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Effects of Central Bank Independence Reforms on Inflation in Different Parts of the World

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Abstract

The purpose of this study is to analyze the effect of CBI-reforms on inflation in different parts of the world from a theoretical and empirical perspective. Compared to previous studies, this study focuses on whether CBI-reforms have different effects on reducing inflation in different parts of the world. The study is based on a 132 country data-set from 1980 to 2005 compiled by Daunfeldt et al. (2008). The result indicates that the reduction in inflation due to the CBI-reforms varies between 2.2 and 12.32 percentage points in Asia, Europe, South America and Oceania, supporting the claim that implementing CBI-reforms can be successful in reducing inflation in most of the parts of the world.

Keywords: central bank; CBI-reforms; inflation; time-inconsistency; geographic differences

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Chapter I Introduction

1.1 Background

In 1609, the bank of Amsterdam was established as a precursor of a central bank. However, it was not until 1664 that the first the central bank in the world was established. It was "Sveriges Riksbank" or simply "Riksbanken," founded in Stockholm and is by that the world's oldest central bank, still operating today.

The central bank is a banking institution with the responsibility for issuing the currency, regulating the money supply and credit, managing the exchange rate, supervising commercial banks and other financial institutions, and regulating the nation's interest rates. The primary function of a central bank is to create and issue the nation's currency as legal tender, other functions include overseeing all kinds of financial institutions to ensure they do not behave recklessly or fraudulently, controlling the interest rate to ensure it keeps stable. Moreover, it is granted the exclusive privilege to lend the government currency to finance its budget deficit, and to lend to commercial banks during times of financial crisis, i.e., acting as a 'lender of last resort' (Elgie and Thompson, 1998).

Historically, there has been a very close relationship between the government and the central bank. To stimulate economic growth, and to maintain social stability and development, the government might adopt resolutions which can then be realized by the central bank's monetary policy. For instance, the central bank can implement an expansionary monetary policy (i.e., lower the interest rate through open market operations to encourage consumption and investment) if the government wants to stimulate the nation's economic growth, and vice versa. However, since there is a time-inconsistency problem¹ in monetary policy, which can induce inflation; more and more central banks have been reformed, becoming more independent from the government.

After the central bank in New Zealand first became independent in the late twentieth century (Singleton, 2009), a wave of central bank independence (CBI)

¹ The time-inconsistency problem will be explained in detail in the following part: 1.2 Previous studies.

reforms started from 1989. Central Bank Independence is defined as “freedom of monetary policymakers from direct political or government influence in the conduct of policy” (Walsh, 2005). “To a large extent, this interest is motivated by the success of the Deutsche Bundesbank in keeping the rate of inflation stable at a low level for several decades,” (Eijffinger et al., 1998). As such, CBI-reforms aim at achieving a low and stable inflation rate, as well as stabilizing monetary policy to avoid financial fluctuations.

According to Alesina (1988), Grill, Masciandaro and Tabellini (1991), and Loungani and Sheets (1997), there is a negative relationship between the level of central bank independence and inflation, but some economists (Daunfeldt and de Luna, 2008; Campillo and Miron, 1997) also argue that CBI has no influence on lowering inflation. Thus, there is still a need to investigate whether CBI-reforms can lower inflation. If there is a robust negative relationship between the level of CBI and inflation, countries that have high inflation should adopt some type of CBI-reform policy. However, countries on every continent in the world have their own characteristics. For example, most of the countries in Asia are still developing countries, while countries in Oceania, North America and Western and Northern Europe can be considered to be developed countries. Therefore, there might be different effects of CBI on inflation in different continents due to the disparity of their economic development.

1.2 Previous studies

If there is a negative relationship between the level of CBI and inflation, then lowering inflation can be achieved by implementing CBI-reforms. From a theoretical perspective, there might be a time-inconsistency problem in monetary policy if implemented by non-independent central bank (Kydland and Prescott, 1977; Barro and Gordon, 1983; and Rogoff, 1985). More specifically, once a low inflation target is achieved, policy makers have an incentive to deviate from the low inflation policy since it is politically popular to achieve low unemployment. Thus, the announcement

of an optimal policy for bringing down inflation is not always credible. Several previous studies (e.g., Alesina, 1988; Bade and Parkin, 1988; Grill, Masciandaro and Tabellini, 1991; Loungani and Sheets, 1997; Eijffinger et al., 1998) all indicate that there is a negative relationship between the level of CBI and inflation with a focus on the level of CBI.

By contrast, it has also been argued that countries can achieve low inflation without CBI-reforms. Daunfeldt and de Luna (2008) concluded that inflation problems can be solved, and a stable price level can be achieved, before CBI-reforms. In their study, they use data from 29 OECD-countries, focusing on the change of CBI instead of level of CBI. The result from Campillo and Miron (1997) also suggests that CBI will not be effective in lowering inflation.

Moreover, there are some previous studies that indicate that different countries have had different effects of CBI-reforms on inflation. According to Landström (2009)'s study, CBI-reforms can lower inflation and stabilize the price level, but only in high-inflation countries. Cukierman, Webb and Neyapti (1992)'s analysis suggested that CBI-reforms have an efficient impact on inflation in developed countries, but not in developing countries. Also, Daunfeldt et al. (2010) use a random effects, random coefficient model, showing that CBI-reforms are not efficient in bringing down inflation in highly democratic countries with political stability. These countries can achieve low and stable inflation only through the announcement of a price stability policy. In totalitarian countries, CBI-reforms also does not affect inflation since laws are not enforced. However, in democratic countries with political instability, CBI-reforms might have a significant effect in bringing down inflation, since the public does not have confidence with politicians and requires that the central bank become independent to achieve low and stable inflation.

1.3 Purpose

The purpose of this study is to analyze the effect of CBI-reforms on inflation in different parts of the world from a theoretical and empirical perspective.

In the theoretical section, the relationship between the governments and the central banks will be discussed, with a focus on the government role before CBI-reforms. Second, the advantages of implementing CBI-reforms based on the time-inconsistency problem in monetary policy will be discussed, followed by a discussion of the reasons for which there might be geographical differences in the effects of CBI-reforms on inflation.

The empirical section of the thesis is based on a 132 country data-set from 1980 to 2005 compiled by Daunfeldt et al. (2008). Using this data, an econometric model will be designed and used to explain the relationship between CBI-reforms and inflation in different parts of the world, and to test whether there exist a negative correlation between the two.

Compared to previous studies, this study will thus focus on whether CBI-reforms are more efficient in reducing inflation in some geographical locations than in others, and if so, also attempt to answer why. Since countries on different continents have their own varying culture, national situation, economic growth and tradition of monetary stability, it is likely that the relationship between CBI-reforms and inflation will also differ.

The thesis is set up as follows. In the next chapter, the relationship of the government and a non-independent central bank will be discussed, with an analysis of the advantages of CBI-reforms. In this section, it will also be discussed why there could be geographical differences in the effects of CBI-reforms on inflation. In chapter 3, the econometric models are specified and the results from the estimations are presented. Finally, chapter 4 draws conclusions.

Chapter II Theoretical Study

2.1 Government Role

There is a very close relationship between the government and the central bank. In most countries, the government would probably like to adopt an expansionary economic policy to encourage economic growth and reduce unemployment. However,

an expansionary economic policy might also cause budget deficits, which could in turn induce the government to borrow from the central bank, thereby solving their short run deficit problem.

Moreover, these problems might be increased in times of elections. More specifically, in order to get more votes in a new election, politicians could try to increase the employment rate to appease citizens using the short-run trade-off between unemployment and inflation (Phillips Curve). This could then cause a latent inflation problem, as monetary policy loses credibility. Also, there is a pattern that the unemployment rate usually rises and inflation decreases after an election (Bandura et al., 2006).

In the short-run, governments can thus benefit from the central bank increasing the money supply and inflation. Expanding government expenditure can be funded through credits from non-independent central banks (i.e., printing money), and thus endogeneizing money supply² (Gutierrez, 2003); yet, currency purchasing power will be reduced because of inflation, which can relieve the real value of the government budget deficit. Therefore, most of the governments in the world prefer to use an expansive economic policy, financed by the money supply from a non-independent central bank, even though this could cause inflation.

However, the objective of central bank policy instead ought to be to stabilize the consumer price index, facilitate reasonable economic growth and maintain equilibrium of the balance of international payments. Stagflation and economic recession will be caused if the money supply and inflation increase. According to the above analysis, a non-independent central bank will follow the government's policy blindly, and then the tasks presented above will not be achieved. Only if the central bank becomes independent and eliminates the intervention from government, can it formulate monetary policy reasonably to deal with inflation, resist reckless government treasury overdraft, and keep a steady currency value.

² Endogenous money supply essentially means that the stock of money in a country is determined by the demand for bank credit (Fontana, 2003).

2.2 Advantages of CBI-reform

According to the discussion above, if the central bank is not independent, inflation will be caused generally when government adopts an expansionary economic policy.

The disadvantage of high inflation is that when inflation increases, domestic currency depreciates, and investment costs increase; thus individuals tend to purchase more goods and require more loans in order to compensate for high inflation. However, such apparently rational behavior will consequently cause a more serious inflation problem.

According to several studies presented above, CBI-reforms have often had a significant effect in reducing inflation. Therefore, the advantages of CBI-reforms are as follows:

i. Since the function of the government and the central bank are different, the government will in most cases put more emphasis on unemployment and economic growth than an independent central bank. After independence, the central bank can regulate the size of the money supply according to money demand independently, thus reducing the risk of an overheated economy. It can also stabilize the real value of domestic currency. Otherwise, it is unlikely that a non-independent central bank could work out an appropriate policy.

ii. After CBI-reforms, as a more professional and objective institution, a central bank has advantages over government agencies when formulating monetary policy. For instance, it can avoid negligence and mistakes in policies that are made by policy makers, and ensure the overall effect of policy and macro-economic controlling (Johnson, 2006).

iii. CBI-reforms can help to prevent fluctuations in the macro economy. Since politicians typically apple-polish voters before voting by using an expansionary economic policy, lowering unemployment rates, and encouraging consumption and investments. After elections they adopt a tight policy to cope with inflation, this might induce economic fluctuations throughout the country (Nordhaus, 1975; Alesina, 1988). An independent central bank should not be influenced by politicians or government,

but instead ensure the consistency and stability of monetary policy and the price level.

iv. CBI-reforms can reduce the problem of budget deficit monetization. Without independence, monetary policy always has a close correlation with fiscal policy. For instance, the central bank will try to reduce interest rates in the market to diminish the cost of government lending or directly lend to the government if the fiscal policy needs this. This indicates that there will be a budget deficit first, then budget deficit monetization, and finally inflation. Hence, CBI-reforms are necessary to resist political pressure from government (Gutierrez, 2003; Maxfield, 1997).

v. After CBI-reforms, central bank can execute policy more precisely and promptly in branches, ensuring the consistency between policy decision and execution, and thus enhance the efficiency and effectiveness when implementing policy (Bandura et al., 2006).

2.3 Reason for Geographic Differences

Generally speaking, there could be different effects of CBI-reforms on inflation in different parts of the world. As mentioned above, countries in different continents have their own different culture, national situation, policy-making and economic growth, so they will likely have different situations when dealing with CBI-reforms and inflation.

In order to analyze the geographic differences, the world has been separated into six parts in this thesis: Africa, Asia, Europe, North America, South America and Oceania.

i. Africa: Most of the countries are war-torn, underdeveloped, and often in political upheaval. Citizens generally live in poverty and under repression by a centralized government. Perhaps the government benefits greatly from inflation through exploiting the citizens, since politicians in this part of the world are often only concerned about their own interest and the people often lack political power. The main problem is that even if some interest groups advocate CBI-reforms, the state does not put them into practice. Hence the CBI-reforms are more like an armchair strategy in these countries and might not have any impact on inflation.

ii. Asia: Most of the countries are developing countries. According to Daunfeldt et al. (2010), CBI-reforms can successfully bring down inflation in democratic countries with political instability. Considering the political culture in Asia, even if some countries, (i.e., Japan, China and Singapore) are characterized as having a high degree of political stability, most countries are politically unstable. Therefore, the effect of CBI-reforms on inflation in these places should be significant and negative.

iii. Europe: Most of the countries in Europe are developed countries. The citizens prefer a steady economic growth, and a harmonious and stable society. In order to achieve these aims, any kind of method for lowering inflation will be welcomed. Especially after the EU was established, the European commission has formulated macroeconomics policies that should be followed by each member country. Also, Cukierman et al. (1992)'s study indicated that CBI-reforms are more efficient for bringing down inflation in industrialized countries. However, according to Daunfeldt and de Luna (2008), price stability can be achieved without CBI-reforms in OECD-countries. Also according to Daunfeldt et al. (2010), a lower-inflation goal can be made credible in democratic countries with political stability without CBI-reforms. Since the social trust is quite high in Europe, the public tends to trust announcements of price stability targets. Therefore the effect of CBI-reforms on inflation is ambiguous in Europe.

iv. North America: Most of the countries are developed countries. Freedom is important in North America, and they put higher weight on the "invisible hand" in the economic market. However, the United States has a huge budget deficit due to extensive spending of the government (i.e., military expenditure), and that is one of the reasons for higher inflation in North America. Moreover, the United States has not executed a real CBI-reform.

"The US has become one of the least operationally independent of the central banks in the industrial world. The fact that the Fed is a creature of congress, and can be abolished or effectively amended out of the existence with simple majorities in both Houses, has acted as a significant constraint on what the Fed can do and say. The Federal Reserve Act has stable prices as one of the goals of monetary policy, which is

different from ECB or other banks in England that stable prices is a primary objective,” (Willem Buiter, 2007). Thus the effect of CBI-reforms on inflation seems insignificant in North America.

v. In South America, most of the countries are developing countries. According to Daunfeldt et al. (2010), CBI-reforms can successfully bring down inflation in democratic countries with political instability. Moreover, “Latin American and Caribbean countries achieved a remarkable reduction in inflation since the mid-1980s, from an average of about 50% in 1985 (excluding Argentina: 672%, and Bolivia: 11.750%) to 7% in 2002” (Jacome and Vazquez, 2008). Therefore, the effect of CBI-reforms on inflation in these places should be significant and negative.

vi. Oceania: Most of the countries are developed countries. Similarly to as in Europe, the citizens in Oceania would like to enjoy a stable price level, sustainable economic growth and a welfare state. In addition, they have a history of innovations in this field, i.e., the central bank in New Zealand was the first that became independent (Hayo and Voigt, 2008). The central bank is indeed granted more independence after CBI-reforms. Hence, CBI-reforms probably have a significant effect on inflation in Oceania.

The hypothesis to be tested in the next section is thus whether CBI-reforms have different effects on inflation in different parts of the world.

Chapter III Empirical Study

3.1 Data Description

The collected data includes 132 countries from 1980 to 2005 from different parts of the world. The data contains information about the inflation rate, GDP, unemployment, national debt, and inflation rate in previous years. This study aims at testing whether CBI-reforms have any significant effect on reducing inflation in different parts of the world, so the dependent variable in the model is inflation rate in period t (inflatio), which is measured by the annualized percentage change in consumer prices.

Then the variables are as follows: (1) $id2$ = a dummy variable for different

continents (1=Africa, 2=Asia, 3=Europe, 4=North America, 5=South America, 6=Oceania); (2) *dcbi* = a dummy variable equal to 1 after the introduction of a CBI-reform in countries that choose to do so, 0 otherwise. (3) *gdp* = gross domestic product per capita; *unemp* = unemployment rate; (4) *debt* = Total national debt³; (5) *inf10000*, *inf1000*, *inf500*, *inf100*, *inf50* and *inf25*= a dummy variable for hyperinflation (=1, if the inflation rate of country *i* above 10000%, 1000%, 500%, 100%, 50% and 25%, separately, =0 otherwise), in this case, hyperinflation is defined if yearly inflation is over 100%; (6) *year* = a trend variable indicates the period from 1980-2005 in this study (0=1980, 1=1981, ..., 25=2005); (7) *inf_lag1* = the inflation rate of country *i* in period *t*-1. The means and standard deviations (SD) of all the used variables in different regions of the world are presented in Table 1.

Table 1: Means and standard deviations of all the variables						
	Africa	Asia	Europe	NA*	SA**	Oceania
Variables	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<i>inflation</i>	12.83 (13.69)	10.76 (16.16)	8.75 (14.03)	11.26 (12.98)	21.45 (20.78)	6.62 (6.03)
<i>dcbi</i>	0.11(0.31)	0.16 (0.37)	0.33 (0.47)	0.19 (0.39)	0.49 (0.5)	0.18 (0.39)
<i>gdp</i>	1553.41 (2013.09)	4837.26 (6836.63)	13383.84 (9953.19)	7514.01 (8079.2)	3027.57 (2060.84)	5619.43 (6809.37)
<i>unemp</i>	9.58(2.14)	7.75 (9.35)	11 (44.03)	10.05(5.23)	9.59 (2.9)	8.62 (1.47)
<i>debt</i>	201088.3 (646177)	102665.7 (122072.8)	79465.14 (52354.97)	90286.91 (132248)	99428.18 (44971.3)	62638.32 (53037.24)
<i>inf_lag1</i>	13.93 (18.54)	15.36 (48.48)	49 (687.48)	11.94 (15.57)	101.24 (1233.47)	6.73 (6.1)
<i>year</i>	12.83 (7.49)	13.5 (7.45)	13.89 (7.53)	12.68 (7.56)	13.32 (7.56)	12.5 (7.52)

NA*: North America; SA**: South America

³ A problem when working with macro-data (i.e., *gdp*, *debt*) for the many countries considered here is missing data. A more detail description of the data can be found in Daunfeldt et al. (2008).

The descriptive statistics in Table 1 show that during the period 1980-2005, the EU and Oceania have had the lowest mean inflation rates, while Africa and South America have had the highest ones. As for CBI-reforms, Europe and South America have the highest mean values, indicating that those continents have had the highest share of country-years when $dcbi$ is equal to one. Africa has had the lowest value. Europe and North America have had the highest GDP in the world during the time under study; Africa and South America have had the lowest GDP. Europe and North America also have the highest unemployment, but not much higher than the rates in Africa and South America. The lowest unemployment rates are recorded in Asia and Oceania. As most countries in Africa are underdeveloped countries, they also have higher debt than other continents, while Oceania and Europe have the lowest value on national debt.

3.2 Econometric Analysis

The relationship between GDP and inflation is ambiguous. For instance, in China the consumer price index increased rapidly in 2010 after a fast growth in GDP in 2008 and 2009; while in some underdeveloped countries, inflation increased sharply during that time regardless of GDP-growth. From the descriptive statistics presented in Table 1, we also see that Africa and South America have the lowest GDP but the highest inflation compared with other continents.

Based on the Phillips curve, there should be a negative short run relationship between inflation and unemployment. The relationship between national debt and inflation should be positive. A country with a high national debt might finance this debt with loans from the central bank, which could induce high inflation. From Table 1, we see that there is a positive relationship between inflation and debt in each of the six continents, in which Africa and South America have the highest debt and inflation, and Europe and Oceania have the lowest debt and inflation. In general, inflation in period t will be affected by former inflation positively. Specifically, the inflation in the present year tends to be higher if the inflation is high in previous years. In this study,

the inflation rates in each country for the previous year are included.

The collected data are panel data for 132 countries over 25 years, with potential heteroskedasticity and autocorrelation problems. Introducing lags of the dependent variable, inflation, is a simple but effective way to deal with the autocorrelation problem, and models with up to four lags have been estimated. However, the results show that it was mainly the first lag that had a significant impact in the estimations⁴. In order to correct for a potential problem with heteroskedasticity, heteroskedasticity consistent standard errors are used in all estimations.

Thus, the following equation will be estimated for six different parts of the world: Africa, Asia, Europe, North America, South America, and Oceania:

$$\text{Model 1: } \inf_{it} = \alpha_0 + \alpha_i + \beta_1 dcbi_{it} + \beta_2 \ln(gdp_{it}) + \beta_3 unemp_{it} + \beta_4 \ln(debt_{it}) + \beta_5 \inf_lag1_{it-1} + \beta_6 year_{it} + \varepsilon_{it}$$

This is a 132 country dataset from 1980-2005, with both time-series and cross-sectional dimensions, called a panel dataset, where \inf_{it} measures the inflation rate in country i at time t . α_i are country specific fixed effects, included in order to indirectly capture the effect from time-invariant omitted variables on inflation. This means that a separate intercept is included in the regression equation for each country. $dcbi_{it}$ is a dummy variable taking the value one after CBI-reforms has been implemented in country i , zero otherwise. gdp_{it} and $debt_{it}$ measures the GDP and national debt in country i at time t , and in the regression model we use the log form of these variables. $unemp_{it}$ represents the unemployment rate in country i at time t .

⁴ Tests for autocorrelation have been performed (for a discussion, see appendix 1). These tests did not reveal any serious problems with autocorrelation.

inf_lag1_{it-1} shows that the inflation rate of country i in period $t-1$. year_{it} is a time trend included to capture possible time trends in the inflation level. Finally, ε_{it} is the stochastic error term including the effects of any omitted variables, such as measures of the money supply. According to Studenmund (2011), it will cause bias if a relevant variable is not included in the estimated equation, unless the omitted variable is perfectly uncorrelated with all the included independent variables—an extremely unlikely case. In this case, money supply should, for example, correlate to GDP and inflation in period $t-1$, thus the error term is no longer independent of the explanatory variables and the expected value of the estimated coefficients are biased. More specifically, assuming that the correlation between money supply and GDP and inf_lag1_{it-1} is positive and negative, respectively, the expected bias in the coefficient of gdp_{it} and inf_lag1_{it-1} is positive and negative, respectively⁵.

Since the data is divided into six different continents in the world, six models will be set up and estimated in the empirical analysis to test whether CBI-reforms have a significant effect on inflation in different parts of the world. Also, in order to avoid the influence of extreme values from hyperinflation, “inf100” is chosen to be a cut-off point. This means that only country-year observations where the inflation rates are below 100% are used in the estimation of the empirical models.

The regression equation presented above is used to test whether CBI-reforms have different effects on inflation in different parts of the world, using OLS regression. The estimated results are presented in Table 2.

⁵ Page 168-175 in Studenmund (2011), the equation for measuring omitted variable bias is given by $\text{Bias} = \beta_{om} \cdot f(r_{in,om})$. Therefore,

$$\text{Expected bias in } \hat{\beta}_{\text{gdp}} = \beta_{\text{money supply}} \cdot f(r_{\text{gdp, money supply}}) = (+) \cdot (+) = (+)$$

$$\text{Expected bias in } \hat{\beta}_{\text{inf_lag1}} = \beta_{\text{money supply}} \cdot f(r_{\text{inf_lag1, money supply}}) = (+) \cdot (-) = (-)$$

	Africa		Asia		Europe	
Variables	Estimate	S.e.	Estimate	S.e.	Estimate	S.e.
constant	-5.30	5.27	1.43	7.33	69.60**	10.44
$dcbi_{it}$	-2.38	1.60	-6.55**	1.66	-3.65**	1.24
$\ln(gdp_{it})$	-0.11	0.37	2.22**	1.00	-6.07**	1.04
$unemp_{it}$	-0.03	0.08	-0.003	0.01	-0.002	0.001
$\ln(debt_{it})$	1.22**	0.30	0.54	0.35	-0.30	0.18
inf_lag1_{it-1}	0.32**	0.06	0.12**	0.03	0.004**	0.002
$year_{it}$	-0.28**	0.06	-0.37**	0.09	-0.22**	0.08
	North America		South America		Oceania	
Variables	Estimate	S.e.	Estimate	S.e.	Estimate	S.e.
constant	-1.72	14.35	79.73**	26.36	10.81**	4.63
$dcbi_{it}$	-2.21	2.12	-12.32**	3.77	-1.76	1.40
$\ln(gdp_{it})$	0.82	1.36	-7.27**	2.91	-0.50	0.53
$unemp_{it}$	-0.04	0.21	-1.12**	0.42	-0.18	0.22
$\ln(debt_{it})$	-0.04	0.34	2.40**	0.55	0.23*	0.14
inf_lag1_{it-1}	0.35**	0.10	0.003**	0.0002	0.25	0.08
$year_{it}$	-0.27**	0.08	-0.24**	0.30	-0.15	0.08

** Significant at the 5 percent level, * Significant at the 10 percent level.

CBI-reforms have a significant impact on reducing inflation in Asia, Europe and South America. The result that CBI-reforms are efficient in reducing inflation, are in line with the results from Cukierman, Webb and Neyapti (1992), Daunfeldt et al. (2010) and the above theoretical analysis. The reduction in inflation due to CBI-reforms lies between 3.65 and 12.32.

GDP has a significant correlation with the levels of inflation in Europe and South America with a negative sign, where 1 percent increase in GDP is associated with a 6.07% and 7.27% reduction in the inflation rate, respectively. GDP has a significant

effect on inflation but with a positive sign in Asia, where a 1 percent increase in GDP is associated with a 2.22% increase in the inflation rate.

Unemployment has a significant negative correlation with inflation only in South America. Most of the countries in South America are developing countries, so the unemployment rate is larger and might therefore have more impact on inflation than the lower unemployment rates in developed countries. The inflation rate decrease with 1.12 percent when the unemployment rate increases by 1 percent.

National debt has a significant and positive correlation with inflation in Africa, South America and Oceania, indicating that governments of Africa, South America and Oceania tend to get loans from the central bank to solve budget deficit problems. A 1 percent increase in national debt is associated with a 1.22%, 2.4% and 0.23% increase in the inflation rate in Africa, South America and Oceania, respectively.

Inflation in the previous year has a positive, significant impact on current inflation in all continents, except Oceania. The time trend shows that inflation rates have been reduced during the time period under study in all continents, except Oceania. The negative sign shows that inflation is reduced as time goes by, holding all other variables, including CBI-reforms, constant.

In model 2, all the insignificant variables except $dcbi$ will be removed from the regressions for each continent in order to see if the results are stable with respect to changes in the econometric set-up of the model. Thus, the regression models to be estimated can be written as follows:

$$\text{Africa: } \inf_{it} = \alpha_0 + \alpha_i + \beta_1 dcbi_{it} + \beta_2 \ln(debt_{it}) + \beta_3 \inf_lag1_{it-1} + \beta_4 year_{it} + \varepsilon_{it}$$

$$\text{Asia: } \inf_{it} = \alpha_0 + \alpha_i + \beta_1 dcbi_{it} + \beta_2 \ln(gdp_{it}) + \beta_3 \inf_lag1_{it-1} + \beta_4 year_{it} + \varepsilon_{it}$$

$$\text{Europe: } \inf_{it} = \alpha_0 + \alpha_i + \beta_1 dcbi_{it} + \beta_2 \ln(gdp_{it}) + \beta_3 \inf_lag1_{it-1} + \beta_4 year_{it} + \varepsilon_{it}$$

$$\text{NA: } \inf_{it} = \alpha_0 + \alpha_i + \beta_1 dcbi_{it} + \beta_2 \inf_lag1_{it-1} + \beta_3 year_{it} + \varepsilon_{it}$$

$$\text{SA: } \inf_{it} = \alpha_0 + \alpha_i + \beta_1 dcbi_{it} + \beta_2 \ln(gdp_{it}) + \beta_3 unemp_{it} + \beta_4 \ln(debt_{it}) + \beta_5 \inf_lag1_{it-1} + \beta_6 year_{it} + \varepsilon_{it}$$

$$\text{Oceania: } \inf_{it} = \alpha_0 + \alpha_i + \beta_1 dcbi_{it} + \beta_2 \ln(debt_{it}) + \varepsilon_{it}$$

The results from these models are presented in Table 3:

	Africa		Asia		Europe	
Variables	Estimate	S.e.	Estimate	S.e.	Estimate	S.e.
constant	-6.13	5.26	5.61	6.29	66.71**	10.31
$dcbi_{it}$	-2.41	1.55	-6.31**	1.66	-3.55**	1.25
$\ln(gdp_{it})$			2.11**	0.99	-6.08**	1.04
$unemp_{it}$						
$\ln(debt_{it})$	1.22**	0.30				
inf_lag1_{it-1}	0.32**	0.06	0.12**	0.03	0.004**	0.002
$year_{it}$	-0.29**	0.05	-0.32**	0.08	-0.24**	0.08
	North America		South America		Oceania	
Variables	Estimate	S.e.	Estimate	S.e.	Estimate	S.e.
constant	5.13**	1.27	79.73**	26.36	9.01**	1.65
$dcbi_{it}$	-2.20	2.15	-12.32**	3.77	-4.56**	1.22
$\ln(gdp_{it})$			-7.27**	2.91		
$unemp_{it}$			-1.12**	0.42		
$\ln(debt_{it})$			2.40**	0.55	-0.01	0.12
inf_lag1_{it-1}	0.35**	0.10	0.003**	0.0002		
$year_{it}$	-0.25**	0.08	-0.24**	0.30		

** Significant at the 5 percent level, * Significant at the 10 percent level.

CBI-reforms have a statistically significant and negative impact on inflation for Asia, Europe, South America and Oceania, which means inflation rates have been reduced after CBI-reforms in these four continents. The reduction in inflation due to CBI-reforms lies between 3.55 and 12.32 percent.

GDP has a significant effect on inflation with a negative sign in Europe and South America, and 1% increase in GDP is associated with a 6.08% and 7.27% reduction in the inflation rate in Europe and South America, respectively. GDP has a significant

effect on inflation with a positive sign in Asia, where a 1% increase in GDP is associated with a 2.11% increase in the inflation rate.

Unemployment has a significant effect on inflation with a negative sign in South America, indicating that the inflation rate decreases when the unemployment rate increases. The inflation rate decreases by 1.12% when the unemployment rate increases by 1%.

The estimate for government debt is statistically significant and has a positive correlation with inflation in Africa and South America. In Africa, a 1% increase of government debt is associated with a 1.22% increase in the inflation rate. In South America, inflation will increase 2.4% if government debt rises by 1%.

The estimate for inflation in the previous year is statistically significant and positive in all of the continents except Oceania. Again the time trend effect is statistically significant and negative in all of the continents except Oceania. This suggests that with the exception of Oceania, the other continents have a clear time trend of lower inflation during the period 1980-2005 regardless of CBI-reforms.

Chapter IV Conclusion

It is widely believed that countries with a more independent central bank will have a lower inflation rate. And CBI-reforms have been one of the most significant waves during the last few decades worldwide. The theoretical background behind implementing CBI-reforms is that this policy probably can solve the time-inconsistency problem of monetary policy efficiently and therefore reduce inflation rates (Kydland and Prescott, 1977; Barro and Gordon, 1983; Rogoff, 1985). Some empirical studies have found that there is a negative relationship between the level of CBI and inflation, with a focus on the level of CBI (Alesina, 1988; Grill, Masciandaro and Tabellini, 1991; Loungani and Sheets, 1997). By contrast, some have argued that countries can achieve low inflation without CBI-reforms (Daunfeldt and de Luna, 2008; Campillo and Miron, 1997). Moreover, there are some empirical studies showing that different countries have had different effects on inflation when

implementing CBI-reforms (Landström, 2009; Cukierman, Webb and Neyapti, 1992; Daunfeldt et al., 2010).

The purpose of this study has been to analyze the effect of CBI-reforms on inflation in different parts of the world. Compared to previous studies, this study focuses on whether CBI-reforms have different effects on reducing inflation in different parts of the world by using a fixed effects panel data model. The estimations are based on a 132 country data-set from 1980 to 2005 compiled by Daunfeldt et al. (2008). Since countries in different continents have their own different culture, national situation, economic growth and tradition of monetary stability, they also have different reactions with CBI-reforms and inflation.

The results show that CBI-reforms are more efficient in reducing inflation in Asia, Europe, and South America than in other continents. The reduction in inflation due to the CBI-reforms ranges between 3.65 and 12.32. In order to study if the results are robust with respect to model specification, another model, taking away all of the insignificant variables has also been estimated. The results from these estimations indicated that CBI-reforms have a negative and statistically significant impact on inflation in Asia, Europe, South America and Oceania, and that the reduction in inflation due to the CBI-reforms varies between 3.55 and 12.32. As such, the results from this study show that CBI-reforms are efficient in bringing down inflation and that there are differences between different continents in how effective CBI-reforms have been.

i. In Africa, most of the countries are war-torn and underdeveloped countries. “There can be wide gaps between the formal, legal institutional arrangements and their practical impact in Africa,” (Walsh, 2005). Also according to the study of Agbeja (2007), “in Sub-Saharan Africa only South Africa is inflation targeting and rewarded with relatively stable prices. The rest of the Africa sub region should wake up and join the bandwagon of inflation target so as to reduce inflation and stabilize prices in the sub region”. In line with the above empirical study, CBI-reforms do not have any significant effect in bring down inflation in Africa since they have not executed a real CBI-reforms.

ii. In Asia, Most of the countries are developing countries characterized by a lower degree of political stability, thus CBI-reforms and the monetary policies for bringing down inflation are regarded as necessary and have a significant effect. In the empirical study, the effect of CBI-reforms on inflation is negative and statistically significant in Asia.

iii. In Europe, most of the countries are developed countries. Citizens prefer steady economic growth, and a welfare state, with a harmonious and stable social situation. The study of Cukierman et al. (1992) indicates that CBI-reforms are more sufficient for bringing down inflation in industrialized countries. In line with the empirical study, CBI-reforms are more efficient at reducing inflation in Europe.

iv. In North America, from the above empirical study in Model 1 and Model 2, CBI-reforms do not show a statistically significant impact on reducing inflation. Based on the theoretical study, the US has not executed a real CBI-reforms. "The US has become one of the least operationally independent of the central banks in the industrial world," (Willem Buiters, 2007). This is the main reason for the insignificant effect of CBI-reforms on inflation in North America.

v. In South America, According to Daunfeldt et al. (2010), CBI-reforms are more efficiency in bring down inflation in democratic countries with political instability. People do not trust the politicians in South America, so to delegate power from politicians to an independent central bank is required. Therefore, CBI-reforms are more efficiency in bringing down inflation in this continent.

vi. In Oceania, CBI-reforms have a statistically significant effect in reducing inflation rate. According to Cukierman et al. (1992), CBI-reforms are more sufficient for bringing down inflation in industries countries. In line with the empirical study, CBI-reforms thus have a significant effect on inflation in Oceania.

In a word, the results in this study indicate that CBI-reforms can be successful in reducing inflation in most regions of the world (Asia, Europe, South America and Oceania).

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Appendix

A. 1 Autocorrelation Tests

We test for autocorrelation by regressing the residual on the lagged value of the residual (1 lag) and all other independent variables used in the Model 1 and Model 2, respectively. The results show that there is a statistically significant parameter estimate for the first lag of the residual for all six specifications, but also that the parameter estimates of the autocorrelation coefficient lie between 0.00003 and 0.08 in Model 1, and between 0.00003 and 0.33 in Model 2. As such, no adjustment for autocorrelation has been made in the specifications estimated and presented in this study, although we have included the one year lag of the inflation rate. This removes the statistically significant autocorrelation without changing the qualitative results presented in this study.