	+
INFL_N	-	-	-	-
DPCGDP		+		
BMG		+		
DEBT		-		
LCBI		+		+
CBAGDP			-	-
LLGDP			-	-
PCDMB			+	+
CONSTANT	-	-	-	-
N	809	488	708	449

Table 4: Summary Statistics

	Combined countries			Non-targeters Countries			Targeters Countries		
Variables	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
Fiscal Position indicator									
CAGDP	**-0.010**	1.36	-2.18	**-0.01**	0.242	-2.18	**-0.01**	1.36	-1.54
DEBT	**68.15**	1209	2.02	**80.09**	1209	2.99	**48.56**	447.1	2.02
Financial Development									
BMG	**44.56**	159.4	6.16	**46.55**	159.4	6.16	**41.29**	113.16	9.68
DPCGDP	**40.06**	165.7	1.54	**37.91**	158.5	2.99	**43.68**	165.72	1.54
LLGDP	**0.44**	1.30	0.05	**0.46**	1.30	0.05	**0.40**	1.14	0.06
PCDMB	**0.43**	1.74	0.01	**0.41**	1.64	0.04	**0.45**	1.74	0.01
GM2	**65.86**	12513	-100	**67.98**	12513	-100	**62.38**	6384.9	-29.82
CBAGDP	**0.10**	1.74	0.00	**0.11**	0.72	0.000	**0.09**	0.86	0
Political Stability									
POLITY2	**3.35**	10	-10	**2.52**	10	-10	**4.70**	10	-9
Macroeconomic structure									
INFL_N	**0.13**	0.99	-0.08	**0.12**	0.99	-0.99	**0.15**	0.99	-0.01
FLXTR	**0.63**	1	0	**0.52**	1	0	**0.81**	1	0
LNRGDP	**7.69**	10.32	5.42	**7.41**	10.32	5.42	**8.14**	9.88	5.74
OPENC	**73.51**	453.4	6.32	**81.56**	453.4	11.52	**60.28**	162.7	6.32
CBI Indices									
TOR	**0.29**	1	0	**0.31**	1	0	**0.24**	0.8	0
LCBI	**0.40**	1	0	**0.41**	1	0	**0.40**	1	0
No of countries		*43*			*25*			*18*	

Table 5: Macroeconomics Performance and Financial Development Indicators

	(A)	(B)	(C)	(D)				
	MARGINAL COEFFICIENTS							
	Inflation<50%							
VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	*XA*	*XB*	*XC*	*XD*
OPENC	-0.00119***	-0.0021***	-0.0014***	-0.00227***	76.85	86.98	78.37	87.47
	(-4.28)	(-4.33)	(-4.50)	(-4.46)				
CAGDP	0.0008		-0.0013		-0.01		-0.01	
	(0.02)		(-0.03)					
CBAGDP	-0.1848		-0.2055		0.08		0.08	
	(-1.79)		(-1.66)					
PCDB	-0.0006	0.0016*	-0.0006	0.00171*	41.11	43.92	41.89	44.28
	(-1.51)	(2.09)	(-1.40)	(2.11)				
BMG	0.0004		0.0005		46.72		47.78	
	(0.63)		(0.54)					
PDBGDP	0.1023		0.1171		0.45		0.46	
	(1.46)		(1.39)					
POLITY2	0.0108***	0.1674***	0.0130***	0.0181***	5.14	5.59	5.08	5.59
	(4.78)	(3.35)	(5.08)	(3.39)				
TOR	-0.2782***		-0.3382***		0.27		0.27	
	(-4.86)		(-5.03)					
LNRGDP	0.0790***	0.1844***	0.0951***	0.199***	7.77	7.88	7.77	7.89
	(5.50)	(5.95)	(5.97)	(6.23)				
INFL_N	-0.7030***	-1.4894***	-0.9497***	-1.579**	0.11	0.07	0.08	0.07
	(-4.85)	(-3.34)	(-4.35)	(-3.06)				
LLGDP		0.0346		0.0377		0.50		.050
		(0.34)		(0.34)				
GM2		-0.0027		-0.0030		15.35		14.81
		(-1.65)		(-1.65)				
XMFX_Y	0.063	0.114	0.076	0.124				
N	**749**	**440**	**707**	**432**				

Note: Marginal effects; t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; *(d) for discrete change of dummy variable from 0 to 1*

1. *Letter A and C are coefficients for pre-inflation targeting framework, while Letter B and D are coefficients for post-inflation targeting framework respectively.*
2. *Letter XA, XB, XC and XD are marginal effects averages in pre/post-inflation targeting framework,*
3. *XMFX_Y-* Marginal effects after logit; y = Pr(**Inflation Targeting**) (predict)
4. *N- Number of observations*

Table 6: Determinants of IT-Framework Variables

Variables	Description and the sources
ITF	A dummy variable if IT-framework is in place, zero otherwise. Sources: Leyva, (2008), (Roger, 2010)
CAGDP	Ratio of Current Account Balance (US dollars in Billions) to GDP ((US dollars in Billions)). *Sources:* IFS, East Africa Community, Inter-America Development Bank, Asian Development Bank, African Development Bank , International Monetary Fund, World Economic Outlook Database, January, 2011 and author's calculation.
BMG	Broad Money Growth (% annual). *Source:* IFS, East Africa Community, and WDI.
DPCGDP	Domestic credit to private sector percent of GDP. Domestic credit to private sector refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits. *Source:* WEO, IFS, AFDB and East Africa Community.
LLGDP	Ratio of liquid liabilities to GDP. Liquid liabilities include currency, demand and interest-bearing liabilities of banks and other financial institutions. Source: Beck and Demirgüç-Kunt 2009 and IFS.
DEBT	Total sum of (public plus private) gross external debt relative to nominal GDP. Source: Reinhart and Rogoff, (2010) databases, IFS, World Bank(debt)
CBAGDP	Central Bank Assets relative to nominal GDP. Assets refer to those claims on nonfinancial real sector comprised of state actors and non-state. Source: Beck and Demirgüç-Kunt 2009, WDI, and ECB
PCDMB	Private credit provided by the banking sector relative to GDP. Private credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits).Source: Beck and Demirgüç-Kunt 2009 and authors .
GM2	Average annual growth rate in money and quasi money. Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government.Source: International Monetary Fund's (IMF) International Financial Statistics (IFS).
POLITY2	Polity2 index (democratic score minus autocratic score. Source: Beck et al (2010), Beck and Demirgüç-Kunt (2009) and Marshall and Jaggers (2010)
INFL_N	Transformed annual percentage change in consumer price index, Source: WDI, IFS and author construction
FLXTR	"*De facto*" Floating exchange rate regime Source: International Monetary Fund coarse exchange rate classification and (Reinhart and Rogoff 2004).
LNRGDP	Log of Real GDP per capita in logs ((current US$) Source: WDI, IFS.
OPENC	Trade openness is the ratio of sum of exports and imports to nominal GDP, all at current US dollars. Source: WDI, IFS and author construction
TOR	Governors Turnover Rate Source: Eijffinger and De Haan (1996);Cukierman et al. (1992); Crowe and Meade (2007), (Sturm and De Haan 2008), (De Haan and Kooi 2000)
LCBI	Legal central Bank independence Index Sources: Cukierman (1992 Cukierman et al. (1992) and (Ja'come and Va'zquez (2005)