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# Towards External Debt Reduction through Inflation Targeting: An Empirical Evaluation of Middle-income Countries

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## Abstract

This study analyses the impact of inflation targeting on the external debt of middle-income countries using the propensity score matching (PSM) method. The results indicate that the adoption of inflation targeting is associated with a significant decrease in external debt, with an average reduction estimated at approximately 15.16 percentage points. This reduction reflects the enhanced credibility of monetary policy, which lowers the risk of default on public debt. These findings suggest that inflation targeting can be a useful tool for managing external debt and reducing fiscal pressures on public finances, but its effectiveness depends on its integration within a broader economic policy framework tailored to each country's specific conditions.

**Keywords:** Inflation targeting, external debt, middle-income countries, propensity score matching, macroeconomic policy

**JEL Classification:** E52, F34, O57, C14, E61

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# 1. Introduction

The external debt of middle-income countries represents a major challenge to their financial stability and sustainable development. According to recent IMF data (2021), the external debt burden of many middle-income countries is increasing, raising concerns about their ability to manage debt servicing costs in a volatile global financial environment. These countries are often exposed to external shocks, such as pandemics and geopolitical conflicts, which can exacerbate their vulnerability to external debt crises. In this context, effective monetary policies, such as inflation targeting (IT), have become crucial tools for mitigating these risks and ensuring macroeconomic stability.

Middle-income countries have widely adopted inflation targeting, which involves setting explicit targets for inflation rates and adjusting interest rates to meet these targets, since the 1990s. This framework has helped reduce inflation volatility, stabilize exchange rates and improve investor confidence, which in turn can help reduce external debt. However, the effectiveness of inflation targeting in reducing external debt remains a matter of debate, particularly in the face of external shocks such as the COVID-19 pandemic and the war between Russia and Ukraine. Some studies suggest that inflation targeting can enhance monetary credibility, reduce borrowing costs and improve access to international financial markets, which can contribute to more effective external debt management (Frankel, 2010; Mishra and Montiel, 2013).

In this context, several studies have emphasized of economic policy adjustments in addressing the challenges posed by the pandemic. Ouakil *et al*. (2024a) illustrated that fiscal policy modifications during the COVID-19 pandemic, together with unorthodox monetary policy measures, were crucial in alleviating inflation and controlling debt in Morocco. Similarly, Moustabchir *et al*. (2023) studied how hybrid financial DSGE-SIR models, which contain pandemic-related shocks, have helped address the economic repercussions of COVID-19 on debt and inflation. These studies have underlined the relevance of policy coordination and institutional robustness in influencing the efficacy of inflation targeting in controlling foreign debt during crises.

In addition to the epidemic, geopolitical conflicts have also provided considerable obstacles for middle-income countries. The Russia-Ukraine conflict, for example, has disrupted global oil markets and worsened inflationary pressures. Moustabchir *et al*. (2024) studied the effect of this war on Morocco's economy using a DSGE model, illustrating how inflation targeting may assist in stabilizing macroeconomic circumstances amid such external shocks. El Ouazzani *et al*. (2023) further underlined that, although inflation targeting may assist macroeconomic stability, its efficacy in decreasing foreign debt during crises relies on

variables such as fiscal discipline and external financing circumstances. El Ouazzani *et al*. (2024a) adopted a DSGE model with labour market frictions and Nash-type wage bargaining to investigate the link between monetary policy and unemployment in Morocco. Their research demonstrated how monetary policy, when paired with labour market changes, may reduce unemployment while stabilizing prices, indirectly contributing to improved debt control via economic stability.

In this study, we examine the impact of adopting an inflation targeting policy on external debt reduction in middle-income countries. Our hypothesis is that inflation targeting contributes to external debt reduction by strengthening fiscal discipline, increasing creditworthiness and attracting more stable capital flows. This premise is backed by economic theory and empirical research, which suggest that inflation targeting positively affects important macroeconomic variables, such as the real exchange rate, interest rates and the current account balance (Lin and Ye, 2009; Minea *et al*., 2021). In addition, the adoption of inflation targeting during times of crisis, particularly during the COVID-19 pandemic and in the face of geopolitical and climate-related shocks such as the (Russian-Ukrainian) war, underscores its importance as a policy tool for managing external debt in volatile environments (Moustabchir *et al.*, 2023; Ouakil *et al.,* 2024b; Moustabchir and Ouakil, 2023; El Ouazzani *et al.,* 2025).

To test this hypothesis, we apply a propensity score matching approach to compare countries that have embraced inflation targeting with those that have not, adjusting for important economic factors. Our research is based on yearly data from 1990 to 2020 for a sample of middle-income countries, including 19 countries that have adopted inflation targeting. Our findings indicate that inflation targeting reduces foreign debt by roughly 10 percentage points on average, highlighting its potential as a policy tool for managing external debt in middle-income countries.

The rest of this article is organized as follows: Section 2 covers the current research into inflation targeting and foreign debt. Section 3 summarizes the stylized facts and features of the data utilized in the study. In Section 4, we describe the method used to measure the effects, making sure that there is balance and support between the treatment and control groups. In Section 5, we summarize our findings. Finally, Section 6 concludes with policy implications and ideas for further study.

## 2. Literature Review

Since its introduction in the 1990s, inflation targeting (IT) has become increasingly popular as a monetary policy tool to improve macroeconomic stability. In fact, inflation targeting aims to ensure price stability by setting explicit medium-term inflation targets and adjusting

monetary policy rates to achieve them. Initially adopted by advanced economies, inflation targeting has gradually been introduced in middle-income countries, where debt dynamics are influenced by external shocks and institutional capacities. The effectiveness of IT in reducing external debt remains a subject of debate in economic research, with results varying depending on institutional, fiscal and macroeconomic contexts.

Lin and Ye (2009) argued that IT promotes fiscal discipline in middle-income and emerging economies by stabilizing inflation expectations and reducing exchange rate volatility. This stability indirectly alleviates external debt pressures by enhancing fiscal balance and mitigating uncertainty. However, they emphasize that the success of IT requires strong institutional and governance structures. Similarly, Frankel (2010) contended that IT bolsters monetary policy credibility, reduces borrowing costs and improves access to international capital markets. By attracting stable capital inflows and lowering default risks, IT facilitates improved external debt management. Frankel highlighted the broader benefits of IT in strengthening macroeconomic management and market confidence, linking these advantages to its effectiveness in debt reduction. In contrast, Petrevski (2023) reviewed empirical evidence on IT in middle-income countries and reported mixed outcomes. While some economies achieved lower inflation and reduced external debt, others saw limited improvements due to weak institutional frameworks and insufficient central bank independence. Petrevski concluded that IT success depends on factors such as prior disinflation efforts, exchange rate flexibility and financial market maturity. This evidence suggests that IT is not universally effective but contingent on country-specific characteristics, with institutional quality emerging as a critical factor.

Minea *et al*. (2021) highlighted the role of strong institutions in amplifying IT fiscal benefits, enabling significant improvements in external debt metrics. Their findings underscore the need for complementary institutional reforms to maximize IT potential, particularly in countries aiming to stabilize fiscal outlooks and debt trajectories. Apeti *et al*. (2023) focused on the fiscal implications of IT over three decades, analysing 89 middle-income countries. They found that IT indirectly reduces external debt by curbing current expenditures and fostering fiscal discipline, contributing to long-term debt sustainability. Dridi and Boughrara (2023) took a financial market perspective, examining the role of IT in stabilizing stock market volatility. They showed that by reducing market fluctuations, IT supports more stable debt dynamics, as lower volatility correlates with reduced sovereign risk premiums. This link between financial stability and debt management highlights the broader macroeconomic benefits of IT.

Overall, the literature offers mixed but generally positive evidence regarding the effectiveness of IT in reducing external debt in middle-income countries. While many studies have emphasized the importance of strong institutions, fiscal discipline and financial stability in enhancing IT outcomes, others have highlighted challenges in countries with weak governance and financial systems. The findings suggest that the success of IT is not automatic and depends heavily on complementary reforms, pre-existing conditions and the broader macroeconomic environment. In conclusion, while IT holds potential for addressing external debt challenges, its implementation must be tailored to specific national contexts, with a focus on strengthening institutional frameworks and fiscal governance to ensure effectiveness.

## 3. Data and Stylized Facts

Our study aims to examine the impact of inflation targeting on middle-income countries' external debt. To achieve this, we compiled an annual dataset that includes key macroeconomic variables, such as external debt, inflation targeting status and other explanatory factors that may influence the relationship between these variables. The dataset covers 36 countries classified as middle-income according to the WB's income classification, ensuring that our analysis focuses on countries with similar economic contexts and challenges.

We divided the countries in our sample into two groups. The treatment group consists of 18 countries that adopted inflation targeting policies between 1990 and 2019. The control group, which also includes 18 countries, comprises those that have not adopted inflation targeting but share similar economic characteristics with the treatment group. These characteristics include comparable income levels, inflation rates, external debt ratios and exchange rate regimes. The selection of the control group was guided by these economic similarities to ensure a fair comparison and to reduce bias in the estimation of the causal effect of inflation targeting.

The data for our analysis were sourced from reliable international institutions such as IMF (2020) and WB (2020). These institutions provide consistent and comprehensive economic indicators, allowing us to accurately classify the countries and ensure the robustness of our analysis. In addition to external debt and inflation targeting, we include variables such as public expenditures, GDP growth rates and exchange rate regimes to control for other factors that may influence external debt dynamics.

Table 1 presents the list of countries included in the study, along with their respective dates of adoption of inflation targeting policies.

**Table 1: Countries in database with years of adoption of inflation targeting**

| Country adopting IT | Year of adoption and fluctuation band | Country without IT |
|---|---|---|
| Albania | 3% ± 1 (2009) | Algeria |
| Armenia | 4% ± 1.5 (2006) | Angola |
| Azerbaijan | 4% ± 2 (2018) | Bhutan |
| Belarus | 5% ± 1 (2016) | Republic of the Congo |
| Bolivia | 5% ± 2 (2003) | Djibouti |
| Cambodia | 3% ± 1 (2019) | Eswatini |
| Georgia | 3% ± 1.5 (2009) | Guinea |
| Ghana | 8% ± 2 (2007) | Haiti |
| Guatemala | 4% ± 1 (2005) | Iran |
| Honduras | 4% ± 1 (2010) | Jordan |
| Indonesia | 3% ± 1 (2005) | Lesotho |
| Kyrgyzstan | 5% ± 1.5 (2010) | Lebanon |
| Mongolia | 8% ± 2 (2007) | Micronesia |
| Nigeria | 9% ± 3 (2007) | Myanmar |
| Paraguay | 4% ± 2 (2011) | Nicaragua |
| Philippines | 3% ± 1 (2002) | Uzbekistan |
| Serbia | 3% ± 1.5 (2009) | Sudan |
| Ukraine | 5% ± 1 (2016) | Morocco |

Note: IT stands for inflation targeting.
Source: IMF (2024) and WB (2024)

To assess external debt, we used the external debt-to-GDP ratio, which reflects the burden of external debt relative to the size of the economy. Data on inflation, public expenditures as a percentage of GDP, GDP per capita growth and total foreign exchange reserves were sourced from the IMF (2020). Additionally, we used the financial openness index, computed using the Chinn–Ito index (KAOPEN), which measures the degree of capital account

openness in each country. The Chinn–Ito index is based on binary variables representing restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) (Chinn and Ito, 2006). This index serves as an additional explanatory variable and a control variable in our matching method.

In this section, we also present stylized facts derived from the data, which highlight the relationship between inflation targeting and external debt in middle-income countries. First, we compare average inflation rates between countries that have adopted inflation targeting (treatment group) and those that have not (control group).

**Table 2: Variable definitions and sources**

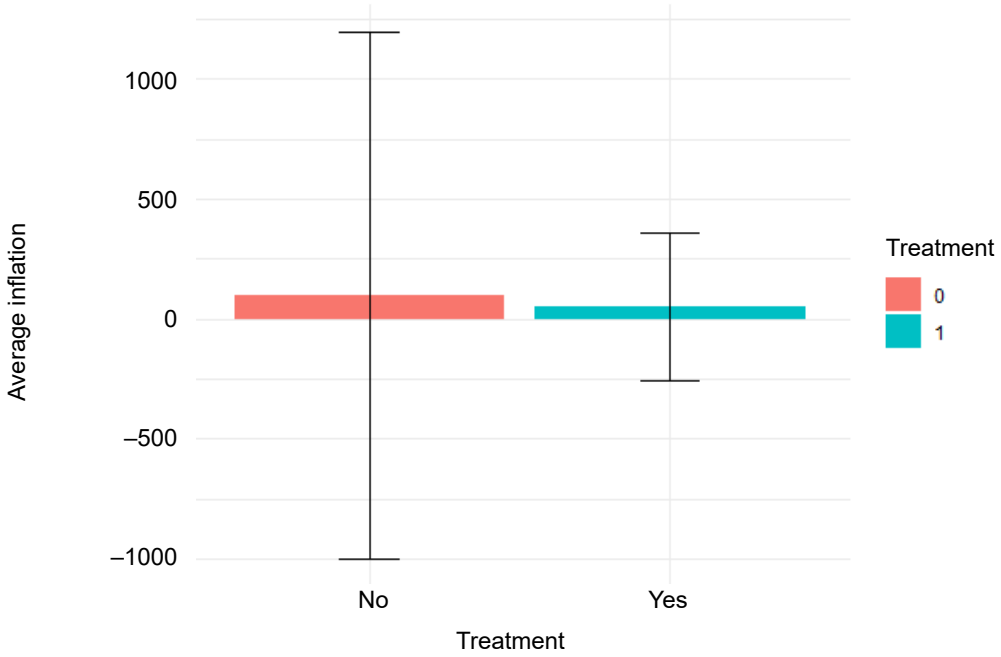
| Variable | Definition | Source |
|---|---|---|
| ***IT*** | A binary variable that takes the value 1 if a country adopts inflation targeting, and 0 otherwise | BIS (2024) |
| ***External_Debt*** | The total amount of central government external debt minus external assets (such as foreign reserves or sovereign wealth fund holdings) as a percentage of GDP | WB (2024) |
| ***FDI*** | Net inflows of foreign direct investment as a percentage of GDP | WB (2024) |
| ***Inflation*** | The annual inflation rate, lagged by one year, measured by the percentage change in the consumer price index (CPI) | IMF (2024) |
| ***Expenditure_GDP*** | Total government expenditures as a percentage of GDP | WB (2024) |
| ***GDP_Capita_Growth*** | The annual percentage growth rate of GDP per capita, calculated using constant local currency | WB (2024) |
| ***Open_Fin_Index*** | The Chinn–Ito index (KAOPEN), which measures a country's degree of capital account openness | Chinn–Ito index |
| ***Total_Res_External_Debt*** | Total reserves as a percentage of total foreign debt | WB (2024) |

Source: Authors' own elaboration

Figure 1 illustrates that the average inflation rate for countries without inflation targeting is 48.4%, while for countries with inflation targeting, the average is 49.4%. Despite the relatively close averages between the two groups, the figure highlights notable variabil-

ity in inflation rates, as indicated by the error bars. This suggests that inflation dynamics differ significantly across countries, reflecting diverse macroeconomic conditions and external pressures. These results highlight the role of inflation targeting in supporting more predictable inflation trajectories, contributing to greater macroeconomic stability in middle-income countries.

**Figure 1: Average inflation in countries adopting and not adopting IT**

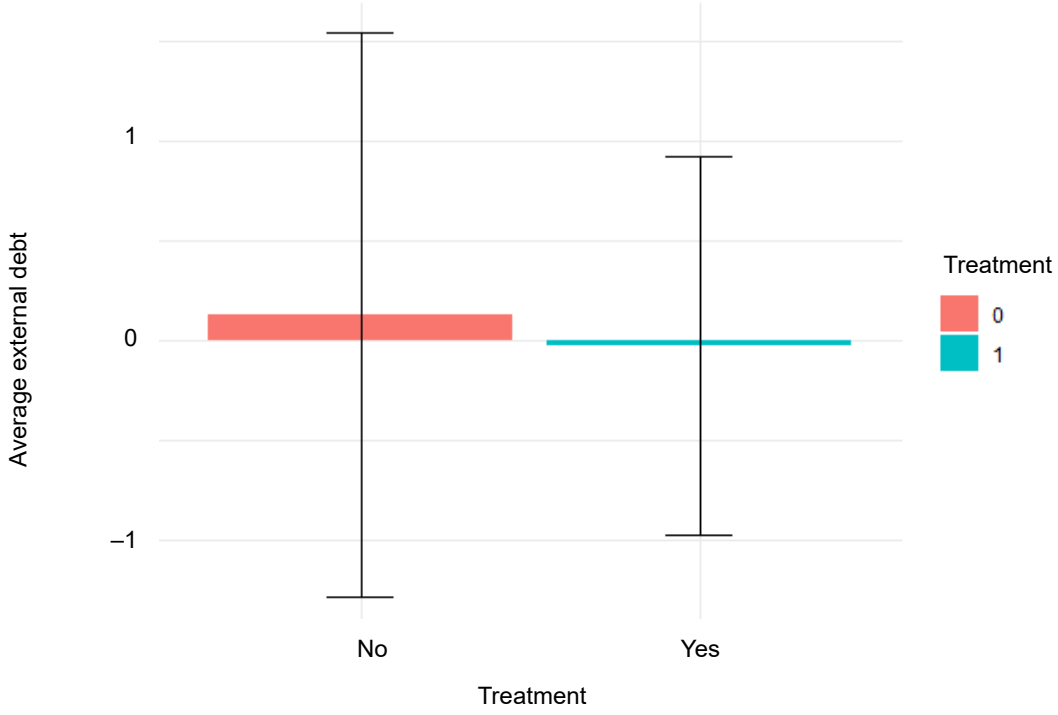



Note: The error bars reflect the interval of variability around the inflation mean for each group (treatment and control).

Source: Authors' own calculations (software R)

Next, we analyse the average levels of external debt between the two groups. Figure 2 shows that countries with inflation targeting exhibit an average external debt level of –2.2% of GDP, compared to 8.8% of GDP for countries without inflation targeting. The figure also highlights that inflation-targeting countries tend to have lower variability in external debt levels, as reflected in smaller error bars compared to non-targeting countries. This observation suggests that inflation targeting is associated with more disciplined fiscal management and enhanced macroeconomic stability. By contrast, non-targeting countries display greater variability in external debt, potentially reflecting more volatile economic conditions or less consistent fiscal policies. Figure 2 illustrates a link between inflation targeting and improved external debt sustainability, as well as reduced fiscal risks in middle-income economies.

**Figure 2: Average external debt in countries adopting and not adopting IT**




Note: The error bars represent the interval of variability around the mean of external debt for each group (treatment and control).

Source: Authors' own calculations (software R)

## 4. Methodology

Using propensity score matching (PSM), we look at how targeting inflation affects the reduction of middle-income countries' external debt. This methodological framework makes it possible to correct for selection biases that could distort the results by comparing countries that have adopted inflation targeting with others that are economically similar but have not. This technique, widely used in empirical economics (Ouakil *et al*., 2024c; El Ouazzani *et al*., 2024b), guarantees better validity of comparisons between groups.

The propensity score is determined by modelling the probability of a country adopting inflation targeting as a function of key economic variables: the level of external debt, the inflation rate, GDP per capita growth and the degree of financial openness. These indicators, selected on the basis of economic studies (Lin and Ye, 2009; Mishra and Montiel, 2013), capture the major determinants influencing both the use of inflation targeting and debt trends. By controlling for these factors, SHP ensures that the treated (inflation-targeting) and

control (non-targeting) groups are comparable, thereby reducing the risk of estimation errors and making it possible to isolate the specific economic effect of inflation targeting on external debt.

These characteristics are selected on the basis of well-established economic literature and include variables such as external debt levels, inflation rate, GDP per capita growth, financial openness, public spending and total reserves. Indeed, the inclusion of external debt is based on the work of Reinhart and Rogoff (2010), who showed that high levels of external debt can dampen economic growth and increase vulnerability, particularly in developing countries. The inflation rate, meanwhile, occupies a central place in the literature on inflation targeting, notably in studies by Svensson (1997) and Mishkin (2001), who highlighted its role in economic stability. In order to measure economic development, we use GDP per capita growth, a widely accepted indicator in the growth literature, as explained by Barro (1996).

Financial openness, as measured by the Chinn–Ito index (Chinn and Ito, 2006), is a crucial indicator for understanding the integration of national economies into international financial markets. Increased openness has a strong influence on capital movements and can modify the dynamics of economic stability, as demonstrated by Obstfeld and Taylor (2004) in their study of historical trends on global capital markets. The public spending variable was included in the model by Alesina and Ardagna (2010), who demonstrated how public spending influences both short-term economic output and long-term debt sustainability. As a last resort, total reserves are used as a measure of resilience to external shocks, based on the work of Frankel and Saravelos (2010), who highlighted the role of reserves in preventing financial crises, particularly in emerging markets.

The propensity score for each country is estimated using a logistic regression model. In this model, the dependent variable is binary, indicating whether a country has adopted inflation targeting, while the independent variables include the key economic indicators. The equation for estimating the propensity score is as follows:

$$\log\left(\frac{P(IT_i = 1|X_i)}{1-P(IT_i = 1|X_i)}\right) = \beta_0 + \beta_1 External_Debt_i + \beta_2 FDI_i + \beta_3 Inflation_i + \beta_4 Expenditure_GDP_i + \beta_5 GDP_Capita_Growth_i + \beta_6 Open_Fin_Index_i + \beta_7 Total_Res_External_Debt_i \quad (1)$$

where $\frac{P(IT_i = 1|X_i)}{1-P(IT_i = 1|X_i)}$ is the probability that the country $i$ adopts inflation targeting given its economic characteristics $X_i$. The coefficients $\beta_0$, …, $\beta_6$ represent the relationship between

the independent variables and the likelihood of adopting inflation targeting. This model generates a propensity score for each country, which serves as the basis for the matching process.

## 4.1 Propensity score matching approach

Following propensity score estimation, we match countries that have adopted inflation targeting (treatment group) with those that have not (control group) according to their propensity scores. This matching is carried out using the nearest neighbour method, where each treated country is matched with a control country having the most similar propensity score. To ensure accurate matches, a calliper is used to limit the maximum acceptable distance between matched propensity scores, thus reducing the risk of inappropriate matches. In addition, matching on income categories, as defined by the World Bank, is imposed. This ensures that countries in the treatment and control groups belong to the same income class, thus eliminating potential biases linked to differences in income levels. This step is fundamental to isolating the real effect of inflation targeting on external debt, without interference from basic economic disparities.

The matching proceeds under the assumption of common support, which requires that there be sufficient overlap in the propensity scores of treated and untreated countries. This ensures that valid comparisons can be made between the two groups and that the treatment effect is estimated only for the region of common support where both treated and untreated countries have similar propensity scores. Mathematically, this is expressed as: $0 < Pr\,(IT_i = 1) \mid S(X_i) < 1$ for all $X_i$ within the common support.

This assumption is crucial for the robustness of the analysis, as it ensures that the matched treated and control countries are comparable in terms of their economic characteristics.

## 4.2 Conditional independence assumption

For the PSM method to yield unbiased estimates of the causal effect, the assumption of conditional independence must hold. This assumption implies that, after controlling for the propensity score and other covariates, the adoption of inflation targeting is independent of the potential outcomes for external debt. In other words, once the observable characteristics are accounted for, the decision to adopt inflation targeting should not be correlated with what would have happened to a country's external debt in the absence of inflation targeting. Formally, this assumption can be written as:

$$IT_i \perp (Y_{i1}, Y_{i0}) \mid S(X_i) \quad (2)$$

Here, $IT_i$ denotes the treatment indicator, representing whether the country $i$ adopted inflation targeting, $Y_{i1}$ represents the external debt outcome for countries that adopted inflation targeting, and $Y_{i0}$ represents the counterfactual external debt outcome for those same countries had they not adopted inflation targeting. The propensity score $S(X_i)$ is used to ensure that the treated and control groups are comparable in terms of their potential outcomes, thus allowing an unbiased estimation of the treatment effect.

### 4.3 Estimating average treatment effect on treated (ATT)

Once the matching process is complete, we estimate the average treatment effect on the treated (ATT) to measure the impact of inflation targeting on external debt. The ATT quantifies the difference between the actual external debt levels of countries that adopted inflation targeting and the counterfactual external debt levels that they would have experienced had they not adopted this policy. The ATT is calculated as follows:

$$ATT_{External_Debt} = E(External_Debt_{i1} \mid IT_i = 1) - E(External_Debt_{i0} \mid IT_i = 1) \quad (3)$$

where $E$ ($External_Debt_{i1} \mid IT_i = 1$) represents the expected external debt for countries that adopted inflation targeting and $E$ ($External_Debt_{i0} \mid IT_i = 1$) represents the counterfactual external debt for those countries, estimated using the matched control group. The ATT provides a direct measure of the causal effect of inflation targeting on external debt reduction, helping us evaluate the effectiveness of this policy in improving debt outcomes for middle-income countries.

## 5. Empirical Results

### 5.1 Statistical analysis

Table 3 provides an overview of the descriptive statistics for the main variables used in this study, enabling a better understanding of the characteristics of the sample. These statistics are crucial in laying the foundations for the empirical analysis by summarizing the central trends and variability in the data. A detailed analysis of these descriptive statistics also enables an initial exploration of the relationships between inflation targeting (IT), external debt (*External_Debt*) and other macroeconomic variables.

**Table 3: Descriptive statistics**

| Variable | Obs. | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|---|
| ***IT*** | 1110 | 0.4852 | 0.5001 | 0.0000 | 1.0000 |
| ***External_Debt*** | 1079 | 0.04008 | 1.1960 | −2.83216 | 9.81001 |
| ***FDI*** | 1110 | 3.4508 | 5.2486 | −37.1726 | 55.0729 |
| ***Inflation*** | 1110 | 71.515 | 773.9266 | −16.860 | 23,773.132 |
| ***Expenditure_GDP*** | 1110 | 15.34 | 11.5289 | 0.0000 | 65.23 |
| ***GDP_Capita_Growth*** | 1110 | 2.099 | 5.9716 | −45.325 | 46.471 |
| ***Open_Fin_Index*** | 1335 | 0.4052 | 0.3665 | 0.0000 | 1.0000 |
| ***Total_Res_External_Debt*** | 1110 | 72.616 | 288.0185 | 0.0000 | 3,840.101 |

Source: Authors' own calculations (software R)

According to the data in Table 3, the variable corresponding to inflation targeting (IT) has an average value of 0.4852, indicating that just under half the countries in the sample have adopted this monetary policy. This result reflects the gradual adoption of inflation targeting in middle-income countries over the period studied while underlining the fact that this approach is not yet in the majority among the countries in the sample. External debt (*External_Debt*) has an average value of 0.04008, suggesting that, on average, net external debt represents around 4.01% of GDP in the countries studied. This relatively low ratio shows that these countries generally maintain moderate levels of external debt, although there are significant variations within the sample. Foreign direct investment (FDI) averages 3.4508, indicating that net FDI flows represent around 3.45% of GDP. This underlines the ability of the middle-income countries in the sample to attract a significant level of foreign investment, which can play an important role in their ability to repay their external debt and stabilize their economies. Finally, inflation shows a highly variable distribution, with a mean of 71.515 and a standard deviation of 773.9266. This high variability reflects the diversity of macroeconomic conditions in the countries studied, many of which continue to face inflationary pressures despite the adoption of inflation targeting frameworks.

Public spending as a percentage of GDP (*Expenditure_GDP*) averages 15.34%. This figure highlights the important role played by governments in the economies studied. This measure is particularly useful for analysing the relationship between fiscal discipline, inflation targeting and their implications for external debt management. Average annual growth

in GDP per capita (*GDP_Capita_Growth*) is 2.099%, or an average rate of 2.10%. This reflects moderate economic progress in middle-income countries, although there are significant disparities between the countries in the sample. The financial openness index (*Open_Fin_Index*) shows an average value of 0.4052, indicating that several countries remain rather closed to international financial markets. However, the median value of 0 illustrates a marked heterogeneity in terms of financial integration among the countries studied. The average total reserves, expressed as a percentage of external debt (*Total_Res_External_Debt*), is 72.616%. This means that, on average, the countries studied have sufficient reserves to cover 72.62% of their external debt. This strong ratio reflects the ability of these countries to meet their external financial obligations and limit their exposure to international economic vulnerabilities.

## 5.2 Equilibrium between treatment and control groups after matching

Following the descriptive statistics for important variables reported in Table 3, we progress to generating the logistic regression coefficients employed in the propensity score matching (PSM) technique. The findings, described in Table 4, give useful insights into the effect of inflation targeting on external debt reduction in middle-income countries. Specifically, the table indicates the efficacy of the matching procedure in aligning the features of the treatment group (countries that implemented inflation targeting) and the control group (countries that did not), enabling more exact comparisons.

The matching procedure seeks to reduce early inequalities between these groups. Table 4 illustrates the changes in important variables before matching (Diff.Un) and after matching (Diff.Adj), demonstrating the usefulness of this strategy. Indeed, inflation, an important variable for understanding external debt dynamics, had a difference of −0.1509 between the treatment and control groups before matching, which was corrected to −0.1514 after matching. This small change, albeit not statistically significant, demonstrates that the matching procedure preserved the baseline inflation difference while accounting for other affecting variables. The PSM technique effectively eliminated differences across multiple variables, guaranteeing that the treatment and control groups are equivalent in terms of important economic measures, including inflation, external debt ratios and GDP growth. This comparability is crucial for drawing accurate causal conclusions on the connection between inflation targeting and foreign debt reduction. The continuous difference in inflation before and after matching suggests that inflation remains a steady factor influencing foreign debt, independent of inflation targeting adoption. By accounting for other complicating factors, the matching method gives a deeper understanding of the precise effect of inflation targeting on foreign debt.

**Table 4: Comparison of characteristics before and after matching between treatment and control groups**

| Summary of balance for all data | | | |
|---|---|---|---|
| | **Means treated** | **Means control** | **Standardized mean difference** |
| ***Distance*** | 0.5037 | 0.4678 | 0.4590 |
| ***FDI*** | 4.1785 | 2.7649 | 0.2252 |
| ***Inflation*** | 49.4231 | 92.3380 | −0.1389 |
| ***Expenditure_GDP*** | 15.7670 | 14.9453 | 0.0715 |
| ***GDP_Capita_Growth*** | 2.2486 | 1.9572 | 0.0423 |
| ***Open_Fin_Index*** | 0.4132 | 0.3977 | 0.0451 |
| ***Total_Res_External_Debt*** | 37.3733 | 105.8347 | −1.6303 |
| **Summary of balance for matched data** | | | |
| | **Means treated** | **Means control** | **Standardized mean difference** |
| ***Distance*** | 0.5037 | 0.4854 | 0.2343 |
| ***FDI*** | 4.1785 | 2.9226 | 0.2001 |
| ***Inflation*** | 49.4231 | 97.6040 | −0.1559 |
| ***Expenditure_GDP*** | 15.7670 | 15.4568 | 0.0270 |
| ***GDP_Capita_Growth*** | 2.2486 | 1.9024 | 0.0503 |
| ***Open_Fin_Index*** | 0.4132 | 0.4075 | 0.0165 |
| ***Total_Res_External_Debt*** | 37.3733 | 38.4673 | −0.0261 |

| Sample sizes | | |
|---|---|---|
| | **Control** | **Treated** |
| **All** | 540 | 509 |
| **Matched** | 509 | 509 |
| **Unmatched** | 31 | 0 |
| **Discarded** | 0 | 0 |

Source: Authors' own calculations (software R)

**Table 5: Tests of mean difference for control variables**

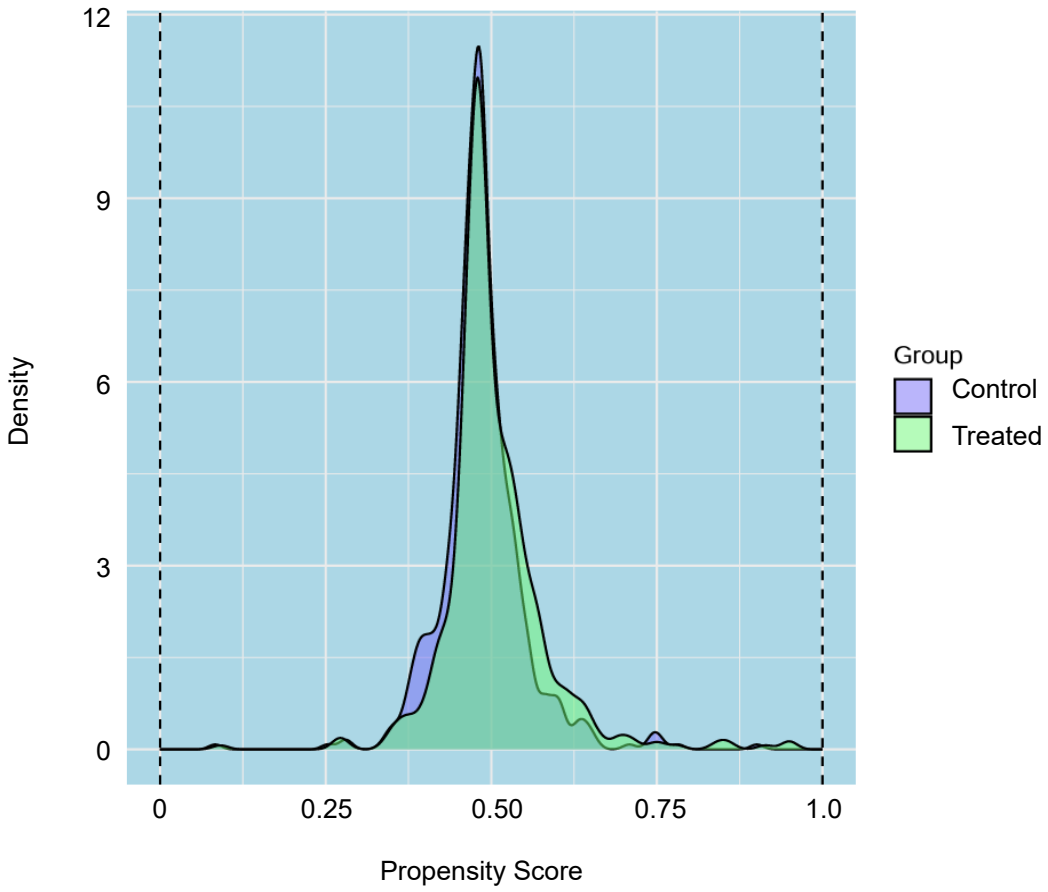
| Variable | *p*-value |
|---|---|
| ***FDI*** | 0.12 |
| ***Inflation*** | 0.09 |
| ***Expenditure_GDP*** | 0.03 |
| ***GDP_Capita_Growth*** | 0.15 |
| ***Open_Fin_Index*** | 0.01 |
| ***Total_Res_External_Debt*** | 0.12 |

Source: Authors' own calculations (software R)

The effectiveness of the matching procedure, represented by the limited variances between the groups after matching, offers a good foundation for further study. This meticulous use of the PSM technique assures that pre-existing group differences do not distort the data, allowing a comprehensive analysis of the influence of inflation targeting on decreasing external debt among middle-income countries. By correcting the differences, the matching procedure strengthens the reliability of the results and permits a deeper study of the links between inflation targets, inflation trends and foreign debt in these countries.

Figure 3 clearly illustrates a large overlap in the distribution of inflation targeting propensity scores between the treatment and control groups, demonstrating that the common support area has been effectively accomplished. This overlap implies that the two groups have equal levels of inflation targeting propensity scores throughout a considerable chunk of the distribution, ensuring that the comparison between the groups is both fair and equitable. This is a significant feature of our analysis, as it increases the validity of our results on the influence of inflation targeting on foreign debt in middle-income countries.

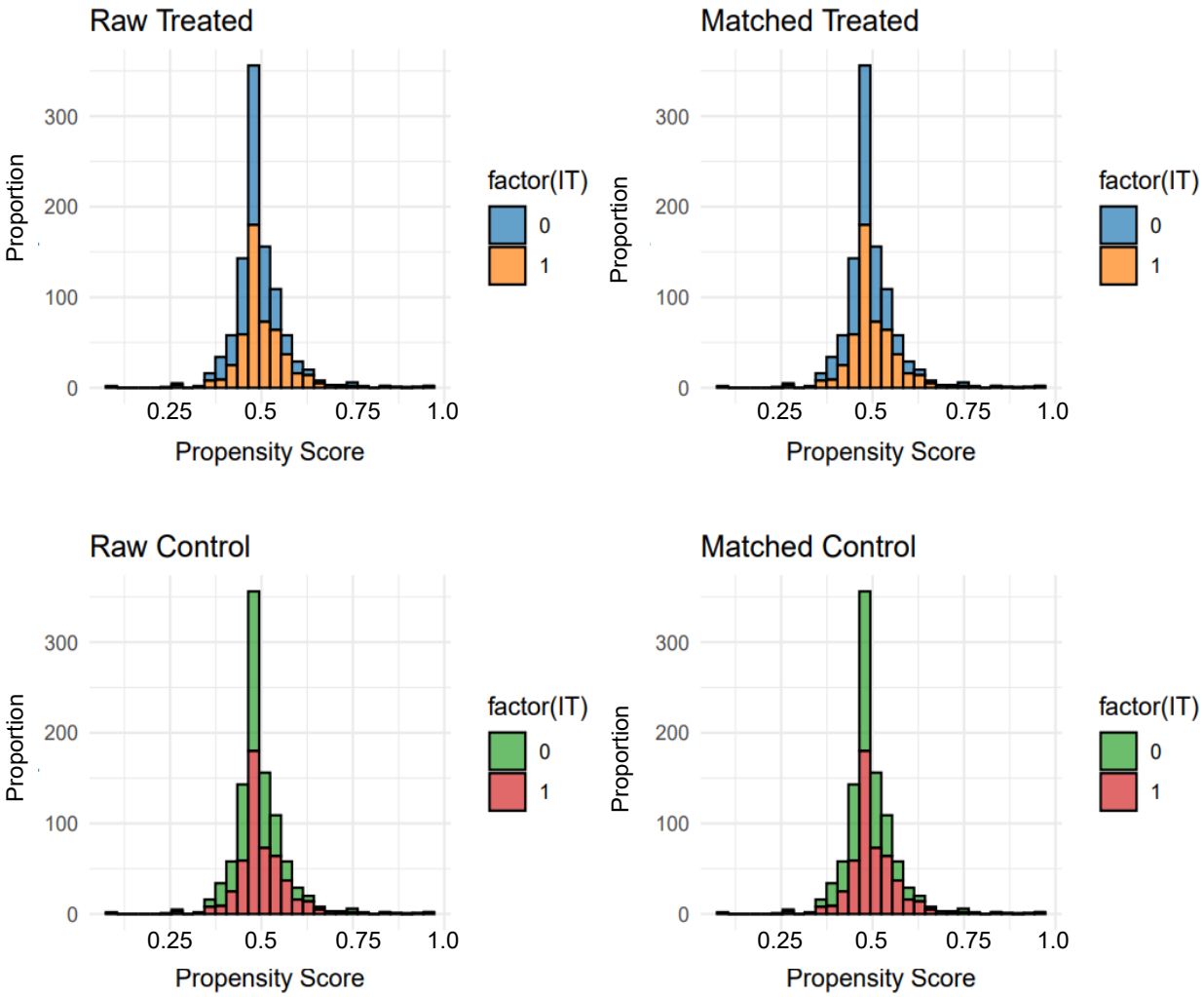
**Figure 3: Propensity score density distribution (common support)**




Source: Authors' own calculations (software R)

Similarly, Figure 4 displays the distribution of propensity ratings for the treatment and control groups following the matching procedure. This figure further confirms that the common support zone is sufficiently fulfilled since the propensity score distributions show a significant overlap. The high overlap after the matching procedure reveals that the propensity score distributions of the two groups are tightly matched, giving strong support for the shared support assumption, which is crucial for confirming the validity of our empirical findings. This alignment implies that the matching procedure has successfully balanced the observable traits of the treatment and control groups, strengthening the validity of our findings about how inflation targeting affects the reduction of external debt and improving the robustness of our analysis.

**Figure 4: The distribution of propensity scores for treatment and control groups after matching**




Source: Authors' own calculations (software R)

## 5.3 Estimated treatment effects (ATT)

Our data, depicted in Table 6, indicates a substantial relationship between inflation targeting (IT) and the decrease of foreign debt in middle-income countries. The calculated coefficient for the IT variable is negative and statistically significant at the 5% level, which demonstrates that the implementation of inflation targeting substantially helps lower external debt, even after accounting for other explanatory factors. The estimated impact of −0.1516 implies that a country adopting inflation targeting decreases its foreign debt by an average of 15.16 percentage points compared to a country that does not execute this strategy. This conclusion supports the hypothesis that inflation targeting promotes macroeconomic stability, lowers

inflation volatility and lessens the dangers associated with over-indebtedness. The negative coefficient accords with economic theory, demonstrating that this strategy generates a situation supports effective debt management. Moreover, the intercept of our model, representing the average level of external debt in countries without inflation targeting, is positive and significant at the 5% level. The coefficient of 0.12946 indicates that these countries, on average, have an external debt that is 12.946 percentage points higher than that of countries that have adopted inflation targeting. This result provides a clear overview of the baseline debt levels in countries not implementing this monetary policy.

These results corroborate the work of Lin and Ye (2009), who demonstrated, through a similar propensity score matching (PSM) methodology, that inflation targeting plays a significant role in reducing economic instability and has positive effects on the management of external debt. Thus, the present analysis confirms that inflation targeting is an effective tool for reducing external debt in middle-income countries, provided it is accompanied by coherent fiscal policies and strong institutional frameworks.

**Table 6: Estimated treatment effects (ATT)**

| Variable | Estimate | Std. error | *t*-value | *P* > \|*z*\| |
|---|---|---|---|---|
| ***Intercept*** | 0.12946 | 0.05348 | 2.420 | 0.0157* |
| ***IT* (inflation targeting), (1 vs. 0)** | −0.15161 | 0.07564 | −2.004 | 0.0453* |

Note: * denotes statistical significance at the 5% level.

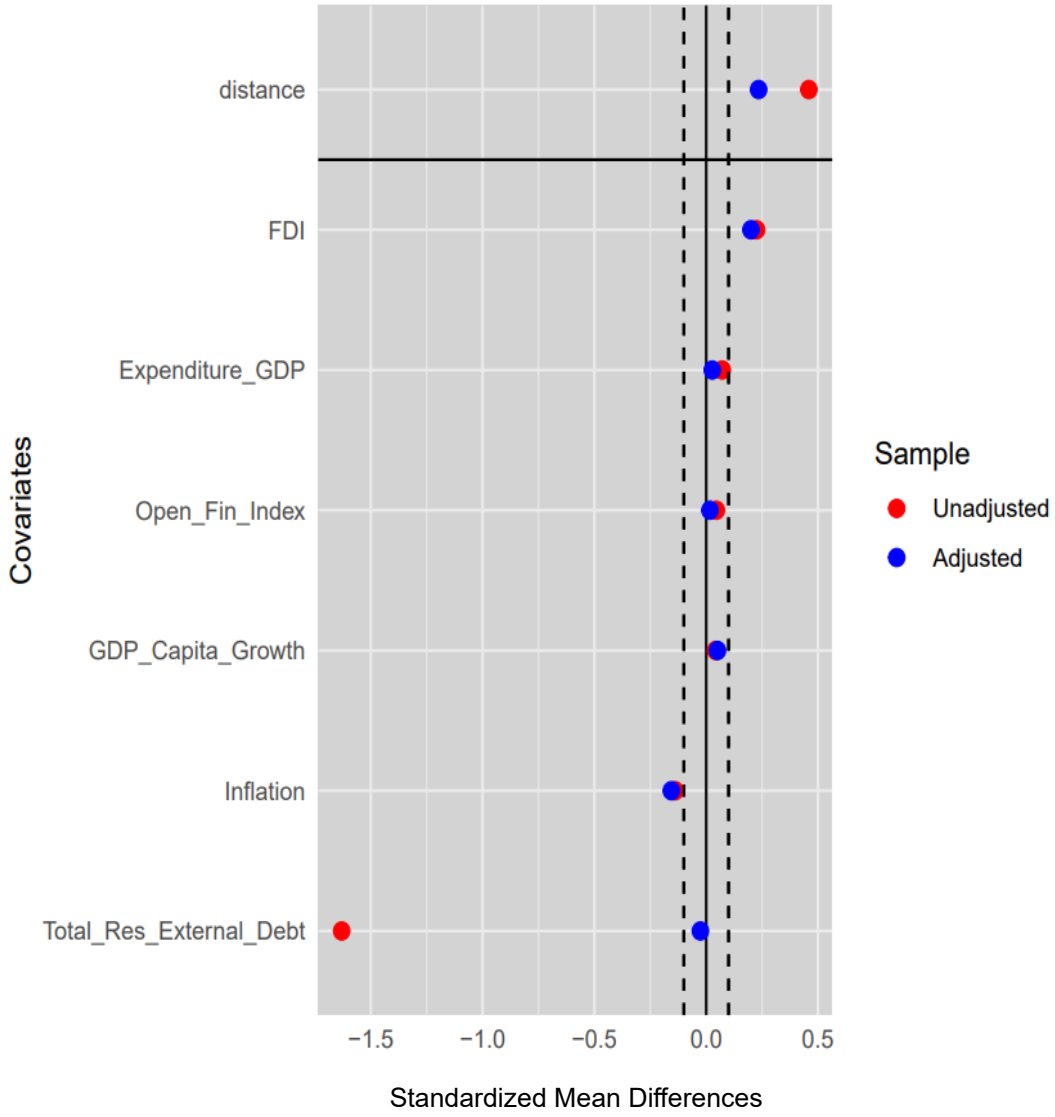
Source: Authors' own calculations (software R)

## 5.4 Quality of matching

The efficiency of the propensity score matching (PSM) approach adopted in this research is critical for obtaining unbiased estimates of the causal impact of inflation targeting on foreign debt reduction in middle-income countries. To measure the quality of the matching process, we analysed the balance of variables both before and after matching. This analysis is crucial for verifying that the matching has succeeded in reducing the initial differences between countries that have adopted inflation targeting (treatment group) and those that have not (control group). By mitigating these gaps, it becomes possible to isolate the actual effect of inflation targeting on external debt while avoiding biases caused by other variables (Rosenbaum and Rubin, 1983). Figure 5 illustrates the standardized mean differences

for important variables before and after matching, with unadjusted differences depicted in red and adjusted differences in blue. The factors analysed are inflation, foreign direct investment (FDI), GDP per capita growth, government spending as a proportion of GDP and the total reserves relative to external debt. Prior to matching, there were large imbalances between the treatment and control groups across various covariates, with major disparities in variables such as "*Total_Res_External_Debt*" and "*Inflation*". These imbalances might possibly skew the estimates of the treatment impact if not effectively addressed (Frankel, 2010).

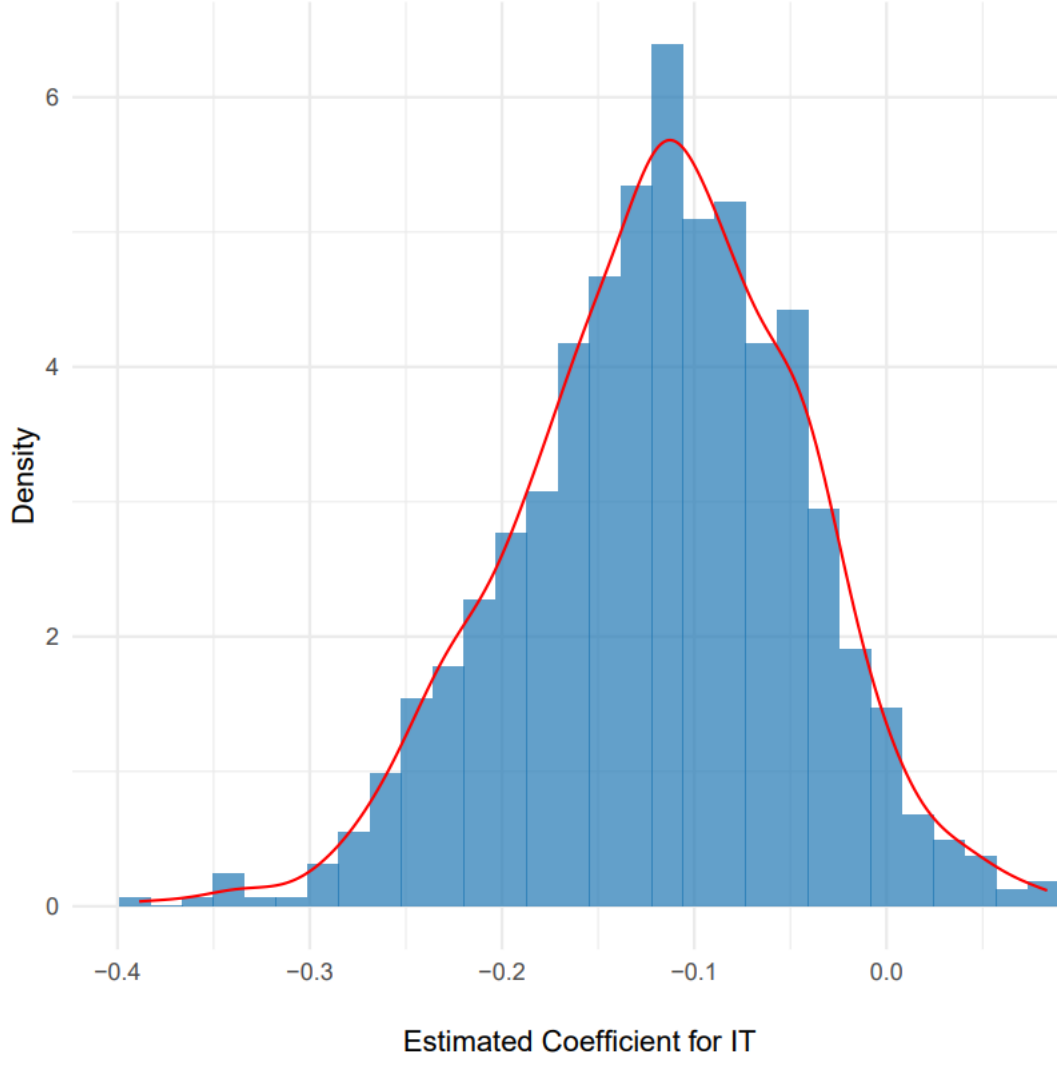
**Figure 5: Covariate balance before and after matching**




Source: Authors' own calculations (software R)

Following the application of the PSM approach, the disparities across most factors were greatly reduced. Indeed, the post-matching balance for inflation and total reserves relative to foreign debt improved dramatically, demonstrating that the matching procedure effectively corrected the initial anomalies. This improved balance is critical because it guarantees that our comparisons between treatment and control groups are not confounded by large variations in key economic factors (Givord, 2014). Moreover, the dashed lines at −0.1 and 0.1 in Figure 5 illustrate the universally recognized levels for appropriate covariate balancing. Most variables now fall within these limits, improving the robustness of the matching process and boosting the validity of the causal conclusions generated from the study.

**Figure 6: Bootstrap distribution of treatment effect (IT on external debt)**




Source: Authors' own calculations (software R)

Further establishing the robustness of our matching approach, we do a bootstrap study on the predicted treatment effects. Figure 6 displays the distribution of the estimated coefficients from 1,000 bootstrap samples, displaying a very symmetric and bell-shaped curve. This distribution suggests that the estimated impacts of inflation targeting external debt are steady and consistent across multiple bootstrap samples, strengthening the trustworthiness of our empirical results. The bootstrap approach enables us to analyse the variability of the treatment effect estimates and verifies that the findings are not susceptible to sample fluctuations, which increases the robustness of our conclusions (Lin and Ye, 2009).

The stability exhibited in Figure 6 further underscores the veracity of our results about the influence of inflation targeting on foreign debt. The bell-shaped distribution shows that the treatment effect estimates are resistant to diverse resamplings of the results, which adds extra confidence in the findings produced from the propensity score matching technique. Moreover, the concentration of the estimated treatment effects around a central value strengthens the conclusion that inflation targeting considerably reduces external debt in middle-income countries, with a consistent impact reported across several bootstrapping iterations (Minea *et al*., 2021). In combination, Figures 5 and 6 illustrate the efficacy of the PSM technique and the stability of our results. The improvement in covariate balance, as shown in Figure 5, demonstrates that the matching technique significantly lowered the bias between the treatment and control groups, enabling a more realistic comparison of external debt outcomes. According to Frankel (2010), these findings highlight the value of inflation targeting as a tool for policymakers looking to reduce foreign debt in middle-income countries and support their sustainable growth and financial stability.

## 6. Conclusion

The present study focused on the influence of inflation targeting on the amount of foreign debt in middle-income countries, utilizing a propensity score matching (PSM) approach to adjust pre-existing imbalances and derive accurate causal findings. The results of our research reveal that inflation targeting is related to a significant decrease in the foreign debt-to-GDP ratio, with an average fall of 15.16 percentage points. These results confirm the idea that inflation targeting strengthens the credibility of monetary policy, thereby reducing the risk of sovereign default and contributing to financial stability. This is consistent with the idea that inflation targeting constitutes a useful macroeconomic strategy in developing countries (Lin and Ye, 2009; Minea *et al*., 2021). Consequently, El Ouazzani *et al*. (2024c) provided additional insights into the issue of inflation. They demonstrated, through a DSGE model, that pursuing higher inflation targets (high objective) requires the implementation of restrictive monetary

policies to control inflation deviations, thereby avoiding exceedances that could disrupt economic balance. This reinforces the previous idea of the inflation targeting strategy as a means to reduce external debt in developing or middle-income countries.

These findings have important policy implications. For middle-income countries dealing with external debt restrictions and economic fragility, inflation targeting may be effective tool for macroeconomic stabilization. Inflation targeting lowers borrowing costs and minimizes default risks by anchoring inflation expectations and minimizing inflation volatility, ultimately leading to a more sustainable debt trajectory. However, the effectiveness of inflation targeting is predicated on the provision of supporting institutional frameworks, including central bank independence, credible fiscal policy and openness in policy execution. These complementing aspects are critical for maintaining inflation control and avoiding the possible detrimental impacts of monetary policy mishandling (Frankel, 2010). Despite the documented advantages, it is essential to recognize that inflation targeting is not always applicable. When implementing this method, policymakers must take into account specific economic conditions, institutional competencies and political stability. To succeed, inflation targeting must be part of a comprehensive political strategy that includes fiscal policies, flexible exchange rates and robust institutional guarantees. In the absence of these criteria, inflation targeting could encounter difficulties in controlling the general price level and achieving the intended economic objectives (Lin and Ye, 2013). Moreover, the trade-offs associated with inflation targeting, such as potential short-term sacrifices in production or employment, must be managed carefully to avoid unexpected negative repercussions. The results highlight the role of inflation targeting as a method of reducing external debt and enhancing macroeconomic stability in middle-income countries. Our results highlight the need to maintain strong institutional frameworks for the successful implementation of inflation targeting policies. For policymakers, the statistics presented here show that inflation targeting may be a useful instrument for addressing foreign debt issues, but it must be used carefully within a larger, cohesive economic policy framework.

This paper contributes to the growing body of information about inflation targeting in developing countries, emphasizing its relevance in ensuring financial stability and debt sustainability. More research is needed to improve our understanding of the long-term implications of inflation targeting and to investigate its interactions with other economic policies and conditions, especially in a rapidly changing global economic context. This work also paves the way for future research by proposing several avenues for exploration. Firstly, a thorough understanding of the interactions between inflation targeting and other macroeconomic factors, such as institutional quality and foreign capital flows, could offer valuable insights into the conditions under which this policy is most effective. Secondly, broaden-

ing the analysis to include other economic and financial indicators – such as exchange rate volatility and budget deficits – would allow an assessment of the overall economic impact of inflation targeting. Finally, a longitudinal study exploring the long-term effects of inflation targeting on debt sustainability, macroeconomic performance and financial market stability would enrich our understanding of the effectiveness of this policy over time.

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