

ESSAYS ON INFLATION DYNAMICS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

TURAL YUSİFZADA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
THE DEPARTMENT OF ECONOMICS

AUGUST 2024

Approval of the thesis:

ESSAYS ON INFLATION DYNAMICS

submitted by **TURAL YUSİFZADA** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Economics, the Graduate School of Social Sciences of Middle East Technical University** by,

Prof. Dr. Sadettin KİRAZCI
Dean
Graduate School of Social Sciences

Prof. Dr. Onur YILDIRIM
Head of Department
Department of Economics

Assoc. Prof. Dr. Dilem YILDIRIM KASAP
Supervisor
Department of Economics

Assoc. Prof. Dr. Hasan CÖMERT
Co-Supervisor
Trinity College
Department of Economics

Examining Committee Members:

Assoc. Prof. Dr. Mustafa Aykut ATTAR (Head of the Examining Committee)
Hacettepe University
Department of Economics

Assoc. Prof. Dr. Dilem YILDIRIM KASAP (Supervisor)
Middle East Technical University
Department of Economics

Assoc. Prof. Dr. Munis Seven AĞIR
Middle East Technical University
Department of Economics

Assoc. Prof. Dr. Emel MEMİŞ PARMAKSIZ
Ankara University
Department of Economics

Assoc. Prof. Dr. İlhan Can ÖZEN
Middle East Technical University
Department of Economics



I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name: Tural YUSİFZADA

Signature:

ABSTRACT

ESSAYS ON INFLATION DYNAMICS

YUSİFZADA, Tural

Ph.D., The Department of Economics

Supervisor: Assoc. Prof. Dr. Dilem YILDIRIM KASAP

Co-supervisor: Assoc. Prof. Dr. Hasan CÖMERT

August 2024, 158 pages

This thesis comprises three distinct essays that examine inflation dynamics, with a particular emphasis on emerging economies. The primary focus of the first essay is to explore the factors contributing to high and volatile inflation in emerging economies as compared to advanced economies. Adopting a structural, institutional, and historical perspective, this essay delves into how global imbalances within the world system lead to distinct inflation dynamics in emerging and advanced economies. The essay posits that exchange rate dynamics resulting from imbalances in the balance of payments, insufficient supply chain systems, the institutional power of firms, asymmetric price settings, and unanchored inflation expectations are the principal causes of high and volatile inflation in emerging economies relative to advanced ones. Building upon insights from structural and institutional inflation dynamics, the second essay examines the determinants of "high inflation." By employing a panel probit model to assess the likelihood of "high inflation" occurrences, the essay develops a novel early warning model for "high inflation." This model underscores that exchange rates serve as the primary driver of "high inflation," with approximately 25% depreciation signaling a "high inflation" probability exceeding 80% in middle-income countries and

70% in high-income countries. The third essay takes a novel approach by exploring climate change as a previously unexplored determinant of inflation. Initially, it consolidates five critical climate variables into a distinct climate index to assess short- and long-term climate change. Using this innovative index, the essay finds that 77% of the analyzed countries are significantly affected by climate change.

Keywords: Inflation, Structural/Institutional Dynamics, High Inflation, Early Warning Model, Exchange Rate



ÖZ

ENFLASYON DİNAMİKLERİ ÜZERİNE MAKALELER

YUSİFZADA, Tural

Doktora, İktisat Bölümü

Tez Yöneticisi: Doç. Dr. Dilem YILDIRIM KASAP

Ortak Tez Yöneticisi: Doç. Dr. Hasan CÖMERT

Ağustos 2024, 158 sayfa

Bu tez, özellikle gelişmekte olan ekonomilere vurgu yaparak enflasyon dinamiklerini inceleyen üç ayrı makaleden oluşmaktadır. İlk makalenin ana odağı, gelişmiş ekonomilere kıyasla gelişmekte olan ekonomilerde yüksek ve oynak enflasyona katkıda bulunan faktörleri araştırmaktır. Yapısal, kurumsal ve tarihsel bir perspektif benimseyen bu makale, dünya sistemindeki küresel dengesizliklerin gelişmekte olan ve gelişmiş ekonomilerde nasıl farklı enflasyon dinamiklerine yol açtığını incelemektedir. Makale, ödemeler dengesindeki dengesizliklerden kaynaklanan döviz kuru dinamiklerinin, yetersiz tedarik zinciri sistemlerinin, firmaların kurumsal gücünün, asimetrik fiyat belirlemenin ve çıpalamamış enflasyon beklentilerinin, gelişmiş ekonomilere kıyasla gelişmekte olan ekonomilerdeki yüksek ve değişken enflasyonun başlıca nedenleri olduğunu öne sürmektedir. İkinci makale, yapısal ve kurumsal enflasyon dinamiklerinden yola çıkarak "yüksek enflasyonun" belirleyicilerini incelemektedir. "Yüksek enflasyonun" ortaya çıkma olasılığını değerlendirmek için bir panel probit modeli kullanan makale, "yüksek enflasyon" için yeni bir erken uyarı modeli geliştirmektedir. Bu model, döviz kurlarının "yüksek enflasyonun" başlıca itici gücü olduğunu ve yaklaşık %25'lik değer kaybının orta

gelirli  lkelerde %80'i, y ksek gelirli  lkelerde ise %70'i aŗan bir "y ksek enflasyon" olasılıđına iŗaret ettiđini vurgulamaktadır.     nc  makale, iklim deđiŗikliđini enflasyonun daha  nce keŗfedilmemiŗ bir belirleyicisi olarak araŗtırarak yeni bir yaklaŗım benimsemektedir. İlk olarak, kısa ve uzun vadeli iklim deđiŗikliđini deđerlendirmek i in beŗ kritik iklim deđerŗkenini ayrı bir iklim endeksinde birleŗtirmektedir. Bu yenilik i endeksi kullanarak, makale incelenen  lkelerin %77'sinin iklim deđerŗikliđinden  nemli  l  de etkilendiđini buluyor.

Anahtar Kelimeler: Enflasyon, Yapısal/Kurumsal Dinamikler, Y ksek Enflasyon, Erken Uyarı Modeli, D viz Kuru



To my family



ACKNOWLEDGMENTS

The author wishes to express profound gratitude to his supervisor, Assoc. Prof. Dr. Dilem Yıldırım Kasap, and co-supervisor, Assoc. Prof. Dr. Hasan Cömert, for their invaluable guidance, advice, constructive criticism, insights, and encouragement throughout this process. Special thanks are also extended to Asst. Prof. Dr. Ömer Kağan Parmaksız and Assoc. Prof. Dr. Mustafa Aykut Attar for their timely interventions and insightful suggestions for each chapter of the thesis. The author also deeply appreciates Assoc. Prof. Dr. Emel Memiş Parmaksız, Assoc. Prof. Dr. Munis Seven Ağır, and Assoc. Prof. Dr. İlhan Can Özen for serving on the examining committee and providing valuable comments and contributions.

The author is particularly grateful to Adviye Hazal Güzel for her assistance throughout the administrative process. Additionally, heartfelt thanks go to the author's colleagues at the Central Bank for their friendship and support during the thesis journey. Lastly, and most importantly, the author extends sincere thanks to his family and friends for their unwavering support and encouragement in overcoming the challenges faced during this process; "Surely with hardship comes ease."

TABLE OF CONTENTS

PLAGIARISM	iii
ABSTRACT	iv
ÖZ.....	vi
DEDICATION	viii
ACKNOWLEDGMENTS.....	ix
TABLE OF CONTENTS.....	x
LIST OF TABLES	xiii
LIST OF FIGURES.....	xiv
LIST OF ABBREVIATIONS	xvi
CHAPTERS	
1. INTRODUCTION.....	1
2. STRUCTURAL INFLATION DYNAMICS IN DEVELOPING COUNTRIES ..	13
2.1. Stylized facts about inflation dynamics	15
2.1.1. Consumer basket shares and food commodities	21
2.2. Imbalances in the world system	25
2.2.1. Current and financial account imbalances	25
2.2.2. Supply chain.....	32
2.2.3. Profit and markup-led inflation.....	35
2.3. Propagation and expectations.....	36
2.4. Concluding remarks	39
3. IS “HIGH INFLATION” ALWAYS AND EVERYWHERE AN EXCHANGE RATE PHENOMENON?	41
3.1. Literature review	43

3.1.1.	What is the “high” level of inflation?	43
3.1.2.	Theoretical framework of determinants of inflation.....	47
3.2.	Data and descriptive statistics	54
3.2.1.	Data preparation.....	54
3.2.2.	Descriptive statistics	56
3.3.	Panel Probit Model.....	60
3.4.	Results	65
3.5.	Discussion and robustness	71
3.5.1.	Robustness check of “high inflation” thresholds	71
3.5.2.	Endogeneity check.....	72
3.5.3.	Robustness check of demand	73
3.5.4.	Sole depreciation-based Panel Probit Model	75
3.6.	Concluding remarks	79
4.	GLOBAL INFLATION DYNAMICS IN THE FACE OF CLIMATE CHANGE: A UNIFIED APPROACH USING THE CLIMATE CONDITION INDEX (CCI)	82
4.1.	Literature review	84
4.1.1.	Theoretical framework of determinants of inflation.....	84
4.1.2.	Where should climate change be placed in the theoretical framework of determinants of inflation?	86
4.2.	Data and Methodology	89
4.3.	Results	94
4.4.	Discussion	99
4.5.	Concluding remarks	102
5.	CONCLUSION	104
	REFERENCES.....	107
	APPENDICES	

A. DATA SOURCES, ADDITIONAL FIGURES AND TABLES.....	124
a. Data	124
b. New Keynesian inflation derivation.....	126
c. Countries analyzed in Chapter 4	137
B. CURRICULUM VITAE.....	138
C. TURKISH SUMMARY / TRKE ZET	140
D. THESIS PERMISSION FORM / TEZ İZİN FORMU	158



LIST OF TABLES

Table 3.1 “High Inflation” Threshold Literature Review: The Panel Analyzes	45
Table 3.2 “High Inflation” Threshold Literature Review: Country-specific Analyses	46
Table 3.3 Hausman Test Results for Unobserved Variable Endogeneity	61
Table 3.4 Estimation Results	65
Table 3.5 Robustness Checks for “High Inflation” Threshold	72
Table 3.6 Test Results for Observed Variable Endogeneity	73
Table 3.7 Estimation Results for Panel Probit Model with Output Gap	75
Table 3.8 Estimation Results of the Random Effects Panel Probit Model Only Depend on the Exchange Rate	77
Table 4.1 Model Properties	93
Table a.1 Analyzed Countries	124
Table b.1 Analyzed Countries	132
Table b.2 Lag Selection	135
Table b.3 Estimation Results for Oil Importers	136
Table c.1 Countries' Group Specifications	137

LIST OF FIGURES

Figure 2.1 Inflation Dynamics Across Country Groups	16
Figure 2.2 Productivity Growth and Hourly Compensation Growth in the US	18
Figure 2.3 Consumer Basket Shares Across Country Groups	21
Figure 2.4 Inflation and Food Commodity Inflation Relationship.....	23
Figure 2.5 Inflation and Climate Change Relationship.....	24
Figure 2.6 The Ratio of Large Company Revenue to GDP	26
Figure 2.7 Current and Financial Account Imbalances.....	27
Figure 2.8 Domestic Currency Depreciation Against USD	28
Figure 2.9 Exchange Rate Depreciation and Federal Funds Effective Rate	29
Figure 2.10 Inflation Dynamics and Exchange Rate Depreciation Against USD	31
Figure 2.11 Exchange Rate Depreciation Dynamics Across Country Groups	32
Figure 2.12 Inflation Dynamics Across Regional Groups	34
Figure 2.13 Non-Financial Corporate Profit Margins in the US.....	36
Figure 2.14 Inflation Expectations	38
Figure 3.1 Outlier Detection.....	55
Figure 3.2 Outlier Detection for Energy Commodity Inflation	55
Figure 3.3 “High Inflation” Episodes.....	57
Figure 3.4 Determinants of Inflation.....	59
Figure 3.5 Actual “High Inflation” Episodes vs. Predicted Probabilities	68
Figure 3.6 “High Inflation” Probabilities in Response to Shocks to Determinants ...	71
Figure 3.7 Exchange Rate and Inflation Dynamics in Selected Countries	76
Figure 3.8 Predicted Probabilities that Only Depend on the Exchange Rate.....	79
Figure 4.1 Climate Variables	90
Figure 4.2 Climate Condition Index (CCI)	94
Figure 4.3 Responses of Prices to the CCI.....	97
Figure 4.4 Structural Differences in Response to the CCI Across Income Groups ...	98
Figure 4.5 Structural Differences in Response to the CCI Across Export Status	99
Figure 4.6 Comparison of Climate Indices	101

Figure a.1 Outlier Detection..... 125

Figure a.2 Outlier Detection for Energy Commodity Inflation..... 126

Figure b.1 Inflation Associated with Determinants Beyond the 75th Percentile 133

Figure b.2 Determinants of Beyond-High Inflation..... 134



LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
ASEAN	Association of Southeast Asian Nations
BIC	Bayesian Information Criterion
BP	Breakpoint
BS	Balassa - Samuelson
CCI	Climate Condition Index
CPI	Consumer Price Index
FRED	Federal Reserve Economic Data
FX	Foreign Exchange
GCRI	Global Climate Risk Index
GDP	Gross Domestic Product
HP	Hodrick - Prescott filter
HQ	Hannan - Quinn criterion
IFS	International Financial Statistics
IQR	Interquartile Range
IV	Instrument Variables
LA	Latin America
PCA	Principal Component Analysis
Q1	25th percentile
Q3	75th percentile
RMSE	The Root Mean Squared Error
ULC	Unit Labor Cost
UMC	Unit Material Cost
USD	United States Dollar
VECM	Vector Error Correction Model

CHAPTER 1

INTRODUCTION

This thesis consists of three separate essays that focus on inflation dynamics, especially in emerging economies. The theme of the first essay is the reasons for high and volatile inflation in emerging economies compared to advanced ones. Based on a structural, institutional, and historical perspective, it focuses on how global imbalances in the world system result in different inflation dynamics in emerging and advanced economies. This essay suggests that exchange rate dynamics resulting from balance of payment imbalances, inadequate supply chain systems, firms' institutional power, asymmetric price setting, and unanchored inflation expectations are the primary reasons for high and volatile inflation in emerging economies compared to advanced ones. Drawing from structural and institutional inflation dynamics, the second essay analyzes the "high inflation" determinants. Utilizing a panel probit model to identify the probability of "high inflation" occurrence, the essay creates a novel early warning "high inflation" model. This model emphasizes that exchange rates are the primary source of "high inflation," where approximately 25% depreciation alerts "high inflation" with a probability of more than 80% in middle-income and 70% in high-income countries. The third essay, on the other hand, focuses on an unexplored inflation determinant: climate change. Firstly, it consolidates five essential climate variables into a unique climate index to measure short- and long-term climate change. Utilizing this novel index, it measures the impact of climate change on inflation in analyzed countries. The essay shows that climate change significantly affects 77% of the studied countries, with impacts observed to be four times higher in emerging economies than in advanced ones, contributing to global imbalances resulting in different inflation dynamics in emerging economies.

These three essays fall within the realm of inflation dynamics, primarily examining

the structural and institutional differences between emerging and advanced economies. While each essay explores various facets of inflation, they collectively conclude that inflation is primarily a reflection of structural global imbalances in the world system rather than a purely monetary phenomenon. As a result, we anticipate that these essays will make a valuable contribution to the general understanding of inflation dynamics and the policymaking process related to price stability, particularly in emerging economies.

We start with a fundamental study of inflation, in which we discuss the structural and institutional reasons that result in different inflation dynamics across countries. The starting point of this study is the observation that emerging economies historically experience higher and more volatile inflation than advanced economies.

In this regard, our chapter takes an institutional, structural, and historical approach to examine the underlying dynamics of imbalances in the global system that lead to elevated and fluctuating inflation rates in emerging economies. We aim to answer two key questions: why does inflation tend to be higher in emerging economies compared to advanced economies, and why does inflation exhibit greater volatility in emerging economies compared to their advanced counterparts?

The Balassa-Samuelson (BS) hypothesis is often considered when analyzing inflation disparities across countries. This hypothesis suggests that higher productivity growth in tradable sectors can elevate wages and prices in non-tradable sectors, potentially leading to inflation differentials, particularly between emerging economies and advanced ones. However, empirical literature argues that real-world wage-productivity dynamics can challenge its assumptions, especially in explaining cross-country inflation differences. For instance, Wang, Xue, & Du (2016) suggest that the BS hypothesis primarily applies to developed economies rather than emerging ones. On the other hand, recent data from Gubler & Sax (2019) show no support for the BS hypothesis, even in advanced economies. Therefore, even the mainstream literature based on the BS hypothesis does not provide enough evidence to explain higher inflation in emerging economies linked to wage and productivity dynamics.

On the other hand, findings from post-Keynesian literature explain conflicting mainstream findings and challenge the Balassa-Samuelson (BS) hypothesis by emphasizing recent trends such as reduced workers' bargaining power. When labor struggles to negotiate commensurate wage increases with productivity gains, relationships between real wages and inflation become flattened, even in advanced economies (Ratner & Sim, 2022). Alongside the empirical mixed results from the BS literature, reduced bargaining power raises questions about the traditional link between productivity and inflation. Since workers cannot negotiate wage increases that align with productivity gains, it becomes unclear how rising productivity in tradable sectors could directly lead to increased inflation in emerging economies. Therefore, in this essay, we are developing an alternative theoretical framework for understanding the structural dynamics of inflation in emerging economies.

While previous studies, notably the book written by Ha, Kose, & Ohnsorge (2019), have identified various factors influencing structural inflation disparities, there remains a significant gap in the mainstream perspective regarding the interconnected structural and institutional issues unique to emerging economies. On the other hand, a significant portion of heterodox literature concentrates either on advanced economies or specific emerging markets, resulting in a blurred comprehension of the broader structural and institutional differences between advanced and emerging economies.

To bridge this gap, our chapter aims to synthesize theoretical insights from both orthodox and heterodox literature. Specifically, we draw inspiration from orthodox literature in exploring the connection between expectations and inflation, while we are largely influenced by heterodox literature's perspective on price formation within a cost-determined price-setting framework (Kalecki, 1971). Rooted in Kalecki's perspective, while we acknowledge the role of demand in influencing raw materials, we portray this type of demand as global rather than domestic.

While vast mainstream literature has evidenced the impact of demand on overall prices, this may be related to global business cycle synchronization and commodity prices. In other words, if the demand growth cycle is global or if the country is sufficiently large, it may exert pressure on global commodity prices, as natural

resources "require long delays to increase their production" (Lavoie, 2022, p. 131). Additionally, if there is synchronization in the global business cycle, where global demand increases the demand for domestic products in small open economies (Benes, Hlédik, Vávra, & Vlček, 2003), it's understandable that empirical models would result in a significant correlation between demand and inflation unless controlled by global commodity prices or global inflation. However, in this framework, it's not the domestic demand of the small open economy but rather the increasing global commodity prices due to high global demand that drives inflation. Therefore, we contend that inflationary dynamics are more intricately tied to global economic conditions and resource constraints rather than solely reflecting domestic demand in smaller, open economies. Consequently, our perspective on inflation is based on structural/institutional factors rather than monetarist/demand-based approaches.

The principal aim of this chapter is to construct a theoretical framework for understanding the structural dynamics of inflation in emerging economies rather than focusing on empirical analysis. Therefore, we prioritize robust literature findings and descriptive analyses to ensure that our theory remains unaffected by specific empirical results, which may vary across different time periods or countries.

Initially, we recognize that discussions about inflation revolve around fluctuations in the prices of goods and services forming a country's consumption basket. Therefore, differences in inflation can stem from two primary factors: varying basket compositions and structural/institutional disparities leading to price divergences among basket components. Although the first part is not the direct focus of our research, we must be mindful that we are comparing different "things" when analyzing inflation dynamics in emerging and advanced economies. Emerging economies allocate more of their consumption to food compared to advanced economies, making them more sensitive to food price shocks from factors like commodity prices or climate change, resulting in higher and more volatile inflation compared to advanced economies.

Indeed, our research aims to explore why inflation in emerging economies would remain higher and more volatile, even if their consumer baskets became identical to

those of advanced economies. To achieve this, we establish an institutional framework that outlines how five structural factors stemming from imbalances in the world system contribute to the elevated inflation levels and volatility seen in emerging economies. We utilize an institutional/structural approach because the inflation difference between advanced and emerging economies is indeed a nominal reflection of real differences in structures and institutions between these economies.

In summary, in addition to its minor contributions and discussions, this chapter presents five main arguments. Firstly, we begin by highlighting significant structural economic differences—referred to as global imbalances—between advanced and emerging economies, which impact inflation through exchange rate dynamics. Advanced economies are characterized by larger service and high-tech sectors, which prioritize innovation and value-added production. In contrast, emerging economies heavily rely on agriculture and commodity exports, therefore depending on high-value-added imports. This reliance leads to persistent current account deficits that exert pressure on the value of domestic currencies.

Consequently, emerging economies primarily finance their continuous current account deficits through borrowing via direct or portfolio investments. As a result, exchange rates in emerging economies become sensitive to the balance of payment dynamics. Any shock that worsens the balance of payments in these economies results in currency depreciation, which in turn leads to higher inflation. Moreover, the volatile nature of the agricultural sector and global shocks, such as fluctuations in commodity prices, make the trade balance in emerging economies more volatile. This volatility is then transferred into inflation volatility due to exchange rate dynamics. In contrast, most advanced economies are protected from persistent depreciation-based inflationary pressures primarily because they typically maintain strong current account surpluses or have reserve currencies.

Furthermore, our essay discusses that the second significant structural factor is the underdeveloped supply chains and limited resource availability in emerging economies compared to advanced economies. This disparity often leads to high and volatile inflation patterns domestically, especially when trading partners of emerging

economies experience similar inflationary trends. Given the clustering of global economies into advanced regions like Europe and North America, contrasted with emerging regions such as Latin America, Sub-Saharan Africa, South Asia, and rapidly developing Asian economies, it is evident that emerging economies, constrained by limited resources and strong trade dependencies with neighboring countries, tend to mirror regional inflation trends. Consequently, emerging economies in Latin America, Sub-Saharan Africa, and South Asia are more susceptible to higher overall inflation compared to countries in other regions.

Thirdly, institutional factors empowered by real structural characteristics of emerging economies create a new path to distinct inflation dynamics. In emerging economies, characterized by weaker domestic competition, limited trade integration, and a higher presence of cartels compared to advanced economies, firms often engage in profit-led inflation by passing cost increases disproportionately onto consumers. Additionally, when confronted with supply-side shocks, firms may not only protect their profit margins but also potentially increase them. As a result, markup increases in specific sectors that have the greatest impact on overall price stability become more prevalent in emerging markets compared to advanced economies. Therefore, emerging economies, experiencing frequent supply chain shocks and exchange rate fluctuations, are more susceptible to both profit-led and markup-led inflation than advanced economies.

Continuing with institutional factors, our chapter emphasizes the importance of asymmetric price-setting behavior among firms. Although this behavior is similar between emerging and advanced economies, it results in different inflation dynamics between these two country groups. The reason for this difference lies in the asymmetry of institutional transmission. If institutional transmission were symmetric, a decline in food commodity prices or exchange rate appreciations should lead to significantly lower inflation in emerging economies compared to advanced economies. Consequently, the overall inflationary impact of global imbalances could be similar between the two income groups in the long run. However, unlike inflationary supply-push shocks, deflationary mechanisms do not effectively reduce prices when costs decrease, as companies avoid price reductions to prevent competitive price wars. In

our context, while cost-push shocks result in higher inflation in emerging economies, the decline in cost factors does not have the same magnitude of impact on the disinflationary process. These insights highlight the asymmetric price responses rooted in institutional dynamics and help explain why the overall inflationary impact of global imbalances is higher in emerging economies, even in the long run.

Lastly, we discuss the well-known phenomenon of unanchored inflation expectations in emerging economies, which is indeed a result of structural and institutional dynamics. Given the frequent impact of highly volatile exchange rates, supply chain disruptions, and the power of sellers on price formation in emerging economies, these instabilities contribute to persistent inflation and lead to high inflation expectations within these economies over time. However, escaping from such unanchored inflation expectations presents a significant challenge for emerging economies, where central banks often face credibility issues and operate in environments characterized by highly volatile exchange rates. As a result, inflation expectations in these countries tend to be backward-looking rather than forward-looking, as observed in advanced economies. When these expectations are reflected in nominal wages, resulting in higher labor costs combined with increased demand, corporations seize opportunities to boost profits, thus leading to further elevated inflation. This self-fulfilling cycle can further worsen structural dynamics, potentially triggering subsequent inflationary waves.

The second essay delves into structural inflation dynamics and seeks to identify the determinants of "high inflation," a frequently occurring problem, especially for emerging economies. The focus on specific high inflation levels is due to their harmful impact on savings, investor confidence, expectations, income inequality, and more. In this regard, while the essay answers what factors predominantly contribute to "high inflation," it also aims to develop a tool to predict "high inflation" to assist policymakers in avoiding being behind the curve.

The starting point of the essay is first to identify the inflation level that can be classified as "high inflation," rooted in historical context. Given the wealth of existing literature and established methodologies in this field, we did not see a need to devise a new estimate of "high inflation." Instead, we opted to define the "high inflation" threshold

based on the median value derived from a comprehensive review of 19 well-regarded "high inflation" thresholds documented in the literature. Employing this approach, we established distinct threshold levels of 10% for middle-income countries and 5.5% for high-income countries, beyond which economic activity is hindered. Additionally, we conducted a robustness check by considering "high inflation" thresholds as the median value ± 0.5 standard deviations (approximately $0.5 * 4.5\%$) of the literature thresholds.

Once the threshold is identified, we return to the theoretical concept of inflation determinants from both orthodox and heterodox perspectives simultaneously. Exploring the deviations from both approaches, firms' price-setting behavior based on profit maximization and wage-cost markup stemming from conflicting claims results in an almost similar inflation equation. Inflation is driven by unit labor and material costs, although there is indeed a fundamental distinction in the definition of unit labor costs between the two schools of thought. Based on these insights, our investigation aligns with the widely acknowledged understanding that supply-side factors wield significant influence on inflation, a topic extensively explored in the literature on inflation.

Firstly, we follow both mainstream studies such as Batini, Jackson, and Nickell (2005), Holmberg (2006), and Rumler (2007), as well as heterodox studies such as Kalecki (1971), Bastian & Setterfield (2020), Lavoie (2022) in terms of including exchange rates and imported input costs as part of an open economy structure. However, we set our inflation equation apart from mainstream models by incorporating endogenous wages and bargaining power, which are a function of depreciation, following the theoretical framework of Bastian & Setterfield (2020), Charles, Bastian, & Marie (2021) and Lavoie (2022). Additionally, the inclusion of markup as a function of supply-side shocks, as suggested by Blecker (2011) and Lavoie (2022), further differentiates our inflation equation from the mainstream inflation equation. While examining inflation as a function of markup, unit labor, and material costs, we underscore the importance of the exchange rate on all three. This framework explains the nonlinear relationship between the exchange rate and inflation, a subject that is not theoretically explored in the majority of existing mainstream literature.

However, our essay distinguishes itself from the existing literature by addressing the overlooked theme of determinants of "high inflation." Consequently, we identify exchange rate depreciations as the primary determinant that holds a predominant share in "high inflation" cases across all analyzed countries, regardless of structural differences. Exchange rate depreciation alone emerges as the predominant factor contributing to nearly all historical instances of high inflation in middle-income countries and a majority of cases in high-income countries.

Moreover, by employing a panel probit model to assess the likelihood of "high inflation" occurrences, the essay introduces an innovative early warning model for inflation. In this regard, the essay emphasizes that a depreciation of approximately 25% serves as a crucial early warning indicator for "high inflation," with a probability exceeding 80% in middle-income countries and 70% in high-income countries. The probabilities increase to over 90% when depreciation exceeds 35%. The model has provided a success rate of predicting "high inflation" of more than 80% historically, and these success rates increase as inflation thresholds rise.

Conversely, the influence of other determinants, such as demand, food commodity prices, and energy price shocks, exhibits varying effects across income groups, showing less consistent and universal predictive power. Among these determinants, demand emerges as a more significant factor in high-income countries, whereas inflation driven by food and energy commodity prices more successfully explains high inflation in lower-middle-income countries. These observed differences underscore the structural disparities discussed within the theoretical framework of both this and previous essays.

Finally, while we suggest that "high inflation is frequently, and in almost everywhere, an exchange rate phenomenon," we contribute to the inflation literature by emphasizing the role of supply-side factors, especially in emerging economies. This insight holds significant implications for policymakers and economists, highlighting the critical importance of monitoring exchange rates as an early warning signal for potential high inflationary pressures. Moreover, due to structural differences in

inflation formation, we suggest that policymakers in emerging economies focus more on supply-side factors rather than traditional demand.

The third essay diverges from the traditional approach of analyzing structural determinants of inflation by exploring a non-traditional determinant—climate change. It begins by acknowledging the significant global impact of climate change over recent decades, characterized by rising temperatures and increased frequency of extreme weather events, particularly affecting sectors like agriculture. Recognizing the profound implications of climate change on agriculture and considering the substantial role of food in consumer baskets, especially in emerging economies, this essay establishes a connection between climate change and inflation.

However, the primary obstacle lies in integrating climate change into the inflation theory, as there is no single variable that represents climate change comprehensively. Previous studies have utilized various climate indicators, such as rainfall (Odongo, Misati, Kamau, & Kisingu, 2022), climate disasters (Parker, 2018), climate change news index (Zhang, 2023), and temperature (Köse & Ünal, 2022), to examine their individual impacts on inflation. Yet, none of these indicators can fully capture the complexity of climate change alone, necessitating the incorporation of multiple climate variables—which poses a challenge due to modeling dimensionality issues.

To address this challenge, the essay proposes a solution by consolidating several key climate variables into a single Climate Condition Index (CCI). The aim is to create a more comprehensive representation of climate conditions and evaluate their combined impact on inflation. This consolidated index resolves the dimensionality issues encountered in existing inflation models when multiple additional climate variables are integrated, thereby serving as a robust tool for analyzing global inflation dynamics. The CCI is structured as a time series, offering a new approach to monitoring climate change trends and increasing public awareness of associated costs.

The CCI is calculated as a weighted average of cloud coverage, temperature, precipitation, wet day frequency, and vapor pressure. These weights are derived from Vector Error Correction Model (VECM) equilibrium coefficients, with the cumulative

price level as the focused dependent variable. This method enables us to capture long-term trends in climate variables while emphasizing the variables most influential in determining inflation across the studied countries. Given that each country's inflation reacts uniquely to climate shocks, we compute a separate CCI for each of the 39 countries within the period spanning from 1950 to 2021. This approach allows for a tailored assessment of climate-related impacts on inflation dynamics at the country level over the specified time frame.

Once the climate change variable is obtained, our focus shifts to understanding the transmission channel of climate impacts on inflation. While there is an emerging literature on the impact of climate change on agriculture and its subsequent effect on inflation, these studies often lack a comprehensive structural understanding of the connection between climate change and inflation. While some studies empirically analyze the impact of rainfall, drought, or temperature on inflation, there remains a theoretical gap in the literature regarding the transmission mechanisms. On the other hand, recent theoretical literature has been exploring new trends such as globalization and digitalization and their integration into traditional inflation equations. Drawing inspiration from one of the related studies written by Friedrich & Selcuk (2022), who examined the impact of globalization and digitization on inflation, and particularly from Weber & Wasner (2023), which focuses on price-setting behavior transmission, we aim to develop a theoretical framework that elucidates the transmission of climate impacts on inflation dynamics. This approach seeks to bridge the gap between empirical findings and theoretical underpinnings in understanding the complex relationship between climate change and inflation.

In this context, we explore how climate change affects marginal cost through productivity and can also modify the inflation elasticity of marginal cost through several mechanisms, including slope parameters and markup dynamics. Regarding productivity, climate-induced yield shocks can diminish output, resulting in higher real marginal costs and subsequent inflation, assuming labor and wages remain constant. Additionally, stemming from institutional price-setting behaviors, common climate-related production shocks like disasters or droughts may amplify the sensitivity of inflation to real marginal cost. Moreover, rooted in price-setting power, businesses

may encounter unique costs due to climate-induced supply disruptions, potentially prompting a significant nominal markup increase to preserve or enhance profit margins.

Finally, after obtaining the climate index and understanding the transmission mechanisms, the essay aims to uncover empirical evidence of climate change's impact on inflation. Our analysis reveals that approximately 77% of the countries studied are significantly affected by climate change, highlighting its widespread influence. While only 3 out of the 39 countries studied experience significant positive benefits from climate change, 27 countries are subject to substantial inflationary effects driven by climate-related factors.

Furthermore, the essay distinguishes itself from existing literature by being one of the first to provide empirical evidence of the higher impact of climate change on emerging economies. It demonstrates that in response to climate change, inflation in middle-income countries is negatively affected nearly four times more than in high-income economies. This finding contributes to the understanding of institutional differences discussed in previous chapters of our thesis.

The structure of the thesis is as follows: The second chapter focuses on an essay concerning the structural dynamics of inflation in emerging economies. The third chapter is devoted to the determinants of "high inflation" and the construction of an early warning model. Finally, the fourth chapter introduces a novel index to measure climate change and its impact on inflation, along with building a theoretical transmission framework.

CHAPTER 2

STRUCTURAL INFLATION DYNAMICS IN DEVELOPING COUNTRIES

Understanding inflation dynamics has been a central focus of economic research, aiming to uncover the factors driving its trends and variations across nations. While global inflation rates have generally trended downward, significant differences persist between advanced and emerging economies. Most existing literature, however, tends to focus on advanced economies, often applying these theories to emerging ones. However, given the structural differences in economic conditions, it is crucial to recognize that inflation dynamics in emerging economies differ from those in advanced ones.

When comparing inflation levels among countries, the Balassa (1964)-Samuelson (1964) (BS) hypothesis often comes to mind. From the theory, one can suggest that in emerging economies, higher productivity growth in tradable sectors can lead to increased wages and prices in non-tradable sectors, contributing to inflation differentials compared to advanced economies. However, a significant decline in workers' bargaining power challenges the assumptions of the BS hypothesis (Ratner & Sim, 2022). As labor lacks the ability to negotiate wage hikes proportional to productivity gains, there appears to be no clear justification for increased inflation linked to rising productivity in tradable sectors.

While several existing research, especially Ha, Kose, & Ohnsorge (2019), have highlighted several factors influencing structural inflation differences, they often overlook the interconnected structural and institutional issues specific to emerging economies. On the other hand, much of the heterodox literature focuses on advanced economies or specific emerging markets, as in Latin American structuralists, providing

a limited understanding of the broader structural and institutional disparities between advanced and emerging economies.

To bridge this gap, our chapter aims to theoretically conceptualize various findings from both orthodox and heterodox literature. Specifically, we draw inspiration from orthodox literature when exploring the relationship between expectations and inflation. However, our perspective on price formation in a cost-driven pricing environment is largely influenced by heterodox literature, particularly informed by Kalecki's (1971) and Latin American structuralists' such as Raúl Prebisch's, Juan Noyola Vásquez's, and Osvaldo Sunkel's insights. We contend that inflationary dynamics are more intricately tied to global economic conditions and resource constraints rather than solely reflecting domestic demand in small, open emerging economies. Thus, our perspective on inflation emphasizes structural and institutional factors over traditional monetarist or demand-driven approaches.

From an institutional, structural, and historical perspective, our chapter aims to delve into the structural dynamics of imbalances in the world system that contribute to high and volatile inflation in emerging economies. Within this framework, we seek to address two fundamental questions:

1. Why is inflation higher in emerging economies compared to advanced ones?
2. Why is inflation more volatile in emerging economies compared to advanced ones?

During the theory-building process, we will reference results from reduced-form econometric models commonly used in literature and our reference chapters. However, it's important to clarify that the primary objective of this chapter is to develop a theoretical framework for understanding the structural dynamics of inflation in emerging economies rather than conducting empirical work. Therefore, we will prioritize robust literature findings and descriptive analyses to ensure that our theory remains untainted by specific empirical findings that may vary across periods or countries.

Our primary contribution lies in proposing that the inflation difference between advanced and emerging economies is indeed a nominal reflection of real imbalances in structures and institutions between these economies. We highlight that emerging economies face higher exchange rate depreciation due to current account deficits, commodity price fluctuations, and capital flow dynamics, leading to higher inflation. Weak supply chains and limited alternatives make Latin America, Sub-Saharan Africa, and South Asia prone to higher inflation. Institutional dynamics worsen this, with firms fully passing cost increases to consumers, and weak competition exacerbates pressures, where disinflation does not occur when costs fall. Additionally, low central bank credibility fuels unanchored inflation expectations, perpetuating high and persistent inflation rates in emerging economies.

From the outset, the research chapter commences by analyzing global inflation dynamics and explores how variations in consumption baskets can contribute to high and volatile inflation in emerging economies in Section 2.1. Section 2.2 delves into the structural factors that underpin high and volatile inflation in these economies. Subsequently, Section 2.3 investigates the influence of expectations and propagation mechanisms on emerging economies. Finally, the research culminates with a concluding section that summarizes the findings and discusses their implications.

2.1. Stylized facts about inflation dynamics

It is evident from Figure 2.1 that middle-income economies consistently demonstrate higher general inflation trends and volatility compared to high-income ones, dating back to 1982. While inflation in high-income economies experienced a strict decline paralleling low commodity inflation during 1982-1998, it surged in oil-exporting middle-income economies and remained elevated in other middle-income ones. Subsequently, although inflation decreased in line with advanced economies, middle-income economies continued to exhibit higher inflation rates than high-income ones, even during the low inflationary era and the post-pandemic global inflation spike.

Besides the overall higher trend in inflation in emerging economies, as illustrated in Figure 2.1.C, inflation also exhibits greater volatility in middle-income economies

than in high-income ones. The sole exception is observed in the post-pandemic era, where volatility in high-income inflation exceeds that in middle-income countries, and volatility in high-income oil-exporting nations surpasses that in middle-income oil-exporting ones. While it stems from the inflation spike transitioning from very low to high in high-income economies, whether this increase signifies a new trend in volatility or a medium-term temporary shock remains uncertain and requires a few more years to pass for conclusive analysis.

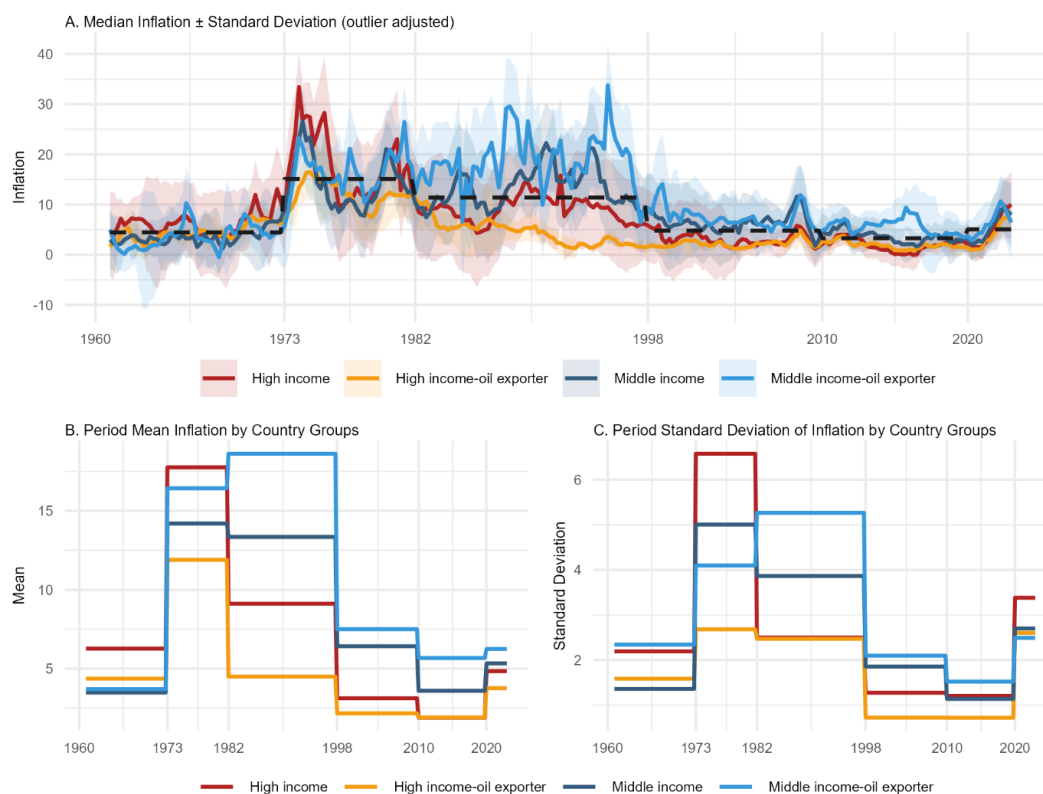


Figure 2.1 Inflation Dynamics Across Country Groups

Source: Authors' calculation.

Note: The lines on Graph A depict the median values for all countries in the group, with the shaded area around them indicating the median plus or minus one standard deviation. Outliers were adjusted using the Tukey fence method, replacing them with the inner fence values. The dashed line represents the mean inflation for all countries during the specified time period. Graphs B and C display the mean and standard deviation values of inflation for the associated country groups for each analyzed period, respectively. The data utilized in the descriptive analyses is detailed in Appendix a.

But why is inflation, in general, higher and has higher volatility in emerging economies than in advanced ones? While comparing the different inflation levels among countries, the first hypothesis that comes to mind is the Balassa (1964)-Samuelson (1964) (BS) hypothesis. It suggests that differences in productivity between tradable and non-tradable sectors contribute to price level variations between countries when currency is standardized. Implicit in this hypothesis is the assumption that the law of one price for tradable goods holds true. Essentially, an increase in productivity within the tradable sector results in higher factor prices, such as wages, subsequently leading to increased prices for non-tradable goods and an appreciation of the real exchange rate (Gubler & Sax, 2019). Conversely, when productivity in the non-tradable sector improves, it leads to reduced marginal costs and lower price levels.

Evidence of the existence of the BS effect in developing economies has been found by Choudhri & Khan (2005), who suggest that the difference in labor productivity significantly impacts the real exchange rate by affecting the relative price of non-traded goods. Similar findings are also evident in Central European Economies (Mihaljek & Klau, 2008) and middle-income African countries (Iyke & Odhiambo, 2017). However, according to Wang, Xue, & Du (2016), the BS hypothesis holds true only for developed economies. Nevertheless, recent estimations for advanced economies' results indicate that the observed data doesn't consistently support the BS hypothesis (Gubler & Sax, 2019). These contentious findings indicate that while the theory offers a structure for comprehending inflation dynamics, real-world intricacies may challenge its assumptions, particularly concerning wage determination in relation to productivity. Consequently, when the relationship between wages and productivity diverges from the assumptions in the Balassa-Samuelson hypothesis, the hypothesis may prove inadequate in elucidating differential inflation trends among countries.

A crucial aspect missing from labor, wage, productivity, and inflation analysis (and hence in BS) is the decline in workers' bargaining power, which has flattened the relationship between real wages and inflation, even considering productivity (Ratner & Sim, 2022). For instance, the study by Ratner & Sim (2022) indicates that the elasticity of inflation to unit labor costs is positively associated with the bargaining power of trade unions in distributing production rents. This suggests that a weaker

bargaining power of trade unions leads to less elastic inflation. In this framework, the lack of inflation pressure after the 1980s is attributed to the weakened bargaining power of workers despite low unemployment rates. Even in advanced economies such as the US and UK, the estimated bargaining power for firms is 0.52 and 0.54, respectively, during the 1961-1978 period. However, in the later period, these values rise to 0.92 and 1.0 for the US and UK, respectively, indicating a substantial shift in power towards firms (Ratner & Sim, 2022).

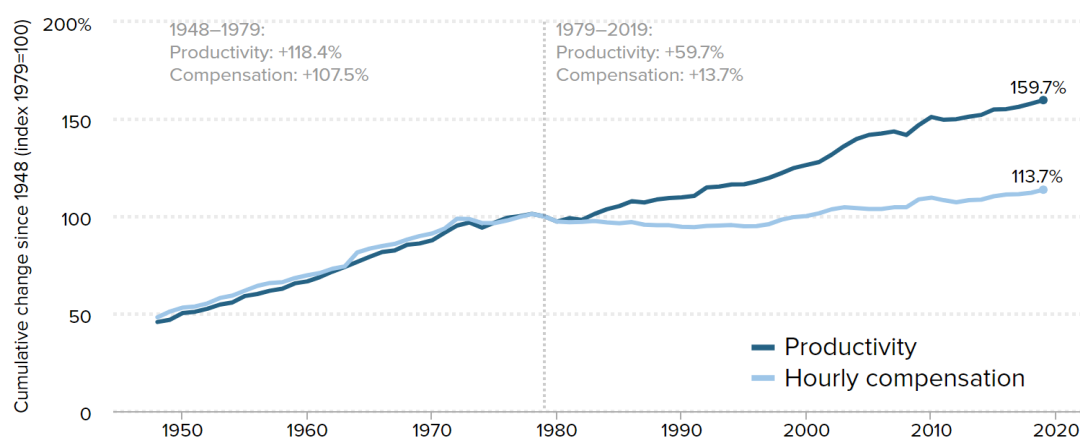


Figure 2.2 Productivity Growth and Hourly Compensation Growth in the US

Source: Mishel (2021).

Note: The data pertain to the compensation (wages and benefits) of production/nonsupervisory workers in the private sector and the net productivity of the total economy. Net productivity refers to the growth of output of goods and services with less depreciation per hour worked. Both sets of data are obtained from the Bureau of Labor Statistics (BLS) (Mishel, 2021).

Therefore, a reduction in workers' bargaining power, such as due to a weakening of trade unions, alters the steady-state equilibrium: inflation decreases, and wage rates decline (Charles, Bastian, & Marie, 2021; Lavoie, 2022). This is because if money wages don't keep increasing, inflation cannot persist over time (Hein, 2023). Whatever factors were driving prices up in the economy would have only led to a one-time increase in prices. Consequently, if labor bargaining power approaches zero, the Balassa-Samuelson hypothesis becomes weak in explaining the inflation differential between advanced and emerging economies. Since labor lacks the power to demand

wage increases parallel to productivity (even in the US, as depicted in Figure 2.2), there is no explanation for higher inflation based on the rise in the productivity of tradable sectors, while the productivity of non-tradable sectors remains constant in emerging economies.

However, real-world data may align with the BS hypothesis, especially when focusing on Latin American countries during the 1950s and 1960s, where industrialization-based productivity rose and inflation increased in parallel. Nevertheless, the rise in productivity was not the true reason for inflation. Since industrialization redirected resources from agriculture to industry (Fischer & Mayer, 1980), urban populations grew rapidly, and the demand for food in urban centers increased significantly (Baer, 1967). Consequently, the inability of agricultural production to keep pace with the growing demand for food resulted in fundamental inflationary pressure in most Latin American economies (Canavese, 1982; Vásquez, 2016). However, unlike others, Mexico's earlier land reforms appear to have contributed to recent economic progress, as food output has increased at a satisfactory rate (Seers, 1962). Therefore, Mexico's inflationary pressures have not been significantly influenced by agricultural production rigidity, although there have been instances where the food supply contracted due to poor harvests caused by adverse weather conditions (Vásquez, 2016).

Therefore, the reason for inflation in Latin America was not monetary or wage expansion as in the BS hypothesis. The relatively high demand for food compared to the inelastic supply was not the result of an increase in the money supply but a change in the direction of demand that did not alter the overall level of intended expenditure (Olivera, 1964). Since the money prices are inflexible downward (Fischer & Mayer, 1980), changes in relative prices necessitate increases in the general price level (Canavese, 1982). In other words, these price increases are not counterbalanced by price declines in the industrial sector when there is excess supply (Fischer & Mayer, 1980). If prices are less responsive to downward pressures compared to their responsiveness to upward pressures, even if they can decrease to some extent, there is a strong likelihood that the rise in money prices due to a shift in demand will surpass the potential decreases (Olivera, 1964). Thus, a positive aggregate excess demand is

not essential for structural inflation, but a sustained rise in the general price level requires recurrent changes in the economic structure over time (Olivera, 1964; Canavese, 1982).

Consequently, even though data support a parallel rise in inflation with productivity increases, which may dominate econometric models that find significant evidence for the BS hypothesis in such economies, the true reason for heightened inflation was structural factors. Therefore, instead of focusing on demand, we address why inflation and its volatility are higher in emerging economies compared to advanced ones by shifting our attention to the structural and institutional disparities stemming from imbalances in the global system.

Firstly, it's important to recognize that when discussing inflation, we are essentially referring to fluctuations in the prices of goods and services that constitute a country's consumption basket. Therefore, differences in inflation can stem from two fundamental factors: varying basket shares and structural differences that influence prices within each basket component. Hence, from the outset, variations in the components and weights of these baskets can lead to divergent inflation outcomes across countries. Thus, we must be mindful that we are comparing different "things" when analyzing inflation dynamics in emerging and advanced economies. Hence, we start emphasizing the countable impact of consumer basket shares on inflation differentials from the outset.

However, the main focus of our research is to analyze the structural factors that contribute to higher and more volatile inflation in identical basket goods in emerging economies compared to advanced economies. In other words, even if consumer baskets became identical to those of advanced economies, inflation in emerging economies would still be higher and more volatile, and we aim to understand why this is the case. Therefore, we develop an institutional framework to elucidate how these structural factors contribute to heightened inflation trends and volatility, specifically in emerging economies.

2.1.1. Consumer basket shares and food commodities

Engel's law posits that as household income increases, the proportion allocated to food declines (Baffes & Etienne, 2016). Therefore, emerging economies, primarily comprised of middle-income countries, often allocate a larger proportion of their consumption towards food compared to their advanced, high-income counterparts (Ha, Ivanova, Ohnsorge, & Unsal, 2019). Research conducted by Amaglobeli et al. (2022) underscores this point, revealing that the median consumption basket weight of food in advanced economies stands at 16 percent, while it rises to 28 percent in emerging economies, as depicted in Figure 2.3.A.

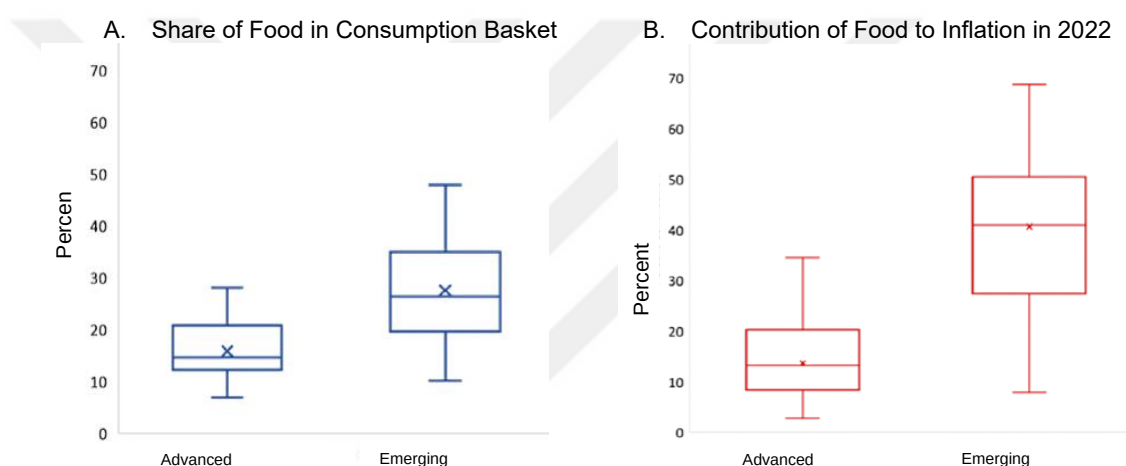


Figure 2.3 Consumer Basket Shares Across Country Groups

Source: Amaglobeli et al. (2022).

This disparity in basket composition exposes emerging economies to higher inflation in response to food price shocks (Figure 2.3.B), resulting in greater volatility in inflation rates, particularly due to the inherent instability in food prices (Dua & Gaur, 2010).

In this framework, any factors that result in a rise in domestic food prices contribute to the differences in inflation between emerging and advanced economies. For instance, by highlighting the considerable share of food, Pourroy, Carton, and Coulibaly (2016), as well as Baba, Duval, Lan, and Topalova (2023), underscore the outsized impact of food commodity price fluctuations on inflation in emerging

economies. Nevertheless, it's important to note that food commodity prices are subject to extensive regulation worldwide aimed at mitigating the adverse effects of food commodity shocks on domestic food prices. Therefore, increases in global food prices may not immediately and significantly pass through to domestic prices (Kandil & Morsy, 2014) because regulated price hikes consistently remain below the inflation rate, acting as a stabilizing force (Frenkel & Friedheim, 2017). Consequently, the explanatory power of food commodity prices for inflation differentials between emerging and advanced economies may weaken when prices are regulated. Conversely, in price-deregulated economies, commodity prices should be associated with higher inflation in emerging economies due to their higher weight in the consumer basket.

However, since these regulations typically involve temporary price caps and subsidies (FAO, 2020), it's challenging to categorize countries based on their regulatory measures. On the other hand, as observed in Gulf countries, many oil-exporting nations enforce strict price regulations for food commodities (Kandil & Morsy, 2014). Consequently, the elasticity of inflation to food commodities is expected to be lower in oil-exporting countries than in importer ones, as also observed in Figure 2.4. Therefore, separating the oil-exporting nations from country groups results in a clearly higher inflation elasticity¹ to food commodity prices in emerging economies than advanced ones. In this regard, it is evident that while the volatility of food commodity prices would result in higher inflation volatility in emerging markets, inflationary shocks to food commodities would lead to higher inflation in emerging economies than in advanced ones.

On the other side, if this transmission is true in any case, one could argue that a decline in food commodity prices may result in much lower inflation in emerging economies than in advanced ones due to basket shares. In this regard, on average, the total inflationary impact of commodity prices can be very close in two income groups when

¹ However, economies with pricing policies may experience inflationary pressures at different times due to the liberalization of administered prices (Dua & Gaur, 2010). Therefore, domestic commodity prices might not synchronize with sudden shifts in international commodity prices in the countries that have price regulations (Dua & Gaur, 2010), which result in lower slope between inflation and food commodity prices.

commodity prices return to their normal values. However, contrary to inflationary supply-push shock transmission, the deflationary mechanism does not work when commodity prices fall. This is because companies refrain from reducing prices because doing so could trigger a competitive price war (Weber & Wasner, 2023). While firms compete for market share, lowering prices to gain a larger market share would likely prompt competitors to also reduce their prices in response, which can significantly reduce business profits, potentially leading to financial ruin and bankruptcies (Lavoie, 2022).

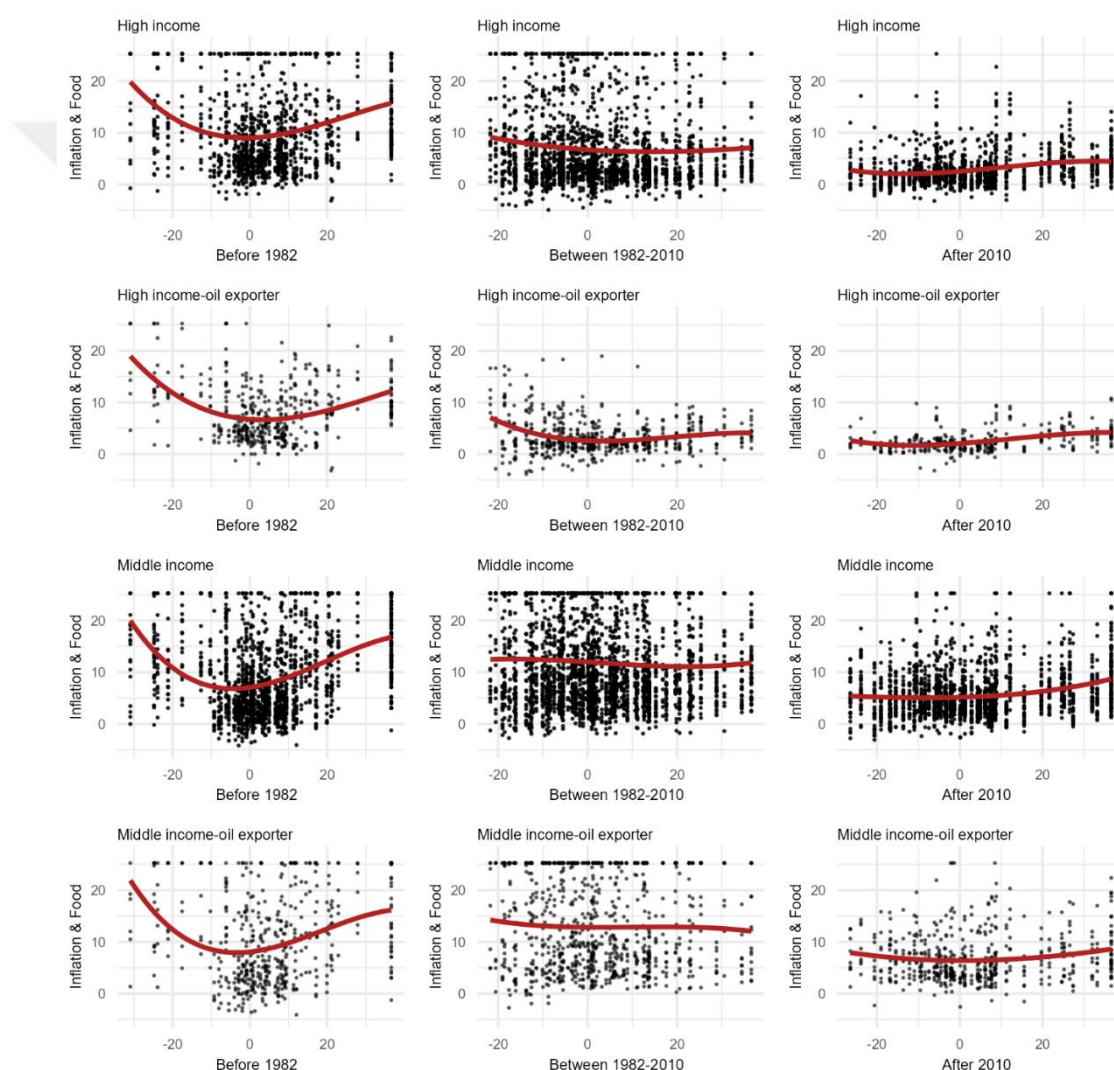


Figure 2.4 Inflation and Food Commodity Inflation Relationship

Source: Authors' calculation.

Note: The red line is a degree-3 polynomial regression line between inflation (on the y-axis) and the determinant (on the x-axis).

Consequently, this institutional pricing behavior creates an asymmetric response of seller prices to supply-push shocks, as clearly observable in Figure 2.4. Even when food commodity prices fall significantly, disinflation does not occur in parallel. In this framework, while emerging economies witness higher inflation in response to food commodity shocks compared to advanced economies, neither of them benefits from a deflationary decline in commodity prices. Therefore, the overall impact on emerging economies remains high.

In addition to external shocks such as commodity prices, domestic food prices can also be significantly influenced by domestic supply factors and climate conditions. For instance, middle-income countries often experience a higher negative impact of climate change on inflation compared to high-income economies, as illustrated in Figure 2.5 (Chapter 4). This further contributes to the explanation of why inflation is high and volatile in emerging economies.

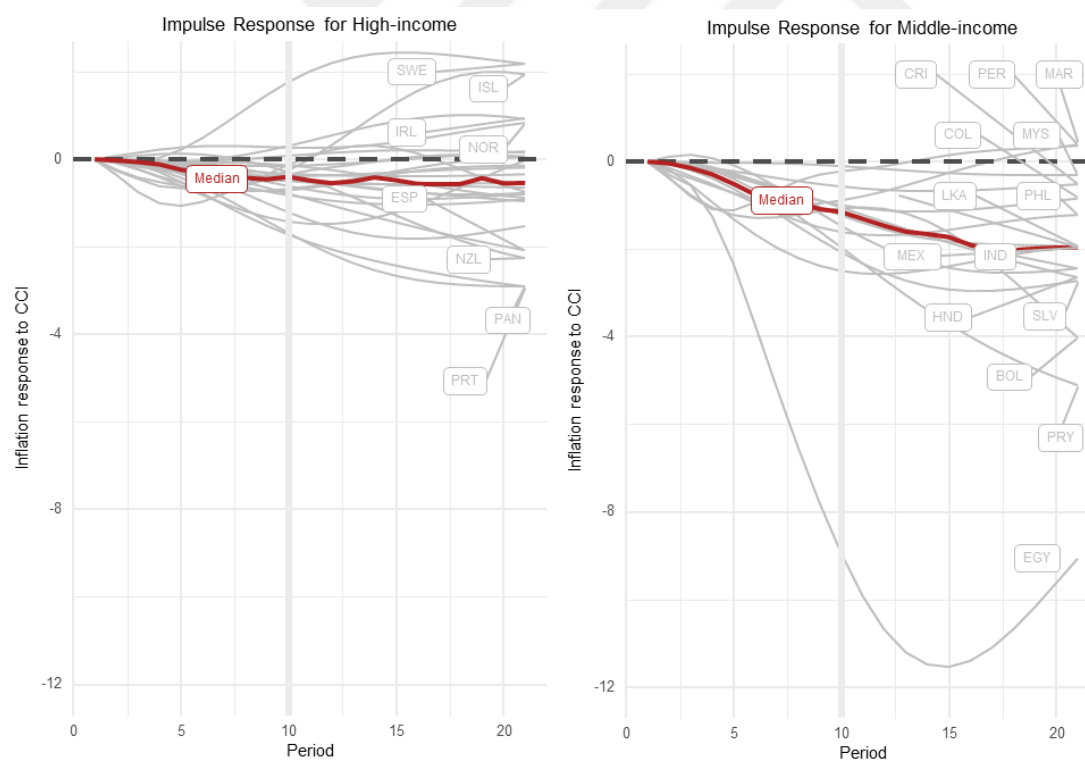


Figure 2.5 Inflation and Climate Change Relationship

Source: Chapter 4.

2.2. Imbalances in the world system

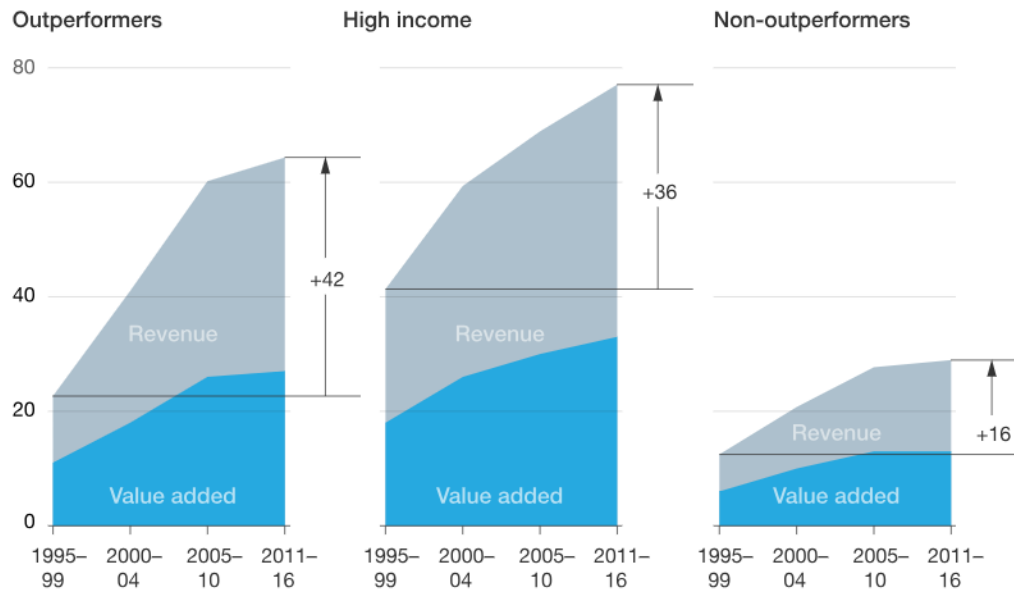
For economists such as Raúl Prebisch, Celso Furtado, Juan Noyola Vásquez, and Osvaldo Sunkel, inflation in underdeveloped countries was a result of a deformed economic structure (Carvalho, 2019). Rooted in this approach, Latin American (LA) structuralism highlights sectoral bottlenecks and balance-of-payments disequilibrium as the primary causes of inflation (Canavese, 1982). In this regard, inflation is not merely a monetary phenomenon; it results from real imbalances, especially in underdeveloped countries compared to industrialized ones (Vásquez, 2016).

2.2.1. Current and financial account imbalances

The crucial aspect contributing to differential inflation rates lies in the deep structural disparities inherent in advanced and emerging economies. Advanced economies typically feature a larger service sector and high-tech industries, emphasizing innovation and value-added production, as depicted in Figure 2.6. They are less import-dependent on demand-inelastic high-value-added products and generally maintain surpluses in their current account balances. In contrast, emerging economies often exhibit a larger agricultural sector (Dua & Gaur, 2010), rely heavily on commodity exports, and have a growing low-value-added manufacturing base due to a lack of high-skilled² labor.

Moreover, when commodity prices rise, emerging economies witness trade surpluses and, thus, strong exchange rates against trading partners. Continuously appreciating exchange rates result in imported inputs becoming cheaper than domestic products, thus leading to less competitiveness and a less industrialized economy, a phenomenon often termed "Dutch disease" (Masson, 2014). Therefore, unlike advanced economies, emerging ones are more import-dependent, especially on high-value-added products and services, which leads to almost history-long persistent current account deficits (Figure 2.7).

² For detailed country analyses please refer to WIPO (2023), "The GII unveils the world's innovation leaders, gauging the innovation performance of 132 economies."



¹Simple average across countries.

²Outperformers include China, India, Indonesia, Malaysia, Singapore, South Korea, and Thailand; high-income economies include Canada, France, Germany, Italy, Japan, United Kingdom, and United States; non-outperformers include Argentina, Brazil, Egypt, Mexico, Nigeria, Pakistan, Poland, Philippines, Russia, South Africa, and Turkey; Hong Kong is excluded as an outlier (large-company revenue is equivalent to more than 340% of GDP).

³Publicly listed companies with more than \$500 million in revenue in 2016.

Figure 2.6 The Ratio of Large Company Revenue to GDP

Source: Woetzel, et al. (2018).

Considering the high share of imported goods in emerging economies' consumer baskets, when commodity prices rise, the appreciation of the domestic currency in commodity-exporting economies may immediately lead to lower imported inputs and, thus, low inflation. However, the challenge arises with the indirect effects of commodity prices through global inflation, where imported inflation rises with a delay and results in an outflow of reserve currency. In this regard, if commodity exports cannot close the structural current account deficits, the outflowed reserve currencies reverse domestic currency appreciation, resulting in much higher imported and, therefore, domestic inflation in emerging economies (Rafi & Ramachandran, 2018). Therefore, emerging economies reliant on commodity exports find themselves highly sensitive to global price fluctuations (Baffes, Koh, & Nagle, 2022). On the other hand, a rise in commodity prices directly increases current account deficits in commodity-importing emerging economies, thus resulting in much higher reserve currency outflows and higher inflation than in commodity-exporting emerging economies.

For instance, many Latin American countries faced slow growth of their traditional

exports due to the low-income elasticity of demand in advanced countries (Baer, 1967) and significant volatility due to a heavy dependency on raw material prices (Maynard, 1961). These balance of payments issues led to persistent pressure on the exchange rate and frequent devaluations (Seers, 1962; Baer, 1967), which was one of the main causes of chronic high inflation in Latin America (Sunkel, 1960).



Figure 2.7 Current and Financial Account Imbalances

Source: Authors' calculation.

Emerging economies primarily finance their continuous current account deficits through borrowing via direct or portfolio investments, as illustrated in Figure 2.7, given the limitations of national reserves. Therefore, the dependence of exchange rates on current accounts not only exposes emerging economies to the volatility of commodity markets, leading to fluctuations in current accounts but also leaves them vulnerable to the unpredictable nature of international capital flows (Masson, 2014). Emerging economies that rely on commodity exports often experience an influx of capital during commodity booms, resulting in increased foreign currency debt and

currency appreciation and, therefore, low imported and domestic inflation. However, when the inevitable downturn occurs, the consequences are severe, with deficits in the current account, increased capital outflows, depreciated domestic currency, and high inflation. This exposes them to various forms of global financial volatility (Baffes, Koh, & Nagle, 2022).

Consequently, countries with large current account deficits are prone to experience higher exchange rate depreciation, as observed in Figure 2.8. The higher value of current account deficits in oil-exporting middle-income economies (Figure 2.7.D) has become associated with historically higher depreciation compared to other country groups. Moreover, it is clear that the huge current account deficits between 1970-1980 and the subsequent large capital outflows during the 1980s correspond closely with significant exchange rate depreciation against the USD in oil-exporting middle-income economies. Similar associations are also evident in other income groups.

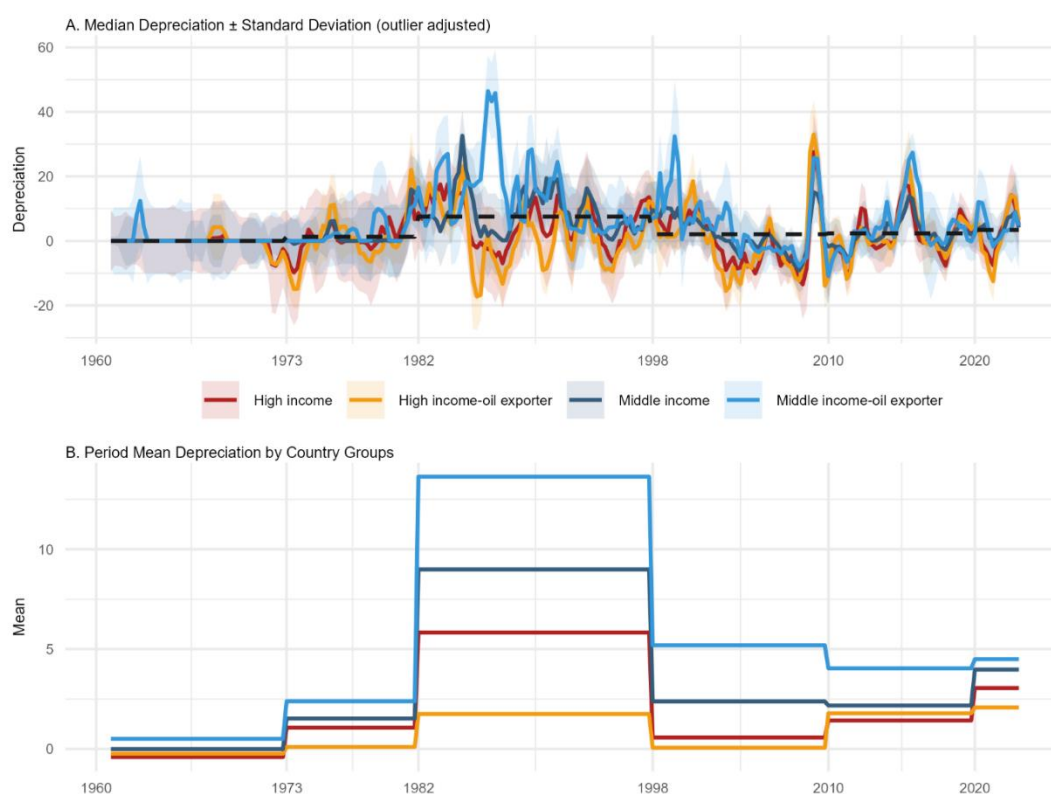


Figure 2.8 Domestic Currency Depreciation Against USD

Source: Authors' calculation.

Considering that exchange rates serve as the primary mechanism for reconciling differences between current and financial accounts, volatility in financial accounts, particularly in portfolio investments, leads to highly unstable exchange rates (Rafi & Ramachandran, 2018). Since portfolio flows are strictly dependent on interest rates and risk premium differential between countries, countries with current account deficits tend to raise interest rates to attract capital inflows (Rafi & Ramachandran, 2018). However, challenges arise in a globally inflationary environment, where advanced economies also increase policy rates to combat inflation (Gopinath & Gourinchas, 2022). These tightening cycles in advanced economies often lead to financial stress in emerging economies, with significant and prolonged macroeconomic repercussions such as capital outflows, pressures for currency depreciation, and record levels of debt (Ha, Kose, & Ohnsorge, 2022). Even if policy rates rise in emerging economies in response, they may not prevent capital outflows due to higher returns available in advanced economies and increased investor risk aversion (Ha, Kose, & Ohnsorge, 2022).

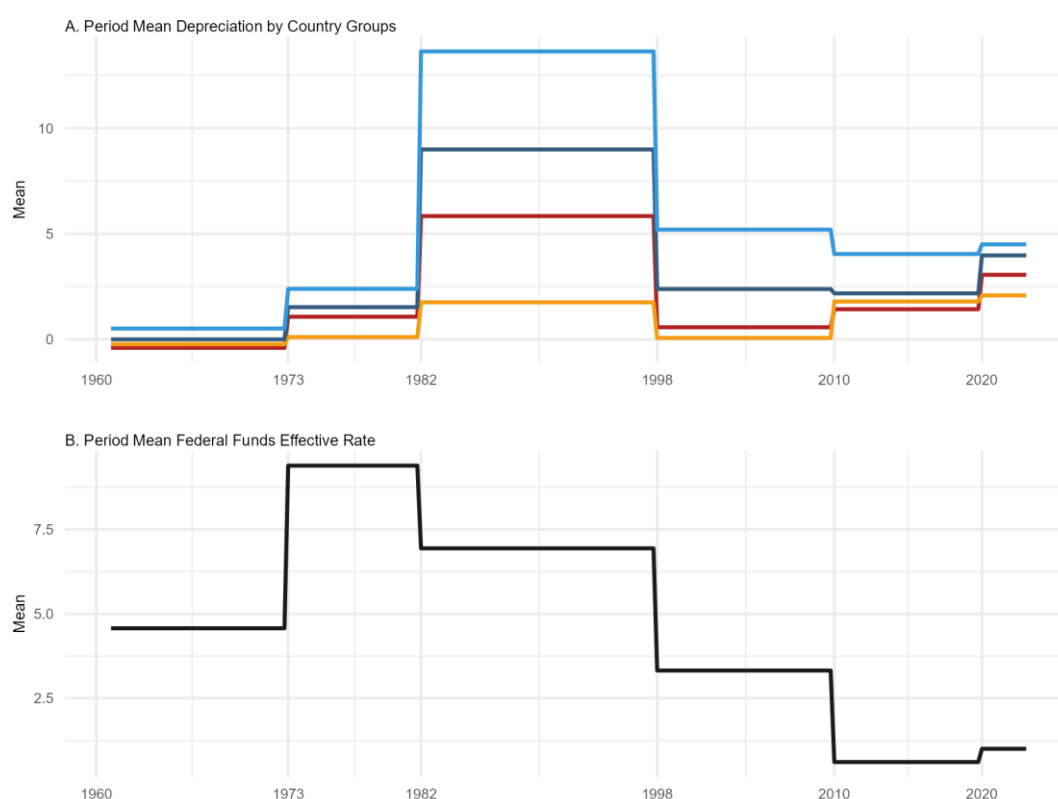


Figure 2.9 Exchange Rate Depreciation and Federal Funds Effective Rate

Source: Authors' calculation.

This phenomenon was clearly evident in the 1980s when a sharp rise in policy rates in the US resulted in high capital outflows, especially from middle-income economies (Figure 2.7.C-D). However, this did not immediately affect exchange rates due to currency pegs to the USD in many countries worldwide. Nevertheless, the long-lasting tight monetary conditions caused the collapse of peg regimes in many countries in the 1990s (Duttagupta, Karacadag, & Fernandez, 2006), resulting in significant currency depreciations against the USD, as seen in Figure 2.9, particularly in middle-income economies.

For instance, in the 1980s, inflation spiraled out of control in many Latin American countries due to increased foreign debt accumulated during the 1970s (Dijkstra, 1997). In this framework, contractionary monetary policies in industrialized countries led to the end of the easy borrowing period, and the recession in the industrialized world reduced demand for primary products, worsening the terms of trade for non-oil exporting developing countries (Dijkstra, 1997). Consequently, the domestic currencies of Latin American countries fell sharply with respect to the USD. Imports became more expensive due to scarcity from rationing or the effects of devaluation, exacerbating the high inflation situation (Dijkstra, 1997). As a result, these economies witnessed historically high inflation during the period. Therefore, as global inflation rises, emerging economies often experience higher inflation compared to advanced economies due to currency depreciation resulting from capital outflows.

More importantly, the resulting differences in currency depreciations align closely with structural inflation differences in analyzed countries (Figure 2.10). Country groups experiencing significant and persistent depreciation (Figure 2.8.B) generally exhibit higher inflation levels than other income groups (Figure 2.1.B). Exceptions were observed until the 1980s when exchange rate pegs restricted the spike in inflation in emerging economies.

Furthermore, when currency depreciation exceeds certain thresholds, it leads to larger impacts on inflation (Frankel, Parsley, and Wei, 2012; Caselli and Roitman, 2019; Chapter 3). However, devaluation/depreciation became not only associated with elevated prices for imported consumer goods but also resulted in high costs for

manufacturers due to their heavy reliance on imported raw materials. The greater the share of imported inputs in costs, the more powerful the pass-through effect observed (Pereira & Missio, 2024). On the other hand, when inflation reaches high levels, the pass-through from exchange rate movements to domestic prices further increases significantly (Cheikh & Zaied, 2020). As a result, emerging economies often experience higher pass-through from exchange rate movements to domestic prices (Ha, Kose, Ohnsorge, & Yilmazkuday, 2019), which can cause inflation to fluctuate with currency volatility (Figure 2.11).

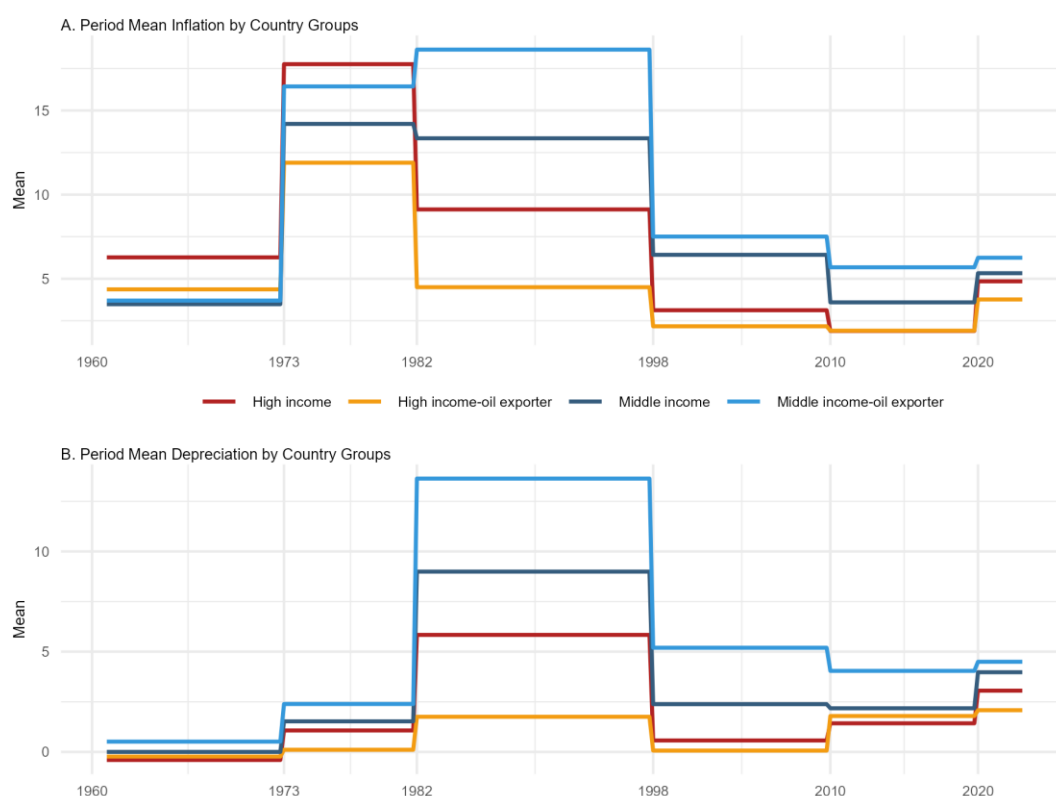


Figure 2.10 Inflation Dynamics and Exchange Rate Depreciation Against USD

Source: Authors' calculation.

As depicted in Figure 2.11, middle-income economies experiencing higher and more frequent depreciation than high-income ones exhibit greater elasticity of inflation to depreciation compared to high-income economies. More interestingly, after the collapse of peg regimes, similar to the responses of sellers to food commodity prices, exchange rate appreciations are not associated with disinflation, highlighting the existence of institutional asymmetric responses. The only exception is observed in

middle-income oil-exporting economies, indicating that higher disinflation can occur in response to appreciation. However, in these economies, currencies depreciate more frequently than they appreciate, leading to overall higher inflation compared to all their counterparts (see Figure 2.10).

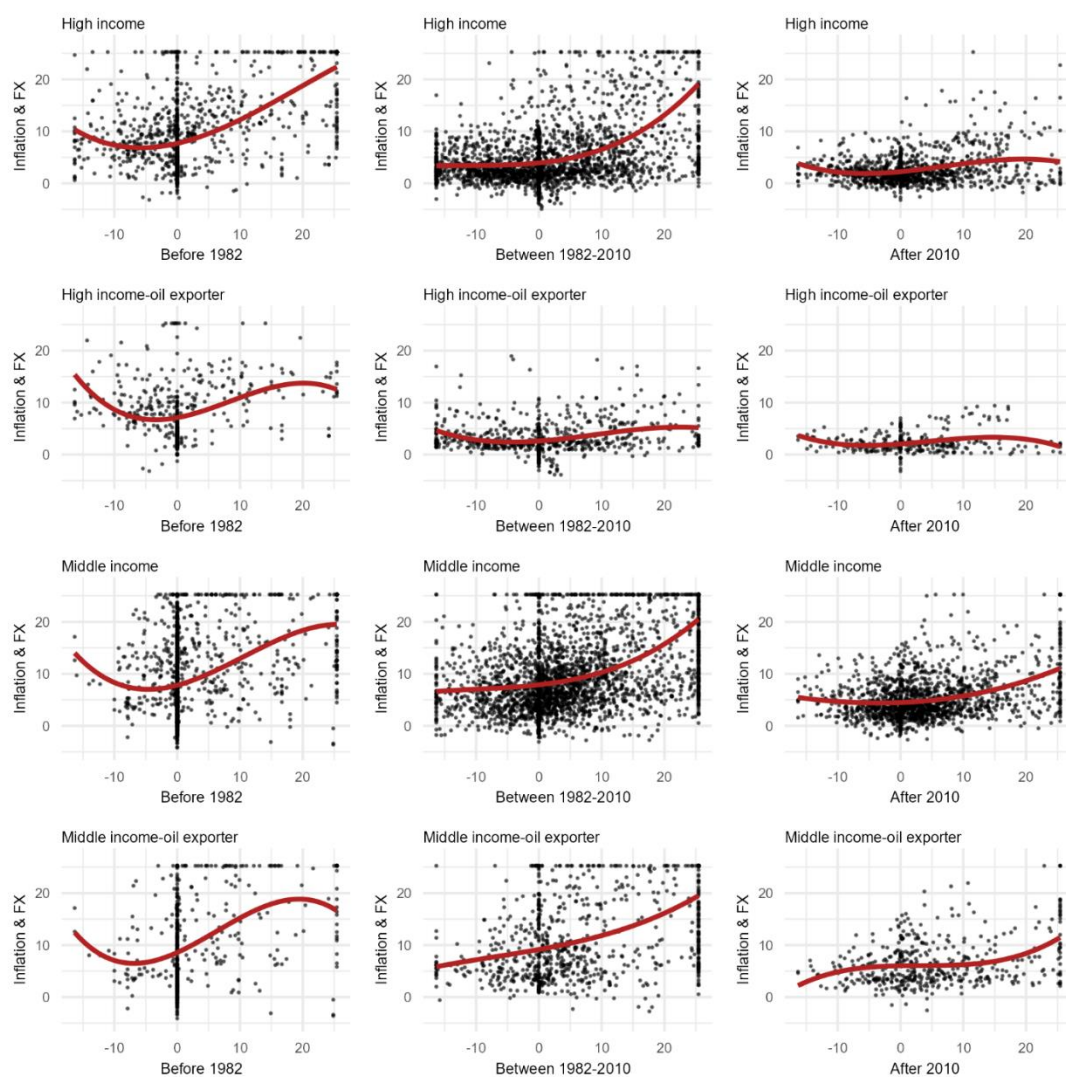


Figure 2.11 Exchange Rate Depreciation Dynamics Across Country Groups

Source: Authors' calculation.

Note: The red line is a degree-3 polynomial regression line between inflation (on the y-axis) and the determinant (on the x-axis).

2.2.2. Supply chain

In addition to import dependency and related exchange rate dynamics, emerging

economies may lack developed supply chains and have fewer resources and alternative supply options compared to advanced economies. This makes them more vulnerable to disruptions that can exacerbate inflationary pressures (Ha, Ivanova, Ohnsorge, & Unsal, 2019). Limited diversification and weaker supply chain resilience leave these economies vulnerable to disruptions, particularly in nations heavily reliant on imports (Attinasi & Balatti, 2021). Consequently, supply chain pressures correspond to higher domestic inflation in emerging economies than in advanced ones (Ye, Mohammed, Tiwari, Raza, & Chen, 2023).

A key indicator of supply chain disparities between advanced and emerging economies is their trading partners. But how does inflation in trading partners result in different inflation trends among countries? The answer lies in the selection of trading partner countries, as evident in Argentina's intermediate good prices, which are mostly driven by Brazil's industrial good prices (Frenkel & Friedheim, 2017). In this framework, high and volatile inflation in countries' trading partners results in high and volatile domestic inflation (Ha, Ivanova, Montiel, & Pedroni, 2019). However, the selection of trading partner countries is not straightforward due to geographical proximity, consumption habits dependent on similar cultural ties, trade agreements, and more.

Consequently, inflation in emerging economies that have immense trade relations with border countries and imported goods that have a large share in the consumption basket may follow regional inflation trends. For instance, Figure 2.12.B displays almost identical inflation trend shifts in Latin American countries, especially between the 1982-1998 period, which is specific to the region. However, Chile, as a high-income country, stands out as an exception. In 1990, three of Chile's top five import partners were located outside of Latin America, comprising approximately 35% of Chile's total import partner share (19.54% with the United States, 8.09% with Japan, and 7.44% with Germany). Only the import share with the US is more than the combined share of the remaining top five import partners, which are Latin American economies (8.03% with Brazil and 7.16% with Argentina) (WITS, 2024). Consequently, the inflation trend in Chile followed North America rather than the Latin American region during this period. On the other hand, a weaker supply chain and high import share with

neighbors resulted in common high inflation in emerging Latin American economies during the period.

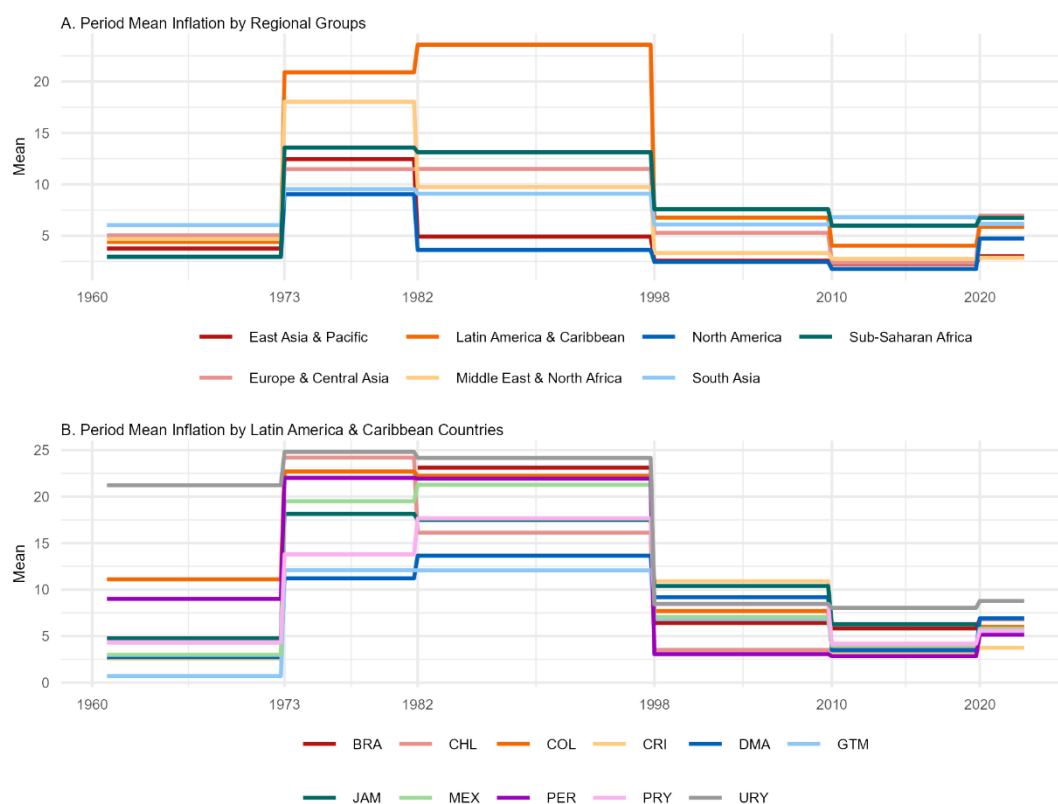


Figure 2.12 Inflation Dynamics Across Regional Groups

Source: Authors' calculation.

Considering the regional clustering of economies, such as advanced European and North American economies, emerging Latin American, African, and Eurasian economies, and rapidly growing Asian economies, it's evident that any emerging economy with fewer resources for alternate supply options and extensive trade relations with border countries tends to follow regional inflation trends. In this context, regional clusters act as a "curse of geography," contributing to structural differences in inflation across income groups. Therefore, emerging economies in Latin America, Sub-Saharan Africa, and South Asia are prone to have higher overall inflation compared to countries in other regions.

2.2.3. Profit and markup-led inflation

The inflationary impact of imbalances in the global system is not only limited to exogenous shocks but also transmits through institutional dynamics. For instance, when there is a supply bottleneck or a common shock in production, such as depreciation leading to heightened import prices, "firms can safely increase prices since they have a mutual expectation that all market players will do the same" (Weber & Wasner, 2023, p. 190). In this framework, firms can shift the burden of adjustment onto prices, a phenomenon often referred to as 'profit-led' inflation, which emphasizes the distributional origins and outcomes of inflation, even while keeping markups constant (Nikiforos, Grothe, & Weber, 2024).

Emerging economies have weaker competitive domestic markets (Ha, Ivanova, Ohnsorge, & Unsal, 2019), limited trade integration (Gonzalez-Garcia & Yang, 2020), and a higher shadow economy, resulting in an unidentified higher share of cartels (Aghion, Cherif, & Hasanov, 2021) compared to advanced economies. As a result, profit-led inflation could be frequently observed in emerging economies because of oligopolistic power resulting from institutional structures that enable firms to potentially pass on cost increases to consumers at a disproportionate rate (Matamoros, 2023).

Moreover, when faced with supply-side shocks, firms may not only safeguard profit margins but could potentially expand them (Weber & Wasner, 2023). As depicted in Figure 2.13, even in industrialized countries like the US, markups have reached historical highs in the post-pandemic period in response to several supply chain disruptions. Furthermore, similar markup increases have become one of the significant reasons for the post-pandemic rise in inflation in industrialized economies (Matamoros, 2023).

Unfortunately, literature on both profit-led and markup-led inflation stories for emerging economies is lacking. Although several research papers have shown historically low increases in aggregate markups in emerging economies compared to advanced ones, these differences in markup increases are generally driven by high-

tech, innovative companies in advanced economies (Loecker & Eeckhout, 2017). Therefore, it is essential to focus on industries with a higher share in the consumer basket when analyzing the impact of markups on inflation.

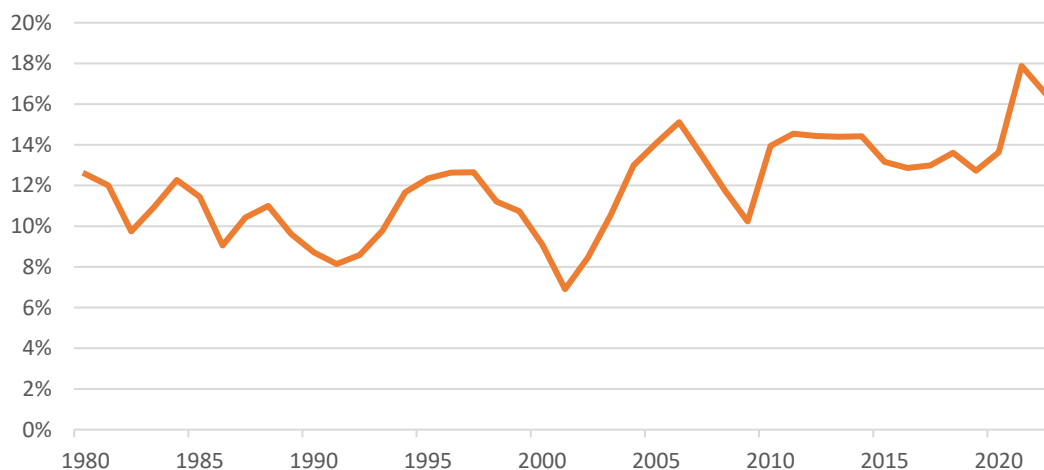


Figure 2.13 Non-Financial Corporate Profit Margins in the US

Source: Palazzo (2023).

For instance, markup increases in utilities such as electricity, gas, steam, air conditioning supply, water supply, sewerage, waste management, and remediation activities are more prevalent in emerging markets compared to advanced economies (Díez, Fan, & Villegas-Sánchez, 2021). More importantly, these specific components, defined as "systemically significant prices" by Weber et al. (2024), are considered to have the greatest impact on overall price stability. Consequently, emerging economies, which face frequent supply chain shocks and exchange rate fluctuations, are expected to be more affected by markup-led inflation than advanced economies, as observed in the case of Türkiye (Kiper, 2021) and Latin America (Baer, 1967). Furthermore, the greater the proportion of imported inputs in costs, the more significant the increase in exchange rate pass-through due to a higher markup rate (Pereira & Missio, 2024).

2.3. Propagation and expectations

If the imbalances that trigger high inflation are not addressed, these structural factors can propagate into higher inflation through three categories: the fiscal mechanism (including social security and exchange-rate systems), the credit mechanism, and the

price and income adjustment mechanism (Vásquez, 2016). In other words, structural non-monetary pressures compel authorities to engage in monetary accommodation. The expansion of the money supply becomes nearly inevitable once the social costs of recession-induced monetary shortages are acknowledged, highlighting money endogeneity (Carvalho, 2019).

Due to wage indexation, civil service and public utility salary hikes exacerbate the problem, causing budget deficits because tax revenues are inflexible due to poor direct tax collection in emerging economies. Public utility price setters face a dilemma: raising prices worsens inflation and political issues while keeping prices stable leads to overloading and increasing deficits, further driving inflation (Seers, 1962). Moreover, in response to inflation, several economic controls set by the government to ease inflationary pressures in the short run result in structural issues in the longer term. For instance, price controls in some sectors lead to low relative prices and decreasing producer incentives to produce or invest, while interest rate controls result in free credit as real interest rates become negative (Baer, 1967). Furthermore, control of exchange rates, especially overvaluation, reduces export competitiveness, worsening the initial foreign exchange shortage (Seers, 1962). On the other hand, in high-inflation economies, if not controlled, the domestic currency tends to lose its functions as an accounting unit and store of value and sometimes even its role as a medium of exchange (Dijkstra, 1997). This can lead to people using foreign currency (like the dollar) extensively. When prices are set in dollars, a depreciation or devaluation of the domestic currency automatically leads to price increases, further fueling inflation (Dijkstra, 1997).

Given that, in attempting to overcome one challenge, underdeveloped countries may find themselves facing another (Maynard, 1961), leading to frequently high inflation, these instabilities result in a high inflation memory and, consequently, high inflation expectations within these economies. As seen in Figure 2.14, inflation expectations in emerging economies are always higher and more volatile than in advanced economies, even in the long run.

Moreover, central banks in emerging economies often face credibility issues and operate within environments of highly volatile exchange rates, causing high inflation expectations to become unanchored (Kose, Matsuoka, Panizza, & Vorisek, 2019). Consequently, the response of expectations to inflation became higher in emerging economies than in advanced ones (Figure 2.14.D), leading to backward-looking inflation expectations (Caballero, Chui, Kohlscheen, & Upper, 2023). On the other hand, trust in the monetary authority results in forward-looking inflation expectations in advanced economies (Galati, Poelhekke, & Zhou, 2011), which indeed results in institutionally different inflation between advanced and emerging economies.

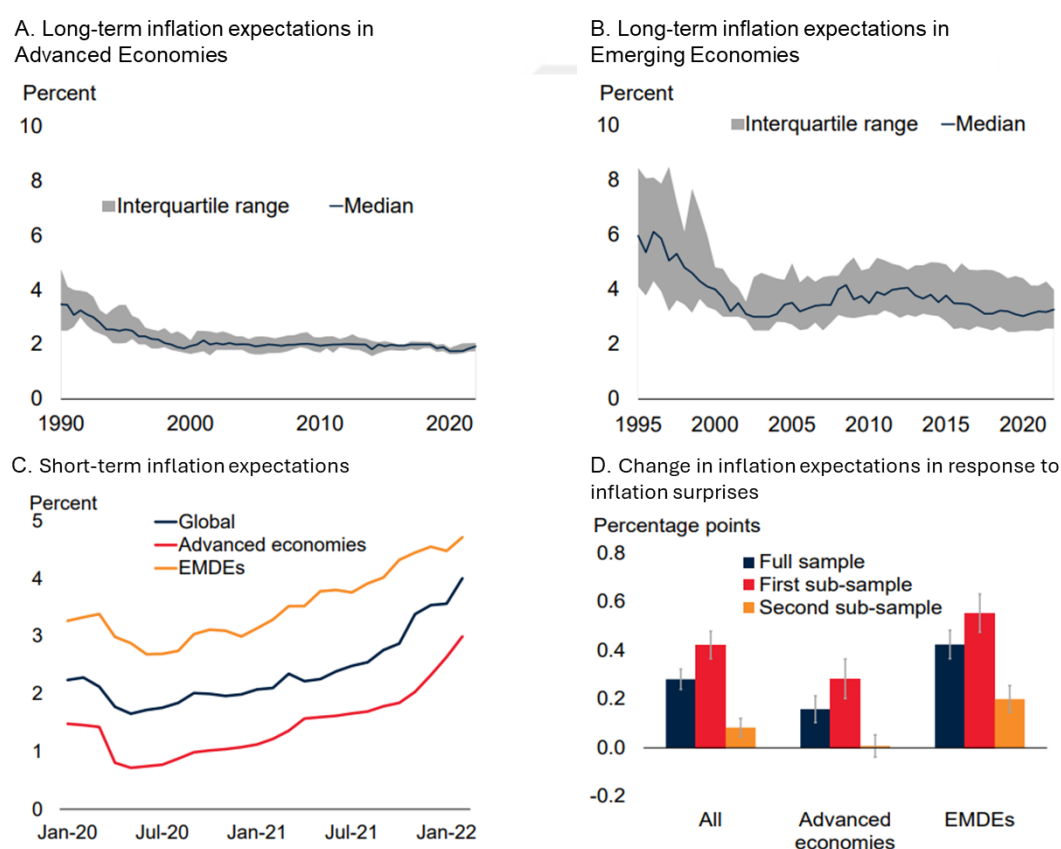


Figure 2.14 Inflation Expectations

Source: Ha, Kose, & Ohnsorge (2022).

Unlike advanced economies, unanchored high inflation expectations encourage consumers to prioritize consumption over saving due to the cost of real loss. While this behavior will keep the demand alive, it may also result in higher nominal wage targets for the labor force (Lavoie, 2022), further driving up costs and prices. This

persistent inflationary pressure creates a self-fulfilling cycle, further eroding the credibility of central banks, especially in environments with higher interest rates that fail to reduce demand and, consequently, inflation.

Consequently, in the event of an inflation shock, expectations remain high and contribute to prolonged high inflation in emerging countries (Mohanty & Klau, 2001; Ha, Kose, & Ohnsorge, 2022), further perpetuating structural supply issues (Pagliacci, 2023) that may reignite exchange rate depreciation and trigger a second inflationary wave. However, such propagation elements are mechanisms that, while not capable of initiating inflation on their own, can sustain and even intensify inflationary pressures originating from structural sources (Canavese, 1982).

2.4. Concluding remarks

In conclusion, our research has provided a comprehensive understanding of the structural dynamics underlying high and volatile inflation in emerging economies compared to advanced ones. By examining institutional, structural, and historical factors, we have identified five interconnected drivers contributing to this phenomenon.

Emerging economies face continuously higher exchange rate depreciation due to persistent current account deficits, commodity price fluctuations, and capital flow dynamics. In this regard, country groups experiencing significant and persistent depreciation generally exhibit higher inflation levels than other income groups. Moreover, the weak supply chain systems in emerging economies, coupled with limited alternative supply options, lead to a mirroring of regional inflation trends. Therefore, emerging economies in Latin America, Sub-Saharan Africa, and South Asia are prone to have higher overall inflation compared to countries in other regions.

Institutional dynamics in emerging economies further worsen the inflationary environment, frequently perpetuating profit-led and markup-led inflation as firms seek to maintain or raise profit margins by passing cost increases onto consumers. Weak domestic competition and limited trade integration further exacerbate inflationary

pressures in these markets. Consequently, due to institutional dynamics discouraging price reductions, disinflationary processes lag behind inflationary pressures, highlighting asymmetry in price adjustments. This phenomenon contributes to the persistence of inflation even when external cost factors decline.

Additionally, the lack of credibility in central banks further fuels structural issues in price formation in emerging economies. Consequently, these interconnected structural/institutional issues are leading to unanchored inflation expectations, which perpetuate high and persistent inflation rates in emerging economies.

The implications of high and volatile inflation in emerging economies are significant, particularly in terms of wealth and income inequality. Poorer households bear the brunt of food price volatility, while real minimum wage increases may lead to layoffs of less skilled workers, further exacerbating income inequality. Therefore, it is essential for emerging economies to control inflation by easing the structural and institutional limits, which are the true reason for inflation. Firstly, addressing the import dependency and supply chain vulnerabilities necessitates robust policies aimed at diversifying sources of essential imports and enhancing domestic production capabilities. This could involve investments in infrastructure, technology, and human capital to bolster domestic supply chains and reduce reliance on volatile global markets. Additionally, prudent management of current account deficits is imperative, requiring policies to attract stable foreign direct investment and mitigate risks associated with volatile portfolio flows. Measures to enhance exchange rate stability, such as building foreign exchange reserves and implementing effective exchange rate management frameworks, are crucial to mitigate inflationary pressures stemming from exchange rate fluctuations. Moreover, anchoring inflation expectations through credible monetary policy frameworks and communication strategies is essential to mitigate the impact of unanchored expectations on inflation dynamics.

CHAPTER 3

IS “HIGH INFLATION” ALWAYS AND EVERYWHERE AN EXCHANGE RATE PHENOMENON?³

In the wake of the pandemic, the world has been grappling with an unexpected resurgence of high inflation, challenging the traditional role of central banks in maintaining price stability. This phenomenon has sparked renewed debates and raised critical questions: What are the main factors driving this surge in inflation? And can we develop reliable tools to predict future episodes of high inflation?

To comprehensively address these questions, we delve into the historical context of "high inflation," analyzing the period from 1961 to 2023 to identify significant episodes. Defining "high inflation" based on a literature review considering diverse economic characteristics, we set threshold levels exceeding 10% for middle-income countries and 5.5% for high-income countries. These benchmarks guide our investigation into the determinants of "high inflation," focusing on 21 high-income, 23 upper-middle-income, and 7 lower-middle-income countries.

Our study corroborates the widely accepted notion that supply factors significantly impact inflation, which is analyzed intensively in inflation literature. Firstly, we follow both mainstream studies such as Batini, Jackson, and Nickell (2005), Holmberg (2006), and Rumler (2007), as well as heterodox studies such as Kalecki (1971), Bastian & Setterfield (2020), Lavoie (2022) in terms of including exchange rates and imported input costs as part of an open economy structure. However, we set our

³ This chapter was presented at the 27th FMM Conference: Inflation, Distributional Conflict, and Just Transition on October 20, 2023, and published on the conference website: https://www.boeckler.de/data/downloads/IMK/FMM%20Konferenz%202023/v_2023_10_20_comert.pdf

inflation equation apart from mainstream models by incorporating endogenous wages and bargaining power, which are a function of depreciation, following the theoretical framework of Bastian & Setterfield (2020), Charles, Bastian, & Marie (2021) and Lavoie (2022). Additionally, the inclusion of markup as a function of supply-side shocks, as suggested by Blecker (2011) and Lavoie (2022), further differentiates our inflation equation from the mainstream inflation equation. While examining inflation as a function of markup, unit labor, and material costs, we underscore the importance of the exchange rate on all three. This framework explains the nonlinear relationship between the exchange rate and inflation, a subject that is not theoretically explored in the majority of existing mainstream literature.

In the beginning, using scatter diagrams, we visually explore the theoretical relationships between variables, particularly observing the nonlinear relationship of exchange rates with inflation. For detailed econometric analysis of these relationships in a binary choice framework to analyze determinants of "high inflation," we employ the random effects panel probit model. By combining various aspects of the literature while establishing a more structural inflation formation, we unravel the primary determinants of "high inflation," a question hitherto unexplored in the literature. Moreover, the panel probit model developed in this study serves as a useful tool for a "high inflation" early warning system.

Our study contributes to prior research on inflation determinants, summarized in three key aspects:

1. Exchange rate fluctuations emerge as the predominant determinant of "high inflation."
2. Solely, exchange rate depreciation itself accounts for nearly all instances of high inflation in upper-middle-income countries and a majority in high and lower-middle-income countries.
3. As an early warning indicator of "high inflation," around 25% depreciation signals "high inflation," with a probability exceeding 80% in middle-income countries and 70% in high-income countries.

With our findings, we confidently revise Friedman's (1963) renowned yet challenged

statement that "Inflation is always and everywhere a monetary phenomenon" to "High inflation is frequently, and in almost everywhere, an exchange rate phenomenon."

In conclusion, our research provides a comprehensive understanding of “high inflation” across income groups, further emphasizing and contributing the critical role of historical exchange rate dynamics and supply-side factors in comprehending the complexities of “high inflation.” This insight holds crucial implications for policymakers and economists, emphasizing the importance of monitoring exchange rates as an early warning signal for potential high inflationary pressures.

From the outset, we embarked on identifying the “high inflation” threshold in Section 3.1.1. Having established the benchmark for “high inflation,” we analyzed the literature, focusing on major factors contributing to inflation in Section 3.1.2. In Section 3.2, we present our data and descriptive statistics. Section 3.3 outlines the panel probit model, and Sections 3.4 and 3.5, respectively, provide the results and discussions. The research concludes with a section summarizing the findings and implications.

3.1. Literature review

3.1.1. What is the “high” level of inflation?

The concept of “high inflation” thresholds, beyond which rising inflation rates may hinder economic growth, has gained significant attention in global studies. However, the relationship between inflation and economic growth is a dynamic and complex process. For instance, inflationary pressures can arise as an unintended consequence of increased aggregate demand, which may not significantly harm economic growth (Pollin & Zhu, 2006). Thus, such inflation levels are not identified as “high.” On the other hand, inflation and economic growth can be negatively related in certain situations, such as when inflation is caused by monopolistic pricing, exchange rate fluctuations, or supply disruptions of goods and services (Pollin & Zhu, 2006). As “high inflation” determination is based on identifying the inflation level that harms real growth, “high inflation” would primarily be associated with non-demand factors.

It's important to note that in this study, we align ourselves with the idea from this literature that high inflation is a level that diminishes growth. Our definition reflects a choice rather than a universal truth.

In earlier research, Bruno and Easterly (1998) noted that a 40 percent inflation rate leads to substantial output losses. However, what constitutes “low” and “high inflation” varies globally due to structural disparities in determinants (Thanh 2015). Several studies have explored the differences in inflation thresholds between developed and developing economies. In-depth analyses that distinguished between industrialized and non-industrialized economies revealed diverse threshold levels. Khan and Senhadji (2000) found that developed countries experience significant output losses when inflation rates reach 1% to 3%, whereas developing countries can tolerate higher inflation rates of 7% to 11%.

Ibarra and R. Trupkin (2016) revealed three distinct threshold categories in a study focused on emerging economies. Inflation rates between 1% and 5% stimulate growth, while rates between 5% and 9% have no significant negative impact on output. However, countries with “regular” institutions experience harmful growth effects at inflation rates above 12% to 15%, and rates above 19% are detrimental to countries with “bad” institutions. On the other hand, “good” institutional emerging economies exhibit a 7% to 8% inflation threshold for stimulating growth. For example, ASEAN countries’ growth experienced significant negative impacts after surpassing a 7.84% inflation threshold (Thanh 2015).

Given the variation in “high inflation” threshold values across different research studies (as presented in Table 3.1), a consensus about what defines a “high inflation” level remains elusive. Considering the extensive existing literature on this topic and the well-established methodologies for such a determination, there is no necessity to generate a new estimate of “high inflation.” Instead, we chose to identify the “high inflation” threshold as the median value that emerged from these 19 well-considered “high inflation” thresholds from the literature (as presented in Table 3.1). Through this methodology, we established unique threshold values of 10% for middle-income countries and 5.5% for high-income countries.

Table 3.1 “High Inflation” Threshold Literature Review: The Panel Analyzes

Authors	Countries	Variables	Methodology	Threshold findings
Bruno and Easterly (1998)	127 countries	CPI, per capita growth	Descriptive analysis	40%
Khan and Senhadji (2000)	140 countries	GDP, CPI, investment, population, initial income, trade	Likelihood ratio (LR)	Developed economies 1-3% Developing economies 7-11%
David, Pedro, and Paula (2005)	138 countries	GDP, CPI, investment, population, trade, openness	Fixed effects	Industrialized economies 2.6% and 12.6% Non-industrialized economies 19.2%
Pollin and Zhu (2006)	80 countries	GDP, CPI, investment, government spending, fiscal deficit, educational level, life expectancy, trade, natural disasters, war impacts	Pooled ordinary least squares (OLS) between effects, fixed effects, and random effects	15-18%
Huang et al. (2010)	71 countries	GDP, CPI, private credit, bank assets, liquid liabilities, schooling, black market premium, government expenditure, openness	Instrumental-variable threshold regression	7.31-7.96%
Omay and Kan (2010)	6 industrialized countries	GDP, CPI, investment, openness	Panel Smooth Transition Regression (PSTR)	2.52%
Yilmazkuday (2011)	84 countries	GDP, CPI, initial secondary enrollment rate, M3, government size, openness	Rolling-window two-stage least squares regressions	8%
Kremer, Brick, and Nautz (2013)	124 countries	GDP, CPI, investment, population, initial income, openness	Dynamic Panel Threshold Model (DPTM)	Industrialized economies 2% Non-industrialized economies 17%
Vinayagathan (2013)	32 Asian Countries	GDP, CPI, investment, population, initial income, trade, openness	Dynamic Panel Threshold Model (DPTM)	5.43%
Muzaffar and Junankar (2014)	14 Asian developing countries	GDP, CPI, household consumption, financial deepening, government expenditure, trade openness, agriculture's share of GDP, Oil and commodity price	SGMM	13%
Thanh (2015)	ASEAN countries	GDP, CPI, employment, investment, government spending, trade	Panel Smooth Transition Regression (PSTR)	7.84%
Ibarra and R. Trupkin (2016)	138 countries	GDP per capita, CPI	Panel Smooth Transition Regression (PSTR)	“Good” institutional emerging economies 7-8% “Regular” institutional emerging economies 12-15% “Bad” institutional emerging economies 19%
Aydın, Esen, and Bayrak (2016)	Azerbaijan, Kyrgyzstan, Kazakhstan, Uzbekistan, Turkmenistan	GDP, CPI, investment, population, initial income, trade, openness	Dynamic Panel Threshold Model (DPTM)	7.97%
Ndoricimpa (2017)	African countries	GDP, CPI, investment, population, initial income, trade, openness, government spending, political instability	Panel threshold model	Low-income countries 9% Middle-income countries 6.5%
Kelikume (2018)	41 African countries	GDP, CPI, investment, population, initial income, trade, openness	Dynamic Panel Threshold Model (DPTM)	11.10%

Table 3.1 (continued)

Authors	Countries	Variables	Methodology	Threshold findings
Ehigiamusoe, Lean, and Lee (2019)	16 West African countries	GDP, CPI, private credit, liquid liabilities, government expenditure, openness, human capital	ARDL	5.62%
Farahani, Ghabel, and Mohammadpour (2021)	8 developing Islamic countries	GDP, CPI, financial development, physical capital, labor force, trade openness	Panel Smooth Transition Regression (PSTR)	11.88%
Ibrahim, Aluko and Vo (2022)	36 sub-Saharan African countries	GDP, CPI, financial deepening, investment, population, openness, human capital	Threshold regression model	6.76-7.65%
Azam and Khan (2022)	16 developing and 11 developed economies	GDP per capita, CPI, investment, household consumption, government expenditure, real exports, population growth rate	FGLS	Developed economies 5.28% Developing economies 12.23%

Table 3.2 “High Inflation” Threshold Literature Review: Country-specific Analyses

Authors	Countries	Variables	Methodology	Threshold findings
Frimpong and Oteng-Abayie (2010)	Ghana	GDP, CPI, labor force, trade, money supply	Threshold regression model	11%
Bawa and Abdullahi Ismaila (2012)	Nigeria	GDP, CPI, investment, population, openness, financial deepening	Threshold regression model	13%
Yabu and Kessy (2015)	Kenya, Tanzania, and Uganda	GDP, CPI, FDI, investment, population, credit, openness	Quadratic regression model	Kenya 6.77% Tanzania 8.8% Uganda 8.41%
Dammak and Helali (2017)	Tunisia	GDP, CPI, M2, REER, export, import	Two-regime structural equation in threshold autoregression (TAR) model	3.48%
Jiranyakul (2017)	Thailand	GDP, CPI, investment, population	Conditional least square (CLS)	3%
Behera and Mishra (2017)	India	GDP, CPI, exchange rate, interest rate	Conditional least square (CLS)	4%
Asaduzzaman (2021)	Bangladesh	GDP, CPI, FDI, M2, trade openness, government spending, savings	Quadratic regression model	8%
Alsabbab and Alnuwaier (2021)	Saudi Arabia	GDP, CPI, investment, M3, trade	Threshold regression model	3%
Tarawalie and Kamara (2022)	Sierra Leone	GDP, CPI, investment, exchange rate, trade, openness	Quadratic regression model	10.30%

Furthermore, we account for “high inflation” thresholds as the median value ± 0.5 standard deviations (approximately $0.5 \times 4.5\%$) of the literature thresholds for a robustness check.

However, it’s important to acknowledge that while panel analyses offer valuable insights, these generalized threshold values might not perfectly fit every country within each income group, as evidenced by the findings outlined in Table 3.2. Nonetheless, this limitation does not undermine the core objective of our study, which

is to establish a global understanding of what qualifies as “high inflation.”

3.1.2. Theoretical framework of determinants of inflation

The inflation equation can be derived from the wage-cost markup setup in Post Keynesian literature or from micro-foundations, as in the mainstream literature (please refer to Appendix b for the derivation of inflation in the New Keynesian framework). According to Kalecki (1971) and Weintraub (1978), a firm, in the pursuit of profitability, determines the price (p) of its product by applying a markup to its direct cost, as shown below:

$$p = (1 + k) \frac{wl}{y} \quad (1)$$

, where k is the average markup, w is average nominal wage, l is labor, and y is real output. From this equation, similar to Charles, Bastian, & Marie (2021) and Lavoie (2022), we can derive inflation as below:

$$\pi = \Delta(1 + k) + \Delta w + \Delta l - \Delta y \quad (2)$$

, where Δ identifies change. Inflation arises from changes in markup, wages, and labor productivity ($\Delta y - \Delta l$). In an open economy structure, following Kalecki (1971) and Lavoie (2022), Equation 2 can be rewritten as below:

$$\pi = \Delta(1 + k) + \Delta w + \Delta l - \Delta y + \Delta j \quad (3)$$

, where j is the share of imported materials in production, which is affected by raw material prices (p_{im}), exchange rates (fx), and changes in the amount of imported materials in production (im) (Lavoie, 2022; Bastian & Setterfield, 2020). Explicitly, the equation became as follows:

$$\pi = \Delta(1 + k) + (\Delta w + \Delta l - \Delta y) + (\Delta p_{im} + \Delta fx + \Delta im - \Delta y) \quad (4)$$

, where $(\Delta w + \Delta l - \Delta y)$ represents Unit Labor Cost (ULC) and $(\Delta p_{im} + \Delta f_x + \Delta im - \Delta y)$ is Unit Material Cost (UMC). While Equation 4 is almost identical to the mainstream inflation equation (please refer to Equation 8 in Appendix b), there are structural differences in the markup and wage formation. Both are formed through conflicting claims between firms and the labor force. Thus, in their simple form, they can be identified as in Lavoie (2022), Bastian & Setterfield (2020), Charles, Bastian, & Marie (2021), and other Post Keynesian authors as follows: ⁴

$$\Delta w = \Omega_1(\omega_w - \omega_{-1}) + \Omega_2\pi_{-1} + \Omega_3(\Delta y - \Delta l) \quad (5)$$

, where Ω_1 is a parameter that indicates to what extent labor unions react to a discrepancy between the previous period's actual real wage (ω_{-1}) and the desired real wage rate of labor (ω_w), Ω_2 is wage indexation bargaining power with respect to the previous period's inflation and Ω_3 denotes the wage adjustment parameter for labor productivity (Lavoie, 2022). Similar to labor, firms also set a real wage target to determine the markup as follows:

$$\pi = \Phi_1(\omega_{-1} - \omega_f) + \Phi_2\Delta w - \Phi_3(\Delta y - \Delta l) + \Phi_4\Delta UMC \quad (6)$$

, where Φ_1 , Φ_2 , Φ_3 , and Φ_4 are the price adjustment parameters of firms with respect to the discrepancy between the previous period's actual real wage (ω_{-1}) and the firms' desired real wage rate (ω_f), labor cost, productivity, and material cost. When $\Phi_{2,3,4} = 1$, implying that firms pass all costs to consumers, Equation 6 became equal to Equation 4, while $\Phi_1(\omega_{-1} - \omega_f)$ identifies a change in the markup.

However, when inflation rates exceed some specific threshold (where it turns out to be “systematically high”), according to Simonsen (as cited in Charles, Bastian, & Marie (2021)), agents often adopt the exchange rate as one of the main references for wage

⁴ Considering that labor bargaining power and wage targets depends on unemployment (Blanchard & Katz, 1997; Ball & Moffitt, 2001; Lavoie, 2022), replacing the term $\Omega_1(\omega_w - \omega_{-1})$ with unemployment results in a wage equation defined by Blanchard & Katz (1997) and Ball & Moffitt (2001). However, unemployment is not the only determinant of wage targets and bargaining power. Thus we follow the structure presented in Equation 5.

indexation. Therefore, while nominal wages indexation considers wage target relative to actual wage and current inflation, exchange rate depreciation became an additional component of wage determination as suggested by Bastian & Setterfield (2020) and Charles, Bastian, & Marie (2021) as below:

$$\Delta w = \Omega_1(\omega_w - \omega_{-1}) + \Omega_2\pi_{-1} + \Omega_3(\Delta y - \Delta l) + \Omega_4\Delta f x_{-1} \quad (7)$$

Moreover, according to Charles, Bastian, & Marie (2021), high-inflation memory-having countries tend to index faster than countries without such experience. When continuous real wage erosions become greater, labor will try to compensate for the loss through harder bargains (Lavoie, 2022). In this framework, the wage adjustment parameter to depreciation becomes an endogenous function of the “admissible distance (ε) between the target and the actual real wage” (Lavoie, 2022, p. 607):

$$\Omega_4 = f_\Omega[\omega_w - (\omega_{-1} + \varepsilon)] \quad (8)$$

But how does this occur? Let’s transform Equation 4 to obtain real wages as follows:

$$\Delta w - \pi = -\Delta(1 + k) + (\Delta y - \Delta l) - UMC \quad (4')$$

Real wages are negatively affected by markup and UMC (Bastian & Setterfield, 2020) and positively affected by productivity. Thus, when a “dramatic supply-side shock” occurs, or the exchange rate significantly depreciates, UMC rises and decreases the real wages, triggering Equation 8 (Lavoie, 2022).

By placing Equation 8 into 7 and 7 into 6, we obtain the inflation equation as below:

$$\pi = \Phi_1(\omega_{-1} - \omega_f) + \Phi_2\{\Omega_1(\omega_w - \omega_{-1}) + \Omega_2\pi_{-1} + \Omega_3(\Delta y - \Delta l) + f_\Omega[\omega_w - (\omega_{-1} + \varepsilon)]\Delta f x_{-1}\} - \Phi_3(\Delta y - \Delta l) + \Phi_4\Delta UMC \quad (9)$$

Moreover, according to Blecker (2011) and Lavoie (2022), firms’ real wage targets are a function of their target markup. In this framework, when there is a common shock to

production from UMC components, firms increase the nominal markup more than the costs. Besides, firms encountering a scarcity of inputs due to a bottleneck on the supply side may adopt a more assertive approach to increasing prices. This strategy not only safeguards profit margins but could potentially lead to their expansion (Weber & Wasner, 2023). Thus, according to Blecker (2011) and Lavoie (2022), when faced with UMC shocks, especially in terms of exchange rate shocks, firms decide to reduce the real wage target to increase markups or at least keep it intact. This adjustment is important because otherwise, an increase in UMC leads to a decrease in markup, as displayed in Equation 4' (Bastian & Setterfield, 2020). In this framework, the real wage target of firms can be identified as in Blecker (2011) below:

$$\omega_f = \frac{1}{1+k_f} \quad (10)$$

, where k_f is the target profit markup rate, which is an increasing function of real exchange rate depreciation ($\Delta f x_{-1} - \pi_{-1}$). The target real wage can also be defined in linear form as in Lavoie (2022), Bastian & Setterfield (2020), and Blecker (2011) below:

$$\omega_f = \omega_{f0} - \Phi_5(\Delta f x_{-1} - \pi_{-1}) \quad (10')$$

One point should be noted: in response to UMC shocks, firms do not necessarily need to squeeze nominal wages but can instead increase inflation targets, which also decreases real wage targets (Matamoros, 2023). Replacing firms' real wage target (Equation 10') in Equation 9, we obtain the final inflation equation as below:

$$\begin{aligned} \pi = & \Phi_1(\omega_{-1} - [\omega_{f0} - \Phi_5(\Delta f x_{-1} - \pi_{-1})]) + \Phi_2\{\Omega_1(\omega_w - \omega_{-1}) + \Omega_2\pi_{-1} + \\ & \Omega_3(\Delta y - \Delta l) + f_{\Omega}[\omega_w - (\omega_{-1} + \varepsilon)]\Delta f x_{-1}\} - \Phi_3(\Delta y - \Delta l) + \Phi_4(\Delta p_{im} + \Delta f x + \\ & \Delta im - \Delta y) \end{aligned} \quad (11)$$

Now, the exchange rate has become not only part of UMC but also directly affects i) wage indexation, ii) the power of indexation, and iii) the markup when inflation is “high.” While this formulation may explain Latin American economies' propensity to

experience high inflation rates (Charles, Bastian, & Marie, 2021), it clarifies how the non-linear relation between inflation and exchange rates emerges.

After obtaining the theoretical structure of inflation determinants, we can now proceed to analyze “high inflation” determinants through an empirical model. However, before doing that, we need to reconcile both theoretical and empirical conflicts in inflation determinants literature. Starting with demand, we will focus on output, following the approach of many Central Banks (Brázdik, et al., 2020), rather than unit labor cost.

Our decision is firstly based on the endogeneity between wage indexation and exchange rate depreciation, which, if ignored, will result in countercyclicality (please refer to Appendix b, where we highlighted Mazumder’s (2010) discussions about countercyclical marginal costs). While most recent mainstream literature ignores this endogenous relation, Holmberg (2006) highlights the possibility of a higher degree covariation between “true” real marginal cost and inflation, explaining their insignificant marginal cost and inflation relationship result. Moreover, Neiss and Nelson (2005) highlight the lack of wage-adjustment equations in their analysis.

Secondly, the issue associated with ULC lies in the difficulties associated with estimating dynamically changing labor bargaining power and firms' cost reflection. According to Lavoie (2022), while the real wage target of labor is a function of the discrepancy between actual and “normal” economic growth, firms’ real wage target depends on capacity utilization and rate of return. Moreover, labor bargaining power is also a function of unemployment (Blanchard & Katz, 1997; Ball & Moffitt, 2001; Lavoie, 2022). Therefore, considering real output to formulate excess demand instead of ULC eases complex dynamics that can be observed in endogenously determined labor market variables.

However, the major issue is that utilizing output instead of ULC is the true output gap estimation, as Neiss and Nelson (2005) discussed (please refer to inflation derivation in the NK framework in Appendix b). Potential output (or normal capacity utilization in the Post Keynesian approach) derived from the production function assumes that potential output is “determined independently from the path of actual short-run levels

of output” (Serrano, 2019, p. 6). However, as Serrano notes, labor is typically not scarce, and capital accumulation is determined by demand trends through the super multiplier mechanism. Therefore, both the trend and the cycle are propelled by identical forces, with their determinants rooted in the evolution of effective demand (Serrano, 2019).

Thus, the commonly used advanced modeling techniques in Central Banks employ the Kalman filter to estimate the output gap in relation to inflation (Capek, Hlédik, Kotlán, Polák, & Vávra, 2003). However, as noted by economists from the Czech National Bank, such models have forced aim to obtain a “measure of potential output that is useful to forecast inflation” because “it makes sense to use the historical information on inflation to condition estimates of potential output. For example, an observation that inflation is rising makes it more likely that there was excess demand at the time (or a bit earlier, given the lags in the system)” (Capek, Hlédik, Kotlán, Polák, & Vávra, 2003, p. 14). Since the Kalman filter estimates the unobservable output gap in relation to inflation, it sounds non-reliable to utilize this purposely artificially generated variable for inflation determinants analysis.

On the other hand, as simple detrended output may result in a completely unreliable impact on inflation, as discussed in the Appendix b, we use real GDP growth instead. This preference burdens the cost of ignoring cyclical fluctuations and the economy's potential but minimizes the estimation error of the demand impact on inflation through filter-based unobservable⁵ gaps and potential. As a result, we opted to initiate our analysis with GDP growth, a directly observable variable that offers greater reliability compared to detrended GDP. Nevertheless, to ensure the robustness of estimates, we will reevaluate the empiric model with the output gap obtained from the HP filter.

Furthermore, considering the difficulties of estimating all imported input prices, empirical models often utilize oil and oil-excluded commodity indices as $p_t^{invoice}$ in the inflation equation for commodity importer economies. In commodity-exporting

⁵ Factors such as the choice of lambda value in the Hodrick-Prescott (HP) filter or initial conditions in the Kalman filter can lead to divergent outcomes in gap estimation.

countries, energy and raw food commodities are not considered as imported intermediate goods but rather as components of local input costs.⁶ In this framework, Forbes, Gagnon, & Collins (2021) and Jasova, Moessner, & Takats (2020) found highly significant results for oil and nonfuel commodity impact on inflation through real marginal cost. However, among many commodity prices, oil and food commodity prices are found to be the most significant in determining inflation (Abbas & Lan, 2020), with impacts varying with country characteristics. For instance, economies characterized by larger proportions of food prices within their Consumer Price Index (CPI) baskets and higher reliance on fuel tend to be more vulnerable to sustained inflationary impacts resulting from fluctuations in commodity prices (Gelos & Ustyugova, 2012).

Following Gopinath et al. (2020) and the dominant currency paradigm (please refer to Appendix b), we use local currency value with respect to the US dollar instead of NEER, commonly employed in the empirical inflation equations. Moreover, although it's acknowledged that monopolistic pricing and expectations also determine inflation, the absence of a universal variable for identifying such pricing and expectations across countries has prevented their inclusion in our analysis as a determinant of "high inflation." To navigate the challenge related to expectations, we adopt a perspective proposed by Nasir, Huynh, and Vo (2020b), suggesting that the determinants of inflation at a given time also shape inflation expectations at that same time. Consequently, we don't explicitly differentiate between the impact of determinants on expectations and the subsequent influence of expectations on inflation. Instead, we recognize that the impacts of all independent variables accumulate in inflation both directly and indirectly through expectations.

In conclusion, considering the determinants of inflation as in Equation 11 (and 8 in Appendix b) and the discussion about proxy variable selection above, the reduced form inflation function that will be used in this research is identified below:

$$\pi_t = f(\Delta GDP_t, \Delta f x_t, \Delta p_t^{energy}, \Delta p_t^{food}) \quad (12)$$

⁶ At the end, the inflation equation will not differ between commodity exporters and importers.

3.2. Data and descriptive statistics

3.2.1. Data preparation

The data used in this research span from the first quarter of 1961 to the first quarter of 2023 and are collected quarterly. The datasets encompass cumulative price levels, real GDP, and exchange rates against the USD, all retrieved from the International Financial Statistics (IFS) with quarterly observations. For Mexico, Türkiye, and South Africa, GDP growth data between the 1961-1992 period is obtained from the FRED. To ensure consistency, all variables are converted into annual percentage changes. The real GDP data is also subjected to a Hodrick–Prescott (HP) filter to discern trend and gap components, where a lambda value 1600 is utilized.

Energy and food commodity indices data are sourced from the World Bank and are denominated in nominal US dollars, with a base year of 2010 and an index value of 100. These monthly indices are transformed into quarterly observations by calculating the averages.

Due to data availability constraints, the analysis focuses on 51 countries with complete datasets for the three variables in the IFS database. Among these, 21 nations are categorized as high-income, 23 as upper-middle-income, and 7 as lower-middle-income, according to the World Bank’s income group classification (selected countries are displayed in Table b.1 in the Appendix).

For several reasons, we preferred annual changes over quarterly ones in the management of the data. Firstly, varying seasonal patterns across the analyzed countries make it challenging to uniformly apply well-known deseasonalization methods such as TRAMO/SEATS and X-13/11. These methods require country-specific adjustments to account for calendar events, as using them without adjustment consideration could distort the inherent characteristics of the data. Secondly, the preference for annual changes over quarterly changes is guided by the existing literature's focus on identifying “high inflation” and exchange rate depreciation. Since both aspects concentrate on annual changes, employing quarterly changes could

complicate the distinction of threshold values.

Before starting our analysis, it should be noted that each income group's dataset is substantially impacted by outliers specific to individual countries. To mitigate the influence of these outliers, we implement Tukey's fences method. This method relies on the concept of the interquartile range (IQR), which spans from the 25th percentile (Q_1) to the 75th percentile (Q_3) of the dataset. Outliers are identified as values that fall below Q_1 minus 1.5 times the IQR (lower fence) or above Q_3 plus 1.5 times the IQR (upper fence) (Dastjerdy, Saeidi, & Heidarzadeh, 2023).

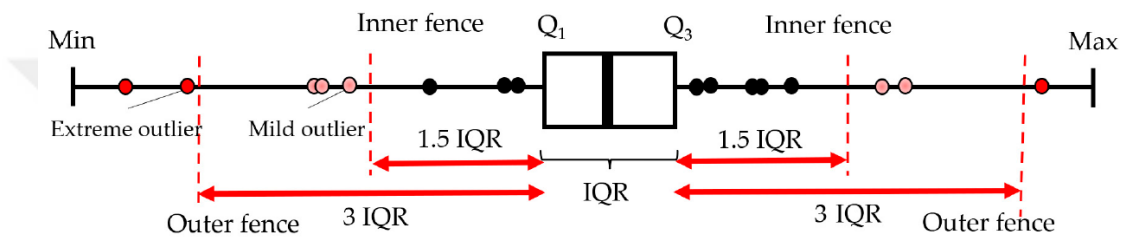


Figure 3.1 Outlier Detection

Source: Dastjerdy, Saeidi, and Heidarzadeh (2023).

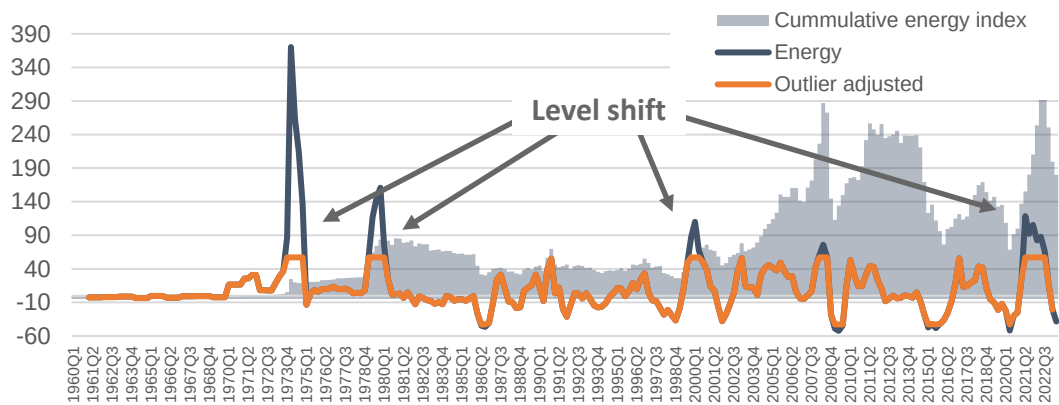


Figure 3.2 Outlier Detection for Energy Commodity Inflation

Source: Authors' calculation.

Generally, the standard practice involves removing outliers once detected in the samples. However, this approach does not align with our dataset and research objectives, where we are seeking answers regarding the determinants of "high inflation," which is, in essence, an outlier itself. Moreover, implementing this

methodology would lead to the exclusion of pivotal years marked by significant energy shocks, such as 1973, 1979, 2000, and 2021-2022, as illustrated in Figure 3.2, along with their associated well-known "high inflation" episodes. Instead of outright removal, we replace these outliers with the border inner fence values. This decision allows us to retain the most critical years in our analysis while mitigating the estimation errors associated with outliers.

3.2.2. Descriptive statistics

After determining the "high inflation" thresholds as the values of 10% for middle-income countries and 5.5% for high-income countries denote "high inflation" levels, to validate the reasonability of these threshold values in explaining the majority of "high inflation" cycles throughout history, we turn to Figure 3.3. From the figure, it becomes evident that these "high inflation" threshold values effectively identify prominent periods such as the 1970s to 1990s, the global financial crisis in 2008-2009, and the recent years of 2021-2023 for most countries. However, it's important to acknowledge that, as previously discussed in Section 3.1, these threshold values might not universally represent all countries. Instances like those observed in Uruguay, China, and Malaysia demonstrate differing inflation dynamics compared to their counterparts within the same income group. While these countries might exert minimal distortion on the global commodity prices and inflation analysis, they could potentially contribute to strengthening the relationship between inflation and internal factors such as exchange rates and demand. Hence, these countries are not excluded from the analysis.

After scrutinizing the reasonability of threshold values in the analyzed countries, we revisit our central question: What determines inflation, and at what level do these factors transform inflation into "high inflation"? According to Figure 3.4.A, the inflation elasticity to the exchange rate is notably high across all countries compared to other determinants. On the other hand, the often-cited inflation determinant, energy inflation impact, seems to be inflationary only when it exceeds the approximately 30% threshold level, which may be explained by high volatility. Furthermore, food commodity inflation and growth exhibit an inflationary process without any threshold

level in the 51 analyzed countries (for additional non-linearity-based relations, please refer to Figure b.1 in the Appendix).



The red area highlights “high inflation” episodes, whereas the gray area is non-high episodes.

Figure 3.3 “High Inflation” Episodes

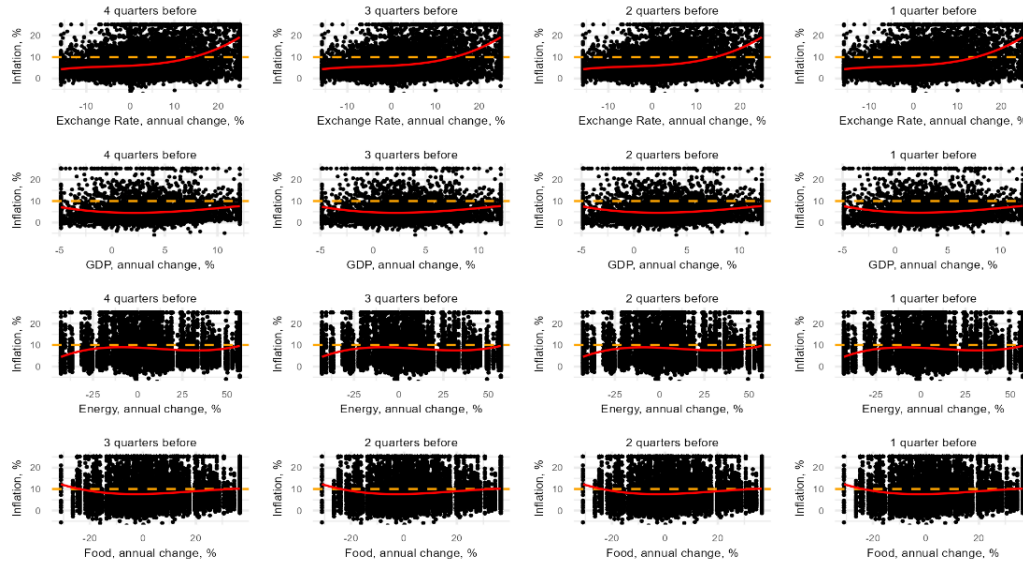
Source: Authors’ calculation.

However, as evident from the figure, the impact of inflation determinants on inflation is not uniform across income groups. For high-income countries, more than a 10% depreciation and growth are associated with “high” and “beyond high inflation.” Moreover, the inflation elasticity to depreciation seems to be almost 1 when the exchange rate depreciates against the US dollar by more than 20%. This result implies that, although all four determinants may contribute to inflation exceeding the “high” threshold, the exchange rate seems to be the powerful determinant that propels

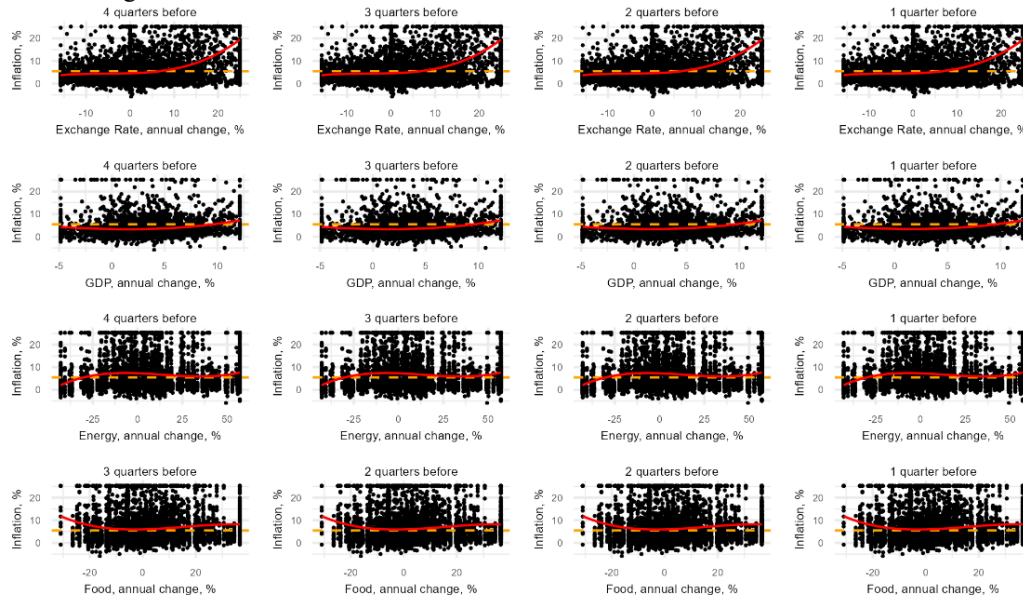
inflation beyond the “high” level (for additional “behind high inflation” determinants scatter plots, please refer to Figure b.2 in the Appendix).

In the upper-middle income scatter plots, the elasticity of inflation to depreciation is much higher than in high-income countries. These results recall Charles, Bastian, and Marie’s (2021) suggestion that wage indexation to depreciation is faster in countries with “high” inflation history, such as those in Latin America. Thus, when a depreciation shock occurs alongside the input cost impact, wage indexation to depreciation may become an additional cost, resulting in much higher inflation.

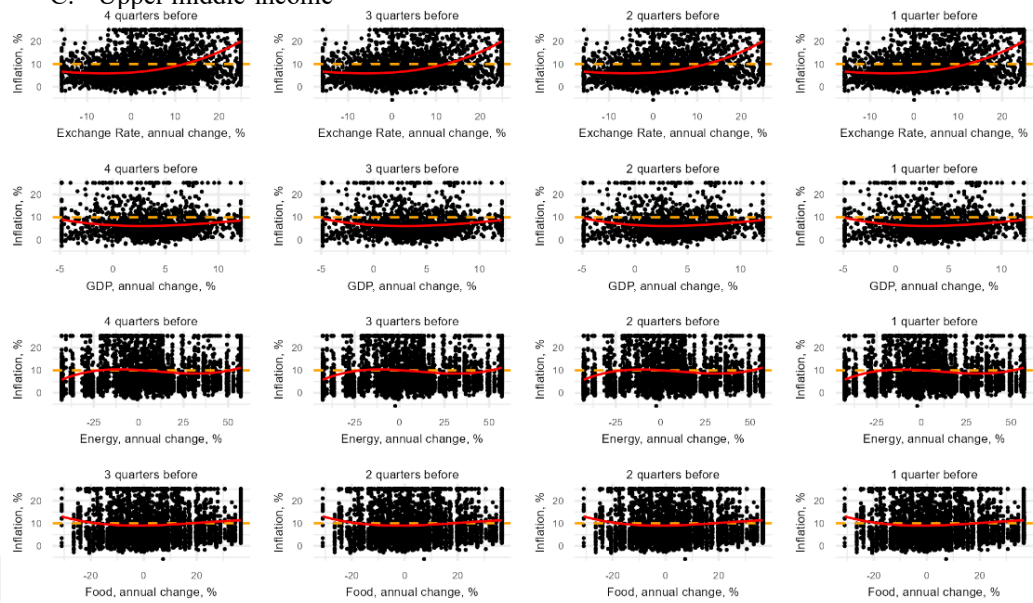
A. All analyzed countries



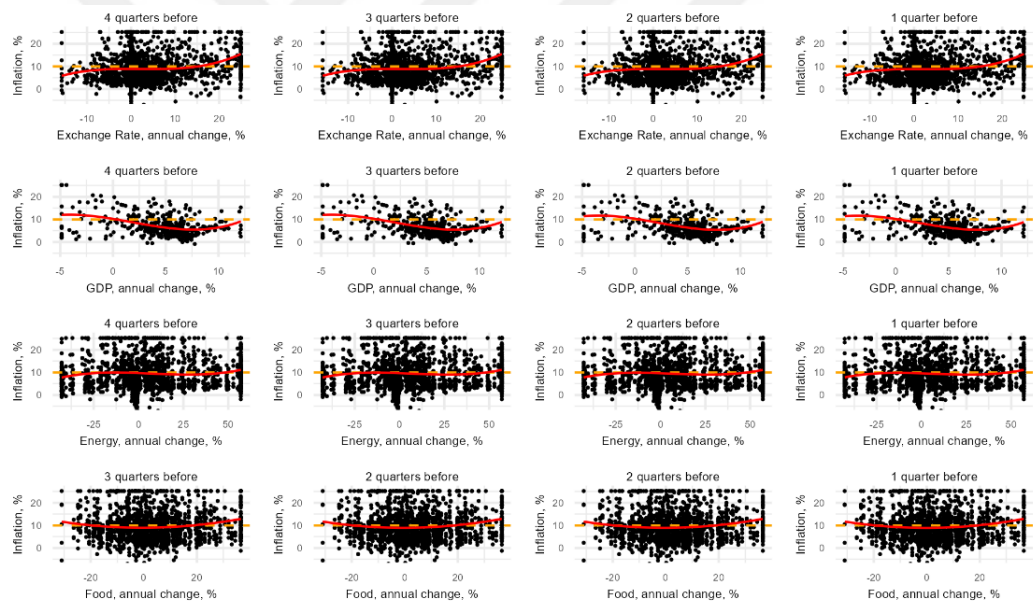
B. High-income



C. Upper middle-income



D. Lower middle-income



The red line is a degree-3 polynomial regression line between inflation and its determinants, and the orange dashed line indicates the “high inflation” threshold level.

Figure 3.4 Determinants of Inflation

Source: Authors' calculation.

Note: The y-axis in each graph displays inflation values, while the x-axis shows associated determinants. Plots display 51 countries' (21 High income, 23 Upper middle income, and 7 Lower middle-income) observations. The subplot titles are labeled as: "n quarter(s) before" if inflation at time t is related to determinants at time

t-n.

On the other hand, while the relationship between demand and inflation is positive in upper-middle-income countries, as theory suggests, demand alone seems insufficient to drive inflation to high levels, even when outliers are not removed and replaced with max inner fence values. This result may once again contribute to the structural differences between high and upper-middle-income countries through labor force dynamics, aligning with the findings of Jasova, Moessner, and Takats (2020).

In lower-middle-income countries, while the comovement of depreciation is not as high as in counterparts, depreciation alongside food commodity inflation appears to be the only determinant of “high inflation.” Contrary to other income groups, the impact of growth seems deflationary up to 8%, although it becomes inflationary afterward.

However, these descriptive results obtained from scatter plots should not be perceived as conclusions. Since scatter plots only analyze the comovement between two variables, this analysis is not enough to conclude about determinants of “high inflation” because inflation formation is a complex process that is determined by various factors. Therefore, a complex model is needed to analyze the true impacts and non-linearities.

3.3. Panel Probit Model

Central to our investigation is to unravel the intricate web of factors contributing to “high inflation.” What sets our study apart is its categorization of inflation into two discrete tiers: “high inflation” and non-“high inflation” levels. Within this context, the panel probit model, acknowledged for its adeptness in managing binary response variables, emerges as the apt choice to cater to the precise nature of our research objectives. By categorizing inflation levels into binary outcomes of “high” and “non-high,” the panel probit model seamlessly aligns with our endeavor to discern the determinants underpinning “high inflation.” While there is a popular alternative called the Signal approach, Boonman, Jacobs, Kuper, and Romero (2019) have consistently

found that the binary choice model performs better than the Signal approach, both in-sample and out-of-sample.

However, another important focus is selecting true effects in panel probit models. Since we have 21, 23, and 7 countries in high-, upper-, and middle-income groups, respectively, and each country has its unique dynamics, we should be aware of the individual-specific effects to eliminate inefficient estimates (Amini, Delgado, Henderson, & Parmeter, 2012). In this regard, the model allows for individual-specific intercepts to vary randomly across entities while assuming a common relationship between the variables of interest is the random effects model. Moreover, panel probit random effects models are designed to strike a balance between fixed effects (which are more flexible but can be less efficient (Bollen & Brand, 2010)) and pooled models (which are more efficient (Shor, Bafumi, Keele, & Park, 2007) but less flexible). However, if there is a correlation between the unobserved individual effect and the conditioning regressors, employing a random effects model without accounting for the endogeneity of the conditioning regressors will result in estimates of the conditional mean that are both biased and inconsistent (Amini, Delgado, Henderson, & Parmeter, 2012). To confirm the compatibility of our data with random effects, we employ the Hausman test, as depicted in Table 3.3. According to the test, the absence of rejection regarding the exogeneity of the unobserved individual effect provides statistical backing for adopting a random effects model (Amini, Delgado, Henderson, & Parmeter, 2012).

Table 3.3 Hausman Test Results for Unobserved Variable Endogeneity

A. High income		B. Upper-middle-income		C. Lower-middle-income	
Chi-squared	5.3117	Chi-squared	4.9099	Chi-squared	0.76032
Statistic:		Statistic:		Statistic:	
p-value:	0.7238	p-value:	0.8421	p-value:	0.6838
Alternative hypothesis: one model is inconsistent					

Since we cannot reject the null hypothesis, we can benefit from the random effect models' efficiency (Amini, Delgado, Henderson, & Parmeter, 2012). The panel probit model with random effects equations can be represented as follows. For each individual i in the panel and time t , the probability of observing "high inflation" is

modeled as:

$$P(y_{it} = 1|X_{it}, X_{it-1}, \dots, X_{it-n}, \alpha_i) = \Phi(X_{it}\beta_0 + X_{it-1}\beta_1 + \dots + X_{it-n}\beta_n + \alpha_i) \quad (13)$$

, where y_{it} is the binary outcome variable for individual i at time t , taking the value of 1 for “high inflation” and 0 otherwise; X_{it-n} is a vector of explanatory variables for individual i at different lags; n identifies lags; β_n represents the vector of coefficients for the explanatory variables; α_i is the individual-specific effect that captures unobservable heterogeneity across different countries; Φ is the cumulative distribution function of the standard normal distribution, which transforms the linear combination of $X_{it}\beta_0 + X_{it-1}\beta_1 + \dots + X_{it-n}\beta_n + \alpha_i$ into a probability value between 0 and 1.

The random effects assumption introduces an additional layer to the model, accounting for the unobservable individual-specific effects (Greene, 2004):

$$\alpha_i = \eta + \mu_i \quad (14)$$

, where η is the common intercept capturing the average effect across all individuals; μ_i is the unobservable individual-specific effect for individual i , assumed to be normally distributed with mean 0 and constant variance σ_μ^2 .

Incorporating the random effects into the panel probit model Equation 13 yields:

$$P(y_{it} = 1|X_{it}, X_{it-1}, \dots, X_{it-n}, \eta, \mu_i) = \Phi(X_{it}\beta_0 + X_{it-1}\beta_1 + \dots + X_{it-n}\beta_n + \eta + \mu_i) \quad (15)$$

The random effects panel probit model accounts for both the observable variables X_{it} and the unobservable individual-specific effects μ_i allowing for a more nuanced understanding of the determinants behind “high inflation” while considering the inherent heterogeneity present within the panel data.

In the lag selection, we did not select lagged values of the dependent variable because, in a panel probit model, it is generally not recommended. Including lagged values of the dependent variable in the model can introduce endogeneity (Guevara & Navarro, 2015) and potentially violate the assumptions of the probit model. This is because the lagged dependent variable is likely to be correlated with the current dependent and independent variables, leading to biased parameter estimates (Carro, 2007).

Instead of using lagged dependent variables, it's generally better to focus on lagged values of independent variables that are theoretically relevant to the model. These lagged independent variables can capture any potential dynamic effects in the relationship we are trying to model while avoiding the endogeneity issues associated with lagged dependent variables.

Literature generally refers to three main criteria for selecting optimal lags: the Akaike Information Criterion (AIC), the Bayesian Information Criterion, and MacFadden's pseudo-R-squared (Hsu, 2016). The AIC criterion, while a valuable tool for model selection, carries the potential risk of overfitting, particularly when it consistently favors models with an increasing number of lags (Medel, 2014). The AIC, designed to find models that fit data well, often favors complexity by being less strict in penalizing the likelihood as parameters increase.

On the other hand, the Bayesian Information Criterion (BIC) serves as an alternative criterion for model selection that accounts for the complexity of the model in a stricter manner. By placing a heavier penalty on the number of parameters, the BIC encourages a parsimonious approach, favoring simpler models that effectively capture the essential patterns within the data. Unlike AIC, BIC's emphasis on model simplicity aligns more closely with the principle of Occam's razor, which posits that simpler explanations should be favored when competing hypotheses exist (Lazar, 2010). This propensity of BIC to discourage overly complex models can act as a safeguard against overfitting (Medel, 2014), ultimately contributing to the selection of models that are more likely to generalize well to new data. However, while decreasing complexity, BIC may fail to fit the model perfectly for actual data.

Additionally, MacFadden's pseudo-R-squared, a metric commonly employed in panel probit models, measures how well the model explains the variation in the binary outcomes compared to a null model (Hsu, 2016). While they provide insights into the proportion of variance captured by the model, pseudo-R-squared measures should not be solely relied upon as the sole criterion for model selection. Instead, they should be considered alongside other criteria, such as AIC and BIC, to arrive at a comprehensive and well-rounded understanding of a model's goodness of fit and its predictive capacity (Hsu, 2016).

Another method that ensures the robustness of lag selection is hold-out validation. The process of hold-out lag selection offers a strategic approach to addressing potential pitfalls associated with excessive lag inclusion. This technique involves designating a specific period, distinct from the estimation sample, to evaluate the model's performance. In our case, we employed hold-out cross-validation by focusing on the period from 2011 to 2023, a span chosen independently from the estimation sample covering 1961 to 2010. By isolating this later timeframe, we aim to gauge how well the selected lag structure generalizes to new and unseen data, effectively simulating real-world conditions. This method allows us to mitigate the risks of overfitting by evaluating the model's ability to make accurate predictions beyond the range of data used for estimation (Hsu, 2016).

Taking into account the advantages and disadvantages of the four different lag selection criteria, it becomes evident that there is no universally optimal criterion that fits all scenarios. Each criterion offers its own unique benefits: AIC and MacFadden's pseudo-R-squared help identify the best-fitting model, BIC aids in reducing model complexity and overfitting, and hold-out validation RMSE enhances model accuracy for unseen data. Rather than relying on a single criterion and making strong assumptions, we adopt a comprehensive approach that considers all four criteria's results.

To navigate this multi-criterion decision-making process, we rank the values obtained from AIC, BIC, pseudo-R-squared, and RMSE. Specifically, for pseudo-R-squared, we opt for higher values indicating better fit, while for the other criteria, we seek lower

values to minimize complexity and increase accuracy. By evaluating the ranks across all four criteria, we identify the optimal lags that provide the best intersection of results from these different perspectives. In this regard, the optimal lags are 1 to 4 for both high- and upper-middle-income countries and 2 for lower-middle-income countries (detailed criterion results and rankings are presented in Table b.2 in the Appendix).

3.4. Results

Once we have established the appropriate model and addressed outliers in the data, we proceed with the estimation using a random effects panel probit model for each income group. The estimation results are presented in Table 3.4. It's important to note that due to the missing real GDP data for lower-middle-income countries between 1961 and 1982, our estimations start in 1982. The dataset encompasses 2695 observations for high-income countries, 2122 for upper-middle-income countries, and 425 for lower-middle-income countries. The random effects panel probit model is employed to derive the estimations, utilizing the Maximum Likelihood method with Newton-Raphson maximization.

Table 3.4 Estimation Results

A. High-income			B. Upper middle-income			C. Lower-middle-income		
Number of Countries: 21			Number of Countries: 23			Number of Countries: 7		
Total Observations: 2695			Total Observations: 2122			Total Observations: 425		
Period: 1961Q1 - 2023Q1			Period: 1961Q1 - 2023Q1			Period: 1982Q1 - 2023Q1		
	Coefficient	Std. error		Coefficient	Std. error		Coefficient	Std. error
Intercept	-1.591***	(0.068)	Intercept	-2.212***	(0.117)	Intercept	-0.842***	(0.178)
GDP (t-1)	0.003	(0.014)	GDP (t-1)	0.013	(0.017)	GDP (t-2)	-0.066*	(0.027)
GDP (t-2)	0.011	(0.017)	GDP (t-2)	-0.004	(0.021)	FX (t-2)	0.070***	(0.012)
GDP (t-3)	0.027	(0.017)	GDP (t-3)	0.020	(0.020)	Energy (t-2)	0.006	(0.004)
GDP (t-4)	0.061***	(0.014)	GDP (t-4)	0.091***	(0.017)	Food (t-2)	0.029***	(0.008)
FX (t-1)	0.041***	(0.007)	FX (t-1)	0.063***	(0.008)	sigma	1.194***	(0.205)
FX (t-2)	0.004	(0.010)	FX (t-2)	0.017	(0.012)			
FX (t-3)	0.0001	(0.010)	FX (t-3)	-0.002	(0.012)			
FX (t-4)	0.030***	(0.007)	FX (t-4)	0.046***	(0.008)			
Energy (t-1)	0.008***	(0.002)	Energy (t-1)	0.011***	(0.003)			
Energy (t-2)	-0.001	(0.003)	Energy (t-2)	0.002	(0.004)			
Energy (t-3)	0.004	(0.003)	Energy (t-3)	0.002	(0.004)			
Energy (t-4)	-0.003	(0.002)	Energy (t-4)	-0.003	(0.003)			
Food (t-1)	0.016**	(0.005)	Food (t-1)	0.016**	(0.006)			
Food (t-2)	0.001	(0.007)	Food (t-2)	0.007	(0.009)			
Food (t-3)	-0.002	(0.007)	Food (t-3)	-0.009	(0.009)			
Food (t-4)	0.012*	(0.005)	Food (t-4)	0.022***	(0.006)			
sigma	1.208***	(0.090)	sigma	1.209***	(0.195)			

*** if p-value < 0.001, ** if p-value < 0.01, * if p-value < 0.05, . if p-value < 0.1

According to model results, both intercept term and sigma values are significant at a

99.9% confidence interval, and all significant independent variables coefficients' signs are positive⁷ except for demand in lower-middle-income countries. GDP shocks at time t significantly imply the emergence of “high inflation” in high- and upper-middle-income countries within 4 quarters, while the coefficient for lower-middle-income doesn't align with the expected theoretical relationship between demand and inflation. This observation could stem from data quality issues within lower-middle-income countries' datasets or indicate that demand factors do not typically contribute to “high inflation” episodes in these countries.

As anticipated, exchange rates have a significant impact on all income groups. Exchange rate depreciation serves as a clear indicator of a potential “high inflation” episode after 1 to 4 quarters across both high and upper-middle-income economies and after 2 quarters for lower-middle-income countries. The findings related to high and upper-middle-income countries, especially the impact of 4th lag, align with the conclusions drawn from the research conducted by Colavecchio and Rubene (2019) and Forbes (2016), which emphasize the gradual and delayed transmission mechanisms associated with exchange rate movements.

Furthermore, the heightened inflation levels in energy and food commodities also indicate potential “high inflation.” However, in the context of lower-middle-income countries, the results reveal that energy inflation does not significantly impact “high inflation” episodes. This may be because 5 of the 7 lower-middle-income countries analyzed are oil exporters. However, when we run a panel probit for only the 2 lower-middle-income oil-importing countries, the coefficient remains insignificant (for model results, please refer to Table b.3. in the Appendix). Therefore, the insignificant energy coefficient seems to be the reason for not being able to observe dynamics up to 1982 in the panel probit model, where we miss two major oil shocks. On the other hand, when oil prices rise sharply, all countries, regardless of income or oil exporter status, face “high inflation” (Figure b.1. in the Appendix).

To assess the model's accuracy in correctly predicting “high inflation” episodes, we

⁷ Positive coefficients indicate that an increase in the independent variable is associated with a higher probability of “high inflation” occurrence.

employ the following evaluation metrics similar to Filippopoulou, Galariotis, and Spyrou (2020):

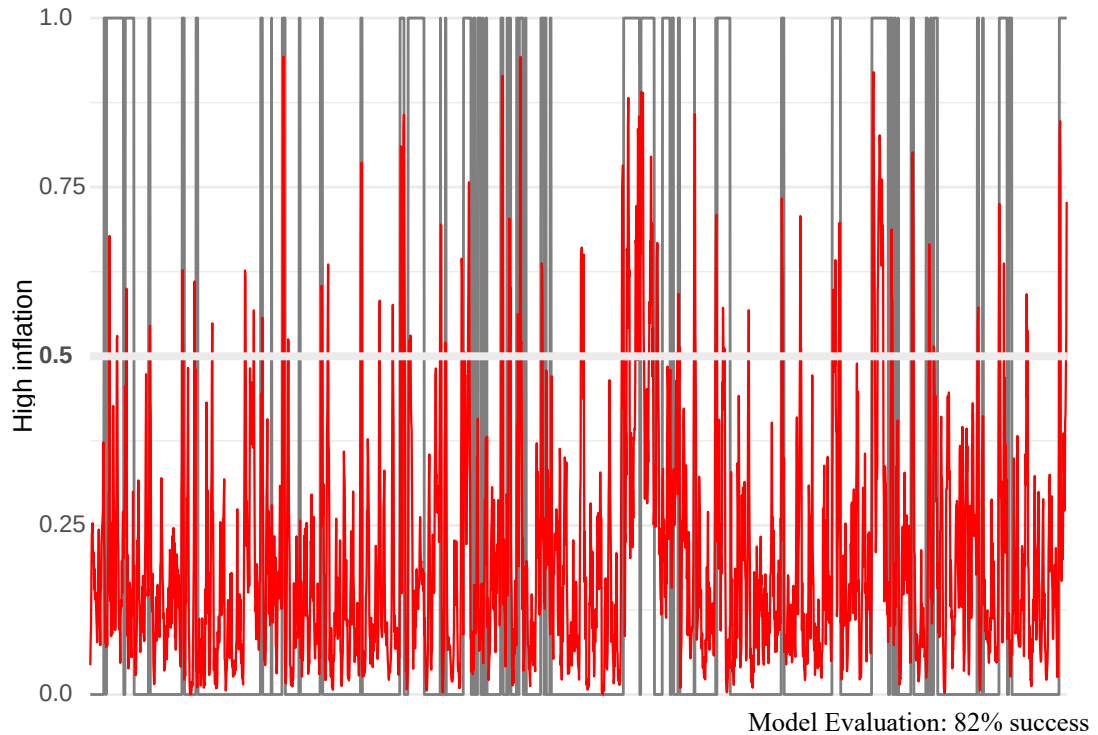
$$\text{Predicted probability}^* = \begin{cases} 1, & \text{if predicted probability} > 0.5 \\ 0, & \text{otherwise} \end{cases} \quad (16)$$

$$\text{Model Evaluation} \rightarrow \begin{cases} \text{Success, if actual value} = \text{predicted probability}^* \\ \text{Failure, otherwise} \end{cases} \quad (17)$$

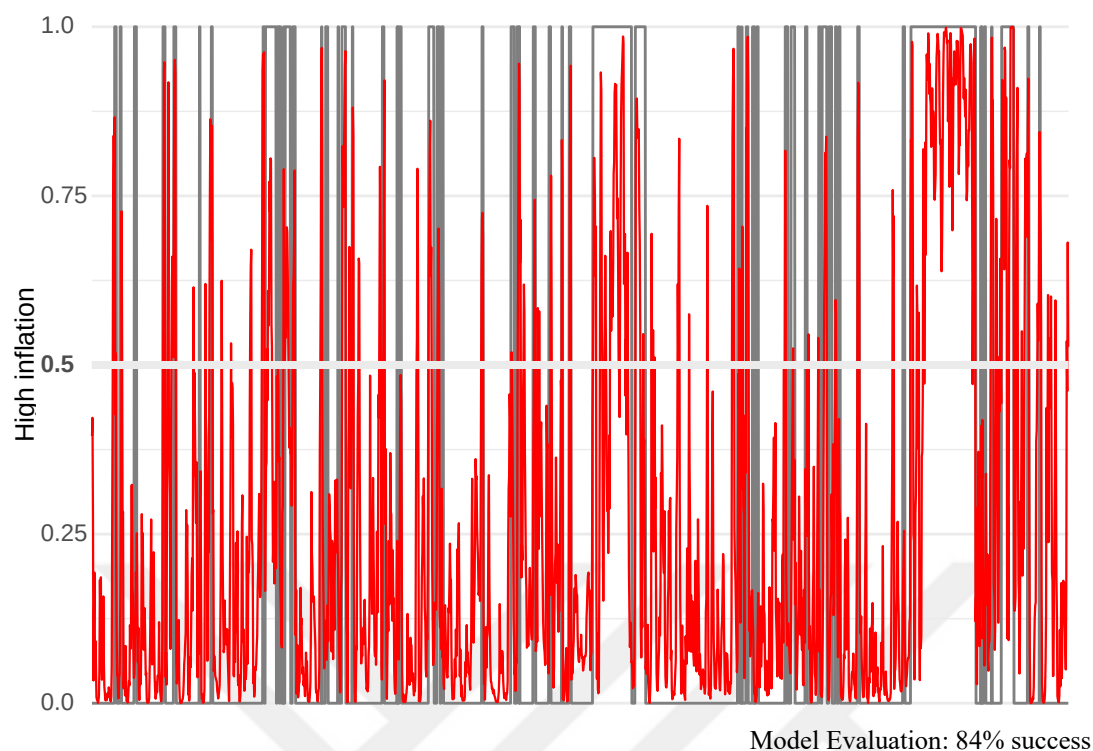
Based on the model results and evaluation criteria, the model demonstrates an 82% success rate in accurately predicting instances of high and non-high inflation in high-income countries. Furthermore, this success rate improves to 84% for upper-middle-income countries and remains at 83% for lower-middle-income countries, as illustrated in Figure 3.5.

Moving forward, we computed the “high inflation” probabilities in response to deviations of inflation determinants from the mean. In this regard, we evaluated deviations ranging from 0 to 3 standard deviations from the mean, with intervals of 0.5 points.

A. “high inflation” probability within High income group



B. “high inflation” probability within the Upper middle-income group



C. “high inflation” probability within the Lower middle-income group

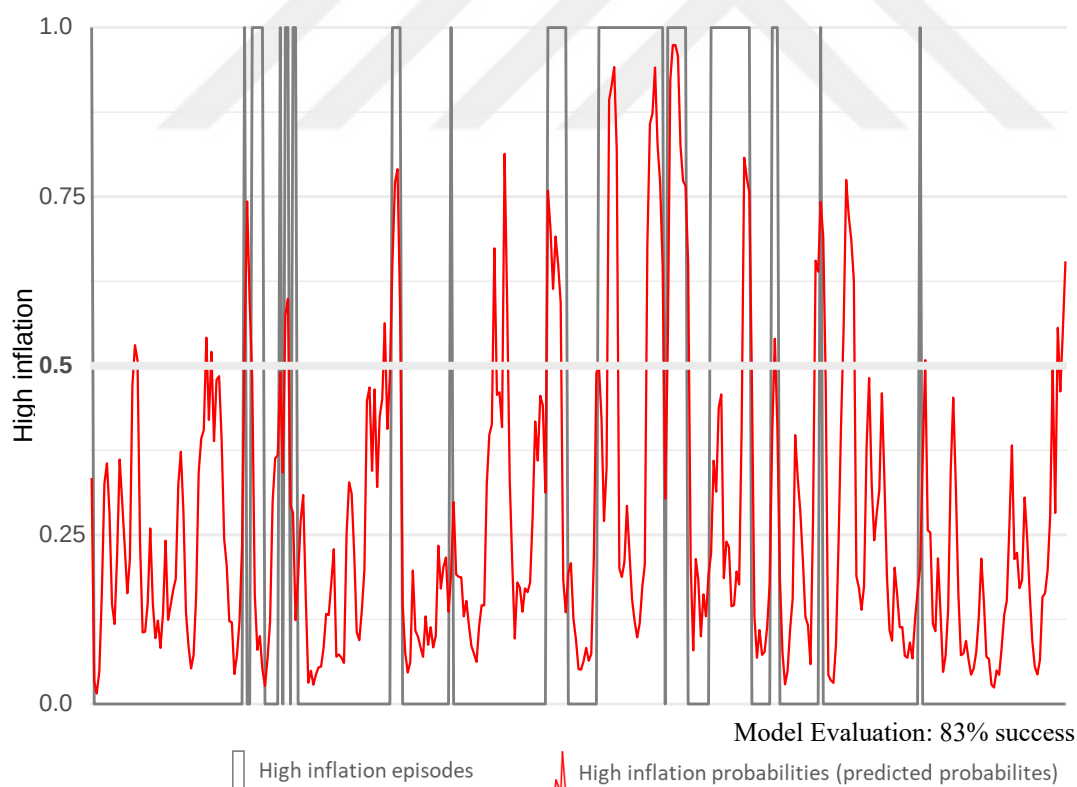


Figure 3.5 Actual “High Inflation” Episodes vs. Predicted Probabilities

Source: Authors’ calculation.

Note: The plots display each country and its associated years on the x-axis in ascending

order. Since gray lines indicate actual high inflation episodes, where the probability is 1, and red lines represent estimated high inflation probabilities by the model, it is expected to observe that red lines and gray lines overlap. Moreover, when red lines exceed the 0.5 threshold, indicating a probability of high inflation occurrence higher than 50%, the model is considered successful for this episode.

Figure 3.6 reveals that exchange rate deviations from the mean serve as the most explanatory variable for occurrences of “high inflation.” To delve deeper, roughly 25% depreciation (approximately 2 positive standard deviations) acts as a strong indicator, forecasting “high inflation” in the subsequent quarters with a probability exceeding 70% in high and ~80% in middle-income countries. When depreciation surpasses 35%, the likelihood of “high inflation” sharply rises to 97% in upper-middle-income countries, 90% in high-income countries, and 95% in lower-middle-income countries. These findings again confirm that exchange rates are the primary determinant of “high inflation” in nearly every context.

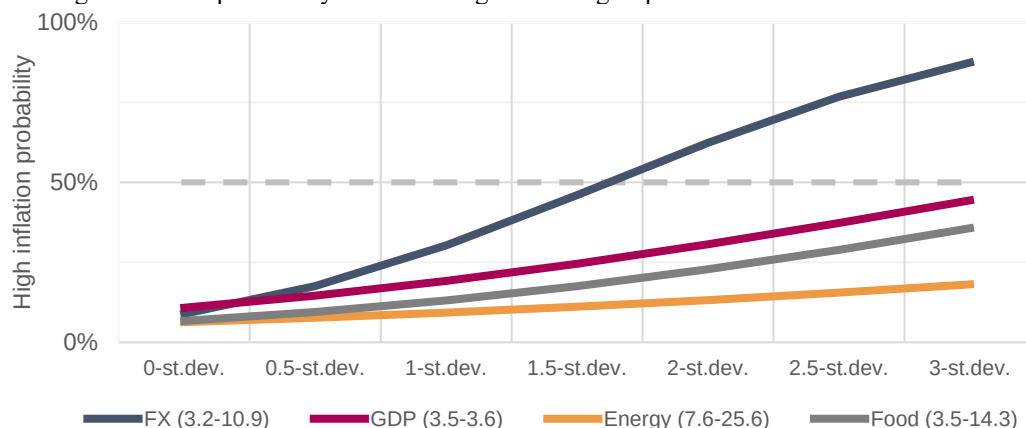
On the other hand, a growth magnitude of up to 3 standard deviations does not necessarily imply a high probability of “high inflation” occurring. Although the associated probability is 44% for high-income, it is low in upper- and lower-middle-income economies (only 30% and ~0%, respectively), which aligns with descriptive statistics.

Moreover, food commodity inflation plays a crucial role in predicting inflation, particularly in lower-middle-income countries, where a deviation of more than 1.75 positive standard deviations in food commodity inflation (around 30%) in 2 quarters before forecasts “high inflation” with more than 50% probability. A similar high probability of signaling “high inflation” is observed in high- and upper-middle-income countries when food commodity prices rise by more than 3 standard deviations.

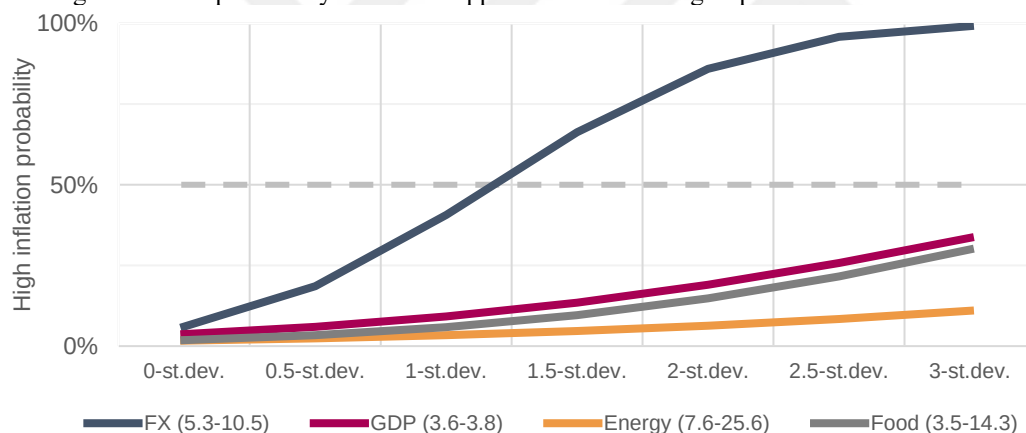
On the other hand, energy price shocks predict “high inflation,” with a 30% probability in lower-middle-income economies when energy inflation rises more than 50%. However, the impact is not significantly pronounced in other income groups, aligning with descriptive statistics and the findings of Tiwari, Cunado, Hatemi-J, & Gupta

(2019), Kilian and Zhou (2022), and Ye et al. (2023); moreover, it synchronizes with Gelos and Ustyugova (2012), who suggest that greater dependence on fuel and a large proportion of food in the consumption basket make economies more susceptible to commodity shocks.

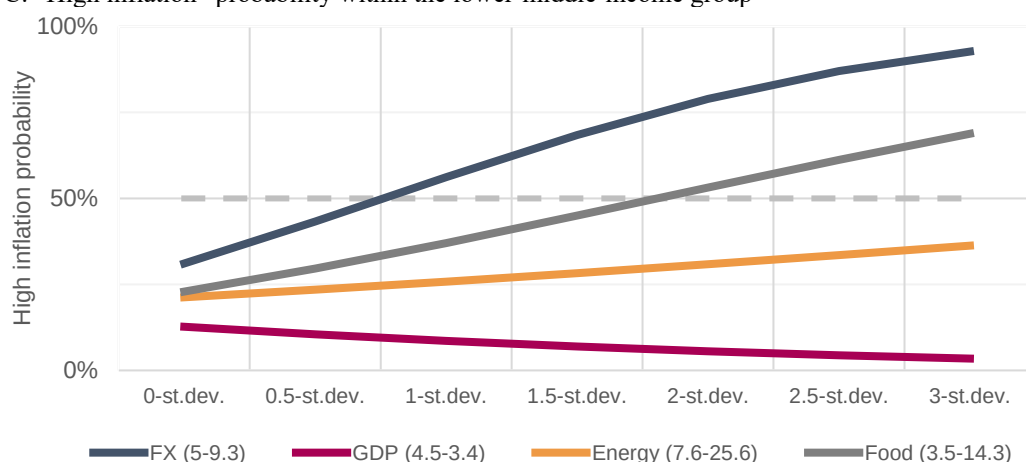
A. “High inflation” probability within the high-income group



B. “High inflation” probability within the upper-middle-income group



C. “High inflation” probability within the lower-middle-income group



Parenthesis in each legend displays mean and standard deviations, respectively.

D. Thresholds resulting in “high inflation” (when probability > 50%)

Determinants, annual change, %	High-income	Upper-middle	Lower-middle
Growth	15.7*	18.6*	-12.7
Exchange rate	20.9	17.7	12.1
Energy	197.5*	189.8*	144.9*
Food	60.3	60.9	29.3

*There are few observations that exceed these threshold levels

Figure 3.6 “High Inflation” Probabilities in Response to Shocks to Determinants

Source: Authors’ calculation.

One point to note is that since this analysis is based on panel estimations, the varying responses of countries' inflations to the same energy shocks may diminish the significance of energy in high inflation formation. These differing responses may stem from factors such as administered energy prices, lagged impacts, balance of payment mechanisms, firms' price adjustment parameters for UMC shocks, and more. However, it is an inevitable truth that huge oil shocks (for instance, more than a 200% increase in energy inflation) will result in "high" inflation, even when considering shelter policies. Nevertheless, these findings do not necessarily imply that energy inflation of less than 200% would not result in "high" inflation.

On the other hand, it is not necessarily the short-run impacts but rather the middle and long-run energy impacts that may have a more significant influence on inflation, as suggested by Tiwari, Cunado, Hatemi-J, & Gupta (2019). Therefore, further detailed studies focusing on the relationship between inflation and energy inflation while controlling for shelter mechanisms and considering the mid and long-run relationship may reveal the true impact of energy on inflation.

3.5. Discussion and robustness

3.5.1. Robustness check of “high inflation” thresholds

To assess the robustness of the results, we revisit the selection of the “high inflation”

threshold. This time, we estimate the panel probit model with the same specifications, defining the “high inflation” threshold as the median value ± 0.5 standard deviations ($\sim 0.5 \times 4.5\%$) of literature thresholds for robustness checks. In this framework, the threshold values are 3.25 and 7.75 for high-income countries and 7.75 and 12.25 for middle-income countries. We compare the models using model evaluation criteria to gauge the differences in estimation based on the threshold.

Table 3.5 Robustness Checks for “High Inflation” Threshold

Model	Model Evaluation / Share of Successful Predictions		
	High income	Upper middle-income	Lower-middle income
Baseline threshold-based model	82%	84%	83%
Threshold + 0.5*std.-based model	88%	89%	91%
Threshold - 0.5*std.-based model	71%	79%	65%

According to Table 3.5, increasing the inflation threshold from 5.5 to 7.75 in high-income and 10 to 12.25 in middle-income increases the model's success by approximately 6 percentage points. This result ensures that even if one defines higher threshold values, such as 40%, as in Bruno and Easterly (1998), our panel probit methodology with selected determinants will be more successful in determining high inflation episodes. Moreover, the model successfully determines high inflation even if thresholds decrease to 3.25 and 7.75.

3.5.2. Endogeneity check

As our primary focus is on incorporating lagged independent variables rather than lagged dependent ones due to concerns about endogeneity, we must ensure the consistency of our model selection. Endogeneity arises when certain explanatory variables within an econometric model are correlated with the error term (Guevara C. A., 2015). This issue leads to estimators of the parameters being inconsistent (Wooldridge, 2012). To check for endogeneity in independent variables, we introduce instrument variables (IV) for possible endogenous variables (GDP, exchange rate, and food commodity prices). As IV, following Holmberg (2006), Rumler (2007), and

Jasova, Moessner, & Takats (2020), we utilize the lags of possible endogenous independent variables that are not included in the main probit model.

In this regard, lags from 5 to 8 are utilized, and the validity of IVs is checked by the Sargan test, similar to Jasova, Moessner, & Takats (2020). The Sargan test results, as depicted in Table 3.6, display that the p-values are 1, which ensures the validity of IVs (Grace, 2021). Following Grace (2021) and Wooldridge (2012), after validation of IVs, we estimate our possible endogenous independent variables in relation to other independent variables used in the main probit model and independent variable-specific IVs (which are their 5-8 lags). Moreover, we obtain fitted values of independent variables and replace them in the main probit model instead of raw variables. Finally, we utilize the Hausman test to analyze the consistency of original and IV-based random effect panel probit models. As shown in Table 3.6, the p-values are higher than 0.05, ensuring that there exists no consistency difference between models, highlighting the non-existence of endogeneity. Therefore, we can say that the model has no endogeneity.

Table 3.6 Test Results for Observed Variable Endogeneity

A. High income		B. Upper-middle-income		C. Lower-middle-income	
A. Sargan test results					
Test Statistic:	38.51996	Test Statistic:	29.55237	Test Statistic:	5.095537
p-value:	1	p-value:	1	p-value:	1
B. Hausman test results					
Chi-squared Statistic:	2.829	Chi-squared Statistic:	4.4359	Chi-squared Statistic:	0.090165
p-value:	0.5868	p-value:	0.3502	p-value:	0.764
Alternative hypothesis of Hausman test: one model is inconsistent					

3.5.3. Robustness check of demand

In the realm of well-developed inflation analysis, it is commonly perceived that the GDP gap holds more utility as a variable than GDP growth, as we discussed in the Literature review section. Thus, in order to test the robustness of our Panel Probit model within the framework of economic theory, we have employed the Hodrick-Prescott (HP) filter to estimate the GDP gaps for all 54 countries under examination. The HP filter, which employs a unique lambda value of 1600, provides an estimation

of potential GDP deviations from actual GDP levels. Given the diverse developmental stages of the countries in our sample, it is reasonable to question whether the lambda value of 1600 is universally applicable.

Considering the variations in development levels and economic characteristics among the countries in our study, the choice of a single lambda value may not be optimal for all economies (Choudhary, Hanif, & Iqbal, 2014). Moreover, the process of identifying optimal lambda values for each analyzed country is beyond the scope of our current research objectives. That was why we opted to initiate our analysis with GDP growth, a directly observable variable that offers greater reliability than GDP gap estimates obtained through the HP filter with a fixed lambda value.

Nonetheless, in order to assess the robustness of our model and its findings, we have undertaken an additional analysis. We have re-estimated the Random Effects Panel Probit model using the GDP gaps derived from the HP filter while maintaining the same model specifications and properties. This parallel investigation serves to provide insights into how different representations of the GDP-inflation relationship might influence the outcomes of our analysis.

As depicted in Table 3.7, the determinant variables maintain their significance within the gap-based probit model. However, the Log-Likelihood and McFadden's Pseudo R-squared values in the gap-based model are relatively lower than those in the growth-based main model. The AIC and BIC values are consistently higher in the gap-based model, although the RMSE in high- and lower-middle-income countries is lower.

When selecting the optimal model, we prioritize higher log-likelihood and McFadden's Pseudo R-squared values, along with lower AIC and BIC values. In this context, the Panel Probit model, incorporating GDP growth, stands out as the more robust choice. This preference may be linked to the application of a singular lambda value (1600) for all countries in the HP filter-based estimation of the GDP gap. This approach might not accurately capture the nuanced economic characteristics of each country, potentially leading to less reliable output gap estimates. Hence, it is conceivable that if optimal lambda values were identified or well-estimated GDP gap

measures were available, the integration of the gap variable might enhance the robustness of this research's findings.

Table 3.7 Estimation Results for Panel Probit Model with Output Gap

A. High income			B. Upper middle-income			C. Lower middle-income		
Number of Countries: 21			Number of Countries: 23			Number of Countries: 7		
Total Observations: 2695			Total Observations: 1838			Total Observations: 425		
Period: 1961Q1 - 2023Q1			Period: 1992Q1 - 2023Q1			Period: 1982Q1 - 2023Q1		
Log-Likelihood: -991.155 (-961.303)			Log-Likelihood: -498.103 (-497.546)			Log-Likelihood: -136.825 (-133.848)		
	Coefficient	Std. error		Coefficient	Std. error		Coefficient	Std. error
Intercept	-0.939***	(0.049)	Intercept	-2.323***	(0.120)	Intercept	-1.157***	(0.129)
Outp. Gap (t-1)	2.352**	(0.766)	Outp. Gap (t-1)	3.532**	(1.135)	Outp. Gap (t-2)	-0.057	(1.660)
Outp. Gap (t-2)	2.893***	(0.763)	Outp. Gap (t-2)	3.398**	(1.110)	FX (t-2)	0.078***	(0.011)
Outp. Gap (t-3)	2.757***	(0.762)	Outp. Gap (t-3)	3.394**	(1.106)	Energy (t-2)	0.004	(0.004)
Outp. Gap (t-4)	2.617***	(0.762)	Outp. Gap (t-4)	3.737***	(1.112)	Food (t-2)	0.030***	(0.008)
FX (t-1)	0.039***	(0.007)	FX (t-1)	0.052***	(0.008)	sigma	1.253***	(0.197)
FX (t-2)	0.003	(0.01)	FX (t-2)	0.020	(0.012)	AIC Values: 285.65 (279.695)		
FX (t-3)	0.001	(0.01)	FX (t-3)	0.001	(0.013)	BIC Values: 309.338 (303.384)		
FX (t-4)	0.027***	(0.007)	FX (t-4)	0.033***	(0.009)	McFadden's Pseudo R-squared Values:		
Energy (t-1)	0.007**	(0.002)	Energy (t-1)	0.009**	(0.003)	0.303 (0.318)		
Energy (t-2)	-0.001	(0.003)	Energy (t-2)	0.003	(0.005)	In sample RMSE Values:		
Energy (t-3)	0.004	(0.003)	Energy (t-3)	0.002	(0.005)	1.108 (1.117)		
Energy (t-4)	-0.002	(0.002)	Energy (t-4)	-0.002	(0.003)			
Food (t-1)	0.015**	(0.005)	Food (t-1)	0.023***	(0.007)			
Food (t-2)	-0.0001	(0.007)	Food (t-2)	0.002	(0.01)			
Food (t-3)	-0.001	(0.007)	Food (t-3)	-0.009	(0.011)			
Food (t-4)	0.012*	(0.005)	Food (t-4)	0.024**	(0.007)			
sigma	0.904***	(0.079)	sigma	1.005***	(0.106)			
AIC Values: 2018.31 (1958.606)			AIC Values: 1032.205 (1031.091)					
BIC Values: 2123.414 (2063.711)			BIC Values: 1130.064 (1128.95)					
McFadden's Pseudo R-squared Values:			McFadden's Pseudo R-squared Values:					
0.256 (0.278)			0.354 (0.355)					
In sample RMSE Values:			In sample RMSE Values:					
1.065 (1.334)			1.950 (1.544)					

*** if p-value < 0.001, ** if p-value < 0.01, * if p-value < 0.05, . if p-value < 0.1
(...) brackets display growth-based probit results

3.5.4. Sole depreciation-based Panel Probit Model

In the previous sections and even in the gap-based model, we demonstrated the significant influence of exchange rate fluctuations on “high inflation” episodes in all analyzed countries. For instance, by narrowing our focus to countries that have experienced chronic exchange rate depreciation throughout history, such as Latin American economies, Türkiye, Kazakhstan, and Hungary, we can see clear historical dynamics between high exchange rate depreciations and "high inflation" (Figure 3.7).

As seen in Figure 3.7, the magnitude of depreciation is closely linked to the magnitude of inflation that exceeds the high threshold. While large exchange rate depreciations

resulted in very high inflation in Brazil a year later, significant depreciations against the USD led to high inflation in all analyzed Latin American economies and Türkiye. On the other hand, moderate depreciations are associated with relatively lower “high inflation” in Hungary and Kazakhstan compared to the others.

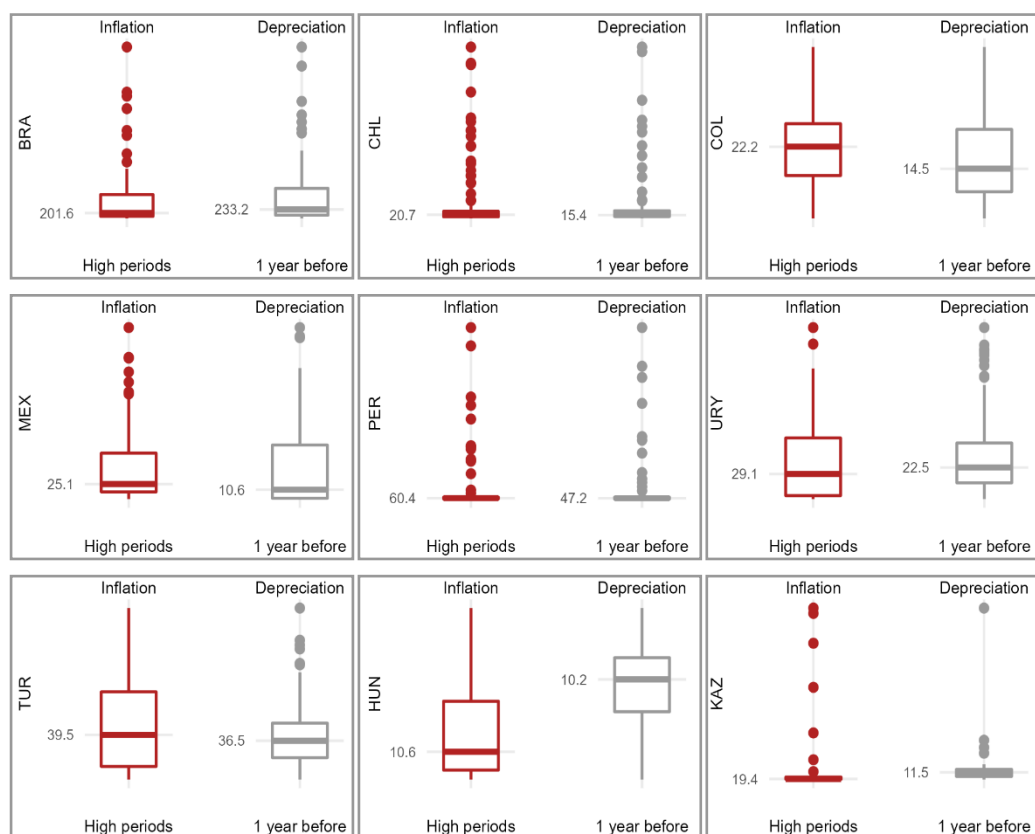


Figure 3.7 Exchange Rate and Inflation Dynamics in Selected Countries

Source: Authors' calculation.

Note: High periods identify the distributions of high inflation, while the 1 year before plots show exchange rate depreciations against the USD one year prior to high inflation episodes. The plots focus on median values.

These case studies also strengthen our research findings that high exchange rate depreciations are the major factor behind "high inflation." First, the exchange rate depreciates, and then economies witness "high inflation" a year later. Based on this, can we go a step further and examine a stronger hypothesis: Can exchange rate depreciation alone account for the occurrence of “high inflation” across the globe

without considering other determinants? In simpler terms, could most “high inflation” cases be attributed solely to exchange rate movements?

To test this hypothesis, we will re-estimate the random effect panel probit model, but this time with only one independent variable: the exchange rate and its corresponding lags. While the lags for each income group will remain the same as in the complete model discussed in Section 3.3, both variables in this model (inflation and exchange rate) will cover the entire analysis period from 1961Q1 to 2023Q1. This extended timeframe allows us to delve into the dynamics of the 1970s and 1980s, particularly in lower-middle-income economies, which can provide valuable insights for our investigation.

Table 3.8 Estimation Results of the Random Effects Panel Probit Model Only
Depend on the Exchange Rate

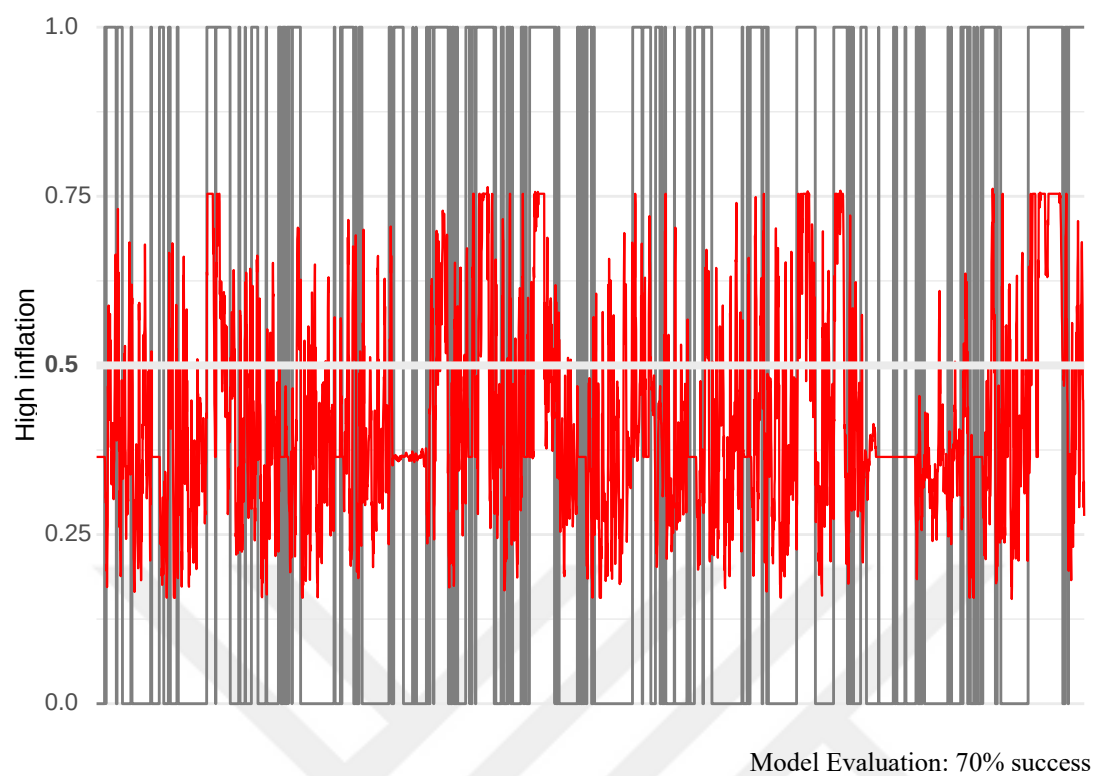
A. High income			B. Upper middle income			C. Lower middle income		
Number of Countries: 21			Number of Countries: 23			Number of Countries: 7		
Total Observations: 4956			Total Observations: 4816			Total Observations: 1593		
Period: 1961Q1 - 2023Q1			Period: 1961Q1 - 2023Q1			Period: 1961Q1 - 2023Q1		
	Coefficient	Std. error		Coefficient	Std. error		Coefficient	Std. error
Intercept	-0.345***	(0.037)	Intercept	-0.768***	(0.05)	Intercept	-0.278***	(0.043)
FX (t-1)	0.0293***	(0.004)	FX (t-1)	0.043***	(0.004)	FX (t-2)	0.034***	(0.004)
FX (t-2)	-0.003	(0.006)	FX (t-2)	-0.001	(0.007)	sigma	0.494***	(0.045)
FX (t-3)	-9.8E-05	(0.006)	FX (t-3)	-0.001	(0.007)			
FX (t-4)	0.014***	(0.004)	FX (t-4)	0.027***	(0.004)			
sigma	0.444***	(0.042)	sigma	0.393***	(0.042)			

*** if p-value < 0.001, ** if p-value < 0.01, * if p-value < 0.05, . if p-value < 0.1

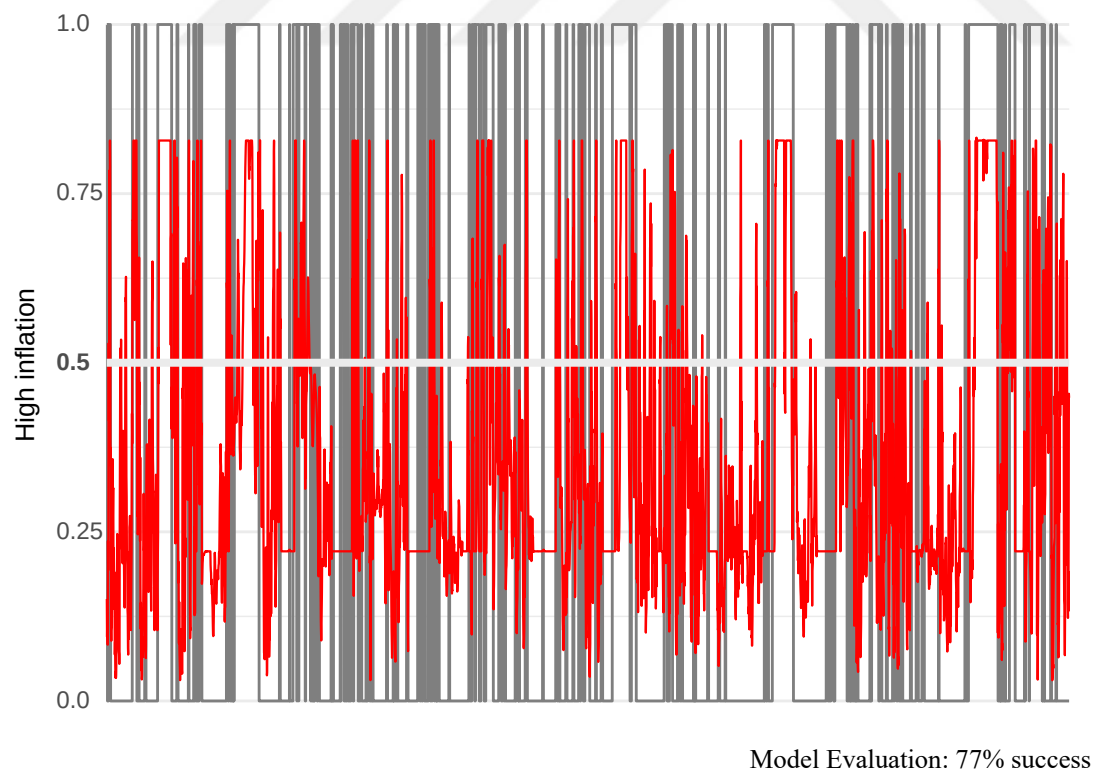
According to the results of Table 3.8, the exchange rate retains its significance for the same lags, similar to the complete model. As illustrated in Figure 3.8, the sole depreciation of the exchange rate is often sufficient to identify “high inflation” episodes. In high-income countries, the exchange rate alone achieves a 70% success rate in predicting whether inflation will be high or not, compared to the 82% success rate of the complete model. In upper-middle-income countries, the corresponding figures are 77% and 86%, while for lower-middle-income countries, they are 63% and 83%. These results strongly indicate that exchange rate depreciation⁸ is a primary driver of “high inflation.” These findings confirm that “high inflation” is frequently and almost universally an exchange rate phenomenon.

⁸ The reasons for the high exchange rate depreciations are explained in detail in Chapter 2.

A. “high inflation” probability within High income group



B. “high inflation” probability within the Upper middle-income group



C. “high inflation” probability within the Lower middle-income group

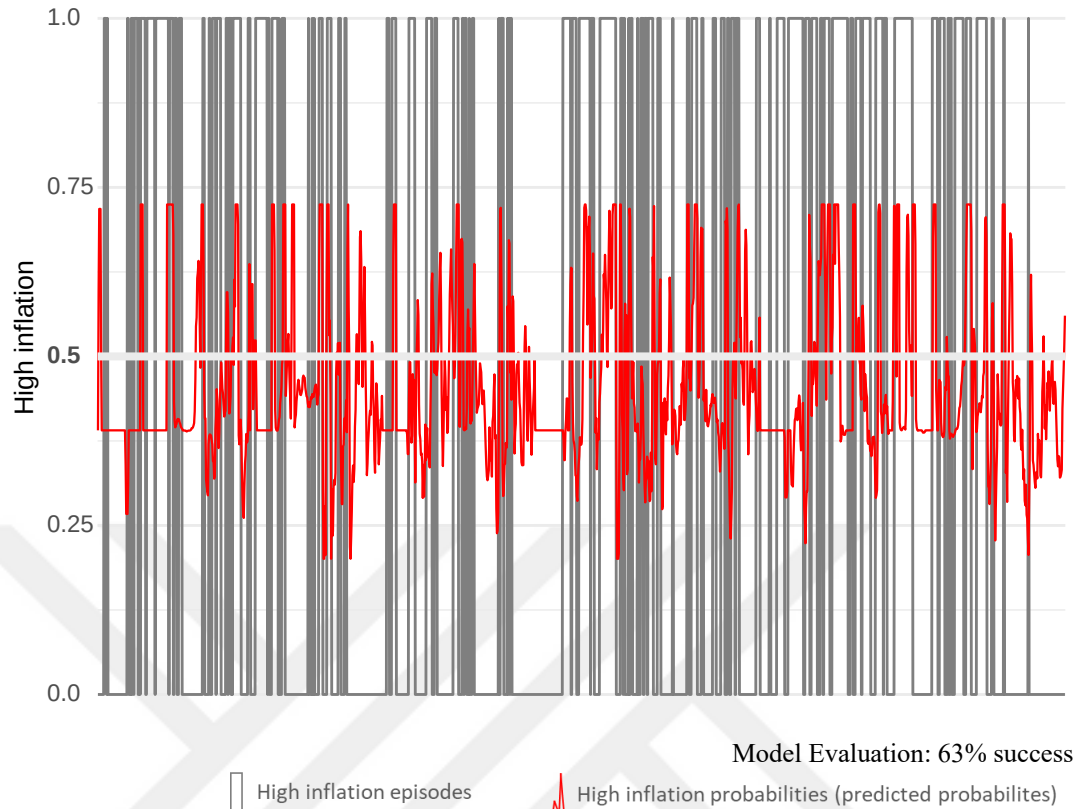


Figure 3.8 Predicted Probabilities that Only Depend on the Exchange Rate

Source: Authors’ calculation.

3.6. Concluding remarks

This study analyzes the determinants of “high inflation.” From the outset, it identifies the value of “high inflation.” To accomplish this, the study reviewed the literature concerning 19 well-estimated “high inflation” thresholds, ultimately identifying threshold as the median value derived from the literature’s threshold values: 10% for middle-income countries and 5.5% for high-income countries. However, the methodology used in the chapter remains effective even with higher (e.g., 40%) or lower thresholds (3.25 for high and 7.75 for middle-income).

Having set the benchmark for “high inflation,” we delved into the theoretical literature, focusing on key factors contributing to inflation. Once we have gained an understanding of the determinants of inflation and their underlying mechanisms, our

attention turns to investigating whether these factors indeed instigate “high inflation” within the context of the 51 countries under analysis. We explore whether these factors equally contribute or if some are more impactful. To achieve this objective, we initiate our investigation with random effects panel probit model due to its adeptness in managing binary response variables. This choice allowed us to categorize inflation levels into discrete outcomes of “high” and “non-high,” enabling a focused investigation into the determinants of “high inflation.”

According to model results, exchange rate depreciation consistently and significantly signals potential “high inflation” in all income groups. For instance, depreciation levels exceeding 35% are associated with more than 95% probability of “high inflation” in middle-income countries and 90% in high-income countries. While other determinants, such as demand, food commodity prices, and energy price shocks, demonstrate significance in specific income groups, their predictive power is less consistent and universal. For instance, demand plays a role in driving “high inflation” in high-income countries, as an approximately 3 standard deviations increase in GDP growth forecasts “high inflation” with a 44% probability. Notably, food commodity inflation proves influential in lower-middle-income nations, with deviations exceeding 1.75 positive standard deviations, signaling “high inflation” with a 50% probability. Similarly, energy price shocks exhibit a 30% probability of predicting “high inflation” in lower-middle-income economies when energy inflation rises by more than 50%. However, these impacts are less pronounced in other income groups, highlighting the structural differences discussed earlier.

Since exchange rates have consistently emerged as a universal driver of “high inflation” in both descriptive and econometric analyses, we took one step further to examine whether exchange rate depreciation alone globally drives “high inflation.” Employing the random effects panel probit model with sole exchange rate as an independent variable shows that exchange rate depreciation is a dominant predictor of “high inflation.” In high-income, upper-middle, and lower-middle-income countries, exchange rate movements achieve success rates of 70%, 77%, and 63%, respectively, in predicting “high inflation,” indicating its primary role as a driver.

Finally, we conclude that:

- Solely, exchange rate depreciation itself explains almost all high-inflation cases in upper-middle-income countries and most high-inflation cases in high and lower-middle-income countries.
- As an early warning indicator of “high inflation,” ~25% of depreciation alerts “high inflation” with the probability of more than 80% in middle-income and 70% in high-income countries.

In conclusion, our research has unearthed a comprehensive understanding of “high inflation,” illuminating the interplay of various determinants and their roles across different income groups. The convergence of findings from descriptive statistics and model results solidifies the significance of exchange rate depreciation as a central driver of “high inflation” while acknowledging food inflation's importance as a key indicator. Appreciating the significance of exchange rate depreciation as a crucial precursor to elevated inflation not only enables more prompt and efficient policy responses but also adds substantial value to the current body of research, reinforcing the pivotal role played by historical exchange rate trends and supply-side factors in our understanding of the intricacies of “high inflation.”

CHAPTER 4

GLOBAL INFLATION DYNAMICS IN THE FACE OF CLIMATE CHANGE: A UNIFIED APPROACH USING THE CLIMATE CONDITION INDEX (CCI)

In recent decades, the growing impact of climate change has emerged as a pressing global concern. This phenomenon, characterized by rising temperatures and increased extreme weather events, has far-reaching implications for various sectors, particularly agriculture. However, the intricate relationship between climate change and inflation remains largely unexplored in economic literature.

Drawing inspiration from Friedrich & Selcuk (2022), who investigated the impact of globalization and digitization on inflation, we aim to introduce climate change into the inflation framework. In this context, we explore how climate change affects marginal cost through productivity and can also modify the inflation elasticity of marginal cost through several mechanisms, including slope parameters and markup dynamics. Regarding productivity, climate-induced yield shocks may decrease output, leading to increased real marginal costs and subsequent inflation, assuming labor and wages remain constant. Moreover, common climate shocks to production, such as disasters or droughts, may elevate the elasticity of inflation to real marginal cost. Additionally, unique costs for companies, especially in the face of climate-induced supply bottlenecks, potentially resulting in an aggressive increase in nominal markup to maintain profit margins.

However, the main challenge lies in integrating climate change into the inflation equation, given the absence of a singular variable representing climate change. Previous studies have utilized diverse climate indicators, including rainfall (Odongo, Misati, Kamau, & Kisingu, 2022), climate disasters (Parker, 2018), climate change

news index (Zhang, 2023), and temperature (Köse & Ünal, 2022), to analyze their isolated impacts on inflation. Yet, none of these indicators can singularly identify climate change, necessitating the incorporation of multiple climate variables—a complex task due to dimensionality issues in modeling.

To address this challenge, we propose a solution by consolidating five diverse climate variables into a single Climate Condition Index (CCI), aiming to represent climate conditions accurately and assess their unified impact on inflation. This consolidated index addresses the dimensionality issues associated with existing inflation models and serves as a comprehensive tool for global inflation modeling. The CCI is also designed to function as a time series, offering a means to monitor climate change and raise public awareness about climate costs.

The CCI is obtained as a weighted average of cloud coverage, temperature, precipitation, wet day frequency, and vapor pressure. The weights are retrieved from Vector Error Correction Model (VECM) equilibrium coefficients, where the focused dependent variable is set as cumulative price level. This approach allows us to retain long-run trends in climate variables while weighting the variables most powerful in determining inflation in the analyzed countries. Since each country's inflation exhibits a different response to climate shocks, we create CCI for each of the 39 countries separately for the period between 1950-2021.

Utilizing the obtained CCI, the study evaluates the impact of climate change on inflation through VECMs, considering both short- and long-run relationships between prices and the CCI. By analyzing the change in the climate condition with a composite index, we set our research apart from previous ones that focused only on one transitory climate variable shock. In this regard, our contribution to inflation studies is threefold:

1. We propose a Climate Condition Index that characterizes both short- and long-run change in climate conditions.
2. We find that approximately 77% of analyzed countries are significantly affected by climate change, while 3 out of 39 countries significantly benefit from climate change, 27 countries witness significant inflationary climate

impulses.

3. In response to climate change, inflation in middle-income countries negatively affected is almost 4 times higher than in high-income economies. Furthermore, the response of food-importing countries is two times higher than that of exporter ones.

Findings reveal that only nine countries display insignificant price reactions to climate variations. Moreover, results highlight the substantial influence of climate change on inflation, especially in middle-income nations and economies reliant on food imports, which resonates with insights from earlier research by Yohe et al. (2006), Ha et al. (2019), Faccia, Parker and Stracca (2021).

From the outset, we review the literature to establish a view about the possible role of climate change in inflation formation in Section 4.1. In Section 4.2, we present our data and methodology to generate the CCI. Sections 4.3 and 4.4 provide the results and discussions, respectively. The research concludes with a section summarizing the findings and implications.

4.1. Literature review

4.1.1. Theoretical framework of determinants of inflation

A fundamental understanding of optimal price formation is essential to implement climate change into the Phillips curve. For a firm that periodically reassesses its pricing, the primary objective is to establish a price P_{it} that maximizes expected profit over the effective period (Holmberg, 2006). The optimization problem can be expressed as follows:

$$\max_{P_{it}} E_t \sum_{j=0}^{\infty} (\beta\theta)^j V_{t,t+j} \left[\frac{P_{it}}{P_{t+j}} Y_{it+j} - \frac{MC_{it+j}}{P_{t+j}} Y_{it+j} \right] \quad (1)$$

, where θ is the probability of the firm not being allowed to change the price in each period, and $\beta^j V_{t,t+j}$ is the stochastic discount factor. P_i is nominal price, Y_i is output

and MC_{it+j} is the firm's marginal cost. The log-linearized solution for this optimization is:

$$p_{it} = (1 - \beta\theta)[mc_{it}^r + p_t] + \beta\theta E_t p_{it+1} \quad (2)$$

, where mc_{it}^r is the real marginal cost. Equation 2 illustrates that in the presence of price rigidity, rational firms will establish prices by applying a margin over a combined value of current and anticipated future marginal costs.⁹

In its simple form, Galí and Gertler (1999) derive marginal cost through the Cobb-Douglas production function ($Y_t = A_t K_t^{1-\alpha} N_t^\alpha$, where A identifies technology, K denotes capital, N is labor, and $0 < \alpha < 1$) as below:¹⁰

$$mc_{it}^r = \frac{1}{(1-\alpha)}(w_t + l_t - p_t - y_t) \quad (3)$$

, where w_t is the nominal wage level in log terms, l_t is log labor, and $(w_t + l_t - p_t - y_t)$ is unit labor cost (the labor share income). Replacing real marginal cost in equation 2 and denoting inflation rate as $\pi_t \equiv p_t - p_{t-1} = \Delta p_t$, similar to Galí and Gertler (1999), we obtain inflation as below:

$$\pi_{it} = (1 - \beta\theta) \left[\frac{1}{(1-\alpha)} \Delta(w_t + l_t - p_t - y_t) + \pi_t \right] + \beta\theta E_t \pi_{it+1} \quad (4)$$

Upon this point, it is assumed that firms "set prices as a constant markup over current marginal cost" (Holmberg, 2006, p. 3). However, markup may change due to several factors during the transition path to a steady state or equilibrium. To account for these changes impact on prices, Weintraub defines level of prices as follows (Dutkowsky & Gianturco, 1986):

$$P = K \frac{WL}{Y} \quad (5)$$

⁹ In this equation, β (discount factor) identifies time preference.

¹⁰ On the other hand, the real marginal costs can be derived from more complex production function, where $Y_t = A_t N_t^\alpha (IM_t^\eta K_t^{1-\eta})^{1-\alpha}$ (here IM is imported inputs and $0 < \eta < 1$), similar to Holmberg (2006).

, where W is nominal wage, L is labor hours, and K is average markup. Differentiating Equation 5 in a logarithmic form, we obtain inflation similar to Equation 4 without the expected inflation term:

$$\pi = \Delta k + \lambda(\Delta w + \Delta l - \Delta y) \quad (6)$$

, where Δk denotes the change in the markup and λ would expected to be one (Dutkowsky & Gianturco, 1986).

4.1.2. Where should climate change be placed in the theoretical framework of determinants of inflation?

Since the onset of the Industrial Revolution and the era of mass consumption production in the 1970s, there has been a persistent increase in temperature. This temperature increase disrupts the balance of various climate variables, such as precipitation, evaporation, cloud coverage, and vapor pressure, leading to extreme weather events such as drought, wildfires, floods, landslides, and storms. These climate impacts exacerbate weather and land conditions for agriculture and harm agricultural productivity (Malhi, Kaur, & Kaushik, 2021). A study by Lesk, Rowhani, and Ramankutty (2016) found that between 1964 and 2007, global cereal productivity decreased by 9-10 percent due to droughts and heat waves.

However, the more important aspect is the expected worsening of climate conditions, highlighting more severe productivity losses. For example, research by Li et al. (2009) indicates that major grain yields are expected to decrease by more than 50 percent by 2050. Liang et al. (2017) found that regardless of technological advancements, the total factor productivity of agriculture in the US could decrease to pre-industrial levels by 2050. Rao, Prasad, and Mohapatra (Rao, Prasad, & Mohapatra, 2020) predict a 30 percent reduction in crop yields in South Asian countries, while Bolatova (2023) estimates a production decrease of 51-80 percent in spring wheat yields in Kazakhstan. In Southern Europe, Hristov et al. (2020) associate global warming with a 49 percent decrease in wheat yield by 2050, whereas Northern Europe may experience a 0.5-0.8 percent agricultural welfare gain by 2080 under global warming scenarios (Ciscar, et

al., 2011). In Brazil, agriculture is projected to shift out of the "optimal climate space" by 74 percent till 2060 (Rattis, et al., 2021).

When there is a decrease in yield and productivity, it disrupts the balance between food supply and demand, potentially leading to inflation. However, the recent literature has not yet built the theoretical connection between climate-related productivity losses and inflation. Therefore, to introduce climate change into the inflation equation, we draw inspiration from Friedrich and Selcuk (2022), who measured the impact of globalization and digitalization on inflation. By introducing two new global determinants into the Phillips curve, authors found that the new determinants affected the slope of the Phillips curve, $\frac{(1-\beta\theta)}{(1-\alpha)}$ in Equation 4, and λ in Equation 6. Moreover, they found considerable change in the slack term (the real marginal cost gap) and the intercept, which is explained through impacts on the non-cyclic degree of competition and markup.

Similar to global changes in Friedrich & Selcuk (2022), climate change may affect the Phillips curve through productivity, slope parameters, and markup. On the productivity side, when faced with climate-based yield shocks, y_t in Equations 4 and 6, may decrease. Holding labor and wages constant, such a decrease in output results in increased real marginal costs and inflation, respectively (Dutkowsky & Gianturco, 1986).

In terms of slope, the parameter of θ is essential, representing the probability of the firm not being allowed to change the price in each period. When there is a common shock into production, for instance, climate-related disasters or drought experienced by all agricultural producers, "firms can safely increase prices since they have a mutual expectation that all market players will do the same" (Weber & Wasner, 2023, p. 190). Thus, in terms of common climate change costs to all agricultural producers, we may expect that θ will decrease and rise the elasticity of inflation to real marginal cost. This possible increment in slope doubles the impact of climate on inflation, both through productivity-based high marginal costs and through high elasticity to high marginal costs.

Furthermore, when faced with unique costs for all companies, at least to keep profit margins intact, firms increase the nominal markup more than the costs (Weber & Wasner, 2023).¹¹ Moreover, firms encountering a scarcity of inputs because of a bottleneck on the supply side may adopt a more assertive approach to increasing prices. This strategy not only safeguards profit margins but could potentially lead to their expansion (Weber & Wasner, 2023). Therefore, when faced with climate-based bottlenecks, the Δk_t in Equation 6 may rise and amplify climate impulses on inflation. However, since the mainstream Phillips curve assumes constant margins, Equation 4 becomes weak in understanding similar markup channels.

Additional special consideration should be based on climate change's possible different impacts in different countries. For instance, emerging economies with agriculture as a key sector may be particularly vulnerable to climate change (Yohe et al. 2006; Faccia, Parker, and Stracca 2021). Furthermore, low-income economies rely highly on agriculture (Ha, Kose, Ohnsorge, & Unsal, 2019), making them more susceptible to economic fragility resulting from climate change. Therefore, these economies may witness higher elasticity to marginal costs and higher markup than advanced economies.

After understanding the possible transmission channel from climate change to inflation, one can introduce climate change into the inflation equation to enhance the slope parameter and markup. However, there is one strict limitation: there is no unique variable that represents climate change. Thus, several past studies utilized various climate indicators and analyzed their impact on inflation separately. For instance, Odongo, Misati, Kamau, and Kisingu (2022) utilized rainfall amount and found its' significant impact on food inflation. Parker (2018) revealed the effects of different types of climate disasters on inflation. Zhang (2023) used the climate change news index, which collects news related to climate change dangers, and Köse & Ünal (2022)

¹¹ “Consider a firm that produces good x at a selling price of \$100 and maintains a profit margin of 10 per cent, or a nominal markup above total costs of \$10. Suppose an upstream shock pushes costs up by \$10. If the cost increase is simply passed on, maintaining a nominal markup above total costs of \$10, the price of good x would be raised to \$110. But while the entirety of the cost increase was passed on, the profit margin has fallen to 9.09 per cent. The firm therefore increases the nominal markup above total costs to \$11, raising the price of good x to \$111” (Weber & Wasner, 2023, p. 194).

used temperature as a representative climate variable.

However, there is no one-size-fits-all interpretation of climate variables, as increasing temperatures may have different effects in different countries. For example, in some countries, rising temperatures may lead to increased rainfall, decreased frost frequency, and improved optimal temperature for crop cultivation. On the other hand, the sole rainfall amount may not be indicative without considering the frequency of the wet day. Moreover, short-run variations like climate disasters can not be effective when analyzing productivity. To avoid such misunderstandings, one should incorporate multiple climate variables and also avoid panel analysis when countries display non-similar responses to the same climate shocks.

Since existing models for determining inflation include many explanatory variables, the addition of multiple climate-related variables is constrained by issues related to the dimensionality of the models (Bulteel, Tuerlinckx, Brose, & Ceulemans, 2018). To address these limitations, this study aims to consolidate climate variables into a single index that accurately represents change in climate conditions and finds its impact on inflation. Ultimately, this index is intended to serve as a valuable tool for modeling inflation on a global scale. Furthermore, it is designed to function as a time series for monitoring climate change, which can raise public awareness about climate costs and foster stakeholder engagement.

4.2. Data and Methodology

The climate variables used in the chapter are obtained from the Climatic Research Unit (University of East Anglia) and Met Office as yearly observations between 1901-2021. The cloud coverage, temperature, precipitation, vapor pressure, and wet day frequency data units are percentages, degrees Celsius, millimeters per month, hectopascals (hPa), and days, respectively. The variables are generated by Harris et al. (2020). On the other hand, cumulative price level data is retrieved from the International Financial Statistics (IFS) as yearly observations between 1950-2021, which covers 39 countries. Climate-related natural disaster frequency data is obtained from the EM-DAT database of the

Centre for Research on the Epidemiology of Disasters as monthly observations between 1901-2021.

As seen in Figure 4.1, cloud coverage is decreasing in most nations; on the other hand, temperature and vapor pressure are continuously increasing. However, there is no common trend in precipitation and wet day frequency, but variation slightly increased.

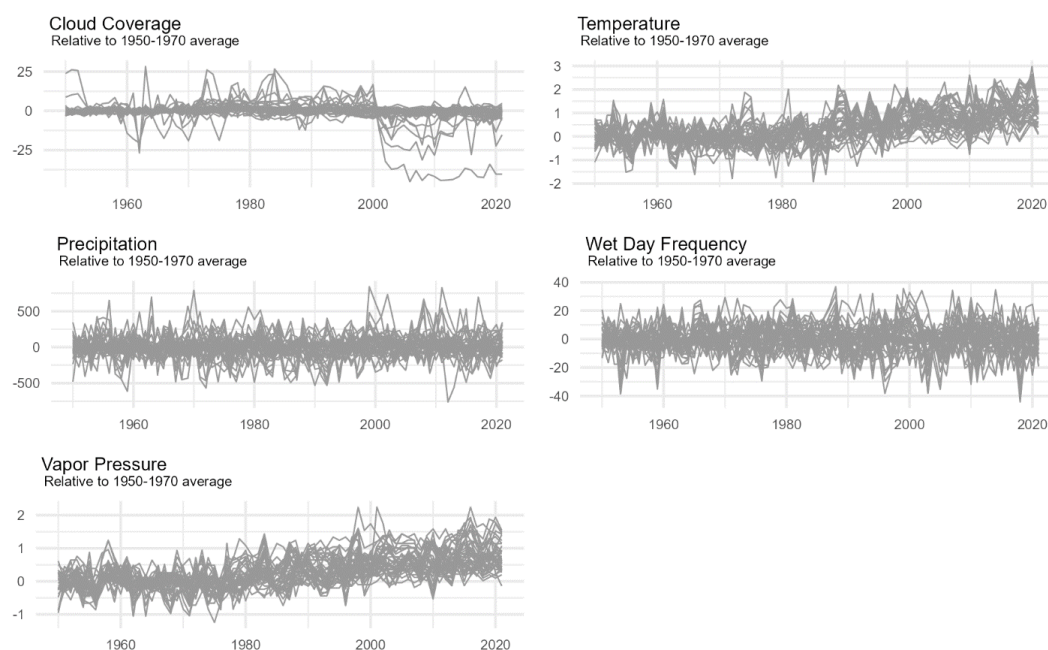


Figure 4.1 Climate Variables

Source: Author's Calculation.

Various techniques can be considered to create a unified climate-change representative index from the five climate variables. The first approach involves an equally weighted index, assigning equal importance to all climate variables. However, this method might oversimplify the impact of climate variables on agricultural productivity. For instance, in some countries, cloud coverage may be more important for productivity than precipitation, vapor pressure, or vice versa; therefore, an equally weighted index may not be optimal. The second alternative for index generation could be the common index generation method of Principal Component Analysis (PCA). However, similar to the equal weight approach, the PCA methodology's disadvantage is treating all indicators

as equally important (Abson, Dougill, & Stringer, 2012), neglecting the relative importance of climate variables affecting agricultural prices.

Since we want to preserve the trends in climate variables by making a unique index and want to consider their importance on agricultural productivity and inflation overall, we choose to weight climate variables through coefficients of the econometric model, where the dependent variable is the focus variable, inflation. With this selection, we can weigh climate variables by their importance in explaining historical inflationary events. However, since we want to preserve the trends in climate variables, especially in temperature and vapor pressure, we avoid transforming series into stationary ones. We should be aware that price levels may eventually adjust to a level that is determined by climate trends related to productivity. Moreover, we should deal with the multidimensional causality between climate variables. In this regard, VECM became a useful tool for weighing climate variables based on their impact on long-run price levels.

Before proceeding with VECM, the existence of at least one cointegration relation among the variables is verified using the Johansen procedure. Table 4.1.A. displays that all Johansen trace statistics for $r=0$, no cointegration, are higher than 95% critical value for all analyzed countries. Since we can reject the null hypothesis of no cointegration (Lutkepohl, 2004), we can utilize VECM for index generation. The model is specified as follows:

$$\Delta x_t = \theta x_{t-1} + \sum_{l=1}^{p-1} \Gamma_l \Delta x_{t-l} + \delta det_t + dum_t^{dis} + dum_t^{sb} + \varepsilon_t \quad (7)$$

, where Δx is the vector x variables' (cumulative price level, cloud coverage, precipitation, temperature, vapor pressure, and wet day frequency) first differences, θ is the cointegrating relationship coefficient matrix, Γ is the lags of differenced variables' coefficient matrix, det is a vector of deterministic terms and δ its corresponding coefficient matrix, dum^{dis} is climate-related natural disaster (drought, storm, flood, landslide, wildfire, extreme temperature, fog, glacial lake outburst) frequency dummy variables, dum^{sb} is structural break dummy, p is the lag order of

the model, and ε is an error term.

The coefficient matrix θ can be written as:

$$\theta = \alpha\beta' \quad (8)$$

, where α is the speed of convergence to equilibrium and β is the long-run cointegration (or equilibrium) coefficient matrix that is used to generate the CCI. The β coefficients are multiplied by -1 to reduce the complexity of understanding CCI. Hence, increased CCI means good climate conditions for agriculture, which decreases the price level.

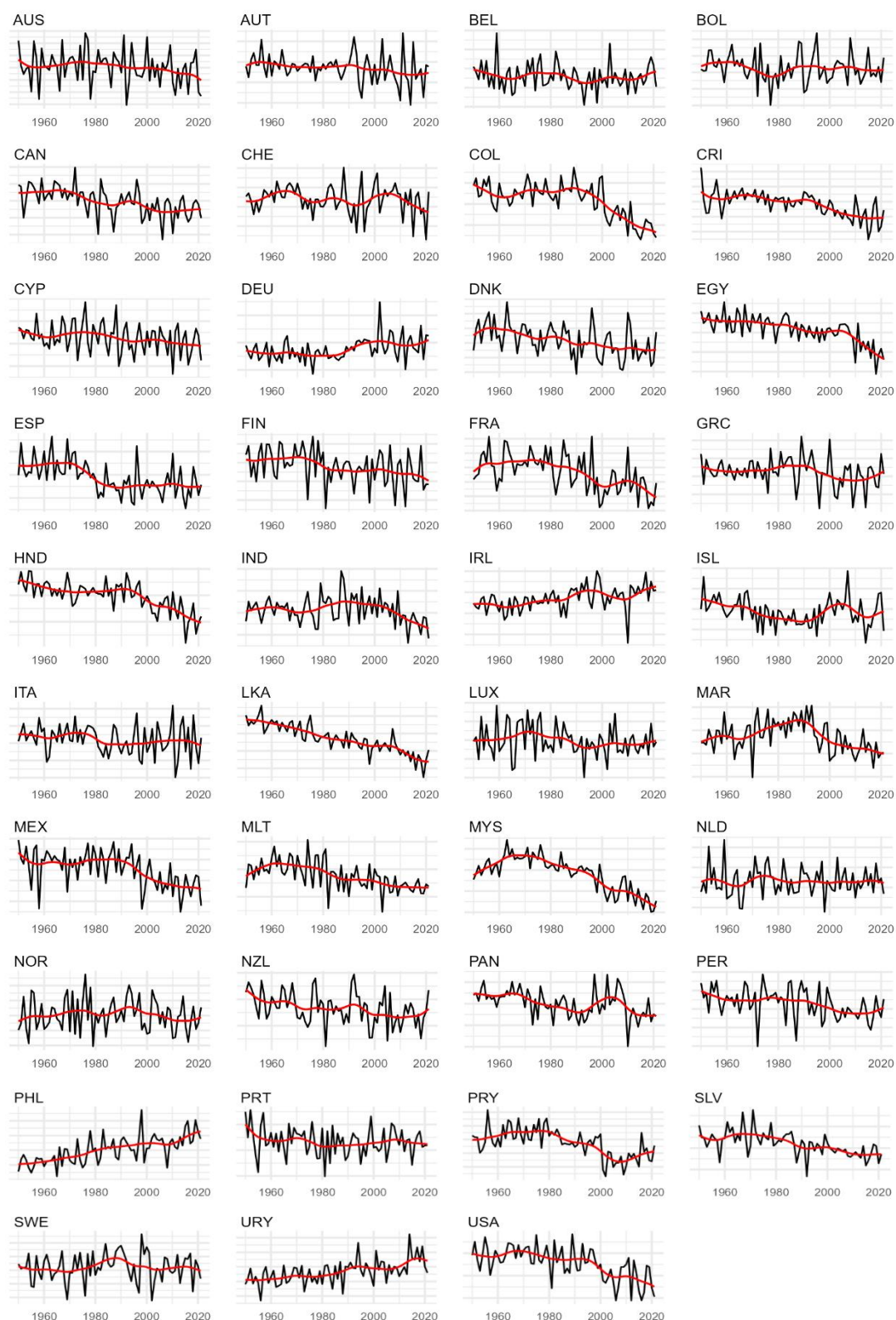
As discussed earlier, since each country may display different responses to the same climate shocks, we avoid utilizing panel analysis. Thus, the VECM above is used separately for 39 analyzed countries. To select the appropriate lag order, we use the Hannan-Quinn criterion (HQ), which estimates orders consistently (Lutkepohl, 2004), and we display lag orders in Table 4.1.B. In terms of deterministic terms, we add a constant term for each country to ensure the long-run steady-state growth of variables (which are different than zero) (Lutkepohl, 2004).

As seen in Figure 4.1, some climate variables like cloud coverage, temperature, and vapor pressure have shifted in their history. Such shifts in explanatory variables may impact the model parameters stability (Calza, Gartner, & Sousa, 2021). Therefore, to ensure the stability of model parameters, following Calza, Gartner, and Sousa (2021), we detect structural break points in the parameters of VECM by breakpoint Chow test. In this regard, following the authors, the Chow test is utilized by first estimating the model for the entire sample and then testing whether there is evidence of structural change in parameters when the sample period is progressively reduced. The test utilizes residual sums of squares (Nielsen & Whitby, 2015) from the entire sample and from each subsample to assess whether there are significant differences between the full and reduced models (Please refer to Table 4.1.C. for Chow breakpoints). After breakpoints are determined, we set dum^{sb} as 1 after the latest break point for each country.

Table 4.1 Model Properties

Country	A. Johansen Test Statistics (trace)		B. Optimal Lag	C. Chow BP
	for r=0 (no cointegration)	Critical Value (95%)	based on HQ	Break years
AUS	199.49	131.7	1	-
AUT	265.87	131.7	1	-
BEL	220.97	131.7	1	-
BOL	161.95	131.7	1	1956
CAN	200.13	131.7	1	-
COL	166.7	131.7	1	-
CRI	193.4	131.7	1	-
CYP	231.48	131.7	1	-
DNK	221.61	131.7	2	-
EGY	217.87	131.7	1	-
SLV	193.6	131.7	1	-
FIN	220.23	131.7	1	1951-1965
FRA	202.06	131.7	2	1951-1959
DEU	198.69	131.7	1	-
GRC	225.59	131.7	2	-
HND	197.21	131.7	1	-
ISL	178.3	131.7	1	-
IND	189.59	131.7	1	-
IRL	206.35	131.7	1	-
ITA	220.76	131.7	1	1951-1964
LUX	180.75	131.7	1	-
MYS	158.92	131.7	1	1953-1963
MLT	161.77	102.14	1	-
MEX	200.08	131.7	1	-
MAR	215.33	131.7	1	-
NLD	202.66	131.7	1	-
NZL	213.21	131.7	4	1951-1955
NOR	232.13	131.7	1	-
PAN	197.58	131.7	2	-
PRY	217.55	131.7	1	-
PER	188.98	131.7	2	-
PHL	174.32	131.7	1	-
PRT	214.13	131.7	2	-
ESP	235.7	131.7	1	-
LKA	199.05	131.7	1	-
SWE	204.37	131.7	1	1952-1953
CHE	235.77	131.7	1	-
USA	173.26	131.7	1	-
URY	193.69	131.7	1	1955-1956

4.3. Results



Black lines denote CCI, and red lines are CCI trends obtained from the Hodrick–Prescott (HP) filter.

Figure 4.2 Climate Condition Index (CCI)

Source: Author's Calculation.

After running the VECM for each of the 39 countries, we obtain long-run equilibrium coefficients for our 5 climate indices. Moreover, by summing the multiplication of the coefficients as the weight with climate series, we obtain CCI for 39 analyzed countries. As depicted in Figure 4.2. climate conditions have a negative trend in most countries, which may highlight that climate conditions became unfavorable for inflation in the majority of analyzed countries. The positive climate trend can be seen in Ireland, Norway, the Philippines, Uruguay, and, after the 2000s, Iceland. However, we should be careful when explaining the CCI in terms of clearly favorable or unfavorable because short- and long-run impacts on inflation exist. Therefore, not just the trends in the CCI but also the cyclic changes affect inflation, which should be analyzed through a robust model.

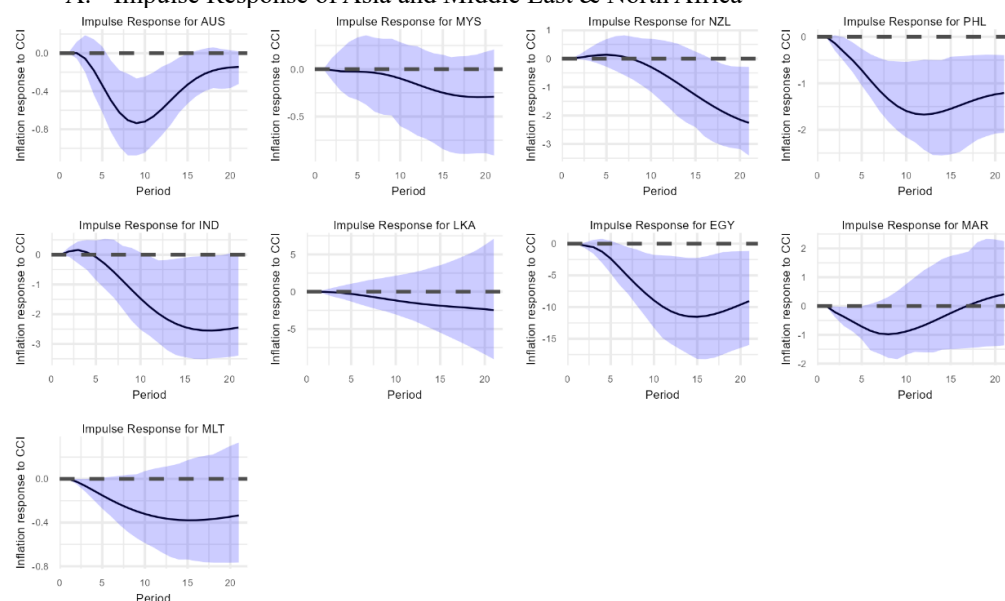
With the indices in hand, we proceeded to test whether climate change significantly affects inflation and whether such changes have a permanent impact on price levels. For this purpose, we employed VECM with only two endogenous variables (inflation and CCI) and exogenous dummy variables. Additionally, impulse-response analysis was conducted to reveal the impact of climate change on inflation at a 90% confidence interval.

As depicted in Figure 4.3.A., inflation is negatively affected by climate change in all analyzed countries in the Middle East & North African region and Asia, excluding Central Asian countries. However, the impulse responses are not significant in all countries. Significant short-run impacts are observed in Malta and Morocco, and mid-run impacts in Australia and India. Moreover, the impact becomes significant in the short-run for the Philippines, in the mid-run for Egypt, and in the long-run for New Zealand, lasting longer. The climate impulses are not significant in Malaysia and Sri Lanka.

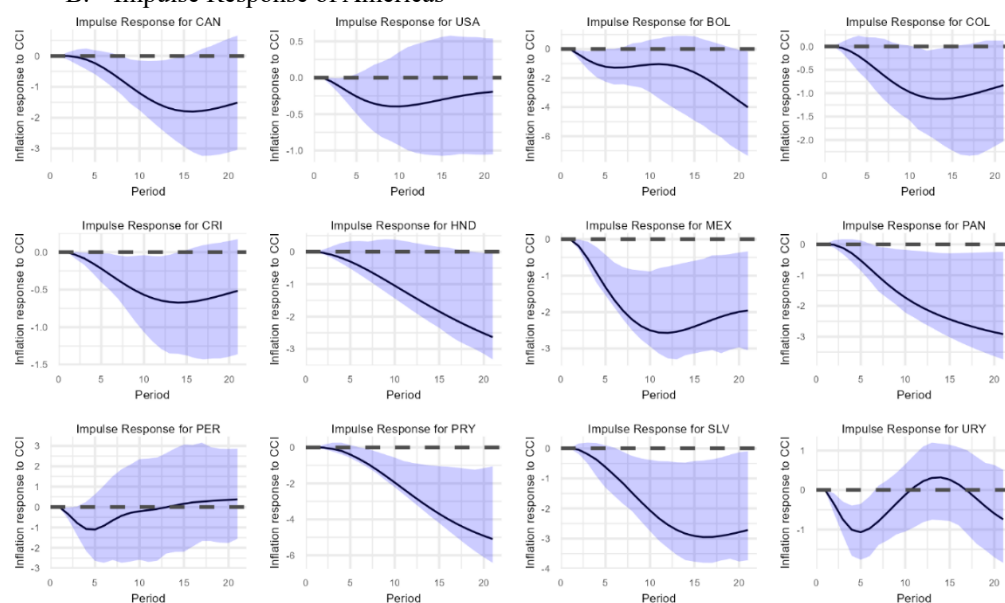
In the Americas, similar to previous regions, all countries have witnessed inflationary impulses from climate change. In the short-run, the impulse is significant in the USA, Peru, and Uruguay. The impulses are significant in the mid-run in Canada, Colombia, and Costa Rica. Furthermore, climate changes permanently affect Bolivia, Honduras, Mexico, Panama, Paraguay, and El Salvador.

As seen in Figure 4.3.C., in Europe & Central Asia region, unlike other regions, climate change has significant deflationary impacts in Ireland, Iceland, and Sweden, and insignificant but deflationary in the Netherlands and Norway. Short-run inflationary climate impulses are observed in Greece. The mid-run impacts are witnessed in Belgium, Finland, Italy, and Sweden. Furthermore, climate change is permanently inflationary in Austria, Denmark, Spain, and Portugal. The impulses are insignificant in Switzerland, Cyprus, Germany, France, Luxembourg, the Netherlands, and Norway.

A. Impulse Response of Asia and Middle East & North Africa



B. Impulse Response of Americas



C. Impulse Response of Europe and Central Asia

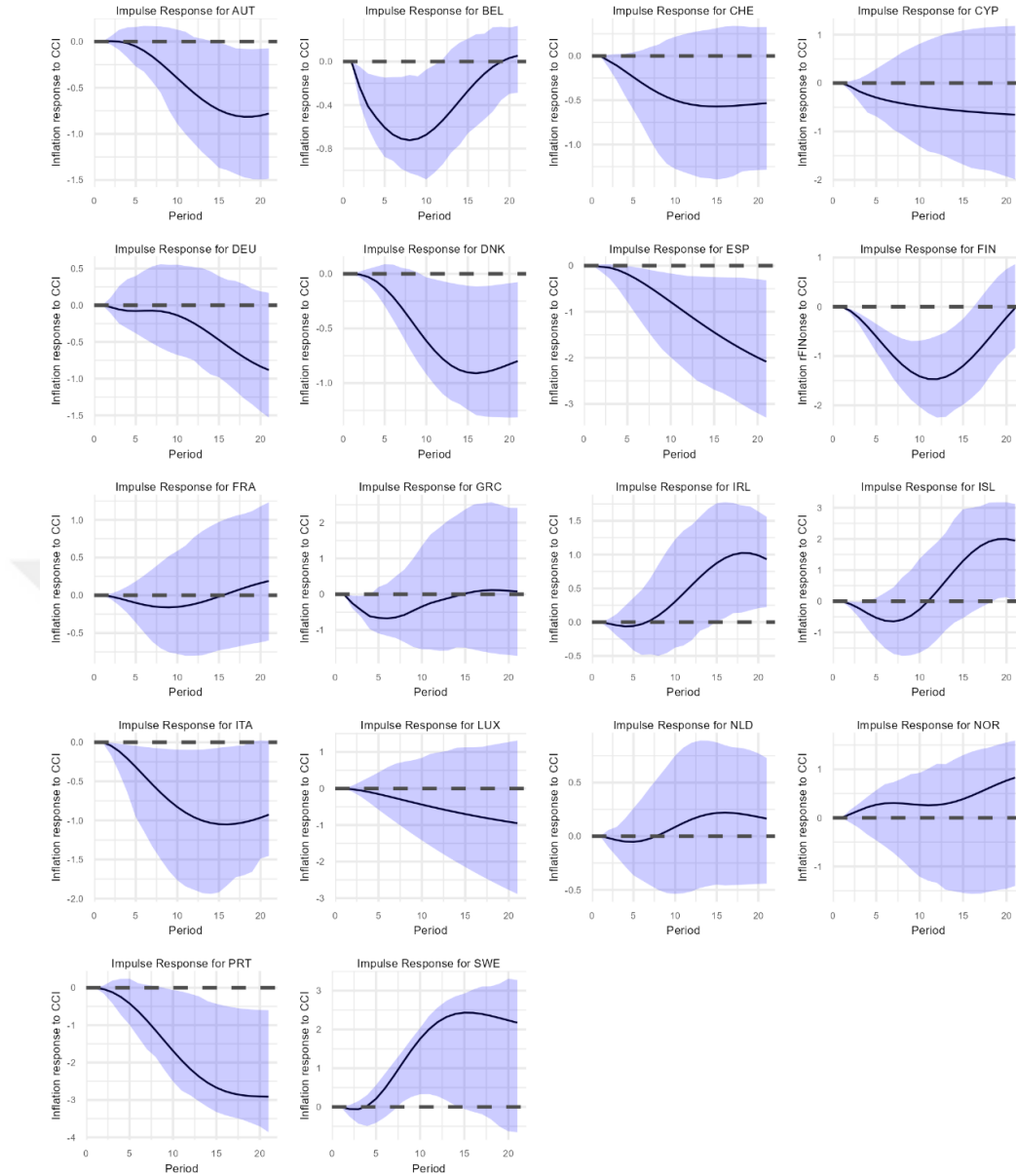


Figure 4.3 Responses of Prices to the CCI

Source: Author's Calculation.

As we witnessed in impulse responses, climate change has a non-unique impact on inflation across countries. The interesting question arises as to whether these differences can be generalized according to the income status of the countries, where the lower-income countries may be prone to be affected more by climate change (Yohe et al. 2006; Ha et al. 2019; Faccia, Parker, and Stracca 2021). To test this hypothesis, we group countries by their income status, which is defined by the World Bank as

depicted in Table c.1. in the Appendix. Moreover, as depicted in Figure 4.4, we utilize each country's impulse responses and take the median of them to represent the group characteristics.

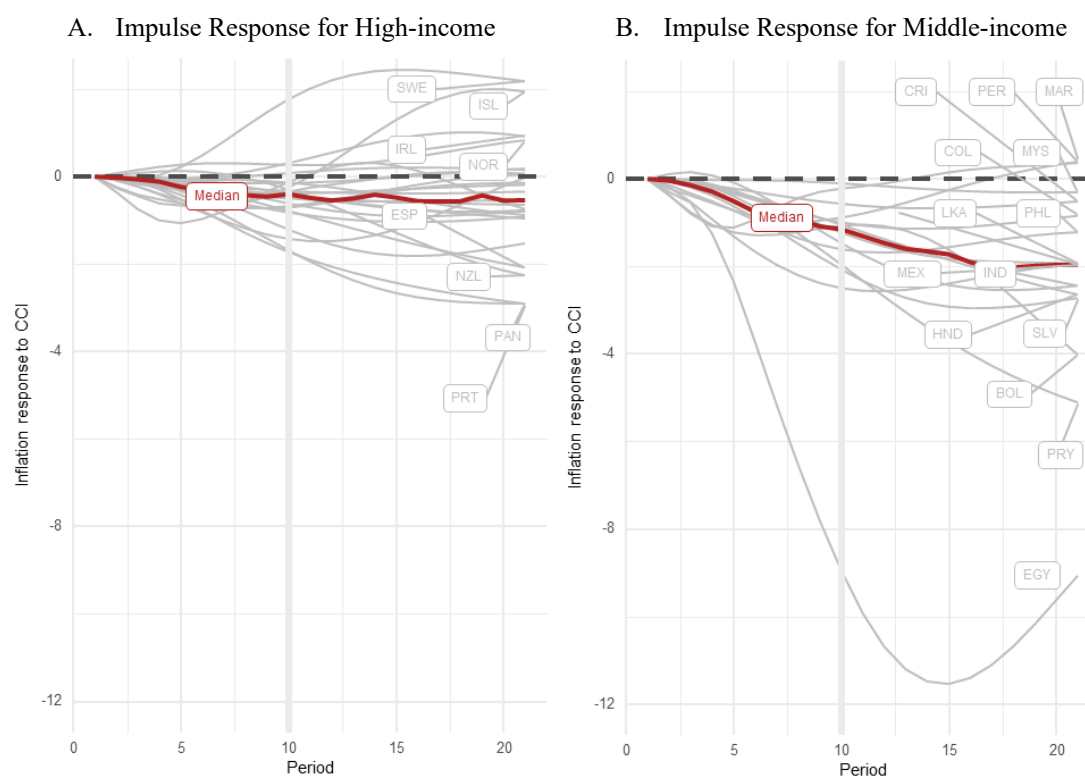


Figure 4.4 Structural Differences in Response to the CCI Across Income Groups
 Source: Author's Calculation.

According to the figure, climate change has a more inflationary impact in middle-income countries than in high-income ones, where the median is significantly lower than in high-income countries. Moreover, for up to 10 years, almost all middle-income countries have been negatively affected by climate change, while Sweden, Norway, and Ireland distort the results for high-income countries.

Similar to income-based grouping results, the grouping based on food export status also displays that food-importing countries are more affected by negative climate conditions, as seen in Figure 4.5.

Although not conclusive evidence, these results may highlight that climate conditions

have historically worsened middle-income/importer countries' agricultural productivity. Thus, marginal costs in these countries may be higher than in high-income/exporter ones. Moreover, the elasticity of the Phillips curve to marginal cost and markup may also be higher than in high-income/exporter countries, as firms in these countries may face more supply bottlenecks compared to others. In this regard, as proposed by Weber and Wasner (2023), firms would be more confident that their rivals do the same, enabling them to reflect climate-based supply costs directly in prices.

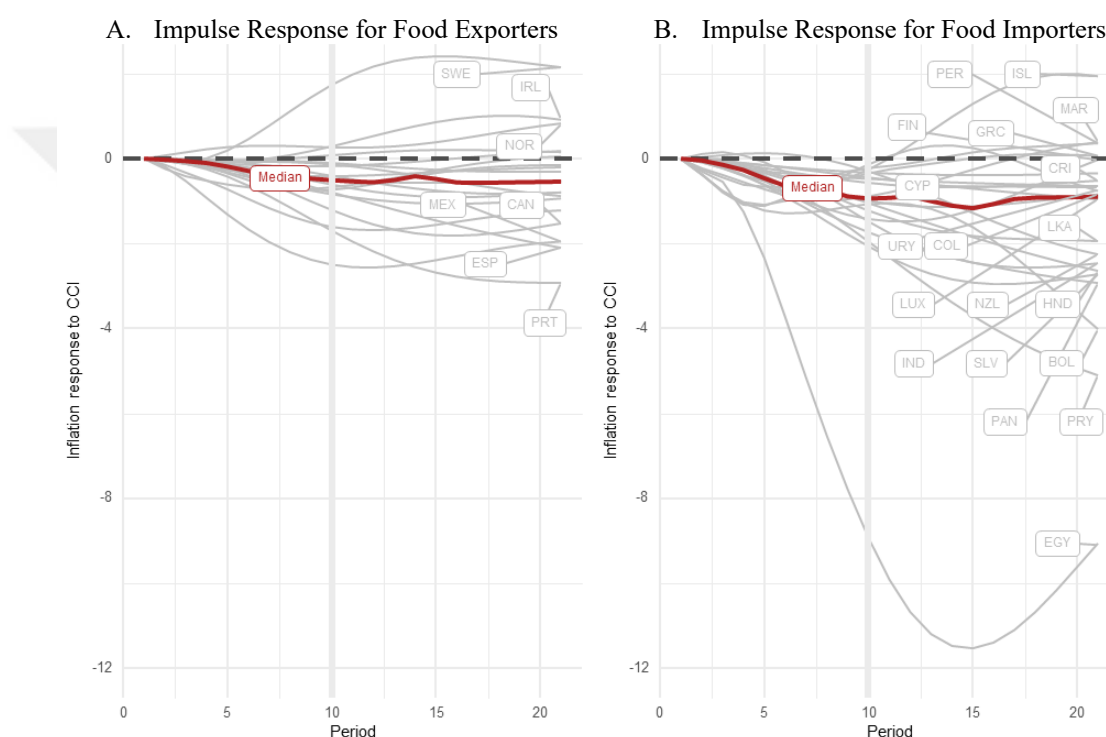


Figure 4.5 Structural Differences in Response to the CCI Across Export Status

Source: Author's Calculation.

4.4. Discussion

The results obtained in this study are majorly consistent with the literature. For instance, climate conditions' unfavorable impacts on agriculture have been proved in Australia (S.Kiem & K.Austin, 2013), the Philippines (WFP, 2021), India (Rao, Prasad, & Mohapatra, 2020), France (AgriAdapt, 2019), Mexico (Feng, Krueger, &

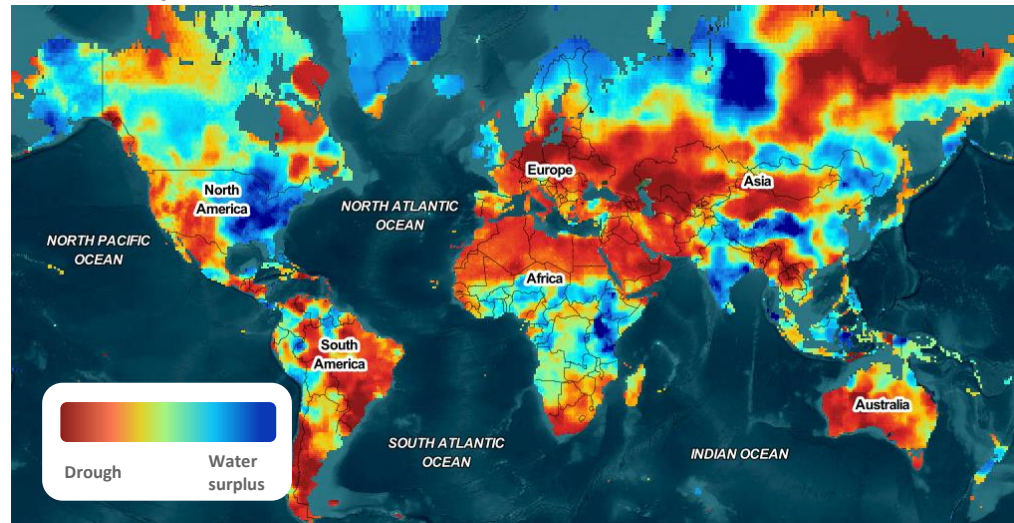
Oppenheimer, 2010), Latin America (Köse & Ünal, 2022) etc. On the other hand, favorable impacts are analyzed in northern Europe (Ciscar, et al., 2011).

Another test of the robustness of the CCI involves comparing it to two other established climate indices: The global SPEI database and the Global Climate Risk Index (GCRI). However, these indices differ significantly from the CCI in their structure and features. For example, the CCI is an average country-specific time series, while the SPEI is a database with a spatial resolution of 0.5 degrees, and the GCRI is a ranking system that assesses the magnitude of climate impacts on countries. The CCI takes into account drought, weather, surface environment, and indirect climate-related disasters, while the SPEI only considers hydroclimate conditions, and the GCRI focuses on extreme weather events like storms, floods, and heat waves.

Due to their differences, each index has its own advantages. The CCI separates favorable and unfavorable climate changes for each country. In contrast, the SPEI has more disaggregated data available, such as data for cities, villages, and regions, due to its higher spatial resolution. The GCRI is more suitable for country comparison and overall risk analysis. However, neither the SPEI nor the GCRI has econometric-friendly structures, which makes CCI required and demanded.

According to the SPEI (Figure 4.6.A), Canada did not face any drought or excess water surplus problems, indicating that climate change-induced drought or water surplus is not a major issue in most parts of Canada, which does not align with CCI. However, Canada's ranking in GCRI aligns with CCI. On the other hand, the USA faces significant challenges with drought and excess water surplus, which aligns with CCI's findings. Additionally, the impact of drought (SPEI) is considerable in Mexico, Uruguay, Colombia, and Bolivia, aligning with unfavorable, inflationary changes in CCI. The three indices generally produce similar results for Europe and Asia. While northern European countries have not faced inflationary climate changes, the rest of Europe, the Middle East, and Australia face droughts. India and the rest of the Pacific countries are mostly affected by water surpluses, which can be counted as harmful to productivity. The GCRI is also high for these countries. Therefore, the results are aligned with CCI's inflationary conclusions.

A. SPEI-48



B. Global Climate Risk Index

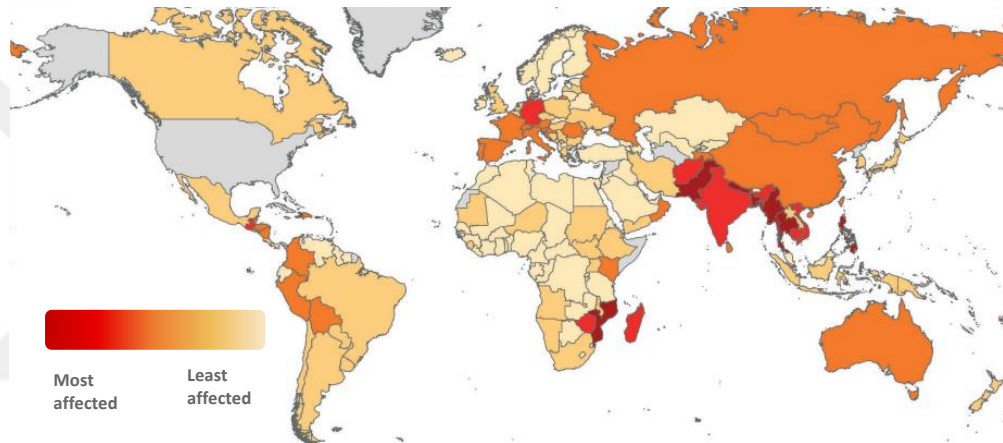


Figure 4.6 Comparison of Climate Indices

In spite of differences in index making process and structure of indices, CCI shows high consistency with both indices, which ensures its robustness. The index offers insights into the worldwide uneven inflation by presenting the climate impact differences among countries. In this regard, structural inflation determinants models may measure CCI's direct long-run contribution to inflation. Moreover, similar to Friedrich & Selcuk (2022), after proving CCI's significant impact on inflation, the inclusion of CCI in a well-developed Phillips curve may enhance the real marginal cost gap, slope of the Phillips curve and better explain the non-constant markups in the economy. While this is left for future research, such studies may open new climate-based discussions in worldwide Central Banking.

Besides, CCI may be a handful of indicators for assessing the risk of non-performing agricultural loans for an overall banking system. Moreover, considering the high vulnerability of agriculture to the climate in emerging economies and high-income dependency on agriculture also makes CCI useful in agricultural Gross Domestic Product (GDP) estimations, which may attract the interest of governments.

It is important to note that the generation of the CCI index is subject to limitations due to the availability and accessibility of observations. As we obtained only 39 countries' price level data starting from 1950, the inclusion of other countries may enhance our conclusion about significantly different impulse responses of middle-income/food importer countries with respect to high-income/food exporter ones. Moreover, the CCI has limitations in capturing the significant impact of climate on inflation in large countries. The index cannot account for regional impacts and their overall shares in the country, which makes it less effective for analyzing climate impacts on these nations. However, this limitation does not affect the comprehensive understanding and tendency of climate in large countries. On the other hand, future research could improve the CCI by incorporating regional disaggregation specifications rather than focusing solely on country-level analysis.

4.5. Concluding remarks

In summary, this study addresses the lack of theoretical background linking climate change to inflation by drawing parallels with the approach taken by Friedrich and Selcuk (2022). We propose that climate change can impact the inflation equation through marginal cost, slope, and markup. However, the absence of a unique climate change variable for integration into the Phillips curve necessitates the creation of a Climate Condition Index (CCI). This index incorporates temperature, precipitation, cloud coverage, wet day frequency, and vapor pressure, using weights derived from the long-run equilibrium coefficients of a Vector Error Correction Model (VECM) with price level as the dependent variable.

The application of country-specific VECMs for 39 nations reveals a predominantly negative trend in the CCI for the majority, with only five exhibiting positive trends.

With the CCI in hand, the study assesses the significance of climate change on inflation using VECMs between prices and the CCI, capturing both short- and long-run relationships. Results indicate that only nine countries show insignificant price responses to climate change. While five experience deflationary effects, with three being significant, in contrast, 34 countries exhibit inflationary pressures from changing climate conditions, with only seven of them showing insignificance.

These findings underscore the significant impact of climate change on inflation, particularly in middle-income countries and food-importing economies, aligning with suggestions from previous literature. Although not explicitly examined, it is conceivable that these economies might demonstrate elevated inflation elasticity and markups in response to climate-induced shocks. Thus, we create a base for discussion about the inclusion of climate change in the inflation formation. In the subsequent stage, incorporating the CCI into an inflation equation could contribute to advancing conversations regarding inflation triggered by climate change—a facet frequently neglected in contemporary central banking.

CHAPTER 5

CONCLUSION

In this thesis, we focused on several perspectives of structural inflation dynamics, with a primary focus on emerging economies. This chapter summarizes the main arguments and findings of this thesis. The first essay analyzes the reasons for high and volatile inflation in emerging economies compared to advanced ones. Drawing from institutional, structural, and historical lenses, our investigation delves into the imbalances within the global system that contribute to elevated and fluctuating inflation rates in emerging economies. Two pivotal questions guide our inquiry: why does inflation tend to be higher in emerging economies compared to advanced ones, and why is inflation more volatile in these economies?

We critically assess the Balassa-Samuelson (BS) hypothesis, a foundational concept often invoked to explain inflation disparities. Contrary to conventional wisdom, recent empirical findings challenge the BS hypothesis, particularly in the context of emerging economies. This has prompted us to develop an alternative theoretical framework that considers the unique structural dynamics of inflation in these contexts. In this regard, we are conceptualizing a new alternative by synthesizing insights from both orthodox and heterodox perspectives. While orthodox literature informs our exploration of the nexus between inflation and expectations, heterodox viewpoints—most notably Kalecki's cost-determined price-setting framework—shape our understanding of price formation within emerging economies. Our theoretical framework emphasizes the role of global economic conditions and resource constraints in shaping inflation dynamics, highlighting the intricate interplay between structural and institutional factors. Rather than subscribing solely to monetarist or demand-based approaches, we contend that inflationary dynamics are fundamentally rooted in broader systemic and institutional frameworks.

This essay has identified five interconnected drivers contributing to structurally different inflation phenomena: persistent exchange rate depreciation due to current account deficits, commodity price fluctuations, and capital flow dynamics leading to high import prices; weak supply chain systems and limited alternative supply options resulting in regional inflation trends mirroring each other; institutional dynamics perpetuating profit-led and markup-led inflation through cost pass-through to consumers; weak domestic competition and limited trade integration exacerbating inflationary pressures; and the lack of central bank credibility leading to unanchored inflation expectations. These interconnected structural and institutional issues result in higher and more persistent inflation rates in emerging economies, highlighting challenges in price formation and disinflationary processes.

Building on the dynamics of structural and institutional inflation, the second essay examines the factors contributing to "high inflation." The essay underscores the detrimental effects of high inflation on savings, investor confidence, income distribution, and economic stability, emphasizing the urgency for policymakers to preemptively address this issue. To begin, the essay establishes a clear definition of "high inflation" by leveraging existing literature, setting threshold levels at 10% for middle-income countries and 5.5% for high-income countries based on a comprehensive review of established thresholds. This methodological approach provides a framework for identifying and analyzing episodes of high inflation.

After defining "high inflation," drawing insights from both orthodox and heterodox perspectives, the essay explores the underlying determinants of historical "high inflation" episodes. Supported by theoretical frameworks, the empirical result of the essay unveils the prominence of exchange rate movements as a primary driver of high inflation across diverse economic contexts. Depreciation rates higher than 35% indicate a very high likelihood of "high inflation" in middle-income countries (over 95%) and high-income countries (90%). Based on this strong evidence of the pivotal role of exchange rate depreciations as a leading indicator, the essay introduces this model as a novel early warning model for predicting high inflation episodes. While the model's success rate in predicting high inflation exceeds 80%, most of its effectiveness stems from exchange rate dynamics. Other factors such as demand, food

commodity prices, and energy price shocks exhibit varying levels of significance across income groups, with less consistent and widespread predictive capability. Notably, demand-driven inflation is more pronounced in high-income countries, whereas inflation triggered by food and energy prices is prevalent in lower-middle-income economies, highlighting the structural differences discussed earlier.

The third essay departs from conventional approaches to inflation analysis by exploring the impact of climate change as a novel determinant. It begins by acknowledging the global repercussions of climate change, particularly its effects on agriculture—a critical sector that significantly influences inflation dynamics, especially in emerging economies.

Recognizing the complexity of integrating climate change into inflation theory, the essay addresses the challenge of utilizing multiple climate variables by proposing a novel Climate Condition Index (CCI). This index consolidates key climate indicators into a single metric, enabling a more holistic assessment of climate-related impacts on inflation across various countries and time periods. In addition to its contribution to measuring climate change through this novel index, the essay delves into the transmission mechanisms of climate impacts on inflation. It draws from theoretical frameworks that explore the relationship between climate change, productivity, price-setting behaviors, and nominal markup dynamics. By bridging empirical findings with theoretical underpinnings, the essay sheds light on how climate-induced shocks can alter inflationary dynamics through changes in marginal costs and supply chain disruptions.

Ultimately, following the acquisition of the climate index and comprehension of the transmission mechanisms, the essay seeks to reveal empirical proof of climate change's effect on inflation. Our examination demonstrates that around 77% of the countries examined are notably impacted by climate change, underscoring its extensive reach. While only 3 out of the 39 countries analyzed show significant positive outcomes from climate change, 27 countries are susceptible to notable inflationary consequences driven by climate-related factors.

REFERENCES

- Abbas, S. K., & Lan, H. (2020). Commodity price pass-through and inflation regimes. *Energy Economics*, Vol. 92.
- Abson, D. J., Dougill, A. J., & Stringer, L. C. (2012). Using Principal Component Analysis for information-rich socio-ecological vulnerability mapping in Southern Africa. *Applied Geography*, Vol. 35, Issues 1-2, 515-524.
- Aghion, P., Cherif, R., & Hasanov, F. (2021). Competition, Innovation, and Inclusive Growth. IMF Working Paper, WP/21/80, 1-28.
- AgriAdapt. (2019). Climate change opportunities for agriculture in France. AgriAdapt.
- Alsabban, S. O., & Alnuwaiser, S. N. (2021). Estimating Optimal Inflation Rate in Saudi Arabia: Using Dynamic Threshold Regression Model. *International Journal of Economics and Finance*, Vol. 13, No. 3, 40-49.
- Amaglobeli, D., Hanedar, E., Hong, G. H., & Thévenot, C. (2022). Fiscal Policy for Mitigating the Social Impact of High Energy and Food Prices. Washington, DC: International Monetary Fund, IMF Note 2022/001.
- Amini, S., Delgado, M. S., Henderson, D. J., & Parmeter, C. F. (2012). Fixed Vs Random: The Hausman Test Four Decades Later. *Essays in Honor of Jerry Hausman (Advances in Econometrics*, Vol. 29), 479-513.
- Asaduzzaman, M. (2021). Relationship between threshold level of inflation and economic growth in Bangladesh: A multivariate quadratic regression analysis. *Social Science Research Network Electronic Journal*.
- Atesoglu, H. S. (1997). A Post Keynesian Explanation of U.S. Inflation. *Journal of Post Keynesian Economics*, 19:4, 639-649.

- Attinasi, M. G., & Balatti, M. (2021). Globalisation and its implications for inflation in advanced economies. *ECB Economic Bulletin*, Issue 4/2021.
- Aydın, C., Esen, Ö., & Bayrak, M. (2016). Inflation and Economic Growth: A Dynamic Panel Threshold Analysis for Turkish Republics in Transition Process. *Procedia - Social and Behavioral Sciences*, Vol. 229, 196-205.
- Azam, M., & Khan, S. (2022). Threshold effects in the relationship between inflation and economic growth: Further empirical evidence from the developed and developing world. *International Journal of Finance & Economics*, Vol. 27, Issue 4, 4224-4243.
- Baba, C., Duval, R., Lan, T., & Topalova, P. (2023). The 2020-2022 Inflation Surge Across Europe: A Phillips-Curve-Based Dissection. *IMF Working Paper*, WP/23/30, 1-25.
- Baer, W. (1967). The Inflation Controversy In Latin America: A Survey. *Latin American Research Review*, 2(2), 3-25.
- Baffes, J., & Etienne, X. L. (2016). Analysing food price trends in the context of Engel's Law and the Prebisch-Singer hypothesis. *Oxford Economic Papers*, Vol. 68 (3) , 688-713.
- Baffes, J., Koh, W. C., & Nagle, P. (2022). The Evolution of Commodity Markets over the Past Century. In J. Baffes, & P. Nagle, *Commodity Markets: Evolution, Challenges, and Policies* (pp. 27-121). Washington, DC: World Bank Group.
- Balassa, B. (1964). The Purchasing-Power Parity Doctrine: A Reappraisal. *Journal of Political Economy*, 72(6), 584-596.
- Ball, L., & Moffitt, R. (2001). Productivity Growth and the Phillips Curve. *NBER, Working Paper 8421*, 1-52.
- Bastian, E. F., & Setterfield, M. (2020). Nominal exchange rate shocks and inflation in an open economy: towards a structuralist inflation targeting agenda. *Cambridge Journal of Economics*, 44 (6), 1271-1299.

- Batini, N., Jackson, B., & Nickell, S. (2005). An open-economy new Keynesian Phillips curve for the U.K. *Journal of Monetary Economics*, Vol. 52, 1061-1071.
- Bawa, S., & Abdullahi, I. S. (2012). Threshold effect of inflation on economic growth in Nigeria. *CBN Journal of Applied Statistics*, Vol. 3, No. 1, 43-63.
- Behera, J., & Mishra, A. K. (2017). The recent inflation crisis and long-run economic growth in India: An empirical survey of threshold level of inflation. *South Asian Journal of Macroeconomics, and FinancePublic*, Vol. 6, Issue 1, 105-132.
- Blanchard, O., & Katz, L. F. (1997). What We Know and Do Not Know About the Natural Rate of Unemployment. *Journal of Economic Perspective*, Vol. 11 (1), 51-72.
- Blecker, R. A. (2011). Open economy models of distribution and growth. In E. Hein, & E. S. (eds.), *A Modern Guide to Keynesian Macroeconomics and Economic Policies* (pp. 215–239). Cheltenham, UK: Edward Elgar.
- Bolatova, Z. (2023). Climate Change Impact on Agriculture of Almaty Region, Kazakhstan. Haddout, S., Krishnamoorthy Lakshmi, P., Hogue, A.M. (eds) *Climate Change and Ocean Renewable Energy* (pp. 154-163). Springer Proceedings in Earth and Environmental Sciences. Springer, Cham.
- Bollen, K. A., & Brand, J. E. (2010). A General Panel Model with Random and Fixed Effects: A Structural Equations Approach. *Social Forces*, Vol. 89, Issue 1, 1-34.
- Boonman, T. M., Jacobs, J. P., Kuper, G. H., & Romero, A. (2019). Early Warning Systems for Currency Crises with Real-Time Data. *Open Economies Review*, Vol. 30, 813-835.
- Braga, J., & Serrano, F. (2023). Post-Keynesian Economics: New Foundations by Marc Lavoie Chapter 8: Inflation Theory. *Review of Political Economy*.
- Brázdk, F., Hlédik, T., Humplová, Z., Martonosi, I., Musil, K., Ryšánek, J., . . . Žáček, J. (2020). The g3+ Model: An Upgrade of the Czech National Bank's Core

- Bruno, M., & Easterly, W. (1998). Inflation crises and long-run growth. *Journal of Monetary Economics*, Vol. 41, Issue 1, 3-26.
- Bulteel, K., Tuerlinckx, F., Brose, A., & Ceulemans, E. (2018). Improved Insight into and Prediction of Network Dynamics by Combining VAR and Dimension Reduction. *Multivariate Behavioral Research*, 853-875.
- Caballero, J., Chui, M., Kohlscheen, E., & Upper, C. (2023). Inflation and labour markets. *BIS Papers No 142*, 1-19.
- Calza, A., Gartner, C., & Sousa, J. (2021). Modelling the Demand for Loans to the Private Sector in the Euro Area. *ECB Working Paper*, No. 55, 1-34.
- Canavese, A. J. (1982). The Structuralist Explanation in the Theory of Inflation. *World Development*, 10(7), 523-529.
- Capek, A., Hlédik, T., Kotlán, V., Polák, S., & Vávra, D. (2003). Historical Perspective on the Development of the Forecasting and Policy Analysis System. In A. Capek, T. Hlédik, V. Kotlán, P. N. Diaye, S. Polák, D. Vávra, & J. Vlcek, *The Czech National Bank's Forecasting And Policy Analysis System* (pp. 7-26). Prague: Czech National Bank.
- Carro, J. M. (2007). Estimating dynamic panel data discrete choice models with fixed effects. *Journal of Econometrics*, Vol. 140, Issue 2, 503-528.
- Carvalho, A. R. (2019). A Second-Generation Structuralist Transformation Problem: The Rise Of The Inertial Inflation Hypothesis. *Journal of the History of Economic Thought*, 41(1), 47-75.
- Caselli, F. G., & Roitman, A. (2019). Nonlinear exchange-rate pass-through in emerging markets. *International Finance*, Vol. 22, Issue 3, 279-306.
- Charles, S., Bastian, E. F., & Marie, J. (2021). Inflation Regimes and Hyperinflation. A Post-Keynesian / Structuralist typology. *hal-03363240*, 1-48.

- Cheikh, N. B., & Zaied, Y. B. (2020). Revisiting the pass-through of exchange rate in the transition economies: New evidence from new EU member states. *Journal of International Money and Finance*, Vol. 100, 1-16.
- Chen, N., Chung, W., & Novy, D. (2022). Vehicle Currency Pricing and Exchange Rate Pass-Through. *Journal of the European Economic Association*, Vol. 20, Issue 1, 312-351.
- Choudhary, M. A., Hanif, M. N., & Iqbal, J. (2014). On smoothing macroeconomic time series using the modified HP filter. *Applied Economics*, Vol. 46, Issue 19, 2205-2214.
- Choudhri, E. U., & Khan, M. S. (2005). Real Exchange Rates in Developing Countries: Are Balassa-Samuelson Effects Present? *IMF Economic Review*, Vol. 52, 387-409.
- Ciscar, J.-C., Iglesias, A., Luc Feyen, L. S., Regemorter, D. V., Amelung, B., Nicholls, R., . . . M, A. (2011). Physical and economic consequences of climate change in Europe. *PNAS* vol. 108, 2678-2683.
- Colavecchio, R., & Rubene, I. (2019). Non-Linear Exchange Rate Pass-Through to Euro Area Inflation: a Local Projection Approach. *Banque centrale du Luxembourg*, Working Paper 138, 1-35.
- Dammak, T. B., & Helali, K. (2017). Threshold Effects on the Relationship Between Inflation Rate and Economic Growth in Tunisia. *International Economic Journal*, Vol. 31, Issue 2.
- Dastjerdy, B., Saeidi, A., & Heidarzadeh, S. (2023). Review of Applicable Outlier Detection Methods to Treat Geomechanical Data. *Geotechnics*, Vol. 3, 375-396.
- David, D., Pedro, G.-P., & Paula, H. -e. (2005). Threshold effects in the relationship between inflation and growth: a new panel-data approach. Germany: University Library of Munich.
- Díez, F. J., Fan, J., & Villegas-Sánchez, C. (2021). Global declining competition? *Journal of International Economics*.

- Dijkstra, A. G. (1997). Fighting Inflation in Latin America. *Development and Change*, 28(3), 531-557.
- Dua, P., & Gaur, U. (2010). Determination of inflation in an open economy Phillips curve framework: the case of developed and developing Asian countries. *Macroeconomics and Finance in Emerging Market*, Vol. 3, No. 1, 33-51.
- Dutkowsky, D. H., & Gianturco, D. J. (1986). On the Inflation-Unit Labor Cost Relation. *Journal of Economics and Business*, Vol. 38, 173-181.
- Duttagupta, R., Karacadag, C., & Fernandez, G. C. (2006). Moving to a Flexible Exchange Rate How, When, and How Fast? *IMF Economic Issue* No. 38, 1-19.
- Ehigiamusoe, K. U., Lean, H. H., & Lee, C.-C. (2019). Moderating effect of inflation on the finance–growth nexus: insights from West African countries. *Empirical Economics*, Vol. 57, 399-422.
- Faccia, D., Parker, M., & Stracca, L. (2021). Feeling the heat: extreme temperatures and price stability. *ECB Working Paper Series*, No. 2626, 1-60.
- FAO. (2020, April 09). Food Price Monitoring and Analysis. Retrieved from National policy responses to limit the impact of COVID-19 on food markets: <https://www.fao.org/giews/food-prices/food-policies/detail/en/c/1270543/>
- Farahani, M. H., Ghabel, S. N., & Mohammadpour, R. (2021). The Effect of Inflation Threshold on Financial Development and Economic Growth: A Case Study of D-8 Countries. *Iranian Economic Review*, Vol. 25, Issue 3, 465-475.
- Feng, S., Krueger, A. B., & Oppenheimer, M. (2010). Linkages among climate change, crop yields and Mexico–US cross-border migration. *PNAS* vol. 107, 14257-14262.
- Filippopoulou, C., Galariotis, E., & Spyrou, S. (2020). An early warning system for predicting systemic banking crises in the Eurozone: A logit regression approach. *Journal of Economic Behavior & Organization*, Vol. 172, 344-363.

- Fischer, B., & Mayer, T. (1980). On the structuralist view of inflation in some Latin American countries: A reassessment. Kiel Working Paper, No. 103, 1-23.
- Forbes, K. (2016). Much Ado about Something Important: How do Exchange Rate Movements Affect Inflation? *The Manchester School*, Vol. 84, Issue S1, 15-41.
- Forbes, K. J., Gagnon, J. E., & Collins, C. G. (2021). Low Inflation Bends the Phillips Curve around the World: Extended Results. Peterson Institute for International Economics, Working Paper 21-15, 1-23.
- Frankel, e., Parsley, D., & Wei, S.-J. (2012). Slow Pass-through Around the World: A New Import for Developing Countries? *Open Economies Review*, Vol. 23, 213-251.
- Frankel, J. A., & Rose, A. K. (1996). Currency Crashes in Emerging Markets: Empirical Indicators. NBER Working Paper Series 5437.
- Frenkel, R., & Friedheim, D. (2017). Inflation in Argentina during the 2000s. *Journal of Post Keynesian Economics*, 40:1, 43-60.
- Friedman, M. (1963). *Inflation: causes and consequences*. Bombay: Asia Publishing House.
- Friedrich, C., & Selcuk, P. (2022). The impact of globalization and digitalization on the Phillips Curve. Bank of Canada Staff Working Paper, No. 2022-7, 1-39.
- Frimpong, J. M., & Oteng-Abayie, E. F. (2010). When is Inflation Harmful? Estimating the Threshold Effect for Ghana. *American Journal of Economics and Business Administration*, Vol. 2, Issue 3, 232-239.
- Galati, G., Poelhekke, S., & Zhou, C. (2011). Did The Crisis Affect Inflation Expectations? *International Journal of Central Banking*, 7(1), 167-207.
- Gali, J., & Gertler, M. (1999). Inflation dynamics: A structural econometric analysis. *Journal of Monetary Economics*, Vol. 44, 195-222.

- Gelos, G., & Ustyugova, Y. (2012). Inflation Responses to Commodity Price Shocks – How and Why Do Countries Differ? . IMF Working Paper, WP/12/225, 1-32.
- Gonzalez-Garcia, J., & Yang, Y. (2020). International Trade and Corporate Market Power. IMF Working Paper, WP/20/131, 1-33.
- Gopinath, G., & Gourinchas, P.-O. (2022, October 14). How Countries Should Respond to the Strong Dollar. Retrieved from IMF Blog: <https://www.imf.org/en/Blogs/Articles/2022/10/14/how-countries-should-respond-to-the-strong-dollar>
- Gopinath, G., Boz, E., Casas, C., Díez, F. J., Gourinchas, P.-O., & Plagborg-Møller, M. (2020). Dominant Currency Paradigm. *American Economic Review*, Vol. 110, No. 3, 677-719.
- Grace, J. B. (2021). Instrumental variable methods in structural equation models. *Methods in Ecology and Evolution*, Vol. 12, Issue 7, 1148-1157.
- Greene, W. (2004). Convenient estimators for the panel probit model: Further results. *Empirical Economics*, Vol 29, 21-47.
- Gubler, M., & Sax, C. (2019). The Balassa-Samuelson effect reversed: new evidence from OECD countries. *Swiss Journal of Economics and Statistics*, 155:3, 1-21.
- Guevara, C. A. (2015). Critical assessment of five methods to correct for endogeneity in discrete-choice models. *Transportation Research Part A: Policy and Practice*, Vol. 82, 240-254.
- Guevara, C. A., & Navarro, P. (2015). Detection of weak instruments when correcting for endogeneity in binary logit models. Windsor, UK: In Proceedings 14th International Conference on Travel Behaviour Research (IATBR).
- Ha, J., Ivanova, A., Montiel, P., & Pedroni, P. (2019). Inflation in Low-Income Countries. In J. Ha, M. A. Kose, & F. Ohnsorge, *Inflation in Emerging and Developing Economies Evolution, Drivers, and Policies* (pp. 323-371). Washington DC: World Bank Group.

- Ha, J., Ivanova, A., Ohnsorge, F., & Unsal, F. D. (2019). Chapter 1. Inflation: Concepts, Evolution, and Correlates. In J. Ha, M. A. Kose, & F. Ohnsorge, Inflation in Emerging Inflation in Emerging and Developing Economies Evolution, Drivers, and Policies (pp. 5-92). World Bank.
- Ha, J., Kose, A., Ohnsorge, F., & Unsal, F. (2019). Chapter 2: Understanding Global Inflation Synchronization. In M. A. Jongrim Ha, Inflation in Emerging and Developing Economies Evolution, Drivers, and Policies (pp. 93-143). World Bank Group.
- Ha, J., Kose, M. A., & Ohnsorge, F. (2019). Inflation in Emerging and Developing Economies: Evolution, Drivers, and Policies. Washington DC: World Bank Group.
- Ha, J., Kose, M. A., & Ohnsorge, F. (2022). From low to high inflation: Implications for emerging market and developing economies. CEPR Policy Insight No. 115, 1-19.
- Ha, J., Kose, M. A., Ohnsorge, F., & Yilmazkuday, H. (2019). Sources of Inflation: Global and Domestic Drivers. In J. Ha, M. A. Kose, & F. Ohnsorge, Inflation in Emerging and Developing Economies Evolution, Drivers, and Policies (pp. 143-205). Washington DC: World Bank Group.
- Hein, E. (2023). Inflation is always and everywhere … a conflict phenomenon: Post-Keynesian inflation theory and energy price driven conflict inflation. Working Paper, No. 224/2023, Hochschule für Wirtschaft und Recht Berlin, Institute for International Political Economy (IPE), Berlin, 1-40.
- Holmberg, K. (2006). Derivation and Estimation of a New Keynesian Phillips Curve in a Small Open Economy. Sveriges Riksbank Working Paper Series, No. 197, 1-27.
- Hristov, J., Toreti, A., Domínguez, I. P., Dentener, F., Fellmann, T., Elleby, C., . . . Bratu, M. (2020). Analysis of climate change impacts on EU agriculture by 2050. Seville, Spain: European Commission.
- Hsu, T. (2016). U.S. recession forecasting using probit models with asset index predictor variables. Baltimore: The University of Maryland Baltimore County.

- Huang, H.-C., Lin, S.-C., Kim, D.-H., & Yeh, C.-C. (2010). Inflation and the finance–growth nexus. *Economic Modelling*, Vol. 27, Issue 1, 229-236.
- Ibarra, R., & R.Trupkin, D. (2016). Reexamining the relationship between inflation and growth: Do institutions matter in developing countries? *Economic Modelling*, Vol. 52, Part B, 332-351.
- Ibrahim, M., Aluko, O. A., & Vo, X. V. (2022). The role of inflation in financial development–economic growth link in sub-Saharan Africa. *Cogent Economics & Finance*, Vol. 10, Issue 1.
- Iyke, B. N., & Odhiambo, N. M. (2017). An empirical test of the Balassa-Samuelson hypothesis: Evidence from eight middle-income countries in Africa. *Economic Systems*, 41(2), 297-304.
- Jasova, M., Moessner, R., & Takats, E. (2020). Domestic and global output gaps as inflation drivers: What does the Phillips curve tell? *Economic Modelling*, Vol. 87, 238-253.
- Jiranyakul, K. (2017). Estimating the threshold level of inflation in Thailand. *Journal of Economics Bibliography*, Vol. 4, Issue 2, 150-155.
- Kalecki, M. (1971). Class Struggle And The Distribution Of National Income. *Kyklos*, Vol. 24, Issue 1, 1-9.
- Kalecki, M. (1971). *Selected Essays in the Dynamics of the Capitalist Economy*. Cambridge: Cambridge University Press.
- Kandil, M., & Morsy, H. (2014). Determinants of Inflation in GCC. *Middle East Development Journal*, Vol. 3 (2), 141-158.
- Kelikume, I. (2018). An Estimation of Inflation Threshold for Africa. *International Journal of Management, Economics and Social Sciences*, Vol. 7, Issue 4, 283-300.
- Khan, M. S., & Senhadji, A. S. (2000). Threshold Effects in the Relationship Between Inflation and Growth. *IMF Working Paper/00/110*, 1-32.

- Kilian, L., & Zhou, X. (2022). The Impact of Rising Oil Prices on U.S. Inflation and Inflation Expectations in 2020-23. *Energy Economics*, Vol. 113.
- Kiper, K. (2021). Industrial Pricing in Turkish Manufacturing During the Early 2000s: A Post-Keynesian Approach. *International Journal of Political Economy*, Vol. 50 (2), 165-181.
- Kose, M. A., Matsuoka, H., Panizza, U., & Vorisek, D. (2019). Inflation Expectations: Review and Evidence. *World Bank Policy Research Working Paper No. 8785*, 1-63.
- Köse, N., & Ünal, E. (2022). The effects of the oil price and temperature on food inflation in Latin America. *Environment, Development and Sustainability*, 1-27.
- Kremer, S., Bick, A., & Nautz, D. (2013). Inflation and growth: new evidence from a dynamic panel threshold analysis. *Empirical Economics*, Vol. 44, 861-878.
- Lavoie, M. (2022). *Post-Keynesian Economics New Foundations*. Cheltenham, UK: Edward Elgar.
- Lazar, N. (2010). Ockham's Razor. *WIREs Computational Statistics*, Vol. 2, 243-246.
- Lesk, C., Rowhani, P., & Ramankutty, N. (2016). Influence of extreme weather disasters on global crop production. *Nature*, Vol. 529, 84-87.
- Li, Y., Ye, W., Wang, M., & Yan, X. (2009). Climate change and drought: a risk assessment of crop-yield impacts. *Climate Research*, Vol. 39, 31-46.
- Liang, X.-Z., Wu, Y., Chambers, R. G., Schmoldt, D. L., Gao, W., Liu, C., . . . Kennedy, J. A. (2017). Determining climate effects on US total agricultural productivity. *PNAS*, 2285-2292.
- Loecker, J. D., & Eeckhout, J. (2017). The Rise Of Market Power And The Macroeconomic Implications. *NBER Working Paper Series*, 1-45.

- Lutkepohl, H. (2004). *Applied Time Series Econometrics*. New York: Cambridge University Press.
- Malhi, G., Kaur, M., & Kaushik, P. (2021). Impact of Climate Change on Agriculture and Its Mitigation Strategies: A Review. *Sustainability*, Vol. 13, No. 3.
- Malikane, C., & Mokoka, T. (2014). The new Keynesian Phillips curve: endogeneity and misspecification. *Applied Economics*, 45:25, 3082-3089.
- Masson, P. (2014). Macroprudential policies, commodity prices and capital inflows. Basel: BIS Paper 76, Bank for International Settlements.
- Matamoros, G. (2023). Are Firm Markups Boosting Inflation? A Post-Keynesian Institutional Approach to Markup Inflation in Select Industrialized Countries. *Review of Political Economy*, 1-23.
- Maynard, G. (1961). Inflation And Growth: Some Lessons To Be Drawn From Latin-American Experience. *Oxford Economic Papers*, 13 (2), 184-202.
- Mazumder, S. (2010). The new Keynesian Phillips curve and the cyclical of marginal cost. *Journal of Macroeconomics*, Vol. 32, 747-765.
- Medel, C. (2014). Probabilidad Clásica de Sobreajuste con Criterios de Información: Estimaciones con Series Macroeconómicas Chilenas. Central Bank of Chile, Working Papers Central Bank of Chile 735.
- Mihaljek, D., & Klau, M. (2008). Catching-up and inflation in transition economies: the Balassa-Samuelson effect revisited . BIS Working Papers, No. 270, 1-26.
- Mishel, L. (2021, September 2). Growing inequalities, reflecting growing employer power, have generated a productivity–pay gap since 1979. Retrieved from Economic Policy Institute, Working Economics Blog: <https://www.epi.org/blog/growing-inequalities-reflecting-growing-employer-power-have-generated-a-productivity-pay-gap-since-1979-productivity-has-grown-3-5-times-as-much-as-pay-for-the-typical-worker/>

- Mohanty, M. S., & Klau, M. (2001). What determines inflation in emerging market economies? BIS Papers No 8, 1-39.
- Montes-Rojas, G., & Toledo, F. (2022). External Shocks and Inflationary Pressures in Argentina: A Post-Keynesian-Structuralist Empirical Approach. *Review Of Political Economy*, Vol. 34, No. 4, 789-806.
- Muzaffar, A. T., & Junankar, P. (. (2014). Inflation–growth relationship in selected Asian developing countries: evidence from panel data. *Journal of the Asia Pacific Economy*, Vol. 19, Issue 4, 604-628.
- Nasir, M. A., Huynh, T. L., & Vo, X. V. (2020b). Exchange rate pass-through & management of inflation expectations in a small open inflation targeting economy. *International Review of Economics & Finance*, Vol. 69, 178-188.
- Ndoricimpa, A. (2017). Threshold effects of inflation on economic growth in Africa: Evidence from a dynamic panel threshold regression approach. African Development Bank Group, Working Paper, No. 249.
- Neiss, K. S., & Nelson, E. (2005). Inflation Dynamics, Marginal Cost, and the Output Gap: Evidence from Three Countries. *Journal of Money, Credit and Banking*, Vol. 37, No. 6, 1019-1045.
- Nielsen, B., & Whitby, A. (2015). A Joint Chow Test for Structural Instability. *Econometrics*, Vol. 3, 156-186.
- Nikiforos, M., Grothe, S., & Weber, J. D. (2024). Markups, profit shares, and cost-push-profit-led inflation. *Industrial and Corporate Change*, Vol. 33 (2), 342-362.
- Odongo, M. T., Misati, R. N., Kamau, A. W., & Kisingu, K. N. (2022). Climate Change and Inflation in Eastern and Southern Africa. *Sustainability*, Vol. 12, Issue 22, 1-17.
- Olivera, J. H. (1964). On Structural Inflation and Latin-American 'Structuralism'. *Oxford Economic Papers*, 16(3), 321-332.

- Omay, T., & Kan, E. Ö. (2010). Re-examining the threshold effects in the inflation–growth nexus with cross-sectionally dependent non-linear panel: Evidence from six industrialized economies. *Economic Modelling*, Vol. 27, Issue 5, 996-1005.
- Pagliacci, C. (2023). Comparing the inflationary impacts of uncertainty between advanced and emerging economies. *Macroeconomics and Finance in Emerging Market Economies*.
- Palazzo, B. (2023). Corporate Profits in the aftermath of COVID-19. Washington: Board of Governors of the Federal Reserve System: FEDS Notes.
- Parker, M. (2018). The Impact of Disasters on Inflation. *Economics of Disasters and Climate Change* volume 2, 21-48.
- Pereira, H. C., & Missio, F. J. (2024). Exchange rate and inflation: a neo-structuralist approach for Brazilian manufacturing sectors (2010–2019). *Journal of Post Keynesian Economics*.
- Pollin, R., & Zhu, A. (2006). Inflation and economic growth: a cross-country nonlinear analysis. *Journal of Post Keynesian Economics*, Vol. 28, Issue 4, 593-614.
- Pourroy, M., Carton, B., & Coulibaly, D. (2016). Food prices and inflation targeting in emerging economies. *International Economics*, Vol. 146, 108-140.
- Rafi, O. M., & Ramachandran, M. (2018). Capital flows and exchange rate volatility: experience of emerging economies. *Indian Economic Review*, New Series, Vol. 53, No. 1/2, 183-205.
- Rao, C. S., Prasad, R. S., & Mohapatra, T. (2020). *Climate Change and Indian Agriculture: Impacts, Coping Strategies, Programmes and Policy*. New Delhi: ICAR.
- Ratner, D., & Sim, J. (2022). Who Killed the Phillips Curve? A Murder Mystery. Finance and Economics Discussion Series 2022-028. Washington: Board of Governors of the Federal Reserve System, 1-36.

- Rattis, L., Brando, P. M., Macedo, M. N., Spera, S. A., Castanho, A. D., Marques, E. Q., . . . Coe, M. T. (2021). Climatic limit for agriculture in Brazil. *Nature Climate Change*, 1098–1104.
- Rumler, F. (2007). Estimates of the Open Economy New Keynesian Phillips Curve for Euro Area Countries. *Open Econ Rev*, Vol. 18, 427-451.
- S.Kiem, A., & K.Austin, E. (2013). Drought and the future of rural communities: Opportunities and challenges for climate change adaptation in regional Victoria, Australia. *Global Environmental Change*, 1307-1316.
- Samuelson, P. A. (1964). Theoretical notes on trade problems. *Review of Economics and Statistics*, 46(2), 145-154.
- Sbordone, A. M. (2002). Prices and unit labor costs: a new test of price stickiness. *Journal of Monetary Economics*, Vol. 49, 265-292.
- Seers, D. (1962). A Theory Of Inflation And Growth In Under-Developed Economies Based On The Experience Of Latin America. *Oxford Economic Papers*, 14(2), 173-195.
- Serrano, F. (2019). Mind The Gaps: The Conflict Augmented Phillips Curve And The Sraffian Supermultiplier. IE-UFRJ Discussion Paper, TD 011, 1-36.
- Shor, B., Bafumi, J., Keele, L., & Park, D. (2007). A Bayesian Multilevel Modeling Approach to Time-Series Cross-Sectional Data. *Political Analysis*, Vol. 15, No. 2, 165-181.
- Sunkel, O. (1960). Inflation In Chile: An Unorthodox Approach. *International Economic Papers*, no. 10, 107-131.
- Tarawalie, A. B., & Kamara, F. (2022). Inflation and Growth Nexus: An Estimate of the Threshold Level of Inflation in Sierra Leone. *Applied Economics and Finance*, Vol. 9, No. 2.

- Thanh, S. D. (2015). Threshold effects of inflation on growth in the ASEAN-5 countries: A Panel Smooth Transition Regression approach. *Journal of Economics, Finance and Administrative Science*, Vol. 20, Issue 38, 41-48.
- Tiwari, A. K., Cunado, J., Hatemi-J, A., & Gupta, R. (2019). Oil price-inflation pass-through in the United States over 1871 to 2018: A wavelet coherency analysis. *Structural Change and Economic Dynamics*, Vol. 50, 51-55.
- Vásquez, J. F. (2016). Inflation And Economic Development In Chile And Mexico. In R. Bielschowsky, *ECLAC Thinking, Selected Texts (1948-1998)* (pp. 165-173). ECLAC.
- Vinayagathan, T. (2013). Inflation and economic growth: A dynamic panel threshold analysis for Asian economies. *Journal of Asian Economics*, Vol. 26, 31-41.
- Wang, W., Xue, J., & Du, C. (2016). The Balassa–Samuelson hypothesis in the developed and developing countries revisited. *Economics Letters*, Vol. 146, 33-38.
- Weber, I. M., & Wasner, E. (2023). Sellers’ Inflation, Profits and Conflict: Why can Large Firms Hike Prices in an Emergency? *Review of Keynesian Economics*, 11(2), 183–213.
- Weber, I. M., Jauregui, J. L., Teixeira, L., & Pires, L. N. (2024). Inflation in times of overlapping emergencies: Systemically significant prices from an input–output perspective. *Industrial and Corporate Change*, Vol. 33 (2), 297-341.
- Weintraub, S. (1978). The Missing Theory of Money Wages. *Journal of Post Keynesian Economics*, 1 (2), 59-78.
- WFP. (2021). Philippine climate change and food. Manila: Alliance of Bioversity International and CIAT & World Food Programme.
- WITS. (2024, March 13). World Integrated Trade Solution. Retrieved from Chile exports, imports, tariff by year.: <https://wits.worldbank.org/CountryProfile/en/Country/CHL/Year/1990/Summarytext>

- Woetzel, L., Madgavkar, A., Seong, J., Manyika, J., Sneader, K., Tonby, O., . . . Gupta, S. (2018, September 11). Outperformers: High-growth emerging economies and the companies that propel them. Retrieved from McKinsey Global Institute: <https://www.mckinsey.com/featured-insights/innovation-and-growth/outperformers-high-growth-emerging-economies-and-the-companies-that-propel-them>
- Wooldridge, J. M. (2012). Instrumental Variables Estimation and Two Stage Least Squares. In J. M. Wooldridge, *Introductory Econometrics* (pp. 512-554). Mason, Ohio: South-Western Cengage Learning.
- Yabu, N., & Kessy, N. J. (2015). Appropriate Threshold Level of Inflation for Economic Growth: Evidence from the Three Founding EAC Countries. *Applied Economics and Finance*, Vol. 2, No. 3.
- Ye, M., Mohammed, K. S., Tiwari, S., Raza, S. A., & Chen, L. (2023). The effect of the global supply chain and oil prices on the inflation rates in advanced economies and emerging markets. *Geological Journal*, Vol. 58 (7), 2805-2817.
- Yilmazkuday, H. (2011). Thresholds in the finance-growth nexus: A cross-country analysis. *The World Bank Economic Review*, Vol 25, Issue 2, 278-295.
- Yohe, G. W., Malone, E., Brenkert, A., Schlesinger, M., Meij, H., & Xing, X. (2006). Global Distributions of Vulnerability to Climate Change. *The Integrated Assessment Journal Bridging Sciences & Policy*, Vol. 6, Issue 3 , 35-44.
- Zhang, Z. (2023). Are climate risks helpful for understanding inflation in BRICS countries? *Finance Research Letters*, *Finance Research Letters*, Vol. 58 , 1-7.

APPENDICES

A. DATA SOURCES, ADDITIONAL FIGURES AND TABLES

a. Data

Table a.1 Analyzed Countries

A. High-income			B. Middle-income		
Abbreviation	Name	Oil exporter	Abbreviation	Name	Oil exporter
CHE	Switzerland		CHN	China	
CHL	Chile		CRI	Costa Rica	
HKG	Hong Kong		DMA	Dominica	
ISR	Israel		GEO	Georgia	
KOR	Korea, Rep.		GTM	Guatemala	
SGP	Singapore		JAM	Jamaica	
URY	Uruguay		JOR	Jordan	
CZE	Czech Republic		KEN	Kenya	
HUN	Hungary		MDA	Moldova	
ISL	Iceland		MUS	Mauritius	
JPN	Japan		PER	Peru	
POL	Poland		PHL	Philippines	
ROU	Romania		PRY	Paraguay	
SVK	Slovak Republic		SRB	Serbia	
SWE	Sweden		ZAF	South Africa	
SAU	Saudi Arabia	+	ALB	Albania	
AUS	Australia	+	BGR	Bulgaria	
DNK	Denmark	+	IND	India	
GBR	United Kingdom	+	MNG	Mongolia	
NOR	Norway	+	THA	Thailand	
NZL	New Zealand	+	TUR	Türkiye	
			BRA	Brazil	+
			COL	Colombia	+
			EGY	Egypt, Arab Rep.	+
			IDN	Indonesia	+
			KAZ	Kazakhstan	+
			MEX	Mexico	+
			MYS	Malaysia	+
			NGA	Nigeria	+
			RUS	Russian Federation	+

The data utilized in this research covers the period from the first quarter of 1961 to the first quarter of 2023, collected quarterly. These datasets include cumulative price levels, current and financial account statistics, and exchange rates against the USD, all sourced from the International Financial Statistics (IFS) with quarterly observations. The food commodity index is obtained from the World Bank and is denominated in

nominal US dollars, with a base year of 2010 and an index value of 100. This monthly index is aggregated into quarterly observations by calculating the averages.

Due to data availability constraints, the analysis focuses on 51 countries with complete datasets for the three variables in the IFS database. Among these, 21 nations are categorized as high-income and 30 as middle-income, according to the World Bank's income group classification (Table a.1). Moreover, the oil-exporting status of countries is obtained from The World Factbook 2021 archive. However, only the top 50 countries (excluding China) are classified as oil exporters due to significantly low oil exports in the remaining countries, making them energy-dependent.

To address the influence of outliers, we employ Tukey's fences method. This method utilizes the interquartile range (IQR), spanning from the 25th percentile (Q_1) to the 75th percentile (Q_3) of the dataset. Outliers are identified as values falling below Q_1 minus 1.5 times the IQR (lower fence) or above Q_3 plus 1.5 times the IQR (upper fence) (Dastjerdy, Saeidi, & Heidarzadeh, 2023).

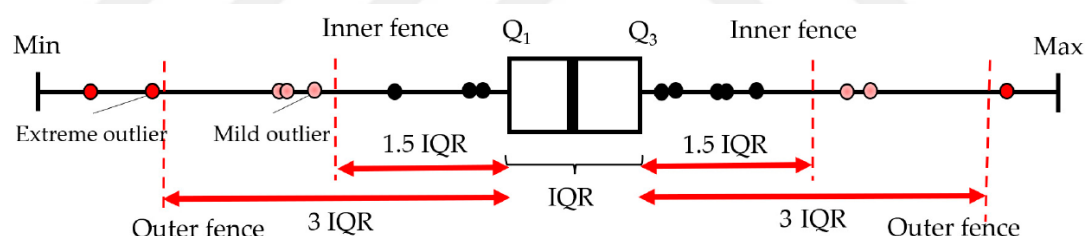


Figure a.1 Outlier Detection

Source: Dastjerdy, Saeidi, and Heidarzadeh (2023).

Generally, the standard practice involves removing outliers once detected in the samples. However, this approach does not align with our dataset and research objectives. Implementing this methodology would lead to the exclusion of pivotal years marked by significant energy shocks, such as 1973, 1979, 2000, and 2021-2022, as illustrated in Figure a.2, along with their associated well-known "high inflation" episodes. Instead of outright removal, we replace these outliers with the border inner fence values. This decision allows us to retain the most critical years in our analysis while mitigating the estimation errors associated with outliers.

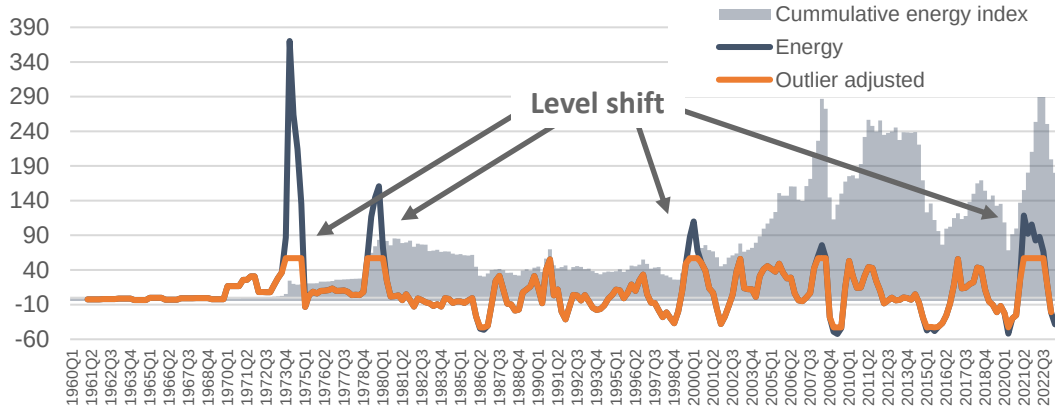


Figure a.2 Outlier Detection for Energy Commodity Inflation

Source: Authors' calculation.

b. New Keynesian inflation derivation

To comprehend the determinants of “high inflation,” an understanding of optimal price formation within nominal price rigidity is crucial. For a firm that periodically reassesses its pricing, the primary objective is to establish a price P_{it} that maximizes expected profit over the effective period (Holmberg, 2006). The optimization problem can be expressed as follows:

$$\max_{P_{it}} E_t \sum_{j=0}^{\infty} (\beta\theta)^j V_{t,t+j} \left[\frac{P_{it}}{P_{t+j}} Y_{it+j} - \frac{MC_{it+j}}{P_{t+j}} Y_{it+j} \right] \quad (1)$$

, where θ is the probability of the firm not being allowed to change the price in each period, and $\beta^j V_{t,t+j}$ is the stochastic discount factor. P_i is nominal price, Y_i is output and MC_{it+j} is the firm's marginal cost. The log-linearized solution for this optimization is:

$$p_{it} = (1 - \beta\theta)[mc_{it}^r + p_t] + \beta\theta E_t p_{it+1} \quad (2)$$

, where mc_{it}^r is the real marginal cost, defined in a significantly different formulation. Equation 2 illustrates that in the presence of price rigidity, rational firms will establish

prices by applying a margin over a combined value of current and anticipated future marginal costs.¹²

A commonly used empirical version is based on the “approximate proportionate relation between marginal cost and output” (Gali & Gertler, 1999, p. 201). When the actual output (real GDP) exceeds the economy's potential, it means that there is excess demand for goods and services. To meet the increased demand for goods and services, businesses may need to hire more workers or increase the hours worked by their existing workforce. As labor becomes more scarce due to increased demand, there can be upward pressure on wages. Workers may demand higher wages, and employers may be willing to pay more to attract and retain. The increase in wages and labor costs, driven by excess demand, can lead to a rise in unit labor costs. In this framework, real marginal cost is identified as below:

$$mc_{it}^r = k(y_t - y_t^*) \quad (3)$$

, where k is the output elasticity of marginal cost, y_t is log output and y_t^* is the natural level of output in log terms. However, Gali and Gertler's (1999) Generalized Methods of Moments estimations for the US demonstrate a negative relationship between the output gap and inflation, contrary to the theoretical structure. Therefore, they derive marginal cost through the Cobb-Douglas production function ($Y_t = A_t K_t^{1-\alpha} N_t^\alpha$, where A identifies technology, K denotes capital, N is labor, and $0 < \alpha < 1$) as below:

$$mc_{it}^r = \frac{1}{(1-\alpha)}(w_t + l_t - p_t - y_t) \quad (4)$$

, where w_t is the nominal wage level in log terms, l_t is log labor and $(w_t + l_t - p_t - y_t)$ is unit labor cost (the labor share income). With this framework, Gali and Gertler find a highly significant and theoretically consistent relation between real marginal cost (unit labor cost) and inflation. Similar findings are also evident from Sbordone (2002), although not from Holmberg (2006) in the case of Sweden. However, according to Mazumder (2010), there are two fundamental issues with unit

¹² In this equation, β (discount factor) identifies time preference.

labor cost (ULC), which are described above as a proxy for marginal cost. The first is the countercyclicality of labor share, in contrast to the expected procyclical nature of marginal costs. For example, Gali and Gertler's data show that during recessions, labor share increases due to acyclical real wages that do not respond to economic downturns, contrary to the theoretically expected fall in marginal costs. Because unemployment is not the only source of wage determination (Atesoglu, 1997), as assumed above. According to both authors, autonomous growth exists in wages, and this countercyclicality may explain the negative output gap coefficient but the positive marginal cost coefficient in the US Phillips curve in Gali and Gertler (1999).

The second issue is related to the restrictiveness of the assumption that labor can be flexibly adjusted at a fixed real wage to obtain ULC as a proxy for marginal cost. Thus, Mazumder divides labor into employment and hours, where real wages turn into average hourly real wages, making marginal cost procyclical. By turning countercyclical marginal cost into theoretically consistent procyclical, the authors find a significantly negative relationship between inflation and real marginal costs, as in output gap estimates.

On the other hand, Neiss and Nelson (2005) reconsider the output gap proxy in a more theoretical model. In their research, the authors show that theory-consistent output gap estimation, instead of detrended output, results in a significant and positive relationship between the output gap and inflation in the US, UK, and Australia. Furthermore, in more recent research utilizing slack¹³ instead of the detrended output, Forbes, Gagnon, & Collins (2021) found a significant relation with inflation in analyzed 31 countries,¹⁴ similar to Neiss and Nelson. These results highlight the importance of output gap determination in the Phillips curve.

In addition to true output gap estimates, the negative relation between the output gap or ULC and inflation could be attributed to an incorrect specification of the marginal

¹³ In their research, measure of slack captures difference between the unemployment rate and estimated Non-Accelerating Inflation Rate of Unemployment (NAIRU), participation, hours worked, and the share of workers that are part-time, self-employed or temporary.

¹⁴ Only 4 of them are emerging economies: Chile, Hungary, Mexico, and Poland

cost, which does not account for supply shock factors like the prices of imported goods, energy, and food (Malikane & Mokoka, 2014). Even though “wages are the main determinant of prices does not necessarily imply that wage increases are the main cause of price inflation” (Lavoie, 2022, p. 593). According to Malikane and Mokoka, if supply factors significantly drive inflation, the model indicates that inflation will likely exhibit a negative correlation with the output gap. This supply integration may be the reason for the theoretically significant coefficient of slack (output gap proxy) in the Phillips curve of Forbes, Gagnon, and Collins (2021).

However, it's worth considering that the labor force dynamics in emerging countries differ from those of advanced economies. In these contexts, where labor force restrictions are not as prevalent, excessive demand relative to the economy's potential might stimulate supply by reducing unemployment without substantial wage hikes (Braga & Serrano, 2023). Consequently, inflationary pressures stemming from demand-based factors might not be as evident in emerging economies, as seen in the findings of Jasova, Moessner, and Takats (2020), where inflation is determined more by global forces.

Firms' costs are not only related to labor costs but also other input costs, such as imported intermediate good prices (Batini, Jackson, & Nickell, 2005), where production function becomes $Y_t = A_t N_t^\alpha (IM_t^\eta K_t^{1-\eta})^{1-\alpha}$ (here IM is imported inputs and $0 < \eta < 1$) (Holmberg, 2006). In this regard, the real marginal cost can be defined by Holmberg (2006) and Rumler (2007) as log deviation from the steady state as below:

$$mc_{it}^r = \frac{1}{\alpha + \eta(1-\alpha)} [\alpha(w_t + l_t - p_t - y_t) + \eta(1-\alpha)(p_t^m + im_t - p_t - y_t)] \quad (5)$$

, where p_t^m is imported input price, im_t is the imported input in log terms, and $(p_t^m + im_t - p_t - y_t)$ is the share of imported intermediate goods to production at current prices. Considering that the import price p_t^m can be divided into imported input's invoice price change and change in the exchange rate, we can modify the equation as below:

$$mc_{it}^r = \frac{1}{\alpha + \eta(1-\alpha)} [\alpha(w_t + l_t - p_t - y_t) + \eta(1-\alpha)(p_t^{invoice} + fx_t + im_t - p_t - y_t)] \quad (6)$$

, where $p_t^{invoice}$ is invoice price and fx_t is the local currency's value with respect to exporter countries' currencies. In general, most empiric Phillips curves utilize NEER as fx_t . However, selecting the appropriate exchange rate type is crucial to obtain accurate and meaningful analysis results. For instance, Gopinath et al. (2020) have recently highlighted the inadequacy of using bilateral exchange rates in pass-through regressions. The Dominant Currency Paradigm suggests that firms typically invoice in a dominant currency, such as the US dollar, and therefore, the US dollar exchange rate, not the bilateral exchange rate, drives global trade prices. For instance, according to Chen, Chung, and Novy (2022), pass-through for imports is low at 24.2% when estimated based on the bilateral exchange rate between exporting and importing countries. However, when the study allows the unit values of currency transactions to depend on the exchange rate between sterling and the vehicle currency, the pass-through is much larger at 59.2% for the UK. Thus, using the bilateral exchange rate underestimates pass-through because it does not adequately measure the invoice-relevant exchange rate variation.

However, introducing exchange rates to real marginal cost equation as a part of import prices ($p_t^m = p_t^{invoice} + fx_t$) assumes that the same amount of change in $p_t^{invoice}$ and fx_t must have the same impact on inflation. Although the same amount of import price increase causes a price rise only by 10%, the same magnitude depreciation shock increases prices by 25% in Argentina (Montes-Rojas & Toledo, 2022). This observation underscores a possible nonlinear nature of the relationship between inflation and exchange rates. Indeed, several researchers proved that the historical relation between inflation and the exchange rate is non-linear. Frankel, Parsley, and Wei's (2012) Error Correction Model (ECM) estimates show that the impact of the exchange rate on prices becomes proportionately larger for depreciation above 25%. Similarly, Caselli and Roitman's (2019) analysis of 27 emerging markets highlights a threshold leading to nonlinearities when the exchange rate experiences a large

depreciation of more than 24%.¹⁵ Similar to emerging economies, using the nonlinear Local projections model, Colavecchio and Rubene (2019) show that significant changes¹⁶ in exchange rates have a greater effect on the pass-through to inflation in the euro area. Therefore, recent Phillips curves employ $\Delta f x_t$, $\Delta f x_t^2$, and $\Delta f x_t^3$ to capture such nonlinearity as in Jasova, Moessner, and Takats (2020). However, the theoretical reason of non-linearity is not yet derived from a microeconomic foundation in this framework.

Concluding exchange rates' nonlinear relation with prices as shown by Jasova, Moessner, and Takats (2020), and imported input prices' disaggregation into oil, food, and other imported inputs prices and exchange rates, we can rewrite Equation 6 as below:

$$mc_{it}^r = \frac{1}{\alpha + \eta(1-\alpha)} \left[\begin{array}{c} \alpha(w_t + l_t - p_t - y_t) \\ + \\ \eta(1-\alpha)(p_t^{oil} + p_t^{food} + f x_t + f x_t^2 + f x_t^3 + im_t - p_t - y_t) \end{array} \right] \quad (7)$$

Afterward, we replace real marginal cost in Equation 2 and obtain the optimal price setting as a log deviation from steady-state as below:

$$p_{it} = (1 - \beta\theta) \left\{ \frac{1}{\alpha + \eta(1-\alpha)} \left[\begin{array}{c} \alpha(w_t + l_t - p_t - y_t) \\ + \\ \eta(1-\alpha)(p_t^{oil} + p_t^{food} + f x_t + f x_t^2 + f x_t^3 + im_t - p_t - y_t) \end{array} \right] + p_t \right\} + \beta\theta E_t p_{it+1} \quad (8)$$

This final version of the price setting equation displays that prices are determined by oil, food, and other imported input prices, exchange rates, and endogenous labor share,

¹⁵ Such high depreciations in exchange rates are referred to as a “currency crash,” as defined by Frankel and Rose (1996) as a nominal depreciation of the currency of at least 25 percent in a year.

¹⁶ One standard deviation of the first difference of the exchange rate series

which is also determined by exchange rate depreciation, prices, and wage targets.

Table b.1 Analyzed Countries

High-income countries		Upper middle-income countries		Lower middle-income countries	
AUS	Australia	ALB	Albania	EGY	Egypt, Arab Rep.
CHE	Switzerland	BGR	Bulgaria	IDN	Indonesia
CHL	Chile	BRA	Brazil	IND	India
CZE	Czech Republic	CHN	China	KEN	Kenya
DNK	Denmark	COL	Colombia	MNG	Mongolia
GBR	United Kingdom	CRI	Costa Rica	NGA	Nigeria
HKG	Hong Kong SAR, China	DMA	Dominica	PHL	Philippines
HUN	Hungary	GEO	Georgia		
ISL	Iceland	GTM	Guatemala		
ISR	Israel	JAM	Jamaica		
JPN	Japan	JOR	Jordan		
KOR	Korea, Rep.	KAZ	Kazakhstan		
NOR	Norway	MDA	Moldova		
NZL	New Zealand	MEX	Mexico		
POL	Poland	MUS	Mauritius		
ROU	Romania	MYS	Malaysia		
SAU	Saudi Arabia	PER	Peru		
SGP	Singapore	PRY	Paraguay		
SVK	Slovak Republic	RUS	Russian Federation		
SWE	Sweden	SRB	Serbia		
URY	Uruguay	THA	Thailand		
		TUR	Türkiye		
		ZAF	South Africa		

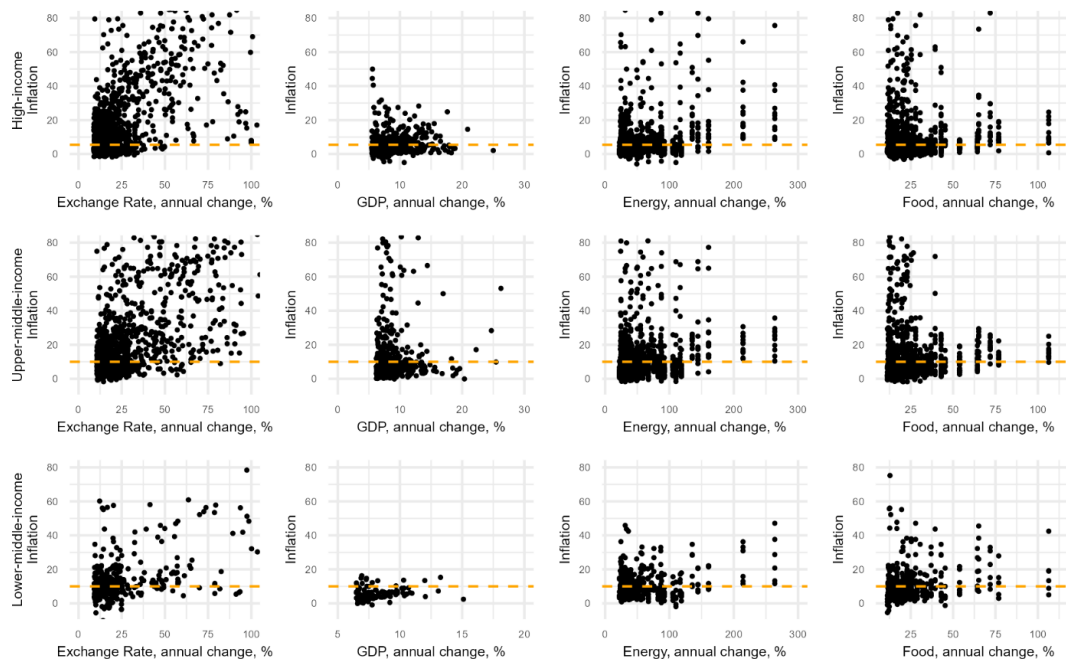
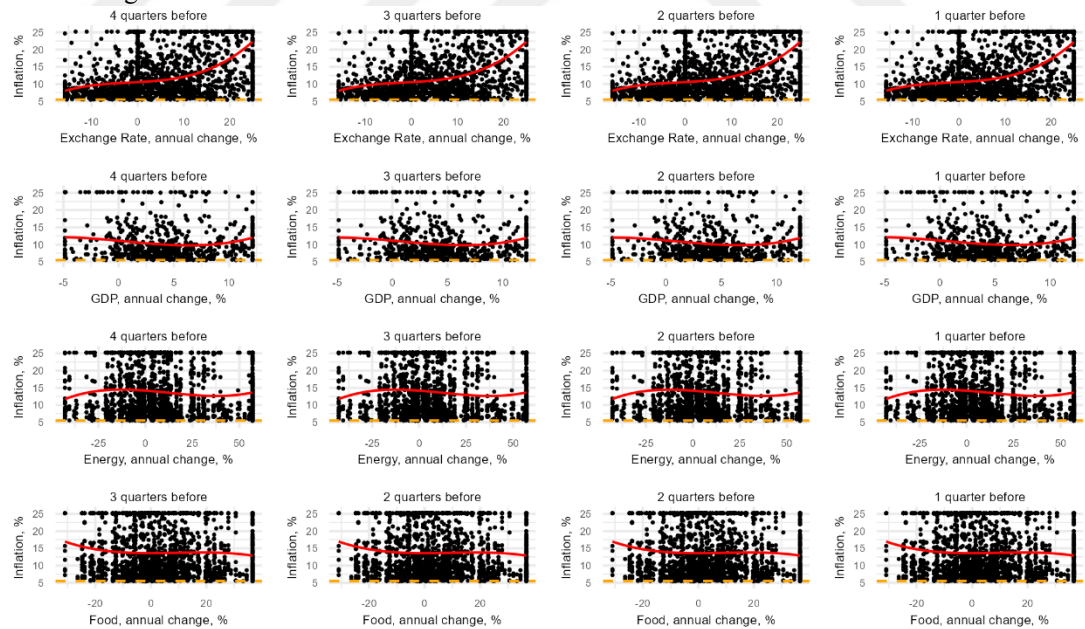


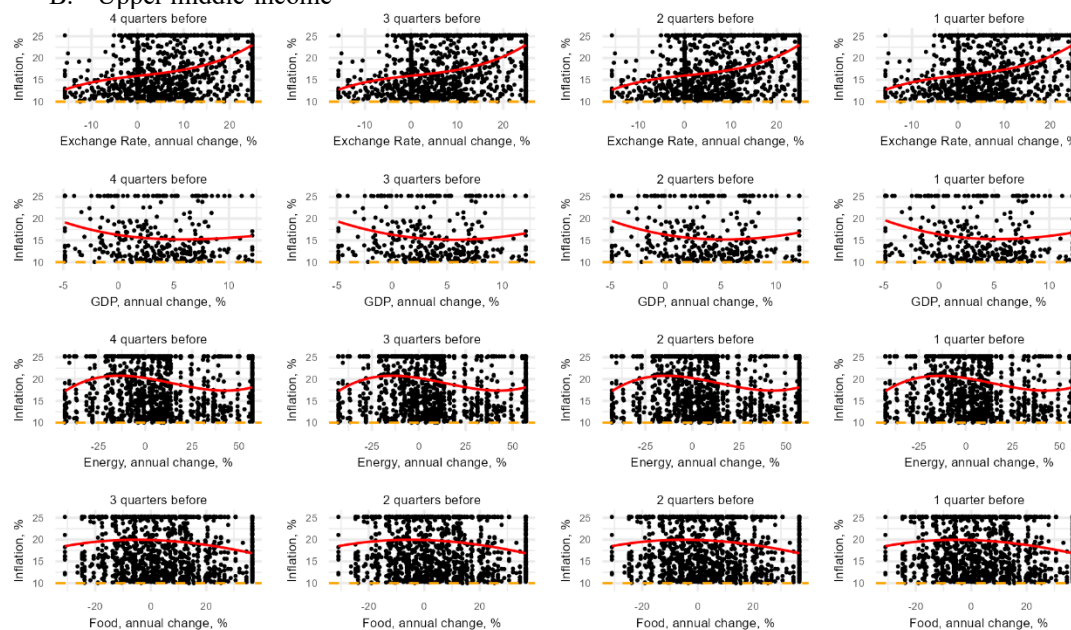
Figure b.1 Inflation Associated with Determinants Beyond the 75th Percentile

Source: Authors' calculation.

A. High-income



B. Upper middle-income



C. Lower middle-income

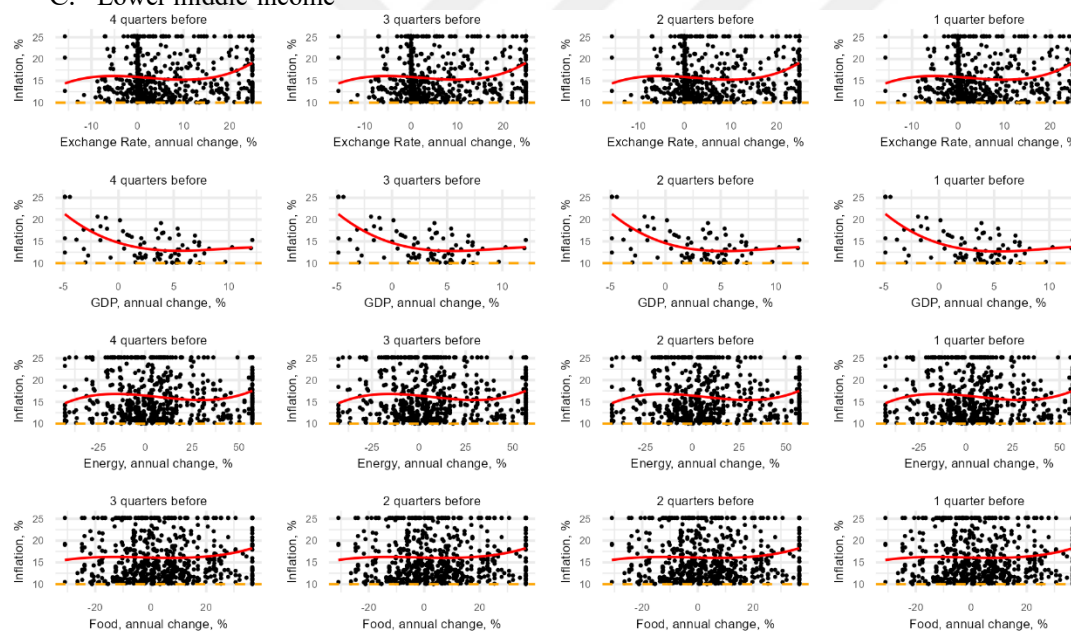


Figure b.2 Determinants of Beyond-High Inflation

Source: Authors' calculation.

Table b.2 Lag Selection

Group	Lag Combination	AIC	AIC rank	BIC	BIC rank	Pseudo R2	Pseudo R2 rank	RMSE	RMSE rank	Total rank
High income	(1 - 1)	1384.60	13	1419.54	1	0.47	14	0.98	9	15
High income	(1 - 2)	1382.66	12	1440.88	3	0.47	12	0.72	2	1
High income	(2 - 2)	1390.23	15	1425.17	2	0.47	15	0.71	1	10
High income	(1 - 3)	1375.91	11	1457.42	6	0.48	11	0.84	4	7
High income	(2 - 3)	1387.52	14	1445.74	4	0.47	13	0.83	3	13
High income	(1 - 4)	1360.41	8	1465.22	7	0.49	8	0.90	6	1
High income	(2 - 4)	1375.85	10	1457.36	5	0.48	10	0.90	5	3
High income	(1 - 5)	1345.49	7	1473.58	10	0.50	7	0.97	8	7
High income	(2 - 5)	1363.77	9	1468.58	8	0.49	9	0.96	7	10
High income	(1 - 6)	1334.13	4	1485.51	11	0.50	4	1.03	11	3
High income	(2 - 6)	1343.11	6	1471.21	9	0.50	6	1.02	10	5
High income	(1 - 7)	1328.84	3	1503.51	14	0.51	3	1.07	13	10
High income	(2 - 7)	1337.07	5	1488.45	12	0.50	5	1.05	12	13
High income	(1 - 8)	1312.02	1	1509.98	15	0.52	1	1.15	15	7
High income	(2 - 8)	1324.89	2	1499.57	13	0.51	2	1.13	14	5
Upper middle income	(1 - 1)	665.24	12	697.69	1	0.56	14	1.07	3	5
Upper middle income	(1 - 2)	650.86	10	704.95	3	0.58	11	1.18	5	3
Upper middle income	(2 - 2)	672.05	14	704.51	2	0.56	15	1.02	1	9
Upper middle income	(1 - 3)	649.64	9	725.37	4	0.58	9	1.25	6	2
Upper middle income	(2 - 3)	672.11	15	726.20	5	0.56	13	1.05	2	12
Upper middle income	(1 - 4)	639.74	5	737.10	6	0.59	8	1.42	8	1
Upper middle income	(2 - 4)	666.87	13	742.60	7	0.57	12	1.14	4	13
Upper middle income	(1 - 5)	637.24	4	756.24	8	0.60	6	1.71	15	10
Upper middle income	(2 - 5)	662.56	11	759.93	9	0.58	10	1.42	10	15
Upper middle income	(1 - 6)	627.51	2	768.15	11	0.61	3	1.53	13	3
Upper middle income	(2 - 6)	645.40	8	764.40	10	0.60	7	1.42	9	11
Upper middle income	(1 - 7)	629.09	3	791.36	13	0.62	2	1.52	12	5
Upper middle income	(2 - 7)	640.99	6	781.62	12	0.60	5	1.39	7	5
Upper middle income	(1 - 8)	626.83	1	810.74	15	0.62	1	1.59	14	8
Upper middle income	(2 - 8)	641.94	7	804.21	14	0.61	4	1.43	11	13
Lower middle income	(1 - 1)	135.67	9	159.15	2	0.67	15	0.97	1	3
Lower middle income	(1 - 2)	136.76	11	175.89	4	0.68	13	1.13	3	4
Lower middle income	(2 - 2)	132.71	2	156.19	1	0.67	14	1.02	2	1
Lower middle income	(1 - 3)	138.29	13	193.08	5	0.70	10	1.26	6	10
Lower middle income	(2 - 3)	134.98	6	174.11	3	0.69	12	1.13	4	2
Lower middle income	(1 - 4)	141.22	15	211.66	8	0.72	9	1.35	7	15
Lower middle income	(2 - 4)	138.73	14	193.52	6	0.70	11	1.19	5	13
Lower middle income	(1 - 5)	135.47	8	221.57	9	0.75	6	1.79	10	8
Lower middle income	(2 - 5)	136.66	10	207.10	7	0.73	8	1.46	8	8
Lower middle income	(1 - 6)	134.87	5	236.62	11	0.78	4	2.19	12	6
Lower middle income	(2 - 6)	137.16	12	223.26	10	0.75	7	1.61	9	14
Lower middle income	(1 - 7)	133.98	3	251.38	13	0.80	2	2.70	13	4
Lower middle income	(2 - 7)	135.45	7	237.20	12	0.77	5	2.06	11	11
Lower middle income	(1 - 8)	127.51	1	260.57	15	0.84	1	4.37	15	6
Lower middle income	(2 - 8)	134.21	4	251.62	14	0.80	3	2.84	14	11

Table b.3 Estimation Results for Oil Importers

A. High income			B. Upper middle-income			C. Lower middle-income		
Number of Countries: 8			Number of Countries: 10			Number of Countries: 2		
Total Observations: 1073			Total Observations: 1079			Total Observations: 122		
Period: 1961Q1 - 2023Q1			Period: 1961Q1 - 2023Q1			Period: 2005Q2 - 2023Q1		
	Coefficient	Std. error		Coefficient	Std. error		Coefficient	Std. error
Intercept	-1.766***	(0.107)	Intercept	-2.177***	(0.154)	Intercept	-2.059***	(0.518)
GDP (t-1)	0.033	(0.023)	GDP (t-1)	0.010	(0.024)	GDP (t-2)	0.062	(0.067)
GDP (t-2)	0.009	(0.028)	GDP (t-2)	-0.050.	(0.029)	FX (t-2)	0.102***	(0.026)
GDP (t-3)	0.029	(0.027)	GDP (t-3)	0.029	(0.029)	Energy (t-2)	0.007	(0.009)
GDP (t-4)	0.073**	(0.022)	GDP (t-4)	0.056*	(0.024)	Food (t-2)	0.008	(0.016)
FX (t-1)	0.053***	(0.013)	FX (t-1)	0.052***	(0.011)	sigma	0	(0.166)
FX (t-2)	-0.007	(0.018)	FX (t-2)	0.029.	(0.017)			
FX (t-3)	-0.003	(0.018)	FX (t-3)	-0.006	(0.018)			
FX (t-4)	0.026*	(0.012)	FX (t-4)	0.046***	(0.012)			
Energy (t-1)	0.005*	(0.004)	Energy (t-1)	0.008*	(0.004)			
Energy (t-2)	-0.003	(0.005)	Energy (t-2)	0.006	(0.006)			
Energy (t-3)	0.002	(0.005)	Energy (t-3)	0.005	(0.006)			
Energy (t-4)	-0.005	(0.004)	Energy (t-4)	-0.005	(0.004)			
Food (t-1)	0.010	(0.008)	Food (t-1)	0.027**	(0.008)			
Food (t-2)	0.002	(0.011)	Food (t-2)	0.003	(0.012)			
Food (t-3)	-0.005	(0.011)	Food (t-3)	-0.008	(0.013)			
Food (t-4)	0.011	(0.008)	Food (t-4)	0.018*	(0.009)			
sigma	1.198***	(0.163)	sigma	0.789***	(0.094)			

*** if p-value < 0.001, ** if p-value < 0.01, * if p-value < 0.05, . if p-value < 0.1

c. **Countries analyzed in Chapter 4**

Table c.1 Countries' Group Specifications

A. High-income			
Abbreviation	Country	Region	Trade status
AUS	Australia	East Asia & Pacific	Exporter
AUT	Austria	Europe & Central Asia	Exporter
BEL	Belgium	Europe & Central Asia	Exporter
CAN	Canada	North America	Exporter
CHE	Switzerland	Europe & Central Asia	Exporter
CYP	Cyprus	Europe & Central Asia	Importer
DEU	Germany	Europe & Central Asia	Exporter
DNK	Denmark	Europe & Central Asia	Exporter
ESP	Spain	Europe & Central Asia	Exporter
FIN	Finland	Europe & Central Asia	Importer
FRA	France	Europe & Central Asia	Exporter
GRC	Greece	Europe & Central Asia	Importer
IRL	Ireland	Europe & Central Asia	Exporter
ISL	Iceland	Europe & Central Asia	Importer
ITA	Italy	Europe & Central Asia	Exporter
LUX	Luxembourg	Europe & Central Asia	Importer
MLT	Malta	Middle East & North Africa	Importer
NLD	Netherlands, The	Europe & Central Asia	Exporter
NOR	Norway	Europe & Central Asia	Exporter
NZL	New Zealand	East Asia & Pacific	Importer
PAN	Panama	Latin America & Caribbean	Importer
PRT	Portugal	Europe & Central Asia	Exporter
SWE	Sweden	Europe & Central Asia	Exporter
URY	Uruguay	Latin America & Caribbean	Importer
USA	United States	North America	Exporter
B. Middle-income			
Abbreviation	Country	Region	Trade status
COL	Colombia	Latin America & Caribbean	Importer
CRI	Costa Rica	Latin America & Caribbean	Importer
MEX	Mexico	Latin America & Caribbean	Exporter
MYS	Malaysia	East Asia & Pacific	Exporter
PER	Peru	Latin America & Caribbean	Importer
PRY	Paraguay	Latin America & Caribbean	Importer
BOL	Bolivia	Latin America & Caribbean	Importer
EGY	Egypt, Arab Rep. of	Middle East & North Africa	Importer
HND	Honduras	Latin America & Caribbean	Importer
IND	India	South Asia	Importer
LKA	Sri Lanka	South Asia	Importer
MAR	Morocco	Middle East & North Africa	Importer
PHL	Philippines	East Asia & Pacific	Exporter
SLV	El Salvador	Latin America & Caribbean	Importer

Note: A country is classified as a main food exporter if its share of global food exports exceeds 0.5%.

B. CURRICULUM VITAE

Personal Information

TURAL YUSİFZADA

Central Bank of the Republic of Azerbaijan

Education

- **Ph.D. in Economics**, August 2024, Middle East Technical University, Department of Economics, Ankara / Türkiye; Thesis Title: “Essays on Inflation Dynamics”; Thesis Supervisor: Assoc. Prof. Dilem Yıldırım Kasap; Thesis Co-Supervisor: Assoc. Prof. Hasan Cömert
- **B.A. in Economics**, June 2019, Marmara University, Department of Economics, Istanbul / Türkiye

Employment and Training

- **Lead Economist**, 2021 Sep – Current, Research Department, Central Bank of the Republic of Azerbaijan, Baku / Azerbaijan

Publications and Presentations

Articles in Academic Journals

- Yusifzada, T. (2023). "Evaluating the global impact of climate change on agricultural inflation: an innovative climate condition index approach." *Environment, Development and Sustainability* 26, 18411–18438, <https://doi.org/10.1007/s10668-023-03394-8>.

Working Papers

- Yusifzada, T. (2022). "Response of Inflation to the Climate Stress: Evidence from Azerbaijan." *Central Bank of The Republic of Azerbaijan Working Paper Series*, 02/2022.

Presentations

- "Is "high" inflation always and everywhere an exchange rate phenomenon?" Yusifzada T. & Comert H.
 - 15th PKES-PEGFA PhD Conference, University of Greenwich, 24/05/2024 – London, UK
 - 27th FMM Conference: Inflation, Distributional Conflict and Just Transition, Hans-Böckler-Stiftung, 19/10/2023 – 21/10/2023 – Berlin, Germany
- "Response of Inflation to the Climate Stress: Evidence from Azerbaijan." Yusifzada T.
 - 10th Annual Conference: Is inflation back, and in which form?, The BCC programme, 22/09/2022 – 23/09/2022 – Geneva, Switzerland

Skills

- English (advanced)
- Computer languages: Matlab, R, EViews

C. TURKISH SUMMARY / TRKE ZET

Bu tez, zellikle geliřmekte olan ekonomilerdeki enflasyon dinamiklerine odaklanan  ayrı makaleden oluřmaktadır. İlk makalenin konusu, geliřmiř ekonomilere kıyasla geliřmekte olan ekonomilerde yksek ve oynak enflasyonun nedenleridir. Yapısal, kurumsal ve tarihsel bir perspektiften hareketle, dnya sistemindeki kresel dengesizliklerin geliřmekte olan ve geliřmiř ekonomilerde nasıl farklı enflasyon dinamiklerine yol atıđına odaklanmaktadır. Bu makale, demeler dengesi dengesizliklerinden kaynaklanan dviz kuru dinamiklerinin, yetersiz tedarik zinciri sistemlerinin, firmaların kurumsal gcnn, asimetrik fiyat oluřumunun ve ıpılanmamıř enflasyon beklentilerinin, geliřmiř ekonomilere kıyasla geliřmekte olan ekonomilerde yksek ve oynak enflasyonun bařlıca nedenleri olduđunu ne srmektedir. İkinci makale, yapısal ve kurumsal enflasyon dinamiklerinden yola ıkarak "yksek enflasyonun" belirleyicilerini analiz etmektedir. "Yksek enflasyonun" ortaya ıkma olasılıđını belirlemek iin bir panel probit modeli kullanan makale, "yksek enflasyon"-u belirlemek iin yeni bir erken uyarı modeli oluřurmaktadır. Bu model, dviz kurlarının "yksek enflasyonun" birincil kaynađı olduđunu vurgulamakta ve yaklaşık %25'lik deđer kaybının orta gelirli lkelerde %80'in zerinde, yksek gelirli lkelerde ise %70'in zerinde bir olasılıkla "yksek enflasyon" uyarısı yaptıđını belirtmektedir. nc makale ise daha nce keřfedilmemiř bir enflasyon belirleyicisine odaklanmaktadır: iklim deđiřikliđi. İlk olarak, kısa ve uzun vadeli iklim deđiřikliđini lmek iin beř temel iklim deđiřkenini tek bir iklim endeksinde birleřtirmektedir. Bu yeni endeksi kullanarak, analiz edilen lkelerde iklim deđiřikliđinin enflasyon zerindeki etkisini lmektedir. Makale, iklim deđiřikliđinin incelenen lkelerin %77'sini nemli lde etkilediđini, etkilerin geliřmekte olan ekonomilerde geliřmiř ekonomilere gre drt kat daha fazla olduđunu ve geliřmekte olan ekonomilerde farklı enflasyon dinamiklerine yol aan kresel dengesizliklere katkıda bulunduđunu gstermektedir.

Bu  makale, ncelikle geliřmekte olan ve geliřmiř ekonomiler arasındaki yapısal ve

kurumsal farklılıkları inceleyerek enflasyon dinamikleri alanına girmektedir. Her bir makale enflasyonun çeşitli yönlerini incelerken, toplu olarak enflasyonun salt parasal bir olgudan ziyade dünya sistemindeki yapısal küresel dengesizliklerin bir yansıması olduğu sonucuna varmaktadır. Sonuç olarak, bu makalelerin enflasyon dinamiklerinin genel olarak anlaşılmasına ve özellikle gelişmekte olan ekonomilerde fiyat istikrarıyla ilgili politika oluşturma sürecine değerli bir katkı sağlayacağını düşünüyoruz.

Çalışmamıza, ülkeler arasında farklı enflasyon dinamiklerine yol açan yapısal ve kurumsal nedenleri tartıştığımız temel bir enflasyon çalışmasıyla başlıyoruz. Bu çalışmanın çıkış noktası, gelişmekte olan ekonomilerin tarihsel olarak gelişmiş ekonomilere kıyasla daha yüksek ve daha oynak enflasyon yaşadıkları gözlemidir.

Bu bağlamda çalışmamız, gelişmekte olan ekonomilerde yüksek ve dalgalı enflasyon oranlarına yol açan küresel sistemdeki dengesizliklerin altında yatan dinamikleri incelemek için kurumsal, yapısal ve tarihsel bir yaklaşım benimsemektedir. İki temel soruyu yanıtlamayı amaçlıyoruz: gelişmiş ekonomilere kıyasla gelişmekte olan ekonomilerde enflasyon neden daha yüksek olma eğilimindedir ve gelişmiş ekonomilere kıyasla gelişmekte olan ekonomilerde enflasyon neden daha fazla oynaklık göstermektedir?

Balassa-Samuelson (BS) hipotezi, ülkeler arasındaki enflasyon farklılıkları analiz edilirken sıklıkla göz önünde bulundurulmaktadır. Bu hipotez, ticarete konu olan sektörlerdeki yüksek verimlilik artışının ticarete konu olmayan sektörlerdeki ücretleri ve fiyatları yükseltebileceğini ve özellikle gelişmekte olan ekonomiler ile gelişmiş ekonomiler arasında enflasyon farklılıklarına yol açabileceğini öne sürmektedir. Ancak ampirik literatür, gerçek dünyadaki ücret-üretkenlik dinamiklerinin, özellikle ülkeler arası enflasyon farklılıklarını açıklamada, bu varsayımlara meydan okuyabileceğini savunmaktadır. Örneğin Wang, Xue ve Du (2016) BS hipotezinin gelişmekte olan ekonomilerden ziyade gelişmiş ekonomiler için geçerli olduğunu öne sürmektedir. Öte yandan, Gubler & Sax'ın (2019) son verileri, gelişmiş ekonomilerde bile BS hipotezini desteklememektedir. Dolayısıyla, BS hipotezine dayanan ana akım literatür bile gelişmekte olan ekonomilerdeki yüksek enflasyonu ücret ve verimlilik dinamiklerine bağlı olarak açıklamak için yeterli kanıt sunmamaktadır.

Öte yandan, post-Keynesyen literatürden elde edilen bulgular, çelişkili ana akım bulguları açıklamakta ve işçilerin pazarlık gücünün azalması gibi son eğilimleri vurgulayarak Balassa-Samuelson (BS) hipotezine karşı çıkmaktadır. İşgücü, verimlilik artışlarıyla orantılı ücret artışlarını müzakere etmekte zorlandığında, gelişmiş ekonomilerde bile reel ücretler ve enflasyon arasındaki ilişkiler yataylaşmaktadır (Ratner & Sim, 2022). BS literatüründen elde edilen ampirik karışık sonuçların yanı sıra, azalan pazarlık gücü, verimlilik ve enflasyon arasındaki geleneksel bağlantı hakkında soru işaretleri doğurmaktadır. İşçiler verimlilik artışlarıyla uyumlu ücret artışlarını müzakere edemediğinden, ticarete konu olan sektörlerde artan verimliliğin gelişmekte olan ekonomilerde nasıl doğrudan enflasyon artışına yol açabileceği belirsizleşmektedir. Bu nedenle, bu makalede gelişmekte olan ekonomilerde enflasyonun yapısal dinamiklerini anlamak için alternatif bir teorik çerçeve geliştireyoruz.

Başta Ha, Kose ve Ohnsorge (2019) tarafından yazılan kitap olmak üzere önceki çalışmalar yapısal enflasyon farklılıklarını etkileyen çeşitli faktörleri tanımlamış olsa da, gelişmekte olan ekonomilere özgü birbiriyle bağlantılı yapısal ve kurumsal konulara ilişkin ana akım bakış açısında önemli bir boşluk bulunmaktadır. Öte yandan, heterodoks literatürün önemli bir kısmı ya gelişmiş ekonomilere ya da belirli gelişmekte olan piyasalara odaklanmakta, bu da gelişmiş ve gelişmekte olan ekonomiler arasındaki daha geniş yapısal ve kurumsal farklılıkların bulanık bir şekilde anlaşılmasına neden olmaktadır.

Bu boşluğu doldurmak için, çalışmamız hem ortodoks hem de heterodoks literatürden teorik anlayışları sentezlemeyi amaçlamaktadır. Özellikle, beklentiler ve enflasyon arasındaki bağlantıyı araştırırken ortodoks literatürden ilham alırken, heterodoks literatürün maliyet belirleyici bir fiyat belirleme çerçevesi içinde fiyat oluşumuna bakış açısından büyük ölçüde etkileniyoruz (Kalecki, 1971). Kalecki'nin perspektifinden yola çıkarak, hammaddeleri etkilemede talebin rolünü kabul etmekle birlikte, bu tür talebi yerel değil küresel olarak tasvir ediyoruz.

Geniş ana akım literatür talebin genel fiyatlar üzerindeki etkisini kanıtlamış olsa da, bu durum küresel iş döngüsü senkronizasyonu ve emtia fiyatlarıyla ilişkili olabilir.

Başka bir deyişle, talep büyüme döngüsü küreselse veya ülke yeterince büyükse, doğal kaynaklar "üretimlerini artırmak için uzun gecikmeler gerektirdiğinden" küresel emtia fiyatları üzerinde baskı oluşturabilir. (Lavoie, 2022, s. 131). Ayrıca, küresel iş döngüsünde senkronizasyon varsa, küresel talep küçük açık ekonomilerdeki yerli ürünlere olan talebi artırır (Benes, Hlédik, Vávra ve Vlâek, 2003). Bu nedenle, küresel emtia fiyatları veya küresel enflasyon tarafından kontrol edilmediği sürece, ampirik modellerin talep ve enflasyon arasında önemli bir korelasyonla sonuçlanması anlaşılabilir bir durumdur. Ancak bu çerçevede, enflasyonu tetikleyen küçük açık ekonominin iç talebi değil, yüksek küresel talep nedeniyle artan küresel emtia fiyatlarıdır. Bu nedenle, enflasyon dinamiklerinin küçük, açık ekonomilerde yalnızca iç talebi yansıtmaktan ziyade küresel ekonomik koşullara ve kaynak kısıtlamalarına daha karmaşık bir şekilde bağlı olduğunu iddia ediyoruz. Sonuç olarak, enflasyona bakış açımız parasalcı/talep temelli yaklaşımlardan ziyade yapısal/kurumsal faktörlere dayanmaktadır.

Bu çalışmanın temel amacı, ampirik analize odaklanmaktan ziyade gelişmekte olan ekonomilerde enflasyonun yapısal dinamiklerini anlamak için teorik bir çerçeve oluşturmaktır. Bu nedenle, teorimizin farklı zaman dilimleri veya ülkeler arasında değişiklik gösterebilen spesifik ampirik sonuçlardan etkilenmemesini sağlamak için sağlam literatür bulgularına ve tanımlayıcı analizlere öncelik veriyoruz. Bu metodolojik yaklaşım, gelişmekte olan ekonomilerde enflasyon dinamiklerini etkileyen temel faktörlere ilişkin kapsamlı ve incelikli bir açıklama sunmamızı sağlayacaktır.

Öncelikle, enflasyonla ilgili tartışmaların bir ülkenin tüketim sepetini oluşturan mal ve hizmetlerin fiyatlarındaki dalgalanmalar etrafında döndüğünü kabul ediyoruz. Dolayısıyla enflasyondaki farklılıklar iki temel faktörden kaynaklanabilir: değişen sepet kompozisyonları ve sepet bileşenleri arasında fiyat farklılıklarına yol açan yapısal/kurumsal eşitsizlikler. Her ne kadar ilk kısım araştırmamızın doğrudan odak noktası olmasa da, gelişmekte olan ve gelişmiş ekonomilerdeki enflasyon dinamiklerini analiz ederken farklı "şeyleri" karşılaştırdığımızı unutmamalıyız. Gelişmekte olan ekonomiler, gelişmiş ekonomilere kıyasla tüketimlerinin daha büyük bir kısmını gıdaya ayırmakta, bu da onları emtia fiyatları veya iklim değişikliği gibi

faktörlerden kaynaklanan gıda fiyat şoklarına karşı daha hassas hale getirmekte ve gelişmiş ekonomilere kıyasla daha yüksek ve daha oynak enflasyona yol açmaktadır.

Gerçekten de araştırmamız, gelişmekte olan ekonomilerin tüketici sepetleri gelişmiş ekonomilerinkiyle aynı hale gelse bile bu ülkelerdeki enflasyonun neden daha yüksek ve daha oynak kalacağını araştırmayı amaçlamaktadır. Bunu başarmak için, dünya sistemindeki dengesizliklerden kaynaklanan beş yapısal faktörün gelişmekte olan ekonomilerde görülen yüksek enflasyon seviyelerine ve oynaklığa nasıl katkıda bulunduğunu özetleyen kurumsal bir çerçeve oluşturuyoruz. Kurumsal/yapısal bir yaklaşım kullanıyoruz çünkü gelişmiş ve gelişmekte olan ekonomiler arasındaki enflasyon farkı aslında bu ekonomiler arasındaki yapı ve kurumlardaki gerçek farklılıkların nominal bir yansımasıdır.

Özetle, küçük katkı ve tartışmalara ek olarak, bu bölüm beş ana argüman sunmaktadır. İlk olarak, gelişmiş ve gelişmekte olan ekonomiler arasında döviz kuru dinamikleri yoluyla enflasyonu etkileyen ve küresel dengesizlikler olarak adlandırılan önemli yapısal ekonomik farklılıkları vurgulayarak başlıyoruz. Gelişmiş ekonomiler, inovasyon ve katma değerli üretime öncelik veren daha büyük hizmet ve yüksek teknoloji sektörleri ile karakterize edilir. Buna karşılık, gelişmekte olan ekonomiler büyük ölçüde tarım ve emtia ihracatına, dolayısıyla yüksek katma değerli ithalata dayanmaktadır. Bu bağımlılık, yerel para birimlerinin değeri üzerinde baskı oluşturan kalıcı cari açıklara yol açmaktadır.

Sonuç olarak, gelişmekte olan ekonomiler sürekli cari açıklarını öncelikle doğrudan veya portföy yatırımları yoluyla borçlanarak finanse etmektedir. Bu yüzden, gelişmekte olan ekonomilerdeki döviz kurları ödemeler dengesi dinamiklerine duyarlı hale gelmektedir. Bu ekonomilerde ödemeler dengesini kötüleştiren herhangi bir şok, para biriminin değer kaybetmesiyle sonuçlanır ve bu da daha yüksek enflasyona yol açar. Ayrıca, tarım sektörünün oynak yapısı ve emtia fiyatlarındaki dalgalanmalar gibi küresel şoklar, gelişmekte olan ekonomilerdeki ticaret dengesini daha oynak hale getirmektedir. Bu oynaklık daha sonra döviz kuru dinamikleri nedeniyle enflasyon oynaklığına dönüşmektedir. Bunun aksine, gelişmiş ekonomilerin çoğu değer kaybına dayalı kalıcı enflasyonist baskılardan korunmaktadır çünkü bu ekonomiler genellikle

güçlü cari işlemler fazlası vermekte veya rezerv para birimlerine sahip olmaktadır.

Ayrıca, makalemizde ikinci önemli yapısal faktörün, gelişmiş ekonomilere kıyasla gelişmekte olan ekonomilerdeki az gelişmiş tedarik zincirleri ve sınırlı kaynak mevcudiyeti olduğu tartışılmaktadır. Bu eşitsizlik, özellikle de gelişmekte olan ekonomilerin ticaret ortakları benzer enflasyonist eğilimler yaşadığında, genellikle yurt içinde yüksek ve değişken enflasyon kalıplarına yol açmaktadır. Küresel ekonomilerin Latin Amerika, Sahra Altı Afrika, Güney Asya ve hızla gelişen Asya ekonomileri gibi yükselen bölgelerin aksine Avrupa ve Kuzey Amerika gibi gelişmiş bölgelerde kümелendiği göz önüne alındığında, sınırlı kaynaklar ve komşu ülkelerle güçlü ticari bağımlılıklarla kısıtlanan yükselen ekonomilerin bölgesel enflasyon eğilimlerini yansıtmaya eğiliminde olduğu açıktır. Sonuç olarak, Latin Amerika, Sahra Altı Afrika ve Güney Asya'daki gelişmekte olan ekonomiler, diğer bölgelerdeki ülkelere kıyasla daha yüksek genel enflasyona karşı daha hassastır.

Üçüncü olarak, gelişmekte olan ekonomilerin reel yapısal özelliklerinden güç alan kurumsal faktörler, farklı enflasyon dinamikleri için yeni bir yol yaratmaktadır. Gelişmiş ekonomilere kıyasla daha zayıf iç rekabet, sınırlı ticari entegrasyon ve daha yüksek kartel varlığı ile karakterize edilen gelişmekte olan ekonomilerde, firmalar genellikle maliyet artışlarını orantısız bir şekilde tüketicilere yansıtarak kâr kaynaklı enflasyona neden olmaktadır. Ayrıca, arz yönlü şoklarla karşılaştıklarında, firmalar kar marjlarını korumakla kalmayıp potansiyel olarak artırabilirler. Sonuç olarak, genel fiyat istikrarı üzerinde en büyük etkiye sahip olan belirli sektörlerdeki fiyat artışları, gelişmiş ekonomilere kıyasla gelişmekte olan piyasalarda daha yaygın hale gelmektedir. Dolayısıyla, sık sık tedarik zinciri şokları ve döviz kuru dalgalanmaları yaşayan gelişmekte olan ekonomiler, gelişmiş ekonomilere kıyasla hem kâr kaynaklı hem de zam kaynaklı enflasyona daha yatkındır.

Kurumsal faktörlerle devam eden bölümümüz, firmaların asimetrik fiyat belirleme davranışının önemini vurgulamaktadır. Bu davranış gelişmekte olan ve gelişmiş ekonomiler arasında benzerlik gösterse de, bu iki ülke grubu arasında farklı enflasyon dinamiklerine yol açmaktadır. Bu farklılığın nedeni kurumsal aktarımın asimetrik olmasında yatmaktadır. Eğer kurumsal aktarım simetrik olsaydı, gıda emtia

fiyatlarındaki bir düşüşün veya döviz kurundaki bir değerlenmenin gelişmekte olan ekonomilerde gelişmiş ekonomilere kıyasla önemli ölçüde daha düşük enflasyona yol açması gerekirdi. Sonuç olarak, küresel dengesizliklerin genel enflasyonist etkisi uzun vadede iki gelir grubu arasında benzer olabilir. Ancak, enflasyonist arz itişli şokların aksine, deflasyonist mekanizmalar maliyetler düştüğünde fiyatları etkin bir şekilde düşürmez, çünkü şirketler rekabetçi fiyat savaşlarını önlemek için fiyat indirimlerinden kaçınır. Bizim bağlamımızda, maliyet itici şoklar gelişmekte olan ekonomilerde daha yüksek enflasyona yol açarken, maliyet faktörlerindeki düşüş dezenflasyonist süreç üzerinde aynı büyüklükte etkiye sahip değildir. Bu görüşler, kurumsal dinamiklere dayanan asimetrik fiyat tepkilerini vurgulamakta ve küresel dengesizliklerin genel enflasyonist etkisinin uzun vadede bile gelişmekte olan ekonomilerde neden daha yüksek olduğunu açıklamaya yardımcı olmaktadır.

Son olarak, gelişmekte olan ekonomilerde iyi bilinen ve aslında yapısal ve kurumsal dinamiklerin bir sonucu olan çıpasız enflasyon beklentileri olgusunu tartışıyoruz. Gelişmekte olan ülkelerde yüksek enflasyonu tetikleyen dengesizlikler ele alınmazsa, bu yapısal faktörler üç kategori aracılığıyla daha yüksek enflasyona yol açabilir: mali mekanizma (sosyal güvenlik ve döviz kuru sistemleri dahil), kredi mekanizması ve fiyat ve gelir ayarlama mekanizması (Vásquez, 2016). Başka bir deyişle, parasal olmayan yapısal baskılar otoriteleri parasal uzlaşmaya zorlamaktadır. Durgunluğun neden olduğu parasal kıtlığın sosyal maliyetleri kabul edildiğinde para arzının genişlemesi neredeyse kaçınılmaz hale gelir ve bu da paranın içselliğini vurgular (Carvalho, 2019).

Ücret endekslemesi nedeniyle, kamu hizmeti ve kamu hizmeti maaşlarındaki artışlar sorunu daha da kötüleştiriyor ve gelişmekte olan ekonomilerde doğrudan vergi tahsilatının zayıf olması nedeniyle vergi gelirlerinin esnek olmaması nedeniyle bütçe açıklarına neden oluyor. Kamu hizmeti fiyatlarını belirleyenler bir ikilemle karşı karşıyadır: fiyatların yükseltilmesi enflasyonu ve siyasi sorunları kötüleştirirken, fiyatları sabit tutmak aşırı yüklemeye ve bütçe açıklarının artmasına yol açarak enflasyonu daha da artırır (Seers, 1962). Üstelik enflasyona tepki olarak, kısa vadede enflasyonist baskıları hafifletmek için hükümet tarafından uygulanan çeşitli ekonomik kontroller, uzun vadede yapısal sorunlara yol açmaktadır. Örneğin, bazı sektörlerdeki

fiyat kontrolleri göreceli fiyatların düşük olmasına ve üreticinin üretme veya yatırım yapma teşviklerinin azalmasına yol açarken, faiz oranı kontrolleri reel faiz oranları negatif hale geldiğinden serbest krediyle sonuçlanır (Baer, 1967). Ayrıca döviz kurlarının kontrolü, özellikle de aşırı değerlendirme, ihracatta rekabet gücünü azaltır ve başlangıçtaki döviz kıtlığını daha da kötüleştirir (Seers, 1962). Öte yandan, yüksek enflasyonlu ekonomilerde, kontrol edilmediği takdirde yerel para, muhasebe birimi ve değer saklama aracı olma işlevini, hatta bazen değişim aracı olma işlevini bile kaybetme eğilimindedir (Dijkstra, 1997). Bu da insanların dövizini (dolar gibi) yoğun kullanmalarına yol açabilir. Fiyatlar dolar cinsinden belirlendiğinde yerel para birimindeki değer kaybı veya devalüasyon otomatik olarak fiyat artışlarına yol açarak enflasyonu daha da artırır (Dijkstra, 1997).

Az gelişmiş ülkelerin bir zorluğun üstesinden gelmeye çalışırken kendilerini bir başka zorlukla karşı karşıya bulabilecekleri (Maynard, 1961) ve bunun da sıklıkla yüksek enflasyona yol açabileceği göz önüne alındığında, bu istikrarsızlıklar bu ekonomilerde yüksek bir enflasyon hafızasına ve dolayısıyla yüksek enflasyon beklentilerine neden olur. Ancak, bu tür çıpasız enflasyon beklentilerinden kurtulmak, merkez bankalarının sıklıkla kredibilite sorunlarıyla karşılaştığı ve son derece oynak döviz kurlarıyla karakterize edilen ortamlarda faaliyet gösterdiği gelişmekte olan ekonomiler için önemli bir zorluk teşkil etmektedir. Sonuç olarak, bu ülkelerdeki enflasyon beklentileri, gelişmiş ekonomilerde gözlemlendiği gibi ileriye dönük olmaktan ziyade geriye dönük olma eğilimindedir. Bu beklentiler nominal ücretlere yansıdığında, artan taleple birlikte daha yüksek işgücü maliyetleri ortaya çıkmakta, şirketler karlarını artırma fırsatlarını değerlendirmekte ve böylece enflasyonun daha da yükselmesine yol açmaktadır. Kendi kendini gerçekleştiren bu döngü, yapısal dinamikleri daha da kötüleştirerek potansiyel olarak müteakip enflasyonist dalgaları tetikleyebilir.

İkinci makale yapısal enflasyon dinamiklerini incelemekte ve özellikle gelişmekte olan ekonomiler için sıkça karşılaşılan bir sorun olan "yüksek enflasyonun" belirleyicilerini tespit etmeye çalışmaktadır. Spesifik olarak yüksek enflasyon seviyelerine odaklanılmasının nedeni, bunların tasarruflar, yatırımcı güveni, beklentiler, gelir eşitsizliği ve daha fazlası üzerindeki zararlı etkileridir. Bu bağlamda, makale "yüksek enflasyona" ağırlıklı olarak hangi faktörlerin katkıda bulunduğunu

yanıtlarken, aynı zamanda politika yapıcılarının eğrinin gerisinde kalmaktan kaçınmalarına yardımcı olmak için "yüksek enflasyonu" tahmin etmek için bir araç geliştirmeyi amaçlamaktadır.

Makalenin başlangıç noktası, öncelikle tarihsel bağlamdan hareketle "yüksek enflasyon" olarak sınıflandırılabilen enflasyon seviyesini belirlemektir. Artan enflasyon oranlarının ekonomik büyümeyi engelleyebileceği "yüksek enflasyon" eşikleri kavramı küresel çalışmalarda büyük ilgi görmüştür. Ancak enflasyon ve ekonomik büyüme arasındaki ilişki dinamik ve karmaşık bir süreçtir. Örneğin, enflasyonist baskılar artan toplam talebin istenmeyen bir sonucu olarak ortaya çıkabilir ve bu durum ekonomik büyümeye önemli ölçüde zarar vermeyebilir (Pollin & Zhu, 2006). Dolayısıyla, bu tür enflasyon seviyeleri "yüksek" olarak tanımlanmaz. Öte yandan, enflasyonun tekelci fiyatlandırma, döviz kuru dalgalanmaları ya da mal ve hizmet arzı kesintilerinden kaynaklanması gibi bazı durumlarda enflasyon ve ekonomik büyüme arasında olumsuz bir ilişki olabilir (Pollin & Zhu, 2006). "Yüksek enflasyon" tespiti reel büyümeye zarar veren enflasyon seviyesinin belirlenmesine dayandığından, "yüksek enflasyon" öncelikle talep dışı faktörlerle ilişkilendirilecektir. Bu çalışmada, bu literatürdeki yüksek enflasyonun büyümeyi azaltan bir seviye olduğu fikrine katıldığımızı belirtmek önemlidir. Tanımımız evrensel bir gerçeği değil bir tercihi yansıtmaktadır.

Daha önceki araştırmalarda Bruno ve Easterly (1998) yüzde 40'lık bir enflasyon oranının önemli çıktı kayıplarına yol açtığını belirtmiştir. Ancak, "düşük" ve "yüksek enflasyonu" neyin oluşturduğu, belirleyicilerdeki yapısal farklılıklar nedeniyle küresel olarak değişmektedir (Thanh 2015). Birçok çalışma gelişmiş ve gelişmekte olan ekonomiler arasındaki enflasyon eşiği farklılıklarını araştırmıştır. Sanayileşmiş ve sanayileşmemiş ekonomiler arasında ayrım yapan derinlemesine analizler, farklı eşik seviyeleri ortaya koymuştur. Khan ve Senhadji (2000), gelişmiş ülkelerin enflasyon oranları %1 ile %3'e ulaştığında önemli çıktı kayıpları yaşadığını, gelişmekte olan ülkelerin ise %7 ile %11 gibi daha yüksek enflasyon oranlarını tolere edebildiğini tespit etmiştir. Ibarra ve R. Trupkin (2016) gelişmekte olan ekonomilere odaklanan bir çalışmada üç farklı eşik kategorisi ortaya koymuştur. 1 ile %5 arasındaki enflasyon oranları büyümeyi teşvik ederken, %5 ile %9 arasındaki oranların çıktı üzerinde

önemli bir olumsuz etkisi yoktur. Ancak, "normal" kurumlara sahip ülkeler %12 ila %15'in üzerindeki enflasyon oranlarında zararlı büyüme etkileri yaşarken, %19'un üzerindeki oranlar "kötü" kurumlara sahip ülkeler için zararlıdır. Öte yandan, "iyi" kurumsal gelişmekte olan ekonomiler büyümeyi teşvik etmek için %7 ila %8'lik bir enflasyon eşiği sergilemektedir. Örneğin, ASEAN ülkelerinin büyümesi %7,84 enflasyon eşiğini aştıktan sonra önemli olumsuz etkiler yaşamıştır (Thanh 2015).

Farklı araştırmalarda "yüksek enflasyon" eşik değerlerinin farklılık gösterdiği göz önüne alındığında, "yüksek enflasyon" seviyesini neyin tanımladığı konusunda bir fikir birliğine varılması zor görünmektedir. Ancak bu konudaki mevcut geniş literatür ve bu tür bir belirleme için iyi kurulmuş metodolojiler göz önüne alındığında, yeni bir "yüksek enflasyon" tahmini oluşturmaya gerek görmedik. Bunun yerine, "yüksek enflasyon" eşiğini, literatürde belgelenmiş 19 iyi kabul görmüş "yüksek enflasyon" eşiğinin kapsamlı bir incelemesinden elde edilen medyan değere dayalı olarak tanımlamayı tercih ettik. Bu yaklaşımı kullanarak, orta gelirli ülkeler için %10 ve yüksek gelirli ülkeler için %5,5 olmak üzere ekonomik faaliyetin engellendiği farklı eşik seviyeleri belirledik. Ayrıca, "yüksek enflasyon" eşiklerini literatürdeki eşiklerin $\pm 0,5$ standart sapma (yaklaşık $0,5 * \%4,5$) medyan değeri olarak kabul ederek bir kaç sağlamlık kontrolü gerçekleştirdik. Bu kriterler, 21 yüksek gelirli, 23 üst-orta gelirli ve 7 alt-orta gelirli ülkeye odaklanarak "yüksek enflasyonun" belirleyicilerine ilişkin araştırmamıza rehberlik ediyor.

Eşik belirlendikten sonra, eş zamanlı olarak hem ortodoks hem de heterodoks perspektiflerden enflasyon belirleyicilerinin teorik kavramına geri dönüyoruz. Her iki yaklaşımdan sapmaları incelediğimizde, firmaların kar maksimizasyonuna dayalı fiyat belirleme davranışı ve çelişkili iddialardan kaynaklanan ücret-maliyet artışı neredeyse benzer bir enflasyon denkleminde yol açmaktadır. Enflasyon, birim işgücü ve malzeme maliyetleri tarafından yönlendirilmektedir, ancak iki düşünce ekolü arasında birim işgücü maliyetlerinin tanımında temel bir farklılık bulunmaktadır. Çalışmamız, enflasyon literatüründe yoğun olarak incelenen arz faktörlerinin enflasyonu önemli ölçüde etkilediği yönündeki yaygın kabulü desteklemektedir. Öncelikle, açık ekonomi yapısının bir parçası olarak döviz kurlarını ve ithal girdi maliyetlerini dahil etme konusunda hem Batini, Jackson ve Nickell (2005), Holmberg (2006) ve Rumler (2007)

gibi ana akım çalışmaları hem de Kalecki (1971), Bastian & Setterfield (2020), Lavoie (2022) gibi heterodoks çalışmaları takip ediyoruz. Bununla birlikte, Bastian & Setterfield (2020), Charles, Bastian, & Marie (2021) ve Lavoie'nin (2022) teorik çerçevesini takip ederek, enflasyon denkleminizi, değer kaybının bir fonksiyonu olan endojen ücretleri ve pazarlık gücünü dahil ederek ana akım modellerden ayırıyoruz. Buna ek olarak, Blecker (2011) ve Lavoie (2022) tarafından önerildiği üzere, arz yönlü şokların bir fonksiyonu olarak kar artışının dahil edilmesi, enflasyon denkleminizi ana akım enflasyon denkleminde daha da farklılaştırmaktadır. Enflasyonu kar artışı, birim işgücü ve malzeme maliyetlerinin bir fonksiyonu olarak incelerken, döviz kurunun her üçü üzerindeki önemini altını çiziyoruz. Bu çerçeve, mevcut ana akım literatürün çoğunda teorik olarak araştırılmamış bir konu olan döviz kuru ve enflasyon arasındaki doğrusal olmayan ilişkiyi açıklamaktadır. Ayrıca makalemiz, "yüksek enflasyonun" belirleyicileri gibi göz ardı edilen bir konuyu ele alarak mevcut literatürden ayrılmaktadır.

Çalışmamız 51 ülkeyi 1961-2023 döneminde analiz etmektedir. Başlangıçta, dağılım diyagramlarını kullanarak, değişkenler arasındaki teorik ilişkileri görsel olarak keşfediyor, özellikle döviz kurlarının enflasyonla doğrusal olmayan ilişkisini gözlemliyoruz. "Yüksek enflasyonun" belirleyicilerini analiz etmek amacıyla ikili seçim çerçevesinde bu ilişkilerin ayrıntılı ekonometrik analizi için rassal etkiler panel probit modelini kullanıyoruz. Çalışmamız, enflasyonun belirleyicileri üzerine daha önce yapılan araştırmalara üç temel açıdan katkıda bulunmaktadır.

İlk olarak, yapısal farklılıklardan bağımsız olarak, analiz edilen tüm ülkelerde "yüksek enflasyon" vakalarında baskın bir paya sahip olan temel belirleyici olarak döviz kuru değer kayıplarını tespit ediyoruz. Döviz kurundaki değer kaybı tek başına, orta gelirli ülkelerdeki neredeyse tüm yüksek enflasyon vakalarına ve yüksek gelirli ülkelerdeki vakaların çoğuna katkıda bulunan baskın faktör olarak ortaya çıkmaktadır. Özellikle, yüksek gelirli ülkelerde, döviz kuru tek başına enflasyonun yüksek olup olmayacağını tahmin etmede %70'lik bir başarı sağlarken, üst-orta gelirli ülkelerde bu oran %77, alt-orta gelirli ülkelerde ise %63'tür.

Ayrıca makale, "yüksek enflasyon" olasılığını değerlendirmek için bir panel probit

modeli kullanarak, enflasyon için yenilikçi bir erken uyarı modeli ortaya koymaktadır. Bu bağlamda makale, yaklaşık %25'lik bir değer kaybının "yüksek enflasyon" için önemli bir erken uyarı göstergesi olduğunu ve bu olasılığın orta gelirli ülkelerde %80'i, yüksek gelirli ülkelerde ise %70'i aştığını vurgulamaktadır. Değer kaybı %35'i aştığında olasılıklar %90'ın üzerine çıkmaktadır.

Model, tarihsel olarak "yüksek enflasyonu" tahmin etmede %80'in üzerinde bir başarı oranı sağlamıştır ve bu başarı oranları enflasyon eşikleri yükseldikçe artmaktadır. Enflasyon eşiğinin yüksek gelir grubunda 5,5'ten 7,75'e, orta gelir grubunda ise 10'dan 12,25'e yükseltilmesi modelin başarısını yaklaşık 6 puan artırmaktadır. Bu sonuç, eğer Bruno ve Easterly'de (1998) olduğu gibi %40 gibi daha yüksek eşik değerleri tanımlansa, seçilmiş belirleyicilere sahip panel probit metodolojimizin yüksek enflasyon dönemlerini belirlemede daha başarılı olacağını garanti etmektedir. Dahası, eşik değerler 3.25 ve 7.75'e düşse bile model yüksek enflasyonu başarılı bir şekilde belirlemektedir.

Buna karşılık, talep, gıda emtia fiyatları ve enerji fiyat şokları gibi diğer belirleyicilerin etkisi gelir grupları arasında değişkenlik göstermekte, daha az tutarlı ve evrensel bir tahmin gücü sergilememektedir. Örneğin, talep analiz edilen ülkelerde "yüksek enflasyonu" yönlendirmede rol oynamaktadır; GSYİH büyümesindeki yaklaşık 3 standart sapmalı bir artış yüksek gelirli ülkelerde %44 olasılıkla "yüksek enflasyonu" öngörse de, üst ve alt-orta gelirli ekonomilerde bu olasılık daha da düşüktür (sırasıyla sadece %30 ve ~%0). Diğer taraftan, gıda emtia enflasyonu özellikle alt-orta gelirli ülkelerde enflasyonun öngörülmesinde önemli bir rol oynamaktadır. 2 çeyrek öncesinde gıda emtia enflasyonunda 1,75'ten fazla pozitif standart sapma (yaklaşık %30) %50'den fazla olasılıkla "yüksek enflasyon" öngörmektedir. Ancak, yüksek ve üst-orta gelirli ülkelerde benzer olasılık gıda emtia fiyatlarının 3 standart sapmadan fazla arttığında gözükmemektedir. Öte yandan, enerji fiyat şokları, enerji enflasyonu %50'den fazla arttığında alt-orta gelirli ekonomilerde %30 olasılıkla "yüksek enflasyonu" öngörmektedir. Ancak, bu etki diğer gelir gruplarında önemli ölçüde belirgin değildir ve tanımlayıcı istatistikler ve Tiwari, Cunado, Hatemi-J ve Gupta (2019), Kilian ve Zhou (2022) ve Ye ve diğerlerinin (2023) bulgularıyla uyumludur.

Gözlemlenen bu farklılıklar, hem bu hem de önceki makalelerin teorik çerçevesinde tartışılan yapısal eşitsizliklerin altını çizmektedir.

Model, endojenlik belirtisi olmadığından emin olmak için endojenlik testi ile kontrol edilmiştir. Ayrıca, talep göstergesi olarak büyüme yerine çıktı açığı kullanılmaya tabi tutulmuştur. Çıktı açığı kullanılan modelde diğer belirleyicilere ilişkin sonuçlar anlamlılıklarını korurken, sonuçlar GSYH büyümesine dayalı modelin karşılaştırmalı istatistik açısından daha iyi olduğunu göstermektedir.

Sonuç olarak, temel analiz modelinde, farklı eşik değerler kullanılan modellerde ve hatta çıktı açığı tabanlı modelde, analiz edilen tüm ülkelerde döviz kuru dalgalanmalarının "yüksek enflasyon" dönemleri üzerindeki önemli etkisi gözüküyor. Bu sonuçlar doğrultusunda, "yüksek enflasyonun sıklıkla ve neredeyse her yerde bir döviz kuru olgusu" olduğunu öne sürerken, özellikle gelişmekte olan ekonomilerde arz yönlü faktörlerin rolünü vurgulayarak enflasyon literatürüne katkıda bulunuyoruz. Bu görüş, politika yapıcılar ve ekonomistler için önemli çıkarımlar içermekte ve döviz kurlarının potansiyel yüksek enflasyonist baskılar için bir erken uyarı sinyali olarak izlenmesinin kritik önemini vurgulamaktadır. Ayrıca, enflasyon oluşumundaki yapısal farklılıklar nedeniyle, gelişmekte olan ekonomilerdeki politika yapıcıların geleneksel talepten ziyade arz yönlü faktörlere daha fazla odaklanmalarını öneriyoruz.

Üçüncü makale, geleneksel olmayan bir belirleyici olan iklim değişikliğini inceleyerek enflasyonun yapısal belirleyicilerini analiz eden geleneksel yaklaşımdan ayrılmaktadır. Makale, özellikle tarım gibi sektörleri etkileyen, yükselen sıcaklıklar ve aşırı hava olaylarının artan sıklığı ile karakterize edilen iklim değişikliğinin son on yıllardaki önemli küresel etkisini kabul ederek başlamaktadır. İklim değişikliğinin tarım üzerindeki derin etkilerini kabul ederek ve özellikle gelişmekte olan ekonomilerde gıdanın tüketici sepetlerindeki önemli rolünü göz önünde bulundurarak, bu makale iklim değişikliği ve enflasyon arasında bir bağlantı kurmaktadır.

Ancak, iklim değişikliğini kapsamlı bir şekilde temsil eden tek bir değişken olmadığından, temel engel iklim değişikliğinin enflasyon teorisine entegre edilmesinde yatmaktadır. Önceki çalışmalarda yağış miktarı (Odongo, Misati, Kamau

ve Kisingu, 2022), iklim felaketleri (Parker, 2018), iklim değışiklięi haber indeksi (Zhang, 2023) ve sıcaklık (Köse & Ünal, 2022) gibi çeşitli iklim göstergeleri kullanarak enflasyon üzerindeki bireysel etkiler incelenmiştir. Ancak bu göstergelerin hiçbirisi tek başına iklim değışiklięinin karmaşıklığını tam olarak yansıtamamaktadır. İklim değışiklięinin enflasyona etkilerini analiz etmek için birden fazla iklim değışkeninin aynı anda analiz edilmesi gerekmektedir ki bu da modelleme boyutluluęu sorunları nedeniyle bir zorluk teşkil etmektedir.

Bu makale, bu zorluęun üstesinden gelmek için birkaç temel iklim değışkenini tek bir İklim Durumu Endeksi'nde (CCI) birleştirek bir çözüm önermektedir. Amaç, iklim koşullarının daha kapsamlı bir temsilini oluşturmak ve bunların enflasyon üzerindeki birleşik etkisini değerlendirmektir. Bu konsolide endeks, birden fazla ek iklim değışkeni entegre edildiğinde mevcut enflasyon modellerinde karşılaşılan boyutsallık sorunlarını çözmekte ve böylece küresel enflasyon dinamiklerini analiz etmek için sağlam bir araç olarak hizmet etmektedir. Zaman serisi olarak yapılandırılan CCI, iklim değışiklięi eğilimlerinin izlenmesi ve ilgili maliyetler konusunda kamu bilincinin artırılması için yeni bir yaklaşım sunmaktadır.

CCI, bulut örtüsü, sıcaklık, yağış, yağışlı gün sıklığı ve buhar basıncının ağırlıklı ortalaması olarak hesaplanır. Bu ağırlıklar Vektör Hata Düzeltme Modeli (VECM) denge katsayılarından türetilmiş olup, kümülatif fiyat seviyesi odaklanılan bağımlı değışkendir. Bu yöntem, iklim değışkenlerindeki uzun vadeli eğilimleri yakalamamızı sağlarken, incelenen ülkelerdeki enflasyonu belirlemede en etkili değışkenleri dikkate almaktadır.

VECM'yi 39 ülkenin her biri için çalıştırdıktan sonra, 5 iklim endeksimiz için uzun dönem denge katsayıları elde ediyoruz. Bu katsayılar iklim endeksi için ağırlık olarak kullanılmaktadır. Katsayıların iklim serileri ile çarpımı sonucunda analiz edilen 39 ülke için ayrı-ayrılıkta iklim endeksi elde ediyoruz. Bu endekse göre iklim koşulları çoęu ülkede negatif bir eğilime sahiptir, bu da analiz edilen ülkelerin çoęunda iklim koşullarının enflasyon için elverişsiz hale geldiğini vurgulayabilir. Pozitif iklim eğilimi İrlanda, Norveç, Filipinler, Uruguay ve 2000'lerden sonra İzlanda'da görülebilir. Ancak, CCI'yi açıkça olumlu ya da olumsuz olarak açıklarken dikkatli

olmalıyız çünkü enflasyon üzerinde kısa ve uzun dönemli etkiler mevcuttur. Dolayısıyla, sadece CCI'daki eğilimler değil, aynı zamanda döngüsel değişimler de enflasyonu etkilemektedir ve bu da sağlam bir model aracılığıyla analiz edilmelidir.

İklim değişikliği değişkeni elde edildikten sonra, odak noktamız iklim etkilerinin enflasyon üzerindeki aktarım kanalını anlamaya kaymaktadır. İklim değişikliğinin tarım üzerindeki etkisi ve ardından enflasyon üzerindeki etkisi konusunda gelişmekte olan bir literatür olsa da, bu çalışmalar genellikle iklim değişikliği ve enflasyon arasındaki bağlantıya ilişkin kapsamlı bir yapısal anlayıştan yoksundur. Bazı çalışmalar yağış, kuraklık veya sıcaklığın enflasyon üzerindeki etkisini ampirik olarak analiz ederken, literatürde aktarım mekanizmalarına ilişkin teorik bir boşluk bulunmaktadır.

Öte yandan, son dönemde teorik literatür küreselleşme ve dijitalleşme gibi yeni trendleri ve bunların geleneksel enflasyon denklemlerine entegrasyonunu araştırmaktadır. Bu akımı takip ederek, Friedrich & Selcuk (2022) tarafından kaleme alınan küreselleşme ve dijitalleşmenin enflasyon üzerindeki etkisini inceleyen çalışmasından ilham alıyoruz. Ek olarak, Weber & Wasner'in (2023) fiyat belirleme davranışı aktarımına odaklanan çalışmasından yola çıkarak, iklim etkilerinin enflasyon dinamikleri üzerindeki aktarımını açıklayan teorik bir çerçeve geliştirmeyi amaçlıyoruz. Bu yaklaşım, iklim değişikliği ve enflasyon arasındaki karmaşık ilişkinin anlaşılmasında ampirik bulgular ve teorik temeller arasındaki boşluğu doldurmayı amaçlamaktadır. Bu bağlamda, iklim değişikliğinin verimlilik yoluyla marjinal maliyeti nasıl etkilediğini ve eğim parametreleri ve kar dinamikleri de dahil olmak üzere çeşitli mekanizmalar yoluyla marjinal maliyetin enflasyon esnekliğini nasıl değiştirebileceğini araştırıyoruz.

Friedrich & Selcuk (2022) çalışmasındaki küresel değişikliklere benzer şekilde, iklim değişikliği Phillips eğrisini verimlilik, eğim parametreleri ve kar artışı yoluyla etkileyebilir. Verimlilikle ilgili olarak, iklim kaynaklı verim şokları çıktıyı azaltarak, işgücü ve ücretlerin sabit kaldığı varsayımıyla, daha yüksek reel marjinal maliyetlere ve ardından enflasyona neden olabilir (Dutkowsky ve Gianturco, 1986). Eğim açısından, firmanın her dönemde fiyatı değiştirmesine izin verilmemesi olasılığını

temsil eden model parametresi önemlidir. Çünkü, üretimde ortak bir şok olduğunda, örneğin tüm tarımsal üreticilerin yaşadığı iklimle ilgili felaketler veya kuraklık, "firmalar, tüm piyasa oyuncularının aynı şeyi yapacağına dair ortak bir beklentiye sahip oldukları için fiyatları güvenle artırabilir" (Weber ve Wasner, 2023, s. 190). Dolayısıyla, iklim değişikliğinin tüm tarım üreticilerine ortak maliyeti açısından, fiyatı değiştirememe olasılığını azaltacağını ve enflasyonun reel marjinal maliyete olan esnekliğini artırmasını bekleyebiliriz. Eğimdeki bu olası artış, hem verimlilik temelli yüksek marjinal maliyetler hem de yüksek marjinal maliyetlere karşı yüksek esneklik yoluyla iklimin enflasyon üzerindeki etkisini iki katına çıkarmaktadır.

Ayrıca, tüm şirketler için benzersiz maliyetlerle karşılaşıldığında, en azından kar marjlarını sağlam tutmak için, firmalar nominal fiyat artışını maliyetlerden daha fazla artırır (Weber ve Wasner, 2023). Dahası, arz tarafındaki bir darboğaz nedeniyle girdi kıtlığıyla karşılaşan firmalar, fiyatları artırma konusunda daha iddialı bir yaklaşım benimseyebilir. Bu strateji yalnızca kâr marjlarını korumakla kalmaz, aynı zamanda potansiyel olarak genişlemelerine de yol açabilir (Weber & Wasner, 2023). Dolayısıyla, iklim temelli darboğazla karşılaşıldığında, kar yükselebilir ve enflasyon üzerindeki iklim etkilerini güçlendirebilir.

Ancak bu aktarım mekanizması tartışıldığında daha önceki 2 makalede olduğu gibi, yapısal farklılıklar dolayısıyla iklim değişikliğinin farklı ülkelerdeki olası farklı etkileri de özel olarak dikkate alınmalıdır. Örneğin, tarımın kilit sektör olduğu gelişmekte olan ekonomiler iklim değişikliğine karşı özellikle kırılgan olabilir (Yohe vd. 2006; Faccia, Parker ve Stracca 2021). Ayrıca, düşük gelirli ekonomiler büyük ölçüde tarıma dayanmaktadır (Ha, Kose, Ohnsorge ve Unsal, 2019) ve bu da onları iklim değişikliğinden kaynaklanan ekonomik kırılganlığa karşı daha hassas hale getirmektedir. Bu nedenle, bu ekonomilerde marjinal maliyetlere karşı daha yüksek esneklik ve gelişmiş ekonomilere kıyasla daha yüksek fiyat artışı görülebilir.

Son olarak, iklim endeksini elde ettikten ve aktarım mekanizmalarını anladıktan sonra, makale iklim değişikliğinin enflasyon üzerindeki etkisine dair ampirik kanıtları ortaya çıkarmayı amaçlamaktadır. Elimizdeki endekslerle, iklim değişikliğinin enflasyonu anlamlı bir şekilde etkileyip etkilemediğini ve bu değişikliklerin fiyat seviyeleri

üzerinde kalıcı bir etkiye sahip olup olmadığını test etmeye başladık. Bu amaçla, sadece iki endojen değişken (enflasyon ve CCI) ve dışsal kukla değişkenler ile her ülke için ayrı VECM kullandık. İklim değişikliğinin enflasyon üzerindeki etkisini %90 güven aralığında ortaya koymak için etki-tepki analizi yaptık.

Analizimiz, incelenen ülkelerin yaklaşık %77'sinin iklim değişikliğinden önemli ölçüde etkilendiğini ortaya koyarak iklim değişikliğinin yaygın etkisini vurgulamaktadır. İncelenen 39 ülkeden sadece 3'ü (İrlanda, İzlanda ve İsveç) iklim değişikliğinden önemli ölçüde olumlu fayda sağlarken, 27 ülke iklimle ilgili faktörlerden kaynaklanan önemli enflasyonist etkilere maruz kalmaktadır. Orta Doğu ve Kuzey Afrika bölgesi ve Asya'da analiz edilen tüm ülkelerde enflasyon iklim değişikliğinden olumsuz etkilenmektedir. Malta ve Fas'ta kısa vadede, Avustralya ve Hindistan'da ise orta vadede önemli etkiler gözlenmektedir. Ayrıca, etki Filipinler için kısa vadede, Mısır için orta vadede ve Yeni Zelanda için uzun vadede anlamlı hale gelmekte ve daha uzun sürmektedir. Amerika kıtasında, önceki bölgelere benzer şekilde, tüm ülkeler iklim değişikliğinden kaynaklanan enflasyonist etkilere tanık olmuştur. Kısa vadede, etki ABD, Peru ve Uruguay'da önemlidir. Orta vadede ise Kanada, Kolombiya ve Kosta Rika'da önemli bir etki söz konusudur. Ayrıca, iklim değişiklikleri Bolivya, Honduras, Meksika, Panama, Paraguay ve El Salvador'u kalıcı olarak etkilemektedir. Avrupa bölgesinde, diğer bölgelerden farklı olarak, iklim değişikliğinin İrlanda, İzlanda ve İsveç'te önemli deflasyonist etkileri, Hollanda ve Norveç'te ise ekonometrik olarak anlamsız ancak deflasyonist etkileri bulunmaktadır. Yunanistan'da kısa vadeli enflasyonist iklim etkileri gözlenmektedir. Orta vadeli etkiler ise Belçika, Finlandiya, İtalya ve İsveç'te görülmektedir. Ayrıca, iklim değişikliği Avusturya, Danimarka, İspanya ve Portekiz'de kalıcı olarak enflasyonisttir. Etkiler İsviçre, Kıbrıs, Almanya, Fransa, Lüksemburg, Hollanda ve Norveç'te ekonometrik olarak anlamsızdır. Çalışma bulguları ve CCI daha önce yapılmış olan akademik çalışmalar ve alternatif endekslerle uyumludur.

Dahası makale, iklim değişikliğinin gelişmekte olan ekonomiler üzerindeki daha yüksek etkisine dair ampirik kanıtlar sunan ilk çalışmalardan biri olmasıyla da mevcut literatürden ayrılmaktadır. Makale, iklim değişikliğine tepki olarak orta gelirli ülkelerdeki enflasyonun yüksek gelirli ekonomilere kıyasla yaklaşık dört kat daha

fazla olumsuz etkilendiğini ortaya koymaktadır. Bu bulgu, tezimizin önceki bölümlerinde tartışılan kurumsal farklılıkların anlaşılmasına katkıda bulunmaktadır.

Açıkça incelenmemiş olsa da, bu ekonomilerin iklim kaynaklı şoklara tepki olarak yüksek enflasyon esnekliği ve kar artışları gösterebileceği düşünülebilir. Böylece, iklim değişikliğinin enflasyon oluşumuna dahil edilmesine ilişkin tartışma için bir temel oluşturuyoruz. Bir sonraki aşamada, CCI'nin bir enflasyon denklemine dahil edilmesi, çağdaş merkez bankacılığında sıklıkla ihmal edilen bir unsur olan iklim değişikliğinin tetiklediği enflasyona ilişkin tartışmaların ilerlemesine katkıda bulunabilir.

Tezin yapısı aşağıdaki gibidir: İkinci bölüm, gelişmekte olan ekonomilerde enflasyonun yapısal dinamiklerine ilişkin bir makaleye odaklanmaktadır. Üçüncü bölüm "yüksek enflasyonun" belirleyicilerine ve bir erken uyarı modelinin oluşturulmasına ayrılmıştır. Son olarak, dördüncü bölümde iklim değişikliğini ve bunun enflasyon üzerindeki etkisini ölçmek için yeni bir endeks tanıtılmakta ve teorik bir aktarım çerçevesi oluşturulmaktadır.

D. THESIS PERMISSION FORM / TEZ İZİN FORMU

(Please fill out this form on computer. Double click on the boxes to fill them)

ENSTİTÜ / INSTITUTE

- Fen Bilimleri Enstitüsü / Graduate School of Natural and Applied Sciences** ☐
- Sosyal Bilimler Enstitüsü / Graduate School of Social Sciences** ☒
- Uygulamalı Matematik Enstitüsü / Graduate School of Applied Mathematics** ☐
- Enformatik Enstitüsü / Graduate School of Informatics** ☐
- Deniz Bilimleri Enstitüsü / Graduate School of Marine Sciences** ☐

YAZARIN / AUTHOR

Soyadı / Surname : Yusifzada
Adı / Name : Tural
Bölümü / Department : İktisat / Economics

TEZİN ADI / TITLE OF THE THESIS (İngilizce / English): Enflasyon Dinamikleri Üzerine Makaleler / Essays On Inflation Dynamics

TEZİN TÜRÜ / DEGREE: Yüksek Lisans / Master ☐ Doktora / PhD ☒

- 1. Tezin tamamı dünya çapında erişime açılacaktır. / Release the entire work immediately for access worldwide.** ☒
- 2. Tez iki yıl süreyle erişime kapalı olacaktır. / Secure the entire work for patent and/or proprietary purposes for a period of two years. *** ☐
- 3. Tez altı ay süreyle erişime kapalı olacaktır. / Secure the entire work for period of six months. *** ☐

* Enstitü Yönetim Kurulu kararının basılı kopyası tezle birlikte kütüphaneye teslim edilecektir. / A copy of the decision of the Institute Administrative Committee will be delivered to the library together with the printed thesis.

Yazarın imzası / Signature

Tarih / Date

(Kütüphaneye teslim ettiğiniz tarih. Elle doldurulacaktır.)
(Library submission date. Please fill out by hand.)

Tezin son sayfasıdır. / This is the last page of the thesis/dissertation.