Why Do Inflation Rates Vary Across Countries?*

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Abstract

I build an APT-like factor model for consumer price fluctuations across 181 countries and regions from January 1990 to February 2022. The sizeable cross-sectional heterogeneity in inflation is well explained by the differential exposures to a set of global factors. It includes three procyclical factors, i.e., energy price, agriculture price, and composite leading indicators, and three countercyclical factors, i.e., the global unemployment rate, precious metals price, and world uncertainty. The empirical estimates are significant and robust to various model specifications, different rolling-window analyses, and additional global factors, revealing that economies with procyclical inflation generally have higher inflation than economies with countercyclical inflation. Furthermore, the comparisons with cross-sectional asset pricing theory are interesting: despite the divergent rationale, factor prices have the same sign, i.e., factor prices for procyclical factors are positive, while for countercyclical factors are negative.

Keywords: Inflation Cyclicality, World Business Cycle, Common Global Factors, Risk Exposure, Fama–MacBeth Regression

JEL Classification: G12, E31, C55

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1 Introduction

"Inflation has come back faster, spiked more markedly, and proved to be more stubborn and persistent than major central banks initially thought possible."

— World Bank in February 2022[1]

Over the past decades, with the deepening of global economic interconnection, the international linkage of inflation has become increasingly prominent.[2] It sparked a growing interest in the role of world shocks and the global business cycle in domestic inflation. Especially during the outbreak of COVID-19, the global supply chains were disrupted due to lockdowns in more than 90 countries by April 2020. The situation was followed by monetary policy responses from central banks worldwide to facilitate economic recovery[3] and people's excessive consumption to release pent-up demand in the post-pandemic period, which led to a marked increase in inflation across the world. To add salt to the wound, the escalation of the Russian-Ukrainian war in late February 2022 hindered the trade of gas, oil, and grains, causing a rapid rise in energy and food prices internationally. Although the extent varies from country to country, the inflationary surge is being felt not just by the advanced economies but also by the majority of emerging markets and developing economies, which has now become a centerpiece of policy discussions at central banks worldwide.[4] These recent events highlight the strong responsiveness of national inflation to world shocks in this era of hyperglobalization[5]. Thus the potential for global factors to determine expected inflation rates across countries carries an obvious appeal. Given the vital role of common global factors in national inflation, why do inflation rates still vary significantly across countries?

To explore the answer, I introduce a factor model for countries' excess inflation rates (EIR). The EIR of a country is defined as its domestic inflation rate (IR) minus the contemporaneous global inflation rate (GIR)[6]. The reason for choosing EIR (instead of IR in the extensive literature) as the variable of interest is that EIR explicitly reflects the inflation performance of a country relative to others.[7] All factors employed in this paper are common observable global factors chosen based on

[1] See "The Return of Global Inflation" on World Bank Blogs, 14 February 2022.

[2] Throughout the paper, the term "countries" refers to countries and regions.

[3] Cantú et al. (2021) provides a global database that summarizes central banks' responses to COVID-19 in 39 economies, including both advanced and emerging market economies.

[4] See "Inflation Is Back: Challenging Central Banks" by Agustín Carstens at the annual general meeting of the Bank for International Settlement (BIS) on 26 June 2022.

[5] ...Trade integration has been more rapid than ever (hyperglobalization)... - Subramanian and Kessler (2013).

[6] GIR is downloaded from the World Bank Open Data. Section 4 provides detailed descriptions for sample data.

[7] For example, a country's EIR > 0 means that the country has higher inflation than the globe's, and vice versa.

economic arguments and the extant literature on the main drivers of global inflation dynamics. The six benchmark factors include three procyclical factors, i.e., the energy price index, the agriculture price index, and the composite leading indicator, as well as three countercyclical factors, i.e., the global unemployment rate, the precious metals price index, and the world uncertainty index. The empirical methodology encompasses two-step regressions of Fama and MacBeth (1973) to estimate factor loadings (exposures or betas) and factor prices (lambdas). Specifically, through studying the monthly consumer price indices (CPI) of 181 countries from January 1990 to February 2022, this paper documents sizeable cross-sectional differences in EIR across countries, e.g., the minimum and maximum average EIR are -3.81% (Japan) and 26.35% (Sudan), respectively. The empirical results show that EIR across countries have divergent exposures to common global factors, resulting in varying degrees of impact of world shocks on countries' EIR; ultimately, countries with procyclical EIR have higher expected EIR than countries with countercyclical EIR. The six benchmark factors are highly significant and robust to various model specifications, explaining up to 41% of the cross-sectional heterogeneity in EIR. This paper also investigates single-factor models with nine additional global factors, including seven procyclical and two countercyclical factors; the estimates have expected signs and are significant overall. Besides, the results are robust to different rolling window analyses. In addition, when the 181 countries were divided into two groups based on GDP per capita, the estimates for both groups are significant and in line with the main finding.

To my knowledge, this is the first study that explains the cross-sectional differences in countries' EIR through common observable global factors. In contrast to the extensive literature,[8] see Mumtaz and Surico (2012), and Forbes (2019), etc., which study national inflation through country-specific (internal or external) factors, I establish a unified approach for all countries in this paper. This approach is essentially consistent with that in the literature: the country-specific factors in previous inflation studies reflect discrepancies in countries' economic functioning (such as production structures, trade and consumption patterns, financial and institutional structures, tax systems, etc.), which are captured by the differential exposures of countries' EIR to common global factors in this paper. This unified approach provides explicit and convenient references for economists and policymakers to study and manage inflation and for consumers and investors whose strategies may benefit from understanding the global determinants of inflation.

[8]A comprehensive literature review is provided in Section 2.

The methodology adopted in this paper is inspired by the cross-sectional asset pricing literature, especially arbitrage pricing theory (APT) and multifactor models. Financial economists have long recognized that economic agents, as investors, care about common factors that affect asset returns. The cross-sectional differences of asset risk premia are linked to different exposures of assets to the common risk factors that capture the business cycle movement well, i.e., systemic risk. Losing money in the asset market is especially awful if it tends to happen during recessions. Hence, assets with procyclical returns (i.e., assets tend to have lower returns in recessions) are riskier than assets with countercyclical returns (i.e., assets tend to have higher returns in recessions) for investors. The risk here is a measure of the procyclicality of asset returns. Therefore, investors typically demand higher risk premia for assets with procyclical returns than assets with countercyclical returns, and procyclical factors have positive risk prices, while countercyclical factors have negative risk prices.

Departing from the asset pricing literature, which primarily considers economic agents as investors, this paper takes consumers' perspectives. It examines how consumption decisions lead to cross-sectional differences in expected EIR across countries. First, this study assumes that a set of global factors captures the common sources of consumer price fluctuations across countries, which reflects the systematic risk from the global business cycle movement; then hypothesizes that differential exposures to these common factors determine the varying expected EIR of consumers across countries. Intuitively, consumers' aversion to high inflation is asymmetric in different economic surroundings. For example, higher inflation in recessions is more painful for consumers than that in economic expansions. Thus, consumers tend to have different consumption behaviors based on the economy's EIR cyclicality. Specifically, in economies with countercyclical EIR, consumers are more cautious and sensitive toward adverse economic shocks, potentially leading to the aggregate consumption demand and money velocity decreasing more quickly and significantly in response to negative shocks than in procyclical EIR economies. Therefore, this paper builds the central argument that economies with more procyclical EIR generally have higher expected EIR, while economies with more countercyclical EIR have lower EIR on average. Or equivalently, procyclical factors have positive factor prices, while countercyclical factors have negative factor prices.

The comparison with the cross-sectional asset pricing theory is interesting. Although the rationale behind the scene is the opposite, factor prices have the same sign theoretically. Because, as investors, economic agents like higher returns on assets; in contrast, from a consumer perspective, economic agents disfavor higher inflation due to its purchasing power erosion effects. What makes consumers particularly anxious is the higher inflation during recessions. The rising cost of living is especially excruciating if it tends to happen when people lose their jobs or houses, businesses lose money, etc. Therefore, consumers have different consumption behavior according to the cyclicality of inflation (expected inflation), thereby affecting the dynamics of consumer goods prices and, ultimately, inflation.

Specifically, suppose that an economy's EIR fluctuates procyclically, which implies the economy has lower relative inflation in global recessions. It helps alleviate the trouble consumers face in bad times. As a result, consumers in such economies tend to have more accommodating spending arrangements, which generally leads to relatively higher aggregate demand for consumption and money velocity. It results in a higher EIR on average. The result acts as if consumers in procyclical EIR economies are more willing to tolerate higher average inflation relatively. This characteristic is somewhat analogous to assets with countercyclical returns in asset pricing theory. Investors are willing to tolerate lower average risk premiums for assets with higher returns in recessions to achieve a hedge effect. On the contrary, suppose an economy's EIR fluctuates countercyclically. The economy tends to have higher inflation in bad economic times, which worsens consumers' situation in recessions. Hence, consumers tend to tighten their daily spending plans faster and more noticeably when they sense a bad condition is around the corner, leading to generally lower aggregate demand for goods and services and the velocity of money, which results in lower relative inflation on average. This result acts as if consumers generally require lower average inflation as compensation for bearing such "higher-inflation-in-recession" risk. It is somehow analogous to the characteristic of assets with procyclical returns; such assets tend to be icing on the cake for holders in times of prosperity but worsen holders' situation in adversity. As a result, investors typically ask for higher risk premia for such assets to compensate for the "lower-return-in-recession" risk.

The rest of the article breaks up as follows. Section 2 provides a literature review. Section 3 defines the setup, discusses the theoretical intuition and testable hypotheses, and presents the empirical methodology. Section 4 introduces the data and the descriptive statistics. Section 5 reports the results of empirical analysis and robustness checks. Section 6 concludes. A supplemental appendix available from the author's web page contains further analyses and robustness checks, as well as a similar IR-based analysis for reference.

2 Literature

Understanding the common component of macroeconomic fluctuations across countries has long been a subject of interest to economists. For example, Mitchell et al. (1927) finds striking similarities in the timing of business cycles peaks and troughs of many countries. Afterward, Backus et al. (1995), Baxter (1995) as well as Mendoza (1995), Kose (2002) and Agénor and Montiel (2015) document the relationship between world price shocks and economic activity in major industrialized economies and developing countries. Significant evidence suggests that business cycles in different countries share common characteristics. Besides, Kose et al. (2003) and Kose et al. (2008) compare business cycles across developed countries and document that macroeconomic fluctuations across countries are closely linked, implying that there is a world business cycle. Kose et al. (2020) argues that recessions were highly synchronized internationally and summarizes the dates of global recessions and downturns.

Specifically, global price synchronization is not a new phenomenon. Inflation as a worldwide phenomenon has been documented before the pandemic of COVID-19. Ciccarelli and Mojon (2010) shows that inflation in industrialized countries is largely a global phenomenon and the inflation rates of 22 OECD countries have a common factor that alone accounts for nearly 70 percent of their variance. Monacelli and Sala (2009) and Mumtaz and Surico (2012) build factor models to decompose national inflation rates into the world and national components. Studies including Bianchi and Civelli (2015), Mikolajun and Lodge (2016), Kamber and Wong (2020) and Attinasi et al. (2021) argue that the global component of inflation largely reflects price swings in energy and commodity markets. Ciccarelli and Mojon (2010), Auer et al. (2017) and Forbes (2019) provide tangible evidence in favor of the view that global economic shocks matter for underlying domestic inflation and that globalization may have lowered the sensitivity of inflation to domestic factors. Clarida et al. (2002) and Borio and Filardo (2007) empirically show that measures of global economic slack are good predictors of domestic inflation in advanced economies. Hakkio (2009), Ciccarelli and Mojon (2010) and Neely and Rapach (2011) estimate the latent global common factors or principal components for inflation in a set of countries.

This paper is inspired by the cross-sectional asset pricing literature, especially arbitrage pricing theory, see Roll and Ross (1980), and factor asset pricing models, see the seminal works by Sharpe

(1964), Fama and French (1993, 2015), to name a few; as well as the two-step regression approach commonly used to estimate parameters for factor asset pricing models by Fama and MacBeth (1973). However, this paper deviates from the broad asset pricing literature, as it is from the perspective of consumers rather than investors. This paper is somewhat related to the globe-centric approach suggested by Borio and Filardo (2007), which sees goods produced in different countries as similar substitutes and assumes that labor characteristics and capital mobility are such that factor input markets are closely integrated globally. This paper primarily views economic agents as consumers and examines how their consumption decisions lead to cross-sectional differences in expected EIR across countries.

Regardless of the research questions in the previous studies, their interest has primarily focused on the time-series properties of consumer price growth and comparing the explanatory power of domestic factors and country-specific external shocks. Drawing on the extensive inflation literature, this article examines the critical role of common world shocks in domestic inflation. Differently, this paper defines the relative inflation rate of a country, i.e., the EIR, and aims to build a unified approach for all countries to analyze the cross-sectional heterogeneity of countries' EIR through their different exposures to a set of common observable global factors which captures common sources of consumer price variations across countries.

This paper is also distinct from previous studies that examine cross-sectional price dynamics in different countries, as Engel and Rogers (1994), Campillo and Miron (1997), Crucini et al. (2005), Gorodnichenko and Tesar (2009) and Messner et al. (2022), among others. First, these studies consider a few domestic and external factors; both types are country-specific, such as institutional characteristics, degree of openness, etc. This paper examines the impact of common world shocks on national inflation across countries. Second, the samples in previous studies only cover a limited type of economy, such as advanced economies, euro area, OECD members, etc. By contrast, this study adopts the most extensive sample data on a global scale, covering the monthly CPI from 181 countries and regions all over the world. The sample period is up-to-date, covering from January 1990 to February 2022. Besides, when studying a country's inflation, this paper takes global inflation as a reference and adopts the country's relative inflation, EIR, as the dependent variable. It is more straightforward and informative for consumers, investors, academic researchers, and policymakers. In addition, this paper is the first study that seeks to explain the cross-sectional heterogeneity of EIR across countries by the different exposures to common global factors, with all factors being observable rather than latent. Moreover, the analysis methodology adopted in this paper is different, i.e., relying on the cross-sectional regressions of Fama and MacBeth (1973), which is different from, e.g., the factor analysis in Stock and Watson (2005).

Xing et al. (2022) is related to this paper in terms of the analysis methodology. Xing et al. (2022) first defines the individual excess inflation rate (IEIR) of an individual good or service as its inflation rate minus the general inflation rate and explains the heterogeneity in IEIR across goods and services by their different exposures to a set of economic factors in the U.S. economy. However, the research target is entirely different from this study. As this current paper is more "macro", i.e., the goal is to explain the relative inflation heterogeneity across countries globally rather than that among individual consumer goods in the U.S. economy. The variable of interest and economic factors are on a global scale instead of within the U.S. economy. In addition, the reasoning and conclusions are entirely different, as in Xing et al. (2022), from a "micro" level, the expected inflation of goods with procyclical inflation is generally lower than those of goods with countercyclical inflation. It implies that procyclical economic factors have negative factor lambdas and the countercyclical factors have positive factor lambdas in the explanation of the heterogeneity across individual consumer goods in the U.S. It is in contrast to what this paper finds on a global level that procyclical global factors have positive factor prices and countercyclical factors have negative factor prices in explaining the differences of countries' inflation on the cross-section.

3 Theoretical intuition and empirical methodology

3.1 The excess inflation rate of an economy

The inflation rate of a country, as measured by the consumer price index (CPI), is defined as the annual growth rate of the CPI. It represents the change in the prices of a basket of goods and services that average households typically purchase and reflects the erosion of living standards. At the same time, countries are linked more closely than ever in the context of global economic integration. World shocks, such as COVID-19 and Russo-Ukrainian War, etc., may lead to consumer price fluctuations on an international scale. Inflation has recently become a global phenomenon,[9] so focusing on a country's domestic inflation in isolation can somehow be confusing. For example, without international comparisons, one might assume that national policies (e.g., excess money supply) are to blame for high domestic inflation. Therefore, it is more explicit and informative to take into account global inflation over the same period when studying a country's consumer price dynamics and measuring its policies.

Therefore, this paper proposes to choose contemporaneous global inflation as a reference point to measure a country's inflation performance. Formally, define the variable of interest, i.e., a country's excess inflation rate (EIR), as the country's inflation rate minus the global inflation rate for the same period. EIR explicitly reflects the inflation performance of a country relative to others. Specifically, if a country's EIR is positive, the country has higher inflation than the globe's, and the higher the value, the more severe its inflation. In contrast, a negative EIR means that the country's inflation rate is lower than that of the globe, and the smaller the value, the lower the inflation rate compared to the world. EIR is somewhat similar in concept to the real return on an asset used to assess investment performance. But the preference is the opposite: economic agents, as investors, like higher real returns on assets while favoring lower EIR from consumers' point of view.

Expressly, assume that there are N countries denoted by $i = 1, 2, \ldots, N$, and $CPI_{i,t}$ is the consumer price level of country i at date t, also, there is a global general price index whose value at date t is denoted by $CPI_{0,t}$; it tracks the consumer price of a representative country of the N countries through time. Then, the consumer price growth rate in a country is measured by the changes in the log price index, and the consumer price growth rates in the N countries can vary widely. Let $\pi_{i,t}$ and $\pi_{g,t}$ denote the inflation rate (IR) of country i and the global inflation rate (GIR), respectively. By definition, the inflation rate of country i is (for monthly data)

$$\pi_{i,t} \equiv \ln\left(\frac{CPI_{i,t}}{CPI_{i,t-12}}\right), \quad \text{for} \quad i = 0, 1, 2, \ldots, N. \tag{1}$$

The EIR of country i at time t, written as $\pi^e_{i,t}$, is defined as the difference between the country's

[9] See "Rising inflation is a global problem, U.S. policy choices are not to blame" by Economic Policy Institute. It compares core inflation across OECD countries between post-pandemic (December 2020 to May 2022) and pre-pandemic (2018 to 2019) periods. It demonstrates that rising inflation is now a global phenomenon that is not unique to a specific country, such as the United States. Furthermore, it argues that the U.S. policies-self does not drive its high domestic inflation.

inflation rate, i.e., $\pi_{i,t}$, and the cotemporaneous global inflation rate, i.e., $\pi_{g,t}$ (for monthly data):

$$\pi^e_{i,t} \equiv \pi_{i,t} - \pi_{g,t} = \ln\left(\frac{CPI_{i,t}}{CPI_{i,t-12}}\right) - \ln\left(\frac{CPI_{0,t}}{CPI_{0,t-12}}\right), \quad \text{for} \quad i = 1, 2, ..., N. \tag{2}$$

3.2 Asset returns versus inflation: testable hypothesis

This analysis is inspired by the cross-sectional asset pricing literature, specifically arbitrage pricing theory (APT) and multifactor models. Since financial economists have found that investors care about the common factors that affect returns across assets, these common risk factors generally capture business cycle movement (i.e., systematic risk) well. Different asset exposures to the common factors correspond to varying amounts of systematic risks and lead to heterogeneity in risk premia across assets. From an investor's point of view, economic agents are particularly afraid of losing money on their investments during bad economic times. So for an asset, if its return is lower in bad times when the investor is worse off, i.e., the asset return is procyclical, a rational risk-averse investor would ask for a higher expected return to investing in such an asset for bearing the "lower-return-in-recession" risk. Bad times may correspond to recessions in that unemployment rates is higher, and people have lower revenue, such as wage and salary. In contrast, an asset with a countercyclical return can be considered a hedge; such an asset can prevent the investor's situation from worsening during hard times. Therefore, an investor would generally tolerate a lower expected return for holding such an asset. Investors have to trade between expected return of an asset and its inherent risk, where risk is a measure of the procyclicality of the asset return. The risk-return tradeoff builds the cornerstone of the modern asset pricing theory. According to the cross-sectional asset pricing theory, procyclical factors should have positive factor prices, and countercyclical factors are expected to have negative factor prices.

Economic agents as investors like higher real returns on their investment assets; in contrast, from the perspective of consumers, rational agents like the goods and services to become cheaper, not more expensive,[10] which means consumers favor lower EIR rather than higher ones. This paper wants to translate the theoretical intuition from asset valuation to inflation valuation. From a consumer's point of view, is there a theoretically sound relationship between an economy's expected

[10] In economic theory, consumer goods generally have downward-sloping demand curves, which means that lower price leads to higher demand and stimulates higher consumption. Since higher consumption brings higher utility, rational economic agents would prefer goods to become cheaper rather than more expensive.

EIR and a measure of its cyclicality of EIR? If any, what is the sign of the relationship?

Consumer income generally declines during bad economic times, such as global recessions and downturns. If inflation increases during this period, the rising cost of living will further deepen the pain for consumers from shrinking budgets. As a result, the rising inflation during recessions is particularly fearsome for consumers compared to that in economic booms. Thus, consumer aversion to higher inflation is asymmetric across different economic environments. Countercyclical EIR are generally considered more "unfriendly to consumers" than procyclical EIR. Thus, consumers may have divergent consumption decisions and behaviors in economies with countercyclical EIR compared to economies with procyclical EIR.

Specifically, consumers in countercyclical EIR economies may be more sensitive and cautious toward recessions than in procyclical EIR economies. For example, in economies with countercyclical EIR, consumers may be inclined to tighten their daily spending faster and more prominently in response to an expected recession. By contrast, in the "consumer-friendly" economies with procyclical EIR, because of the hedge effect of lower relative inflation in bad times, consumers may have more accommodating plans for everyday spending and respond less sensitively and markedly to recessions. As a result, when consumers perceive a possible recession, the aggregate consumption demand and the velocity of money may be reduced more quickly and significantly in countercyclical EIR economies than in procyclical EIR economies, which ultimately results in lower relative inflation in countercyclical EIR economies than in procyclical EIR economies.[11] From a pricing perspective, it is as if consumers in procyclical EIR economies appear, on average, to be willing to tolerate higher EIR for the "hedge effect" of such economies, resulting in higher EIR in economies with procyclical EIR. By analogous, consumers in cyclical EIR economies require lower EIR on average, leading to lower EIR in such economies.

[11] According to the quantity theory of money (QTM), as shown by the equation of exchange:

$$M_t V_t = P_t Y_t,$$

where M_t is the supply of money; V_t is the velocity of the circulation of money; P_t is the price level; and Y_t is the real output. Then, the inflation rate is

$$\pi_t = m_t + v_t - y_t$$

where m_t is the money supply growth rate; v_t is the money velocity growth rate; and y_t is the real output growth rate. The equation illustrates the positive relationship between inflation and the change in money velocity.

It is worth noting that although the linkage between inflation and the growth rate of money supply shows a strong positive link over the long term (as supported by the neutrality of money theory), the velocity of money is not constant, which can hardly be measured directly, nor is it predictable, especially over the short run.

Compared to that investors prefer higher real returns, consumers prefer lower EIR. Economies with procyclical EIR are more favorable to consumers for similar reasons hedge assets with countercyclical returns would be for investors. Assets with procyclical returns are riskier, while assets with countercyclical returns are safer, so investors require a lower average return for safe assets. By contrast, economies with procyclical EIR are more "consumer-friendly" than those with countercyclical EIR. Thus, consumers are willing to tolerate higher EIR for more "friendly" economies.

From the above reasoning and intuition, I form the testable hypothesis that the expected EIR is higher (lower) for countries whose EIR fluctuates more procyclically (countercyclically). More formally, let f_t be a procyclical factor, i.e., a variable that covariates positively with the world gross domestic product (GDP). If $\text{cov}\left(\pi^e_{i,t}, f_t\right) > 0$ (or equally $\beta > 0$), then country i tends to have higher (lower) EIR in booms (recessions). I hypothesize that the higher the covariance (or β) with the procyclical factor, the higher the expected EIR (i.e., $\mathbb{E}\left[\pi^e_{i,t}\right]$), is tolerated by consumers, and it is the opposite for countercyclical factors. In the cross-section of countries, there should be a positive relationship between the time-series average of EIR (i.e., the expected EIR, $\mathbb{E}\left[\pi^e_{i,t}\right]$) and its covariance ($\beta$) with a procyclical factor, which means the price for procyclical factor (the λ) should be positive. Conversely, the relationship should be negative if the factor is countercyclical. It implies that the price for the countercyclical factor (the λ) should be negative. This rational intuition is comparable to the one that holds for the cross-sectional relationship between expected asset returns and their exposure (i.e., covariance or β) to business cycle variables as widely studied in the asset pricing literature but with opposite underlying logics.

3.3 Empirical methodology

To empirically assess the relationship between countries' expected EIR and their comovement with global business cycle fluctuations, I rely on the two-pass cross-sectional regression method of Fama and MacBeth (1973). This approach is popular for evaluating linear factor models in asset pricing studies. This methodological choice is motivated by the analogy between asset returns from investors' perspectives and inflation from consumers' perspectives, as shown in the last subsection.

Formally, I assume that there are K global business cycle variables, denoted by $f_j, j = 1, 2, \ldots, K$, which are the main factors economic agents care about when making their consumption decisions. I assume that the EIR of a country is related to the factors through the following linear factor time series model:

$$\pi^e_{i,t} = \alpha_i + \beta_{i,1} f_{1,t} + \beta_{i,2} f_{2,t} + \ldots + \beta_{i,K} f_{K,t} + \epsilon_{i,t}, \quad \text{for} \quad i = 1, 2, \ldots, N. \tag{3}$$

where $\pi^e_{i,t}$ is the EIR of country i at time t, $f_{j,t}$ is the realization of the factor j at date t, and $\epsilon_{i,t}$ is the idiosyncratic component of the country's EIR, i.e., the component uncorrelated to global business cycle fluctuations. Given the time series data on consumer price indices across countries, I measure the EIR of these countries as defined in equation (2). Together with the time-series data on the global business cycle variables, equation (3) can be estimated using ordinary least squared time series regressions in the first pass to obtain the exposures of the country's EIR to global business cycle fluctuations, i.e., the $\beta_{i,j}, \quad i = 1, 2, \ldots, N, \quad j = 1, 2, \ldots, K$.

I further postulate the following linear cross-sectional relationship between the expected EIR of countries and their exposures to the global business cycle fluctuations as measured by the βs estimated in the first pass:

$$\mathbb{E}\left[\pi^e_i\right] = \lambda_0 + \lambda_1 \beta_{i,1} + \lambda_2 \beta_{i,2} + \ldots + \lambda_K \beta_{i,K}. \tag{4}$$

where the coefficients $\lambda_j, \quad j = 1, 2, \ldots, K$, measure the sensitivities of the expected EIR of countries to their loadings on global business cycle fluctuations. These coefficients can be estimated using ordinary least squared cross-sectional regressions in the second pass. Cochrane (2005, Section 12.3) discusses in detail the Fama-MacBeth procedure for running cross-sectional regressions and for producing standard errors and test statistics. Given the previous analysis, I expect $\lambda_j > 0$ if the factor j is procyclical and $\lambda_j < 0$ if the factor j is countercyclical.

3.4 Factor selection

This is the first study to explain the heterogeneity in EIR across countries by the differential exposures to a group of observable global factors that capture common sources of consumer price fluctuations around the world. There is a lack of theoretical guidance on the selection of unified global economic factors, like asset pricing theories that guide the choice of factors that determine asset returns, e.g., the capital asset pricing model (CAPM). The variable of interest, i.e., the

EIR of a country as defined in equation (2), is essentially inflation-based, so in principle, I should choose factors that capture common sources of global inflation. Inspired by arbitrage pricing theory (APT) and cross-sectional multifactor models, I build a common global factor model for EIR across countries, with all factors chosen based on economic arguments and the extant literature on the main drivers of global inflation dynamics, e.g., Forbes (2019) et al. I further examine the robustness of the findings to other potential factors.

I start with a Phillips curve-like model and refer to the world shocks analyzed in Borio and Filardo (2007), Forbes (2019), among others. It is not a "standard version" of the Phillips curve model established in the inflation literature; see in Friedman et al. (1968) and its subsequent development. Since the factors adopted in this paper are all globally common rather than country-specific, e.g., the unemployment rate in the Phillips curve model is domestic rather than the aggregated global unemployment rate I employed in this paper, other factors are similar. Formally, the baseline specification for equation (3) writes as an augmented Phillips curve-like model for a country's EIR as follows:

$$\pi_i^e = \alpha_i + \beta_{i,u} u_t + \beta_{i,e} e_t + \beta_{i,a} a_t + \beta_{i,m} m_t + \beta_{i,wu} wu_t + \beta_{i,cli} cli_t + \epsilon_{i,t}. \tag{5}$$

The first factor is linked to variations in the global labor market slack – as measured by the global unemployment rate, u_t. In this paper, I depart from the existing literature on inflation time-series dynamics and explore the effects of these variables on the cross-sectional heterogeneity of EIR across countries. The first factors drive the "Phillips curve". The baseline model specification (5) is "augmented" as it also incorporates the log year-on-year growth rate of the energy price index (e_t), the agriculture price index(a_t), the precious metals price index (m_t), the world uncertainty index (wu_t), and the composite leading indicator (cli_t) as additional factors. These factors are analyzed in the literature as external shocks for a country's inflation, but in country-specific form, which is different from the common global factors for all countries as I adopted in this paper.

The following section discusses the data on consumer price indices to build the variable of interest, i.e., EIR; and data used for constructing global factors employed in the analysis; as well as the relevant summary statistics and factors' cyclicality. Section 5 empirically examine the central hypothesis that EIR loadings on procyclical factors are positively related to the average EIR in the cross-section, while the relationship is the opposite for countercyclical factors.

4 Data and descriptive statistics

4.1 Data

To establish the variable of interest, i.e., EIR, since the most common measure of a country's inflation is the annual growth rate in the headline consumer price index (CPI) which includes both domestically produced and imported consumer goods and therefore reflects the living cost of the average consumer in the country. I first obtained the monthly headline CPI for different countries and regions from the regularly updated database by Ha et al. (2021) of the World Bank Group.[12] The CPI data adopted in this study is an unbalanced panel comprising 181 countries and regions, covering 386 months from January 1990 to February 2022;[13] the panel has a minimum number of 115 countries' CPI available per month, and for each country, at least 49 months of CPI are available during the sample period. Then I use the CPI to compute the inflation rate, i.e., IR, for each of the 181 countries and regions, which is the natural logarithm of the year-on-year growth rate of the 181 CPI time series. To avoid the influence of a few extreme observations on the results, I filter out samples of annual inflation rates over 100%. Next, I downloaded the data (monthly frequency) on the global inflation rate (GIR) from the World Bank's Global Economic Monitor (GEM) database, which is the median inflation rate calculated for geographical aggregates of the annual percent change of the CPI. Data is seasonally adjusted.[14] Then I converted it to the natural log of the year-on-year growth rate. The original GIR series from the GEM database is the simple year-on-year growth rate (in percentage). I transform it into the natural logarithm of year-on-year growth rate (in percentage) by $lg_t = \ln(g_t/100 + 1) * 100$. Besides, the available data ended in July 2020,[15] so from August 2020 to February 2022 (19 months), GIR was approximated by the median of the 181 IR per month. Then I took the differences between each of the 181 IR series and the GIR series to get the panel of the dependent variable, i.e., EIR. Table 1 lists the 181 countries and regions included in this study and their corresponding EIR time series averages, as well as the time series correlations with the real GDP growth rate of all OECD members.

[12] In this database, the monthly headline CPI are available for 183 countries from January 1970 to February 2022 (as of the data download time on August 30, 2022). To eliminate the effect of extreme values on the analysis results, two countries, Argentina and Venezuela, were excluded due to the hyperinflation over most of their available sample period. Please see Ha et al. (2021) for a detailed description of the variables and data sources.

[13] So the year-on-year log inflation rates are from January 1991 to February 2022.

[14] World Bank staff calculations of GIR are based on Datastream data.

[15] As of the data download time on August 30, 2022.

To the best of my knowledge, this is the most extensive sample set to study the cross-sectional differences in inflation across countries and regions. The choice of the sample start date reflects the desire to maximize the length of the CPI series to construct the dependent variable as well as the sample lengths of economic factors that are available to build the independent variables.

For global economic factors, the global unemployment rate and the world exchange rate[16] are from the GEM database; the commodity price indices, including price indices of energy, agriculture, and precious metals as three of the six benchmark factors, and price indices of crude oil, food, grains, raw materials and timber as additional factors for robustness checks, are from the World Bank Commodity Price (the pink sheet); the world uncertainty index: GDP weighted average and simple average are from the Federal Reserve Economic Data (FRED); the composite leading indicator (CLI), production of total industry index (MEI) and consumer confidence index (CCI) are from OECD Database and OECD Statistics. These data are used to construct the global economic factors to capture the common sources of variation in EIR across countries and regions.

Specifically, to construct the global unemployment rate, u_t, since the world unemployment rate data are only available from February 2001 to March 2020, for the period from January 1991 to January 2001, the unemployment rate of high-income countries was used as the approximation, because of their highly similar patterns, but the unemployment rate of high-income countries ends in May 2020, for the period after that, the unemployment rate was approximated by the OECD total members unemployment rate.[17] These three unemployment rate series share a consistent trend based on their overlapped sample period. Figure 1 plots the three series and the synthetic global unemployment rate adopted in this analysis.

For the "augmented" factors, the energy price index is a weighted average of coal (4.7%), crude oil (84.6%), and natural gas (10.8%); the agriculture price index is a weighted average of food (40%), beverages (8.4%) and agricultural raw materials (16.5%); the food price index is a weighted average of cereals (rice, wheat, maize, barley) (11.3%), vegetable oils and meals (soybeans, soybean oil, soybean meal, palm oil, coconut oil, groundnut oil) (16.3%), and other good (sugar, bananas, beef meat, chicken meat, oranges) (12.4%); the precious metals price index is a weighted average

[16] Local currency units (LCU) per U.S. dollar, with values prior to the currency's introduction presented in the new currency's terms. World Bank staff calculations are based on Datastream and IMF International Finance Statistics data.

[17] OECD total members' unemployment rate is available starting from January 2001 (as of the data download time on August 30, 2022).

of gold (77.8%), silver (18.9%), and platinum (3.3%).

The remaining factors of different commodity prices, exchange rate, CLI, MEI, CCI, and the world uncertainty (both GDP weighted average and simple average) are constructed as the percent natural log of the year-on-year growth rate:

$$x_t = \ln(X_t/X_{t-12}) * 100.$$

This paper assesses the cyclicality of economic factors by the correlation between the factor and the real GDP growth rate, I obtained the growth rate of the real GDP of all OECD members from the OECD Statistics (quarterly frequency), which is the percentage change in the same quarter of the previous year and then transformed into the natural logarithm of the year-on-year growth rate.

The variables used to construct EIR and the six benchmark factors of equation (5) are listed and further described in the upper panel of Table 2. The lower panel lists data descriptions for nine additional variables to verify the robustness of the empirical findings and the GDP growth rate. The following part presents relevant descriptive statistics of the data.

4.2 Descriptive statistics

Table 1 lists the 181 countries and regions and the time series means of their EIR, as well as the time series correlations with the real GDP growth rate of all OECD members. 79 countries have negative EIR, and 102 countries have positive EIR; Japan has the lowest EIR at −3.81%, while Sudan has the highest EIR at 26.35%. Table 1 reflects the significant differences in EIR and the cyclicity across countries and regions, which is also visually illustrated by the left panel of Figure 2. In addition, Table 1 shows that, as the EIR changes from low to high, the corresponding economies gradually change from high-income to low-income. From the panel of EIR, I also found that the occurrence of hyperinflation (e.g., inflation rate over 100%) in developed economies is significantly lower than that in underdeveloped economies, which implies that an economy's GDP per capita tends to be negatively related to the inflation and the occurrence probability of hyperinflation. This may be because advanced economies have more sophisticated economic policies, e.g., monetary and trade policies and more flexible regulatory tools to maintain the supply and demand robustness in their commodity markets and the stability of the consumer price levels.

To further illustrate the cross-sectional differences, Table 3 presents the time series descriptive statistics of the cross-sectional mean, standard deviation, skewness, excess kurtosis, and percentiles of the 181 EIR series. A typical country's inflation grows annually 2.68% more than the global inflation rate. The average annual dispersion of 9.26% around the typical EIR indicates the considerable heterogeneity among countries' inflation over time. Also, the 5th percentile averages -4.76% while the 95th percentile averages 19.81% through time; a discrepancy of 24.57% further illustrates the heterogeneity. Notice that the 25th and 75th percentiles, -2.32% and 4.50% respectively, are quite large compared to the median EIR that averages 0.03% through time, illustrating that an EIR of a country is likely to be more extreme than normal; this is confirmed by the large cross-sectional excess kurtosis of EIR that averages 17.06 through time. The positive EIR cross-sectional skewness, averaging 3.12 through time, is in line with the fact that, on average, the cross-sectional mean is more than the cross-sectional median of the EIR, which is also consistent with the feature shown by the right panel of Figure 2, in which the fitted probability density function (pdf) demonstrates spiked right-skewed distribution.

Figure 3 plots the EIR time series of five countries with typical procyclical EIR, including Kiribati, Seychelles, Iceland, Rwanda, and Lesotho, and five countries with typical countercyclical EIR, including Moldova, Uzbekistan, Thailand, Bosnia, and Herzegovina, and Zimbabwe, shaded areas correspond to global recessions and downturns. This figure intuitively reflects the fact that inflation in different countries could have very different patterns in terms of cyclicity.

Figure 4 plots the time series of the cross-sectional moments of the EIR and highlights the global economic recessions and downturns.[18] These cross-sectional moments show substantial time-series variations, as confirmed by their descriptive statistics in Table 3. It can be observed that something is going on during recessions and downturns. In particular, the cross-sectional mean of EIR tends to decrease during bad global times. Their time-series correlation with real GDP growth rates is 0.13, as shown in Table 3, although the cross-sectional median is slightly negatively correlated with GDP, with a correlation of -0.08. Likewise, the cross-sectional standard deviation of EIR tends to drop around bad times, which positively correlated with the real GDP growth rate with a correlation of 0.10, as shown in Table 3. The skewness and excess kurtosis show that the cross-sectional distribution of EIR tends to be more asymmetry and high-peaked around recessions and

[18]Dates of global recessions and downturns are from Kose et al. (2020).

downturns, then come back during economic recoveries.

Recall that the hypothesis involves the cyclicality of the factors driving countries' EIR. This paper measures the cyclicality of a given factor by its correlation with the real GDP growth rate. In Table 4, Panel A reports the descriptive statistics of the six benchmark factors, their correlations with the real GDP growth rate, and their implied cyclicality. The three factors, u_t, m_t, and wu_t, are countercyclical factors with correlations of -0.29, -0.09, and -0.06 with GDP growth, respectively. The other three factors, e_t, a_t, and cli_t, are procyclical factors with correlations of 0.55, 0.23, and 0.67 with GDP growth rate respectively. Moreover, the first-order autocorrelation coefficients for the factors are very high, which implies that those factors are predictable by their past values. Panel B of Table 4 displays the correlations between the six benchmark factors, which shows that, generally, procyclical factors are negatively correlated with countercyclical factors.

Since economic agents are primarily concerned with deviations from their predictions of economic variables, the actual factors should be considered the innovations in the original variables. For this purpose, the paper works with factor innovations in equation (5) instead of the original factors. Precisely, the factor innovations in this analysis are measured by the residuals from univariate ARMA(1,1) models estimated on the original factors. Working with factor innovations also avoids potential econometric issues in time series regressions on persistent factors. The descriptive statistics of the final factors are presented in Panel A of Table 5. The sample means, medians, and AR(1) coefficients are nearly zero. In Panel B, the residuals of procyclical factors are generally negatively correlated with those of countercyclical factors, and final factor correlations are much lower overall than those of original factors, implying that multicollinearity will be lower in regression. In the subsequent empirical investigation, the actual factors represent factor innovations rather than the original ones.

5 Empirical estimation and robustness checks

5.1 Fama-MacBeth regressions

This section focuses on the empirical evaluation of equations (3) and (4). Using Fama and MacBeth (1973, henceforth FM) two-step regression approach, this study estimates the factor prices, i.e., factor lambdas, of EIR to the factor loadings, measured by the conditional betas. In the first step of the FM procedure, running time series regressions to estimate conditional betas, this paper follows Lewellen and Nagel (2006), which uses short-window regressions to estimate the factor loadings rather than determining the appropriate conditioning variables. The benchmark results are based on a 60-month rolling window regression. Besides, the results calculated from a longer rolling window of 90 months are presented for robustness checks. After obtaining factor loadings, in the FM second step, this study performs month-by-month cross-sectional regressions of the 181 EIR series on the betas to acquire monthly coefficients for each factor and then uses each coefficient's time series mean as the corresponding factor lambda.

Table 6 and Table 7 show the factor lambda estimates for the listed models with the six benchmark factors. Table 6 reports the baseline results based on the rolling window of 60 months. Table 7 presents results found on the 90-month rolling window (labeled with $'$) for robustness checks. In both tables, the columns marked by Arabic numerals, i.e., **1** to **6**, show estimates of univariate models; the columns marked by Roman numerals, i.e., **I** to **XVI**, report results for model specifications with more than one factor.

Focusing on Table 6, columns labeled **1**, **4**, and **5** correspond to single-factor model specifications with a countercyclical benchmark factor. Specifically, this study sees negative and statistically significant factor lambdas for the global unemployment rate, the precious metals price index, and the world uncertainty index. By contrast, columns labeled **2**, **3**, and **6** display estimate results for single-factor specifications that are related to a procyclical benchmark factor. In particular, this study sees positive and statistically significant factor lambdas for the energy price index, the agriculture price index, and the composite leading indicator. It implies that economies with procyclical EIR have higher expected EIR on average, while economies with countercyclical EIR generally have lower expected EIR. This observation is consistent with the central hypothesis that economies that tend to have lower EIR in global economic recessions, i.e., economies with higher positive (lower negative) betas on procyclical (countercyclical) factors, generally have higher EIR (i.e., higher $\mathbb{E}\left[\pi_{i,t}^{e}\right]$) compared to other economies. Likewise, economies that tend to have higher EIR in global recessions when consumers are worse off, i.e., economies with lower negative (higher positive) betas on procyclical (countercyclical) factors, undergo, on average, relatively lower EIR (i.e., lower $\mathbb{E}\left[\pi_{i,t}^{e}\right]$) than other economies. The remaining columns of Table 6, numbered in Roman numerals from **I** to **XVI**, show results for all the sixteen possible multivariate combinations with the global unemployment rate and the energy price index fixed as common factors in all specifications. In all these model specifications, estimates of factor lambdas are in line with the central hypothesis; the signs of factor lambdas are stable and remain highly statistically significant; the observation is valid for all factors. Regarding the goodness of fit, the univariate specifications for the six benchmark factors have explanatory power ranges from 10% to 16%, climbing up to 41% in the multivariate specifications.

For a robustness check of the six benchmark factors, this analysis presents the estimates from a longer rolling window of 90 months, which obtained very similar results to the baseline estimation of 60 months. All three countercyclical factor lambdas remain negative, and the three procyclical factor lambdas remain positive and highly statistically significant regardless of the model specifications. The estimates of factor lambdas based on the 90-month rolling window are shown in Table 7 and structured identically to Table 6.

Furthermore, in order to examine the impact of world shocks on relative inflation in countries with different levels of prosperity, I divide the sample countries into two groups by their per capita GDP. The threshold is the median of the 181 countries' GDP per capita. The first group includes 90 countries with per capita GDP above the threshold, and the second group comprises 90 countries with per capita GDP below the threshold. The lambda estimates are based on the 60-month rolling window, and the results for the first group are shown in Table 8, and for the second group are shown in Table 9, respectively. Table 8 illustrates that the central hypothesis firmly holds for the global unemployment rate and the agriculture price index and generally holds for the world uncertainty index and the composite leading indicator, although the evidence for the energy price index is less significant, and for the precious metals index is mixed. The explanatory power goes up to 48% regarding the goodness of fit. By contrast, the central hypothesis is strongly proved in the group with lower per capita GDP, as shown in Table 9. The three countercyclical factors have negative estimates for lambdas, while the three procyclical factors have positive lambdas estimates, which are statistically significant across all model specifications. The goodness of fit of the six-factor model achieves 45%. From this, we can see that the central hypothesis holds well for both groups and that the evidence is stronger in the group with lower GDP per capita.

To conclude this subsection, this paper uses the FM two-step approach to estimate the relationship between average EIR and the exposures (betas) to the six unified global economic factors that potentially capture the common sources of variation in consumer price changes across countries and regions. The results demonstrate that, on the cross-section of relative inflation, average EIR positively correlates with loadings on the three procyclical factors; by contrast, it is negatively correlated with loadings on the three countercyclical factors. The associated factor lambdas are statistically significant, and their signs are stable and consistent with expectations. Up to 20% of the heterogeneity in average EIR across countries and regions can be explained by the EIR exposures to the global unemployment rate and the energy price index. Expanding the set of factors to the agriculture price index, the precious metals price index, the world uncertainty index, and the composite leading indicator increase the explanatory power to 41%. The hypothesis holds well when dividing countries into two groups based on their per capita GDP. The evidence is more substantial for countries with lower than median GDP per capita. The following subsection further assesses the robustness of these findings by using additional common global factors.

5.2 Further robustness checks

This subsection provides further robustness checks by considering data on nine additional global economic factors that, similar to the six benchmark economic variables, can potentially affect consumer price changes across countries and regions. These additional data descriptions are summarized in the lower panel of Table 2. Similar to the six benchmark factors, the analysis builds the actual factors as the ARMA(1,1) innovations in the original series. Likewise, this subsection uses factor correlations with the global real GDP growth rate to classify the factors by their cyclicality. This analysis ends up with six procyclical global factors and two countercyclical global factors for further robustness checks. Notice that, given the relatively large number of additional factors, this subsection restricts to single-factor model specifications involving them.

This analysis reports two sets of estimates for each factor. Table 10 is based on the 60-month rolling window estimation, and Table 11 corresponds to the 90-month rolling window analysis. In Table 10 and Table 11, the first column lists the factor names. The second column shows their correlations with the global real GDP growth rate, from which we can see that the six procyclical factors have positive correlations with the global real GDP growth rate, which are negative for the two countercyclical factors. The first five factors (columns **7** to **11**, and columns **7′** to **11′**) capture variations in different commodity prices, including the crude oil, food, grains, raw materials, and timber. Their correlations with the GDP are positive and range from 0.07 to 0.54. The estimated lambdas for all five price factors are positive in both the 60-month and 90-month rolling window scenarios and strongly statistically significant at conventional levels. The following two factors mei_t and cci_t (columns **12** and **13**, then columns $\mathbf{12'}$ and $\mathbf{13'}$) are the year-on-year growth rates of production of total industry index and the consumer confidence index. The correlations are 0.88 and 0.55 with the global real GDP growth rate, respectively. The associated factor lambdas are both positive and statistically significant for both rolling window scenarios.

The last two variables, wus_t and ex_t, are countercyclical global factors, (columns **14** and **15**, then columns $\mathbf{14'}$ and $\mathbf{15'}$); they are the growth rates of the world uncertainty index (simple average) and the exchange rate; the correlations are -0.10 and -0.02 with the global real GDP growth rate, respectively. The associated factor lambdas are both negative and statistically significant for both 60-month and 90-month rolling window estimations.

6 Conclusion

This paper aims to explain the considerable cross-sectional differences in inflation across countries and regions. To provide a more explicit and informative reference to consumers, investors, researchers, and policymakers on a country's inflation performance relative to others, this paper proposes to choose the relative consumer price growth of a country to the world to measure its inflation performance, i.e., the excessive inflation rate (EIR), which is defined as the country's inflation rate (IR) minus the contemporaneous global inflation rate (GIR). This paper studies the most extensive sample on a worldwide basis, consisting of the consumer price indices (CPI) of 181 countries and regions, with an up-to-date sample period from January 1990 to February 2022.

As world shocks and the global business cycle play an increasingly important role in domestic inflation across countries and regions, this paper assumes that a set of global factors captures common sources of consumer price fluctuations in different countries around the world and explains the cross-sectional heterogeneity in countries' EIR by the differential exposures to the shared global factors, then build up the central hypothesis that countries with procyclical EIR have higher expected EIR on average; conversely, countries with countercyclical EIR generally have lower expected EIR than others.

The analysis methodology adopted in this paper is inspired by the cross-sectional asset pricing literature, especially the APT and multifactor models. The empirical findings are significant and robust to various model specifications supporting the central hypothesis that the average EIR is negatively related to exposures to three countercyclical factors, including the global unemployment rate, the precious metals price index, and the world uncertainty index, while it is positively related to loadings on three procyclical factors, including the energy price index, the agriculture price index, and the composite leading indicator. The results hold well for 60-month and 90-month rolling window estimations. When dividing countries into two groups by their GDP per capita, the results of both groups are in line with the main findings. Moreover, the main findings are further supported when nine additional global economic factors are considered.

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Table 1: **181 Countries and Regions**

This table reports the 181 countries and regions included in this analysis; their corresponding excess inflation rates are listed in column **EIR**; the the time series correlations with the real GDP growth rate of all OECD members are shown in column **Corr**. EIR are annualized and in percentage units. The sample period is from January 1991 to February 2022, with monthly frequency.

#	Countries	EIR	Corr	#	Countries	EIR	Corr
1	Aruba	-1.47	0.26	*41*	Czech Republic	0.28	0.03
2	Afghanistan	2.28	0.26	*42*	Germany	-2.38	0.00
3	Angola	24.11	0.09	*43*	Djibouti	-0.47	-0.10
4	Albania	3.53	0.04	*44*	Dominica	-2.60	0.01
5	United Arab Emirates	-1.20	0.05	*45*	Denmark	-2.44	0.01
6	Armenia	2.22	0.08	*46*	Dominican Republic	4.15	0.10
7	Antigua and Barbuda	-1.52	0.26	*47*	Algeria	3.52	0.03
8	Austria	-2.13	-0.04	*48*	Ecuador	10.42	0.16
9	Azerbaijan	0.73	-0.02	*49*	Egypt, Arab Rep.	4.90	-0.12
10	Burundi	5.55	0.07	*50*	Spain	-1.60	0.26
11	Belgium	-2.21	0.00	*51*	Estonia	3.88	0.09
12	Benin	-0.23	0.06	*52*	Ethiopia	6.34	-0.20
13	Burkina Faso	-1.41	-0.04	*53*	Finland	-2.62	-0.04
14	Bangladesh	2.34	-0.08	*54*	Fiji	-1.07	-0.02
15	Bulgaria	8.72	0.10	*55*	France	-2.69	-0.02
16	Bahrain	-3.05	-0.08	*56*	Gabon	-1.75	0.03
17	Bahamas	-2.11	-0.16	*57*	United Kingdom	-1.87	-0.10
18	Bosnia and Herzegovina	-1.79	0.37	*58*	Georgia	3.44	0.18
19	Belarus	18.05	0.10	*59*	Ghana	11.99	0.03
20	Belize	-2.20	0.12	*60*	Guinea	10.47	0.21
21	Bolivia	1.38	-0.06	*61*	Gambia, The	1.54	-0.09
22	Brazil	3.52	0.08	*62*	Guinea-Bissau	6.38	0.07
23	Barbados	-0.84	-0.08	*63*	Equatorial Guinea	0.79	0.00
24	Brunei Darussalam	-3.13	-0.26	*64*	Greece	-0.18	0.12
25	Botswana	3.30	0.11	*65*	Grenada	-2.23	0.07
26	Central African Republic	1.10	0.00	*66*	Guatemala	2.86	0.01
27	Canada	-2.22	0.05	*67*	Guyana	0.72	0.25
28	Switzerland	-3.28	-0.01	*68*	Hong Kong SAR, China	-1.27	-0.04
29	Chile	0.89	-0.04	*69*	Honduras	5.15	0.13
30	China	-0.40	0.06	*70*	Croatia	1.03	-0.01
31	Cote d'Ivoire	-0.79	0.04	*71*	Haiti	8.43	0.01
32	Cameroon	-1.02	0.02	*72*	Hungary	4.42	0.13
33	Congo, Dem. Rep.	9.32	-0.17	*73*	Indonesia	3.90	0.04
34	Congo, Rep.	-0.18	0.05	*74*	India	2.82	-0.21
35	Colombia	4.76	0.12	*75*	Ireland	-2.28	0.23
36	Comoros	-0.45	-0.06	*76*	Iran, Islamic Rep.	14.71	-0.02
37	Cabo Verde	-1.42	-0.06	*77*	Iraq	0.24	-0.10
38	Costa Rica	4.64	0.09	*78*	Iceland	-0.10	-0.37
39	Curacao	-1.16	0.01	*79*	Israel	-0.22	0.04
40	Cyprus	-2.00	0.17	*80*	Italy	-1.90	0.04

Table 1: Continued from previous page

#	Countries	EIR	Corr	#	Countries	EIR	Corr
81	Jamaica	8.36	0.01	*131*	Philippines	1.12	-0.01
82	Jordan	-0.98	-0.02	*132*	Poland	5.20	0.04
83	Japan	-3.81	-0.09	*133*	Portugal	-1.43	0.08
84	Kazakhstan	6.78	0.10	*134*	Paraguay	3.71	0.14
85	Kenya	6.13	-0.07	*135*	West Bank and Gaza	-0.47	0.15
86	Kyrgyz Republic	5.77	0.16	*136*	Qatar	-1.43	0.30
87	Cambodia	0.95	0.03	*137*	Romania	12.41	0.22
88	Kiribati	-1.48	-0.66	*138*	Russian Federation	10.29	0.12
89	St. Kitts and Nevis	-1.88	0.11	*139*	Rwanda	2.67	-0.36
90	Korea, Rep.	-1.00	0.01	*140*	Saudi Arabia	-2.19	-0.28
91	Kuwait	-1.34	-0.18	*141*	Senegal	-1.74	0.06
92	Lao, PDR	8.32	0.16	*142*	Singapore	-2.58	-0.04
93	Lebanon	9.25	-0.10	*143*	Solomon Islands	2.93	-0.08
94	Liberia	6.72	0.02	*144*	Sierra Leone	6.03	-0.05
95	Libya	-1.18	-0.05	*145*	El Salvador	-0.05	0.08
96	St. Lucia	-1.99	0.13	*146*	San Marino	-1.51	-0.01
97	Sri Lanka	3.94	0.00	*147*	Serbia	13.31	0.14
98	Lesotho	2.23	-0.31	*148*	South Sudan	26.24	0.20
99	Lithuania	2.37	0.08	*149*	Sao Tome and Principe	9.87	0.03
100	Luxembourg	-2.19	0.01	*150*	Suriname	15.96	0.08
101	Latvia	2.76	0.05	*151*	Slovakia	1.13	0.13
102	Macao SAR, China	-1.00	-0.11	*152*	Slovenia	3.36	0.02
103	Morocco	-1.93	-0.06	*153*	Sweden	-2.53	-0.09
104	Moldova, Rep.	6.84	0.31	*154*	Eswatini	2.95	-0.05
105	Madagascar	6.15	0.12	*155*	Seychelles	-0.19	-0.41
106	Maldives	0.17	-0.06	*156*	Syrian Arab Republic	3.08	-0.18
107	Mexico	4.14	0.14	*157*	Chad	-0.84	-0.13
108	North Macedonia	0.60	0.07	*158*	Togo	-0.71	0.04
109	Mali	-1.96	-0.04	*159*	Thailand	-1.49	0.34
110	Malta	-1.98	-0.10	*160*	Tajikistan	6.50	-0.04
111	Myanmar	11.06	0.08	*161*	Timor-Leste	1.41	0.10
112	Montenegro	-1.14	0.00	*162*	Tonga	0.54	0.12
113	Mongolia	8.01	0.12	*163*	Trinidad and Tobago	0.97	-0.13
114	Mozambique	4.05	0.17	*164*	Tunisia	0.10	-0.15
115	Mauritania	0.96	0.10	*165*	Turkey	23.08	0.21
116	Mauritius	0.85	0.05	*166*	Taiwan, China	-2.74	0.16
117	Malawi	13.55	0.14	*167*	Tanzania, United Rep.	5.05	-0.02
118	Malaysia	-1.66	0.20	*168*	Uganda	1.88	-0.18
119	Namibia	1.91	-0.26	*169*	Ukraine	10.23	0.19
120	New Caledonia	-1.54	0.16	*170*	Uruguay	11.13	-0.02
121	Niger	-1.54	0.02	*171*	United States	-1.79	0.19
122	Nigeria	11.89	0.02	*172*	Uzbekistan	11.88	0.32
123	Nicaragua	3.19	0.09	*173*	St. Vincent and the Grenadines	-1.97	-0.04
124	Netherlands	-2.13	-0.09	*174*	Vietnam	2.09	-0.20
125	Norway	-2.02	-0.08	*175*	Samoa	-0.71	0.00
126	Nepal	2.97	-0.25	*176*	Kosovo	-1.45	0.19
127	Oman	-1.03	-0.08	*177*	Yemen, Rep.	7.14	0.28
128	Pakistan	3.86	-0.28	*178*	South Africa	1.99	-0.17
129	Panama	-2.31	-0.04	*179*	Zambia	16.21	0.04
130	Peru	3.47	0.01	*180*	Zimbabwe	4.61	0.60
				181	Sudan	26.35	-0.10

Table 2: **Data Description**

This table reports the data descriptions of consumer price indices of 181 countries and regions, 15 world economic factors (6 benchmark factors and nine additional robustness-check factors), and the global real GDP growth rate. The first column shows the factor number, the second column displays the acronyms, the third column demonstrates the descriptions, the fourth column presents the data sources, and the last column illustrates the data frequency.

#	Variable	Description	Data Source	Frequency
Headline Consumer Price Indices, CPI, for 181 countries and Global Inflaltion Rate, GIR				
	$CPI_{i,t}, i = 1, 2, ..., 181.$		Ha et al. (2021) of the World Bank Group[a]	Monthly
	GIR_t		World Bank - Global Economic Monitor (GEM) Database[b]	Monthly
Benchmark Factors (6)				
1	u_t	Unemployment Rate	World Bank - Global Economic Monitor (GEM) Database OECD Database[c]	Monthly
2	e_t	Energy Price Index	World Bank Commodity Price Data (The Pink Sheet)[d]	Monthly
3	a_t	Agriculture Price Index	World Bank Commodity Price Data (The Pink Sheet)	Monthly
4	m_t	Precious Metals Price Index	World Bank Commodity Price Data (The Pink Sheet)	Monthly
5	wu_t	World Uncertainty Index: Global: GDP Weighted Average	Federal Reserve Economic Data (FRED) (FRED code: WUIGLOBALWEIGHTAVG)	Quarterly
6	cli_t	Composite leading indicator (CLI)	OECD Database	Monthly
Additional Robustness-Check Factors (9)				
7	oil_t	Crude Oil Price Index	World Bank Commodity Price Data (The Pink Sheet)	Monthly
8	$food_t$	Food Price Index	World Bank Commodity Price Data (The Pink Sheet)	Monthly
9	$grain_t$	Grains Price Index	World Bank Commodity Price Data (The Pink Sheet)	Monthly
10	raw_t	Raw Materials Price Index	World Bank Commodity Price Data (The Pink Sheet)	Monthly
11	$timber_t$	Timber Price Index	World Bank Commodity Price Data (The Pink Sheet)	Monthly
12	mei_t	Production of total industry sa, Index (PRINTO01)	OECD Statistics [e]	Monthly
13	cci_t	Consumer Confidence Index (CCI)	OECD Database	Monthly
14	wus_t	World Uncertainty Index: Global: Simple Average	Federal Reserve Economic Data (FRED) (FRED code: WUIGLOBALSMPAVG)	Quarterly
15	ex_t	Exchange Rate, New LCU per USD Extended Backward, Period Average	World Bank - Global Economic Monitor (GEM)	Monthly
	GDP_t	Growth rates of real gross domestic product - OECD Total	OECD Statistics	Quarterly

[a] https://www.worldbank.org/en/research/brief/inflation-database
[b] https://databank.worldbank.org/reports.aspx?source=global-economic-monitor-%28gem%29#
[c] https://data.oecd.org/
[d] https://www.worldbank.org/en/research/commodity-markets
[e] https://stats.oecd.org/

Table 3: **Descriptive Statistics of Excess Inflation Rates (EIR)**

This table presents the mean, standard deviation (Std.), skewness (Skew.), excess kurtosis (Kurt.) and the real per capita GDP growth correlations of the cross-sectional mean, standard deviation (Std.), skewness (Skew.), excess kurtosis (Kurt.), and 5%, 25%, 50%(median), 75% and 95% percentiles among the excess inflation rates (EIR) of 181 countries and regions, which is constructed as $\pi^e_{i,t} \equiv \pi_{i,t} - \pi_{g,t}$ (see equation (2)). The EIR of 181 countries and regions are displayed in Table 1, which are annualized and in percentage units. The sample period is from January 1991 to February 2022, with monthly frequency.

	Mean	**Std.**	**Skew.**	**Kurt.**	**5%**	**25%**	**50%**	**75%**	**95%**
Mean	2.68	9.26	3.12	17.06	−4.76	−2.32	0.03	4.50	19.81
Std.	1.68	4.55	1.63	15.48	2.05	1.29	0.32	2.84	13.12
Skew.	1.02	0.71	0.44	1.97	−1.38	−1.69	−1.76	2.06	1.09
Kurt.	−0.06	−0.82	0.81	4.55	1.58	2.50	7.10	4.18	−0.15
corr(π^e, gdp)	0.13	0.10	−0.05	−0.06	0.00	−0.03	−0.08	0.09	0.11

Table 4: **Descriptive Statistics and Correlations for Benchmark Original Factors**

Panel A in this table presents the time-series mean, median, minimum (Min.), maximum (Max.), standard deviation (Std.), skewness (Skew.), excess kurtosis (Kurt.), first-order autocorrelation coefficient (AR(1)), the correlation with log real GDP growth rate and the cyclicity of each original benchmark factor. Panel B presents correlations between the original benchmark factors. Factors are annualized and in percentage units. The sample period is from January 1991 to February 2022.

Panel A: Descriptive Statistics for Original Factors

	Mean	**Median**	**Min.**	**Max.**	**Std.**	**Skew.**	**Kurt.**	**AR(1)**	**corr**(f, gdp)	**cyclicity**
u_t	6.99	6.89	5.16	8.81	0.67	0.39	0.00	0.98	−0.29	counter
e_t	3.94	3.83	−100.51	93.78	32.89	−0.23	0.14	0.94	0.55	pro
a_t	2.26	0.51	−28.69	40.59	11.88	0.51	0.58	0.96	0.23	pro
m_t	4.95	2.46	−34.95	50.12	14.92	0.37	−0.16	0.94	−0.09	counter
wu_t	1.61	2.88	−154.41	134.23	49.41	−0.23	0.19	0.79	−0.06	counter
cli_t	0.03	0.07	−8.31	9.62	1.83	−0.12	5.27	0.94	0.67	pro

Panel B: Correlations Between Original Factors

	e_t	a_t	m_t	wu_t	cli_t
u_t	−0.26	0.01	0.06	−0.10	−0.06
e_t		0.56	0.28	−0.15	0.49
a_t			0.67	−0.18	0.36
m_t				−0.09	0.18
wu_t					−0.32

Table 5: **Descriptive Statistics and Correlations for Benchmark Actual Factors**

Panel A in this table presents the time-series mean, median, minimum (Min.), maximum (Max.), standard deviation (Std.), skewness (Skew.), excess kurtosis (Kurt.), first-order autocorrelation coefficient (AR(1)) of each actual benchmark factor. Each actual factor is the ARMA(1,1) residual of the corresponding original factor. Panel B presents correlations between the actual benchmark factors. Factors are annualized and in percentage units. The sample period is from January 1991 to February 2022.

Panel A: Descriptive Statistics for Actual Factors

	Mean	**Median**	**Min.**	**Max.**	**Std.**	**Skew.**	**Kurt.**	**AR(1)**
u_t	0.00	−0.01	−0.54	2.61	0.16	11.39	181.95	0.00
e_t	−0.02	−0.04	−43.08	37.30	10.42	0.09	1.19	0.03
a_t	0.00	−0.06	−15.40	16.30	3.04	0.00	3.86	0.07
m_t	0.00	0.03	−14.61	16.81	5.14	0.02	0.36	−0.01
wu_t	0.05	−0.21	−137.25	152.29	30.46	−0.05	5.09	0.02
cli_t	0.00	−0.01	−4.63	4.90	0.53	0.68	49.63	0.04

Panel B: Correlations Between Actual Factors

	e_t	a_t	m_t	wu_t	cli_t
u_t	−0.16	−0.04	0.07	−0.09	−0.41
e_t		0.33	0.18	−0.11	0.35
a_t			0.34	−0.07	0.15
m_t				−0.02	0.02
wu_t					0.05

Table 6: **Fama-Macbeth Factor Lambda Estimation (60-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (unemployment rate u_t, energy e_t, agriculture a_t, precious metals m_t, world uncertainty wu_t and composite leading indicator cli_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
Intercept		2.01^{***}	2.01^{***}	1.82^{***}	1.94^{***}	1.98^{***}	1.99^{***}	1.93^{***}	1.76^{***}	1.69^{***}	1.69^{***}	1.67^{***}
		(34.50)	(34.70)	(39.25)	(35.06)	(35.35)	(37.20)	(31.79)	(34.22)	(35.01)	(34.83)	(34.71)
1. u_t	−0.29	-0.23^{***}						-0.16^{***}	-0.16^{***}	-0.15^{***}	-0.10^{***}	-0.09^{***}
		(−3.49)						(−3.32)	(−3.95)	(−3.60)	(−3.04)	(−2.65)
2. e_t	0.55		7.36^{***}					6.54^{***}	4.30^{***}	7.78^{***}	5.83^{***}	8.88^{***}
			(4.42)					(3.39)	(2.55)	(3.92)	(2.96)	(4.36)
3. a_t	0.23			3.25^{***}					2.50^{***}	3.89^{***}	3.06^{***}	2.32^{***}
				(5.46)					(3.88)	(6.11)	(5.19)	(4.10)
4. m_t	−0.09				-3.24^{***}					-4.34^{***}	-3.11^{***}	-7.11^{***}
					(−2.84)					(−3.82)	(−2.51)	(−5.87)
5. wu_t	−0.06					-24.22^{***}					-19.24^{***}	-30.24^{***}
						(−4.54)					(−4.03)	(−5.42)
6. cli_t	0.67						0.48^{***}					0.29^{***}
							(3.34)					(2.79)
R^2		0.11	0.13	0.16	0.12	0.11	0.10	0.20	0.28	0.33	0.37	0.41
	$corr(f, gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
Intercept		1.83^{***}	1.92^{***}	1.92^{***}	1.76^{***}	1.74^{***}	1.82^{***}	1.84^{***}	1.87^{***}	1.71^{***}	1.71^{***}	1.78^{***}
		(31.05)	(32.12)	(33.48)	(34.12)	(34.97)	(30.87)	(32.61)	(33.37)	(35.40)	(34.74)	(32.11)
1. u_t	−0.29	-0.17^{***}	-0.07^{***}	-0.16^{***}	-0.11^{***}	-0.14^{***}	-0.09^{***}	-0.14^{***}	-0.08^{***}	-0.14^{***}	-0.10^{***}	-0.08^{**}
		(−3.37)	(−2.50)	(−3.18)	(−3.53)	(−3.36)	(−2.81)	(−2.79)	(−2.70)	(−3.12)	(−2.98)	(−2.32)
2. e_t	0.55	12.34^{***}	4.36^{***}	5.76^{***}	3.53^{**}	5.59^{***}	8.04^{***}	9.24^{***}	8.02^{***}	7.86^{***}	7.43^{***}	9.36^{***}
		(5.92)	(2.75)	(2.96)	(2.25)	(2.96)	(4.48)	(4.31)	(4.44)	(3.69)	(4.15)	(4.73)
3. a_t	0.23				2.20^{***}	0.84				2.64^{***}	0.97^{*}	
					(3.52)	(1.28)				(4.40)	(1.49)	
4. m_t	−0.09	-6.21^{***}					-5.61^{***}	-10.39^{***}		-7.77^{***}		-10.02^{***}
		(−5.30)					(−4.59)	(−8.46)		(−6.73)		(−8.15)
5. wu_t	−0.06		-10.50^{***}		-7.01^{**}		-21.69^{***}		-26.77^{***}		-27.02^{***}	-36.56^{***}
			(−2.37)		(−1.72)		(−4.42)		(−4.27)		(−4.99)	(−5.91)
6. cli_t	0.67			0.65^{***}		0.43^{***}		0.58^{***}	0.30^{***}	0.53^{***}	0.26^{***}	0.23^{**}
				(4.02)		(3.57)		(3.88)	(2.85)	(3.98)	(2.52)	(2.19)
R^2		0.27	0.25	0.26	0.32	0.33	0.31	0.32	0.31	0.37	0.36	0.36

Table 7: **Fama-Macbeth Factor Lambda Estimation (90-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (unemployment rate u_t, energy e_t, agriculture a_t, precious metals m_t, world uncertainty wu_t and composite leading indicator cli_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 90-month rolling window. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**1′**	**2′**	**3′**	**4′**	**5′**	**6′**	**I′**	**II′**	**III′**	**IV′**	**V′**
Intercept		1.78^{***}	1.82^{***}	1.59^{***}	1.72^{***}	1.83^{***}	1.78^{***}	1.68^{***}	1.47^{***}	1.43^{***}	1.42^{***}	1.40^{***}
		(38.18)	(39.83)	(50.95)	(37.53)	(38.74)	(44.46)	(36.12)	(40.84)	(40.82)	(39.58)	(41.86)
1. u_t	−0.29	-0.25^{***}						-0.18^{***}	-0.18^{***}	-0.20^{***}	-0.15^{***}	-0.13^{***}
		(−3.73)						(−4.02)	(−4.61)	(−4.56)	(−4.49)	(−3.77)
2. e_t	0.55		9.72^{***}					9.50^{***}	8.08^{***}	8.54^{***}	7.62^{***}	6.00^{***}
			(5.81)					(4.81)	(5.53)	(5.48)	(4.89)	(4.11)
3. a_t	0.23			1.76^{***}					1.47^{**}	2.76^{***}	2.05^{***}	1.48^{***}
				(2.88)					(2.32)	(4.25)	(3.46)	(2.53)
4. m_t	−0.09				-5.01^{***}					-5.83^{***}	-3.33^{***}	-5.39^{***}
					(−3.78)					(−5.05)	(−2.54)	(−3.72)
5. wu_t	−0.06					-24.40^{***}					-22.00^{***}	-27.91^{***}
						(−4.05)					(−4.14)	(−5.01)
6. cli_t	0.67						0.42^{***}					0.18^{**}
							(3.25)					(1.73)
R^2		0.09	0.09	0.13	0.11	0.08	0.09	0.17	0.25	0.30	0.33	0.38
	$corr(f, gdp)$	**VI′**	**VII′**	**VIII′**	**IX′**	**X′**	**XI′**	**XII′**	**XIII′**	**XIV′**	**XV′**	**XVI′**
Intercept		1.58^{***}	1.65^{***}	1.66^{***}	1.46^{***}	1.48^{***}	1.56^{***}	1.57^{***}	1.59^{***}	1.45^{***}	1.44^{***}	1.50^{***}
		(33.33)	(35.22)	(40.01)	(40.82)	(41.68)	(31.99)	(37.11)	(38.72)	(41.24)	(43.05)	(35.54)
1. u_t	−0.29	-0.19^{***}	-0.10^{***}	-0.18^{***}	-0.13^{***}	-0.17^{***}	-0.13^{***}	-0.19^{***}	-0.06^{***}	-0.20^{***}	-0.10^{***}	-0.11^{***}
		(−3.79)	(−3.70)	(−4.09)	(−4.67)	(−4.41)	(−4.08)	(−3.89)	(−2.70)	(−4.18)	(−3.92)	(−3.38)
2. e_t	0.55	11.38^{***}	8.36^{***}	9.70^{***}	8.81^{***}	7.19^{***}	8.76^{***}	8.46^{***}	8.21^{***}	6.55^{***}	7.34^{***}	6.89^{***}
		(6.90)	(4.90)	(4.85)	(5.99)	(4.89)	(5.88)	(5.18)	(5.28)	(4.08)	(5.52)	(4.85)
3. a_t	0.23				1.68^{***}	1.59^{**}				1.98^{***}	1.68^{***}	
					(2.69)	(2.35)				(3.14)	(2.67)	
4. m_t	−0.09	-8.35^{***}					-7.45^{***}	-8.74^{***}		-5.95^{***}		-9.19^{***}
		(−6.50)					(−5.67)	(−6.08)		(−4.35)		(−6.47)
5. wu_t	−0.06		-14.39^{***}		-8.53^{**}		-26.79^{***}		-22.46^{***}		-12.19^{**}	-38.20^{***}
			(−3.00)		(−1.76)		(−5.16)		(−3.58)		(−2.25)	(−6.78)
6. cli_t	0.67			0.44^{***}		0.22^{**}		0.48^{***}	−0.04	0.41^{***}	0.00	0.13^{*}
				(3.35)		(2.26)		(3.37)	(−0.51)	(3.10)	(−0.05)	(1.30)
R^2		0.24	0.22	0.21	0.29	0.29	0.28	0.29	0.27	0.34	0.33	0.33

Table 8: **Fama-Macbeth Factor Lambda Estimation for Countries with GDP>Median (60-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (unemployment rate u_t, energy e_t, agriculture a_t, precious metals m_t, world uncertainty wu_t and composite leading indicator cli_t) for 90 countries with real GDP higher than the median of 181. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Columns **[1]** to **[6]** in this table report the univariate estimation for the corresponding factors, and columns **[I]** to **[XVI]** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[I]**	**[II]**	**[III]**	**[IV]**	**[V]**
Intercept		0.55^{***}	0.61^{***}	0.43^{***}	0.60^{***}	0.53^{***}	0.63^{***}	0.47^{***}	0.24^{***}	0.17^{***}	0.14^{***}	0.13^{***}
		(8.87)	(10.79)	(10.78)	(11.18)	(9.08)	(11.52)	(8.37)	(5.94)	(4.33)	(3.58)	(3.27)
1. u_t	−0.29	-0.38^{***}						-0.21^{**}	-0.14^{***}	-0.17^{***}	-0.13^{***}	-0.19^{***}
		(−2.91)						(−2.33)	(−2.87)	(−3.40)	(−3.38)	(−5.09)
2. e_t	0.55		8.72^{***}					1.90	-3.31^{*}	0.52	3.13^{*}	0.91
			(3.68)					(0.72)	(−1.60)	(0.26)	(1.44)	(0.43)
3. a_t	0.23			0.77					2.65^{***}	2.40^{***}	1.94^{**}	2.24^{***}
				(0.96)					(3.04)	(2.76)	(2.24)	(2.50)
4. m_t	−0.09				−2.16					6.12^{***}	7.01^{***}	2.56^{*}
					(−1.12)					(4.05)	(4.50)	(1.58)
5. wu_t	−0.06					−6.89					-8.89^{*}	−7.11
						(−0.83)					(−1.41)	(−1.05)
6. cli_t	0.67						0.97^{***}					0.16
							(3.81)					(1.07)
R^2		0.15	0.16	0.20	0.19	0.16	0.14	0.26	0.35	0.41	0.45	0.48

	$corr(f, gdp)$	**[VI]**	**[VII]**	**[VIII]**	**[IX]**	**[X]**	**[XI]**	**[XII]**	**[XIII]**	**[XIV]**	**[XV]**	**[XVI]**
Intercept		0.40^{***}	0.40^{***}	0.44^{***}	0.18^{***}	0.19^{***}	0.37^{***}	0.35^{***}	0.38^{***}	0.14^{***}	0.17^{***}	0.33^{***}
		(8.08)	(7.23)	(7.98)	(4.57)	(4.66)	(7.20)	(7.29)	(6.90)	(3.56)	(3.97)	(6.71)
1. u_t	−0.29	-0.23^{***}	−0.04	-0.18^{***}	-0.08^{**}	-0.18^{***}	-0.09^{**}	-0.21^{***}	-0.14^{***}	-0.20^{***}	-0.17^{***}	-0.16^{***}
		(−3.24)	(−0.81)	(−3.80)	(−2.14)	(−4.35)	(−2.27)	(−4.18)	(−4.28)	(−4.33)	(−5.24)	(−4.49)
2. e_t	0.55	2.35	0.90	−1.30	−1.72	-3.74^{**}	2.44^{*}	−1.22	0.12	−1.35	−0.97	−1.04
		(1.07)	(0.45)	(−0.59)	(−0.90)	(−1.72)	(1.30)	(−0.57)	(0.06)	(−0.64)	(−0.49)	(−0.54)
3. a_t	0.23				2.16^{***}	2.47^{***}				2.21^{***}	2.68^{***}	
					(2.63)	(2.76)				(2.48)	(2.99)	
4. m_t	−0.09	0.67					0.68	-3.38^{**}		3.08^{**}		-3.48^{**}
		(0.39)					(0.42)	(−1.84)		(1.87)		(−2.01)
5. wu_t	−0.06		3.79		−2.61		0.53		-17.37^{**}		-14.68^{**}	-10.35^{*}
			(0.55)		(−0.46)		(0.09)		(−2.23)		(−2.15)	(−1.46)
6. cli_t	0.67			0.36^{**}		0.25^{*}		0.32^{**}	0.06	0.40^{**}	0.10	0.00
				(1.91)		(1.44)		(1.68)	(0.39)	(2.15)	(0.71)	(−0.01)
R^2		0.33	0.31	0.31	0.39	0.40	0.37	0.38	0.36	0.45	0.43	0.42

Table 9: **Fama-Macbeth Factor Lambda Estimation for Countries with GDP<Median (60-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (unemployment rate u_t, energy e_t, agriculture a_t, precious metals m_t, world uncertainty wu_t and composite leading indicator cli_t) for 90 countries with real GDP lower than the median of 181. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Columns **(1)** to **(6)** in this table report the univariate estimation for the corresponding factors, and columns **(I)** to **(XVI)** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(I)**	**(II)**	**(III)**	**(IV)**	**(V)**
Intercept		3.55^{***}	3.61^{***}	3.38^{***}	3.40^{***}	3.52^{***}	3.47^{***}	3.56^{***}	3.45^{***}	3.38^{***}	3.35^{***}	3.35^{***}
		(46.76)	(42.64)	(49.39)	(46.30)	(47.27)	(49.36)	(40.71)	(41.86)	(41.90)	(41.74)	(41.40)
1. u_t	-0.29	-0.14^{***}						-0.09^{***}	-0.12^{***}	-0.10^{***}	-0.08^{**}	-0.06^{**}
		(-3.82)						(-2.96)	(-3.39)	(-2.86)	(-2.33)	(-1.83)
2. e_t	0.55		5.06^{***}					5.00^{***}	5.41^{***}	9.00^{***}	6.65^{***}	12.02^{***}
			(3.21)					(3.28)	(3.44)	(4.62)	(3.46)	(5.88)
3. a_t	0.23			3.77^{***}					1.50^{***}	2.31^{***}	1.50^{***}	-0.20
				(7.20)					(2.63)	(4.14)	(2.88)	(-0.41)
4. m_t	-0.09				-1.52^{*}					-4.97^{***}	-3.84^{***}	-7.92^{***}
					(-1.47)					(-5.02)	(-3.37)	(-7.12)
5. wu_t	-0.06					-15.78^{***}					-16.39^{***}	-35.70^{***}
						(-3.02)					(-3.15)	(-5.67)
6. cli_t	0.67						0.26^{***}					0.30^{***}
							(3.11)					(2.77)
R^2		0.15	0.15	0.15	0.12	0.12	0.12	0.23	0.31	0.35	0.40	0.45
	$corr(f, gdp)$	**(VI)**	**(VII)**	**(VIII)**	**(IX)**	**(X)**	**(XI)**	**(XII)**	**(XIII)**	**(XIV)**	**(XV)**	**(XVI)**
Intercept		3.42^{***}	3.53^{***}	3.56^{***}	3.43^{***}	3.47^{***}	3.39^{***}	3.47^{***}	3.51^{***}	3.44^{***}	3.41^{***}	3.39^{***}
		(40.75)	(41.04)	(42.75)	(41.43)	(42.26)	(39.93)	(41.45)	(42.48)	(41.74)	(41.57)	(40.53)
1. u_t	-0.29	-0.09^{***}	-0.07^{***}	-0.09^{**}	-0.10^{***}	-0.09^{***}	-0.08^{**}	-0.07^{**}	-0.07^{**}	-0.08^{**}	-0.09^{**}	-0.07^{**}
		(-2.70)	(-2.53)	(-2.36)	(-3.01)	(-2.55)	(-2.32)	(-1.93)	(-2.26)	(-2.26)	(-2.35)	(-1.88)
2. e_t	0.55	11.22^{***}	2.83^{**}	4.16^{**}	3.82^{***}	7.00^{***}	7.42^{***}	10.64^{***}	6.31^{***}	11.32^{***}	8.40^{***}	10.72^{***}
		(6.36)	(2.03)	(2.36)	(2.56)	(3.86)	(4.41)	(5.16)	(3.67)	(5.21)	(4.76)	(5.46)
3. a_t	0.23				1.04^{**}	-0.96^{**}				0.25	-1.00^{**}	
					(1.84)	(-1.68)				(0.50)	(-1.72)	
4. m_t	-0.09	-6.72^{***}					-5.99^{***}	-10.91^{***}		-8.57^{***}		-10.31^{***}
		(-6.50)					(-5.30)	(-9.64)		(-8.25)		(-8.91)
5. wu_t	-0.06		-8.05^{**}		-6.78^{*}		-17.49^{***}		-19.60^{***}		-27.38^{***}	-34.98^{***}
			(-1.77)		(-1.53)		(-3.31)		(-3.38)		(-4.55)	(-5.60)
6. cli_t	0.67			0.47^{***}		0.36^{***}		0.45^{***}	0.30^{***}	0.48^{***}	0.24^{**}	0.24^{**}
				(4.03)		(3.98)		(4.35)	(3.59)	(4.36)	(2.30)	(2.26)
R^2		0.30	0.29	0.30	0.36	0.36	0.36	0.37	0.35	0.41	0.41	0.41

Table 10: **Robustness Check: 60-Month Rolling Window**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of additional nine factors (seven procyclical factors: commodity prices of crude oil oil_t, food $food_t$, grains $grain_t$, raw materials raw_t, timber $timber_t$, as well as production of total industry mei_t, consumer confidence index cci_t; two countercyclical factors: world uncertainty-simple average wus_t, and exchange rate ex_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Intercept		2.01^{***}	1.95^{***}	2.00^{***}	1.95^{***}	1.99^{***}	2.05^{***}	2.04^{***}	1.98^{***}	2.00^{***}
		(35.58)	(35.90)	(36.85)	(38.41)	(37.62)	(34.62)	(36.17)	(37.16)	(32.47)
7. oil_t	0.54	8.15^{***}								
		(4.20)								
8. $food_t$	0.21		2.43^{***}							
			(3.35)							
9. $grain_t$	0.15			5.28^{***}						
				(3.84)						
10. raw_t	0.20				2.38^{***}					
					(4.88)					
11. $timber_t$	0.07					2.00^{***}				
						(4.05)				
12. mei_t	0.88						0.98^{***}			
							(2.46)			
13. cci_t	0.55							0.05^{**}		
								(2.29)		
14. wus_t	−0.10								-8.29^{***}	
									(−3.46)	
15. ex_t	−0.02									-8.97^{***}
										(−6.57)
R^2		0.12	0.15	0.14	0.13	0.13	0.10	0.10	0.10	0.12

Table 11: **Robustness Check: 90-Month Rolling Window**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of additional nine factors (seven procyclical factors: commodity prices of crude oil oil_t, food $food_t$, grains $grain_t$, raw materials raw_t, timber $timber_t$, as well as production of total industry mei_t, consumer confidence index cci_t; two countercyclical factors: world uncertainty-simple average wus_t, and exchange rate ex_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 90-month rolling window. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**7′**	**8′**	**9′**	**10′**	**11′**	**12′**	**13′**	**14′**	**15′**
$Intercept$		1.83^{***}	1.75^{***}	1.79^{***}	1.70^{***}	1.78^{***}	1.88^{***}	1.84^{***}	1.84^{***}	1.86^{***}
		(40.64)	(37.52)	(38.99)	(48.72)	(46.95)	(38.37)	(42.42)	(39.37)	(36.97)
7. oil_t	0.54	12.02^{***}								
		(6.11)								
8. $food_t$	0.21		1.38^{**}							
			(1.94)							
9. $grain_t$	0.15			3.68^{***}						
				(2.97)						
10. raw_t	0.20				1.87^{***}					
					(3.45)					
11. $timber_t$	0.07					2.73^{***}				
						(5.30)				
12. mei_t	0.88						0.51^{*}			
							(1.48)			
13. cci_t	0.55							0.04^{**}		
								(2.24)		
14. wus_t	-0.10								-13.68^{***}	
									(-5.19)	
15. ex_t	-0.02									-8.13^{***}
										(-5.76)
R^2		0.09	0.11	0.12	0.11	0.09	0.06	0.08	0.08	0.09

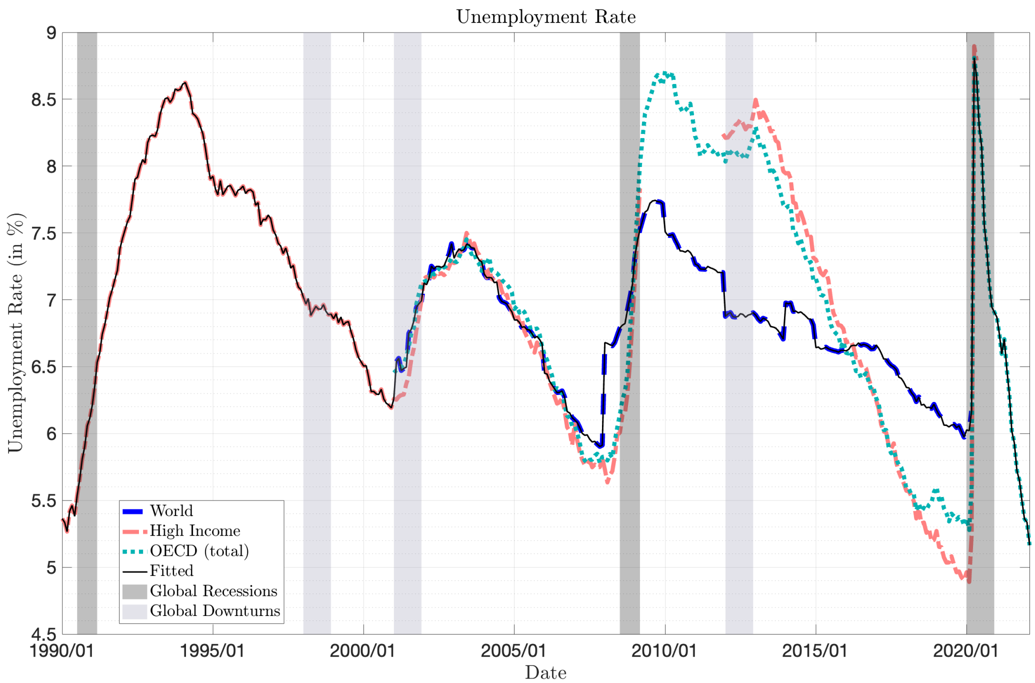
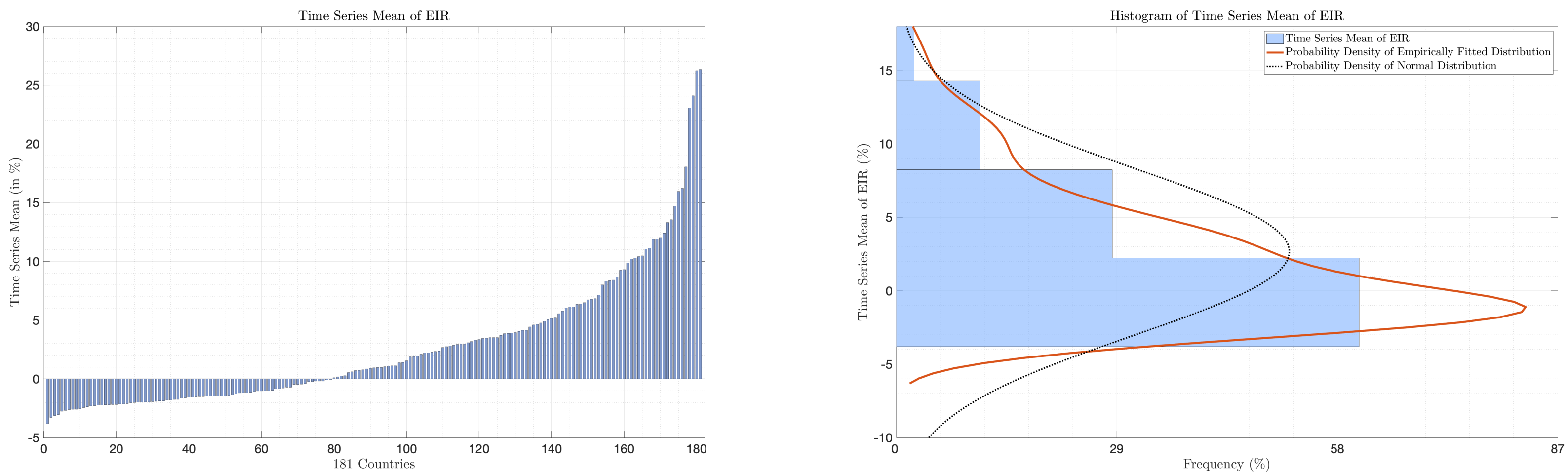


Figure 1: **Time Series of Global Unemployment Rate**
The global unemployment rate are fitted, data sources are reported in Table 2. Data are monthly, from January 1991 to February 2022.



(a) Sorted Time Series Mean of EIR

(b) Time Series Mean of EIR Histogram

Figure 2: **Time Series Mean of Excess Inflation Rate (EIR)**
The 181 countries of countries are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

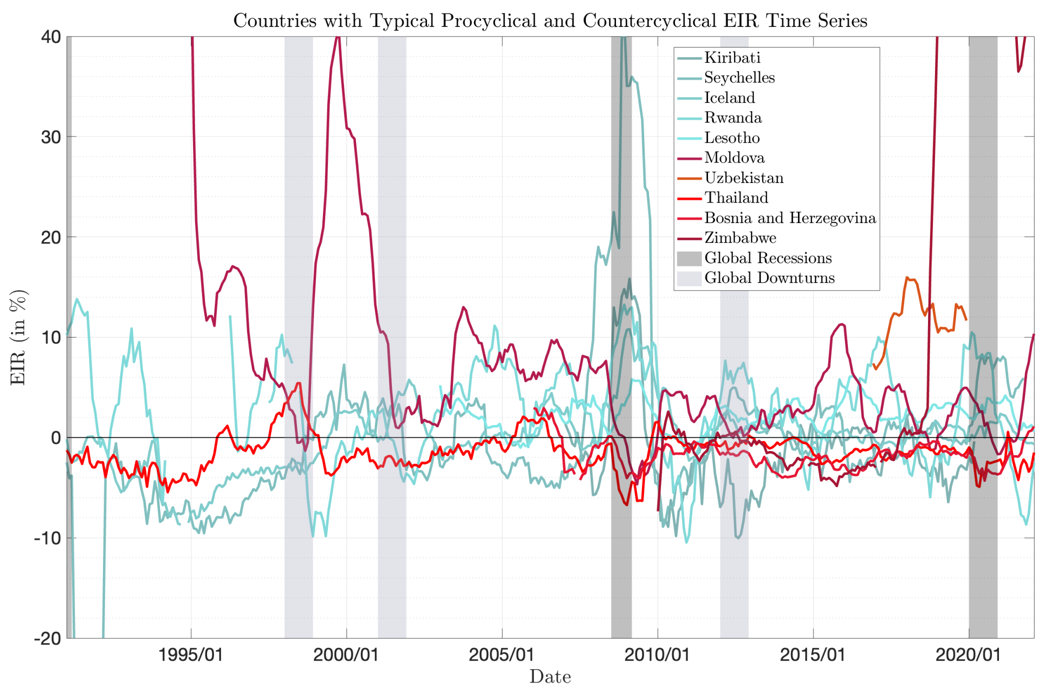
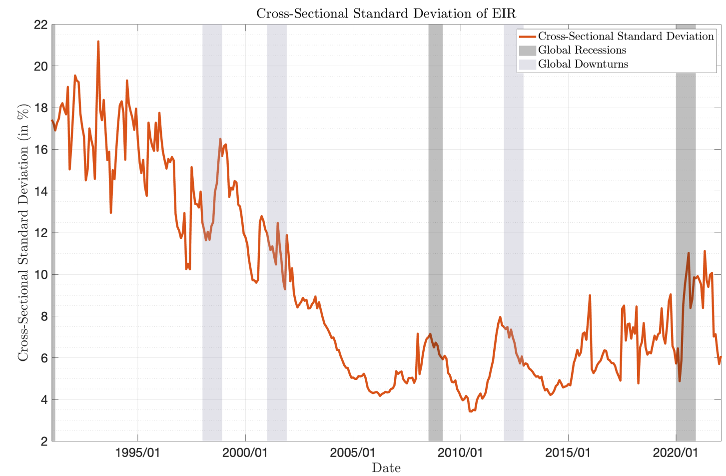
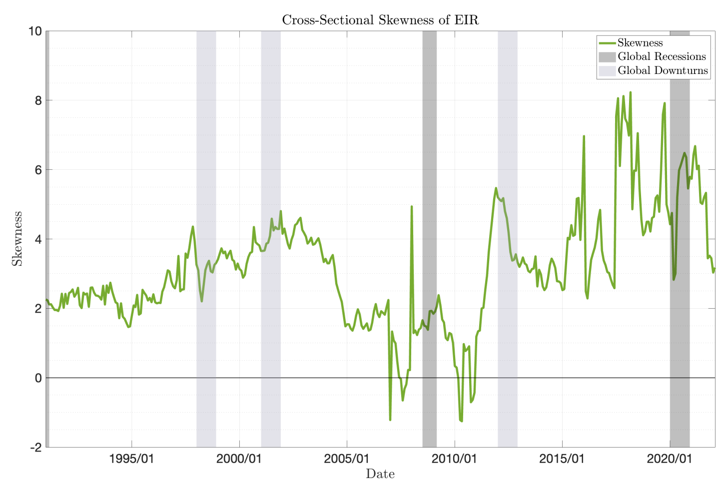


Figure 3: **Countries with Typical Procyclical and Countercyclical EIR Time Series**
This figure plots the time series of the most procyclical EIR of five countries (red series), and the most countercyclical EIR of five countries (blue series) based on their correlation with global real GDP growth. Data are annualized monthly, from January 1991 to February 2022.

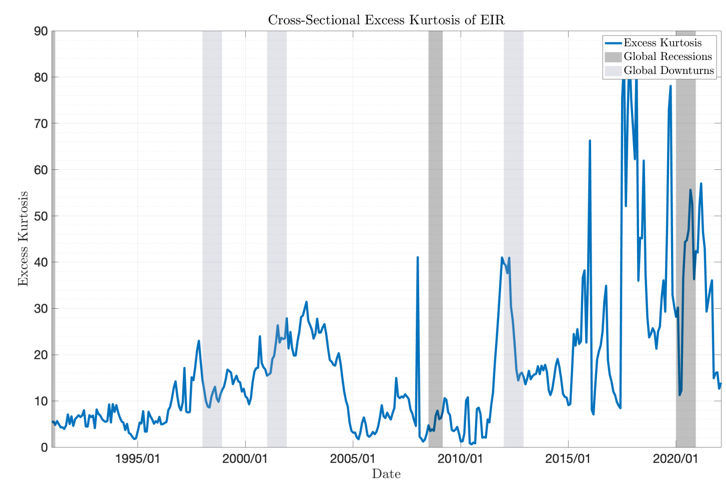
(a) Cross-Sectional Mean and Median of EIR



(b) Cross-Sectional Standard Deviation of EIR



(c) Cross-Sectional Skewness of EIR



(d) Cross-Sectional Excess Kurtosis of EIR

Figure 4: **Time Series Plots of Cross-Sectional Moments of Excess Inflation Rate (EIR)**
The 181 countries of their EIR are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

Online Appendix for

"Why Do Inflation Rates Vary Across Countries?"

Bingxin Xing*

ESSEC Business School

November 14, 2022

Abstract

This document contains supplementary material, additional studies, and robustness checks that are relevant or briefly discussed in the main paper. Precisely, it consists of two sets of further analyses: Appendix A reports supplementary material and more details to the article; Appendix B provides the results based on inflation rates (IR), in contrast with those of the excess inflation rates (EIR).

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Appendix A Supplemental details

Table A1: **Fama-Macbeth Factor Lambda Estimation (60(t1)-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window; in the 2nd stage estimation of FM, the sample month is one month ahead (labeled as (t1) in the caption) of the 60 months used in the 1st stage estimation of FM. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multivariate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$		1.99^{***}	2.00^{***}	1.81^{***}	1.93^{***}	1.97^{***}	1.97^{***}	1.92^{***}	1.74^{***}	1.67^{***}	1.67^{***}	1.65^{***}
		(35.10)	(35.12)	(39.73)	(35.51)	(35.38)	(37.88)	(32.10)	(34.44)	(35.37)	(34.96)	(34.98)
1. u_t	-0.29	-0.20^{***}						-0.15^{***}	-0.16^{***}	-0.15^{***}	-0.11^{***}	-0.10^{***}
		(-3.18)						(-2.94)	(-3.98)	(-3.72)	(-3.24)	(-2.74)
2. e_t	0.55		6.87^{***}					6.35^{***}	4.30^{***}	7.83^{***}	5.72^{***}	9.12^{***}
			(4.49)					(3.44)	(2.65)	(3.96)	(2.93)	(4.41)
3. a_t	0.23			3.09^{***}					2.53^{***}	3.86^{***}	3.05^{***}	2.27^{***}
				(5.39)					(3.95)	(6.00)	(5.10)	(4.01)
4. m_t	-0.09				-3.30^{***}					-4.07^{***}	-2.64^{**}	-6.98^{***}
					(-3.06)					(-3.64)	(-2.15)	(-5.80)
5. wu_t	-0.06					-25.71^{***}					-21.88^{***}	-32.34^{***}
						(-5.00)					(-4.60)	(-5.71)
6. cli_t	0.67						0.51^{***}					0.34^{***}
							(3.41)					(2.95)
R^2		0.10	0.12	0.15	0.12	0.11	0.10	0.19	0.26	0.31	0.35	0.39

	$corr(f, gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$Intercept$		1.82^{***}	1.90^{***}	1.90^{***}	1.73^{***}	1.72^{***}	1.81^{***}	1.82^{***}	1.85^{***}	1.69^{***}	1.69^{***}	1.77^{***}
		(31.54)	(32.21)	(34.00)	(34.21)	(35.34)	(31.02)	(33.10)	(33.69)	(35.91)	(34.98)	(32.30)
1. u_t	-0.29	-0.17^{***}	-0.06^{**}	-0.14^{***}	-0.11^{***}	-0.14^{***}	-0.09^{***}	-0.13^{***}	-0.09^{***}	-0.14^{***}	-0.11^{***}	-0.09^{***}
		(-3.40)	(-1.91)	(-2.59)	(-3.64)	(-3.20)	(-2.96)	(-2.41)	(-2.79)	(-2.97)	(-3.06)	(-2.54)
2. e_t	0.55	12.13^{***}	3.76^{***}	5.40^{***}	3.30^{**}	5.81^{***}	7.40^{***}	9.12^{***}	7.57^{***}	8.01^{***}	7.69^{***}	9.19^{***}
		(5.94)	(2.53)	(2.90)	(2.18)	(3.11)	(4.25)	(4.29)	(4.33)	(3.75)	(4.26)	(4.62)
3. a_t	0.23				2.30^{***}	0.72				2.53^{***}	0.89^{*}	
					(3.67)	(1.11)				(4.26)	(1.37)	
4. m_t	-0.09	-6.11^{***}					-5.44^{***}	-10.23^{***}		-7.76^{***}		-10.03^{***}
		(-5.39)					(-4.58)	(-8.50)		(-6.89)		(-8.32)
5. wu_t	-0.06		-13.88^{***}		-8.83^{**}		-24.40^{***}		-30.97^{***}		-29.16^{***}	-39.09^{***}
			(-3.14)		(-2.13)		(-4.95)		(-4.98)		(-5.40)	(-6.34)
6. cli_t	0.67			0.63^{***}		0.45^{***}		0.57^{***}	0.31^{***}	0.56^{***}	0.31^{***}	0.27^{**}
				(3.78)		(3.59)		(3.68)	(2.77)	(3.93)	(2.67)	(2.38)
R^2		0.25	0.23	0.24	0.30	0.31	0.29	0.30	0.29	0.35	0.35	0.34

Table A2: **Fama-Macbeth Factor Lambda Estimation (60(t2)-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window; in the 2nd stage estimation of FM, the sample month is two month ahead (labeled as (t2) in the caption) of the 60 months used in the 1st stage estimation of FM. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multivariate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$		1.98^{***}	2.00^{***}	1.79^{***}	1.92^{***}	1.96^{***}	1.96^{***}	1.92^{***}	1.72^{***}	1.65^{***}	1.65^{***}	1.63^{***}
		(35.72)	(35.73)	(40.41)	(36.07)	(35.42)	(38.66)	(32.58)	(35.06)	(36.08)	(35.43)	(35.57)
1. u_t	-0.29	-0.16^{***}						-0.13^{***}	-0.14^{***}	-0.13^{***}	-0.09^{***}	-0.09^{**}
		(-2.80)						(-2.37)	(-3.17)	(-3.14)	(-2.63)	(-2.38)
2. e_t	0.55		6.06^{***}					5.83^{***}	3.96^{***}	7.14^{***}	4.94^{***}	8.26^{***}
			(4.30)					(3.36)	(2.56)	(3.89)	(2.75)	(4.28)
3. a_t	0.23			2.94^{***}					2.51^{***}	3.83^{***}	3.04^{***}	2.13^{***}
				(5.29)					(3.95)	(5.92)	(4.99)	(3.79)
4. m_t	-0.09				-3.22^{***}					-4.10^{***}	-2.48^{**}	-6.91^{***}
					(-3.10)					(-3.67)	(-2.01)	(-5.67)
5. wu_t	-0.06					-27.43^{***}					-25.05^{***}	-34.66^{***}
						(-5.36)					(-5.14)	(-5.93)
6. cli_t	0.67						0.52^{***}					0.28^{***}
							(3.39)					(2.56)
R^2		0.10	0.11	0.14	0.11	0.11	0.09	0.17	0.25	0.30	0.34	0.37

	$corr(f, gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$Intercept$		1.81^{***}	1.89^{***}	1.88^{***}	1.71^{***}	1.71^{***}	1.80^{***}	1.80^{***}	1.84^{***}	1.67^{***}	1.68^{***}	1.75^{***}
		(32.26)	(32.40)	(34.67)	(34.56)	(36.03)	(31.38)	(33.82)	(34.10)	(36.63)	(35.46)	(32.76)
1. u_t	-0.29	-0.15^{***}	-0.04	-0.11^{**}	-0.09^{***}	-0.12^{***}	-0.07^{**}	-0.11^{**}	-0.08^{**}	-0.12^{***}	-0.10^{***}	-0.08^{**}
		(-2.85)	(-1.12)	(-2.08)	(-2.70)	(-2.78)	(-2.19)	(-2.09)	(-2.30)	(-2.59)	(-2.70)	(-2.19)
2. e_t	0.55	11.23^{***}	3.01^{**}	4.91^{***}	2.65^{**}	5.37^{***}	6.36^{***}	8.63^{***}	6.56^{***}	7.22^{***}	6.65^{***}	8.32^{***}
		(5.73)	(2.19)	(2.72)	(1.87)	(2.95)	(3.83)	(4.09)	(3.94)	(3.55)	(3.87)	(4.25)
3. a_t	0.23				2.37^{***}	0.70				2.43^{***}	0.84	
					(3.76)	(1.09)				(4.14)	(1.32)	
4. m_t	-0.09	-6.09^{***}					-5.27^{***}	-9.91^{***}		-7.59^{***}		-10.00^{***}
		(-5.50)					(-4.56)	(-8.23)		(-6.73)		(-8.31)
5. wu_t	-0.06		-17.61^{***}		-12.17^{***}		-26.94^{***}		-34.30^{***}		-31.36^{***}	-40.65^{***}
			(-4.01)		(-2.80)		(-5.45)		(-5.45)		(-5.76)	(-6.55)
6. cli_t	0.67			0.59^{***}		0.44^{***}		0.55^{***}	0.26^{***}	0.53^{***}	0.26^{**}	0.23^{**}
				(3.56)		(3.47)		(3.54)	(2.40)	(3.68)	(2.32)	(1.98)
R^2		0.24	0.22	0.23	0.28	0.29	0.28	0.29	0.27	0.34	0.33	0.33

Table A3: **Fama-Macbeth Factor Lambda Estimation (60(t3)-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window; in the 2nd stage estimation of FM, the sample month is three month ahead (labeled as (t3) in the caption) of the 60 months used in the 1st stage estimation of FM.. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multivariate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$		1.97^{***}	1.99^{***}	1.78^{***}	1.92^{***}	1.95^{***}	1.94^{***}	1.91^{***}	1.71^{***}	1.64^{***}	1.63^{***}	1.61^{***}
		(36.34)	(36.40)	(41.47)	(36.71)	(35.54)	(39.66)	(33.15)	(36.00)	(37.20)	(36.37)	(36.71)
1. u_t	-0.29	-0.13^{**}						-0.10^{**}	-0.11^{***}	-0.11^{***}	-0.07^{**}	-0.07^{**}
		(-2.37)						(-1.87)	(-2.56)	(-2.64)	(-2.14)	(-1.77)
2. e_t	0.55		5.13^{***}					5.22^{***}	3.53^{***}	6.47^{***}	4.47^{***}	7.87^{***}
			(3.95)					(3.26)	(2.44)	(3.67)	(2.60)	(4.16)
3. a_t	0.23			2.86^{***}					2.61^{***}	3.91^{***}	3.07^{***}	2.02^{***}
				(5.31)					(4.17)	(6.06)	(4.99)	(3.58)
4. m_t	-0.09				-3.07^{***}					-4.18^{***}	-2.36^{**}	-6.75^{***}
					(-3.05)					(-3.86)	(-1.96)	(-5.53)
5. wu_t	-0.06					-27.44^{***}					-25.91^{***}	-35.13^{***}
						(-5.33)					(-5.27)	(-5.95)
6. cli_t	0.67						0.48^{***}					0.25^{***}
							(3.15)					(2.42)
R^2		0.09	0.10	0.13	0.11	0.10	0.08	0.16	0.23	0.29	0.32	0.35

	$corr(f, gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$Intercept$		1.80^{***}	1.88^{***}	1.87^{***}	1.69^{***}	1.69^{***}	1.79^{***}	1.79^{***}	1.82^{***}	1.65^{***}	1.67^{***}	1.74^{***}
		(33.12)	(32.81)	(35.81)	(35.31)	(37.32)	(32.01)	(35.05)	(34.97)	(38.02)	(36.44)	(33.68)
1. u_t	-0.29	-0.11^{**}	-0.01	-0.07^{*}	-0.07^{**}	-0.09^{**}	-0.04^{*}	-0.08^{*}	-0.05^{*}	-0.09^{**}	-0.07^{**}	-0.05^{*}
		(-2.29)	(-0.41)	(-1.45)	(-1.99)	(-2.04)	(-1.38)	(-1.61)	(-1.49)	(-2.06)	(-1.93)	(-1.49)
2. e_t	0.55	10.40^{***}	2.44^{**}	4.72^{***}	2.18^{*}	5.16^{***}	5.61^{***}	8.47^{***}	6.03^{***}	6.68^{***}	6.30^{***}	7.83^{***}
		(5.64)	(1.92)	(2.72)	(1.65)	(2.95)	(3.58)	(4.08)	(3.78)	(3.36)	(3.81)	(4.14)
3. a_t	0.23				2.48^{***}	0.71				2.37^{***}	0.82^{*}	
					(3.92)	(1.14)				(4.06)	(1.32)	
4. m_t	-0.09	-6.02^{***}					-5.22^{***}	-9.78^{***}		-7.48^{***}		-10.06^{***}
		(-5.58)					(-4.70)	(-8.25)		(-6.66)		(-8.49)
5. wu_t	-0.06		-19.03^{***}		-14.46^{***}		-26.66^{***}		-36.46^{***}		-33.08^{***}	-40.54^{***}
			(-4.33)		(-3.17)		(-5.47)		(-5.71)		(-6.00)	(-6.47)
6. cli_t	0.67			0.49^{***}		0.36^{***}		0.47^{***}	0.23^{**}	0.46^{***}	0.22^{**}	0.21^{**}
				(3.15)		(3.00)		(3.24)	(2.11)	(3.31)	(2.10)	(1.91)
R^2		0.22	0.20	0.21	0.27	0.28	0.26	0.27	0.26	0.32	0.31	0.31

Table A4: **Group by EIR (EIR >0, 102 Countries and Regions) Fama-Macbeth Factor Lambda Estimation (60-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f,gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$		4.82^{***}	4.72^{***}	4.43^{***}	4.54^{***}	4.65^{***}	4.66^{***}	4.73^{***}	4.53^{***}	4.41^{***}	4.40^{***}	4.38^{***}
		(38.53)	(37.76)	(41.77)	(39.39)	(39.55)	(41.27)	(35.64)	(37.43)	(37.45)	(37.35)	(36.32)
1. u_t	-0.29	-0.31^{***}						-0.24^{***}	-0.23^{***}	-0.21^{***}	-0.16^{***}	-0.16^{***}
		(-3.77)						(-3.61)	(-4.28)	(-4.02)	(-3.56)	(-3.30)
2. e_t	0.55		6.32^{***}					6.41^{***}	3.43^{**}	6.98^{***}	4.70^{**}	7.71^{***}
			(3.78)					(3.18)	(1.92)	(3.43)	(2.36)	(3.76)
3. a_t	0.23			3.55^{***}					3.32^{***}	5.17^{***}	4.36^{***}	3.09^{***}
				(5.97)					(5.15)	(7.93)	(7.04)	(5.23)
4. m_t	-0.09				-2.30^{**}					-4.55^{***}	-3.71^{***}	-8.43^{***}
					(-2.06)					(-3.90)	(-2.85)	(-6.83)
5. wu_t	-0.06					-20.91^{***}					-14.54^{***}	-29.01^{***}
						(-3.88)					(-2.85)	(-4.79)
6. cli_t	0.67						0.53^{***}					0.47^{***}
							(3.52)					(3.55)
R^2		0.13	0.14	0.17	0.13	0.13	0.11	0.23	0.31	0.37	0.42	0.46

	$corr(f,gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$Intercept$		4.53^{***}	4.72^{***}	4.74^{***}	4.52^{***}	4.51^{***}	4.53^{***}	4.56^{***}	4.66^{***}	4.44^{***}	4.46^{***}	4.49^{***}
		(34.08)	(35.73)	(36.36)	(37.25)	(37.31)	(33.96)	(34.77)	(36.24)	(36.88)	(36.96)	(34.40)
1. u_t	-0.29	-0.23^{***}	-0.12^{***}	-0.23^{***}	-0.19^{***}	-0.21^{***}	-0.15^{***}	-0.20^{***}	-0.14^{***}	-0.20^{***}	-0.18^{***}	-0.14^{***}
		(-3.72)	(-3.19)	(-3.51)	(-4.02)	(-3.81)	(-3.37)	(-3.20)	(-3.24)	(-3.64)	(-3.60)	(-2.99)
2. e_t	0.55	12.64^{***}	3.69^{**}	4.89^{**}	2.54^{*}	4.43^{**}	8.23^{***}	9.52^{***}	7.73^{***}	6.80^{***}	6.73^{***}	9.99^{***}
		(5.74)	(2.20)	(2.37)	(1.51)	(2.22)	(4.28)	(4.16)	(3.93)	(3.15)	(3.48)	(4.63)
3. a_t	0.23				2.87^{***}	1.05^{*}				3.62^{***}	1.00^{*}	
					(4.57)	(1.56)				(5.84)	(1.50)	
4. m_t	-0.09	-4.80^{***}					-4.16^{***}	-9.76^{***}		-8.44^{***}		-9.93^{***}
		(-4.09)					(-3.39)	(-7.68)		(-7.22)		(-7.57)
5. wu_t	-0.06		-5.42		-2.82		-17.56^{***}		-24.42^{***}		-26.02^{***}	-37.03^{***}
			(-1.19)		(-0.67)		(-3.44)		(-3.69)		(-4.35)	(-5.55)
6. cli_t	0.67			0.80^{***}		0.56^{***}		0.72^{***}	0.46^{***}	0.64^{***}	0.44^{***}	0.40^{***}
				(4.26)		(4.04)		(4.20)	(3.53)	(4.36)	(3.33)	(3.13)
R^2		0.30	0.29	0.30	0.36	0.37	0.35	0.36	0.35	0.42	0.42	0.41

Table A5: **Group by EIR (Import < Meidan) Fama-Macbeth Factor Lambda Estimation (60-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$		2.86^{***}	2.87^{***}	2.61^{***}	2.74^{***}	2.75^{***}	2.83^{***}	2.82^{***}	2.54^{***}	2.44^{***}	2.35^{***}	2.28^{***}
		(38.91)	(39.30)	(44.14)	(39.16)	(42.01)	(43.93)	(36.23)	(39.21)	(37.55)	(36.61)	(35.90)
1. u_t	-0.29	-0.16^{***}						-0.13^{***}	-0.15^{***}	-0.15^{***}	-0.13^{***}	-0.15^{***}
		(-4.25)						(-3.76)	(-4.09)	(-3.89)	(-3.49)	(-3.61)
2. e_t	0.55		2.56^{*}					2.23^{*}	0.28	6.33^{***}	2.42	0.25
			(1.54)					(1.38)	(0.17)	(2.78)	(1.09)	(0.11)
3. a_t	0.23			3.79^{***}					2.51^{***}	4.52^{***}	3.75^{***}	3.60^{***}
				(5.95)					(3.49)	(6.46)	(5.56)	(4.80)
4. m_t	-0.09				-4.69^{***}					-7.53^{***}	-6.15^{***}	-8.89^{***}
					(-3.76)					(-5.58)	(-4.04)	(-5.07)
5. wu_t	-0.06					-29.77^{***}					-42.44^{***}	-48.38^{***}
						(-4.79)					(-6.00)	(-5.65)
6. cli_t	0.67						0.24^{***}					0.37^{***}
							(2.62)					(2.93)
R^2		0.13	0.13	0.14	0.13	0.12	0.12	0.21	0.30	0.36	0.41	0.46

	$corr(f, gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$Intercept$		2.64^{***}	2.67^{***}	2.75^{***}	2.40^{***}	2.44^{***}	2.54^{***}	2.59^{***}	2.69^{***}	2.36^{***}	2.36^{***}	2.51^{***}
		(34.18)	(36.65)	(37.86)	(37.91)	(38.98)	(33.96)	(34.23)	(37.35)	(37.39)	(38.25)	(33.45)
1. u_t	-0.29	-0.14^{***}	-0.10^{***}	-0.12^{***}	-0.13^{***}	-0.15^{***}	-0.12^{***}	-0.13^{***}	-0.12^{***}	-0.17^{***}	-0.16^{***}	-0.13^{***}
		(-3.59)	(-3.49)	(-3.24)	(-3.93)	(-4.07)	(-3.31)	(-3.10)	(-3.20)	(-4.17)	(-3.63)	(-3.03)
2. e_t	0.55	8.16^{***}	-2.18^{*}	-0.90	-1.84	-3.48^{**}	2.25^{*}	1.52	1.09	0.33	-0.47	-0.91
		(4.44)	(-1.44)	(-0.48)	(-1.12)	(-1.84)	(1.30)	(0.68)	(0.62)	(0.13)	(-0.27)	(-0.45)
3. a_t	0.23				1.90^{***}	1.04^{*}				4.00^{***}	1.80^{**}	
					(2.68)	(1.34)				(5.36)	(2.18)	
4. m_t	-0.09	-9.73^{***}					-8.14^{***}	-11.93^{***}		-10.37^{***}		-10.56^{***}
		(-7.38)					(-5.77)	(-7.87)		(-6.83)		(-6.31)
5. wu_t	-0.06		-34.32^{***}		-24.88^{***}		-47.57^{***}		-32.84^{***}		-32.70^{***}	-53.76^{***}
			(-5.64)		(-3.98)		(-7.14)		(-4.32)		(-3.94)	(-6.71)
6. cli_t	0.67			0.48^{***}		0.38^{***}		0.47^{***}	0.35^{***}	0.58^{***}	0.35^{***}	0.23^{**}
				(3.65)		(3.56)		(3.98)	(2.85)	(4.15)	(2.65)	(1.78)
R^2		0.29	0.28	0.28	0.36	0.35	0.35	0.35	0.33	0.41	0.40	0.40

Appendix B Inflation Rates (IR)-Based Analysis

Table B1: **Descriptive Statistics of Inflation Rates (IR)**

This table presents the mean, standard deviation (Std.), skewness (Skew.), excess kurtosis (Kurt.) and the real per capita GDP growth correlations of the cross-sectional mean, standard deviation (Std.), skewness (Skew.), excess kurtosis (Kurt.), and 5%, 25%, 50%(median), 75% and 95% percentiles among the inflation rates (IR) of 181 countries and regions, which is constructed as $\pi^e_{i,t} \equiv \pi_{i,t} - \pi_{g,t}$. The IR of 181 countries and regions are displayed in Table 1, which are annualized and in percentage units. The sample period is from January 1991 to February 2022, with monthly frequency.

	Mean	**Std.**	**Skew.**	**Kurt.**	**5%**	**25%**	**50%**	**75%**	**95%**
Mean	6.85	9.26	3.12	17.06	-0.59	1.85	4.20	8.67	23.97
Std.	3.48	4.55	1.63	15.48	1.34	1.17	2.09	4.69	14.67
Skew.	1.00	0.71	0.44	1.97	-0.10	0.53	0.85	1.55	1.09
Kurt.	-0.13	-0.82	0.81	4.55	0.55	0.78	-0.13	1.95	-0.15
corr(π^e, gdp)	0.13	0.10	-0.05	-0.06	0.19	0.17	0.10	0.10	0.11

Table B2: **IR-Based Fama-Macbeth Factor Lambda Estimation (60-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of 181 Inflation Rate (IR) series on the 6 benchmark factors (unemployment rate u_t, energy e_t, agriculture a_t, precious metals m_t, world uncertainty wu_t and composite leading indicator cli_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multivariate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$		5.44^{***}	5.51^{***}	5.12^{***}	5.20^{***}	5.53^{***}	5.29^{***}	5.38^{***}	5.10^{***}	5.01^{***}	5.04^{***}	5.09^{***}
		(52.23)	(48.78)	(48.13)	(46.69)	(48.57)	(48.36)	(47.61)	(49.57)	(51.07)	(51.74)	(54.85)
1. u_t	−0.29	-0.23^{***}						-0.16^{***}	−0.16	-0.14^{***}	-0.10^{***}	-0.09^{***}
		(−3.52)						(−3.33)	(−3.95)	(−3.60)	(−3.08)	(−2.63)
2. e_t	0.55		7.29^{***}					6.37^{***}	4.18^{***}	7.73^{***}	5.64^{***}	8.75^{***}
			(4.38)					(3.31)	(2.50)	(3.88)	(2.86)	(4.31)
3. a_t	0.23			3.22^{***}					2.46^{***}	3.85^{***}	3.03^{***}	2.30^{***}
				(5.44)					(3.84)	(6.05)	(5.11)	(4.09)
4. m_t	−0.09				-3.18^{***}					-4.36^{***}	-3.36^{***}	-7.18^{***}
					(−2.79)					(−3.81)	(−2.69)	(−5.93)
5. wu_t	−0.06					-24.53^{***}					-20.02^{***}	-31.01^{***}
						(−4.61)					(−4.19)	(−5.48)
6. cli_t	0.67						0.48^{***}					0.27^{***}
							(3.34)					(2.61)
R^2		0.11	0.13	0.16	0.12	0.11	0.10	0.20	0.28	0.33	0.37	0.40
	$corr(f, gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$Intercept$		5.22^{***}	5.37^{***}	5.33^{***}	5.13^{***}	5.11^{***}	5.20^{***}	5.28^{***}	5.29^{***}	5.10^{***}	5.09^{***}	5.24^{***}
		(46.93)	(47.80)	(49.07)	(50.18)	(53.10)	(46.77)	(49.85)	(48.89)	(54.38)	(53.27)	(49.65)
1. u_t	−0.29	-0.16^{***}	-0.07^{***}	-0.15^{***}	-0.11^{***}	-0.14^{***}	-0.09^{***}	-0.14^{***}	-0.08^{***}	-0.13^{***}	-0.10^{***}	-0.08^{**}
		(−3.38)	(−2.53)	(−3.18)	(−3.58)	(−3.35)	(−2.83)	(−2.78)	(−2.69)	(−3.12)	(−2.96)	(−2.31)
2. e_t	0.55	12.25^{***}	4.20^{***}	5.63^{***}	3.34^{**}	5.36^{***}	7.99^{***}	9.15^{***}	7.78^{***}	7.72^{***}	7.20^{***}	9.13^{***}
		(5.88)	(2.65)	(2.90)	(2.14)	(2.85)	(4.45)	(4.27)	(4.32)	(3.64)	(4.04)	(4.62)
3. a_t	0.23				2.13^{***}	0.83				2.63^{***}	0.94^{*}	
					(3.40)	(1.26)				(4.41)	(1.45)	
4. m_t	−0.09	-6.21^{***}					-5.73^{***}	-10.37^{***}		-7.80^{***}		-10.01^{***}
		(−5.31)					(−4.67)	(−8.43)		(−6.77)		(−8.12)
5. wu_t	−0.06		-10.94^{***}		-7.48^{**}		-22.29^{***}		-27.22^{***}		-28.17^{***}	-37.12^{***}
			(−2.48)		(−1.84)		(−4.55)		(−4.36)		(−5.15)	(−5.98)
6. cli_t	0.67			0.64^{***}		0.41^{***}		0.57^{***}	0.27^{***}	0.52^{***}	0.23^{**}	0.21^{**}
				(4.00)		(3.53)		(3.84)	(2.72)	(3.95)	(2.32)	(2.04)
R^2		0.27	0.25	0.26	0.31	0.33	0.31	0.32	0.31	0.37	0.36	0.36

Table B3: **IR-Based Fama-Macbeth Factor Lambda Estimation (90-Month Rolling Window)**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of 181 Inflation Rate (IR) series on the 6 benchmark factors (unemployment rate u_t, energy e_t, agriculture a_t, precious metals m_t, world uncertainty wu_t and composite leading indicator cli_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 90-month rolling window. Columns **1** to **6** in this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multivariate specifications while holding unemployment rate and energy price index fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f,gdp)$	**1**	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$		4.80^{***}										
		(60.89)	(50.49)	(52.35)	(50.79)	(58.12)	(57.24)	(53.23)	(57.58)	(59.18)	(57.80)	(67.69)
1. u_t	−0.29	-0.25^{***}						-0.18^{***}	-0.18^{***}	-0.19^{***}	-0.14^{***}	-0.13^{***}
		(−3.76)						(−4.09)	(−4.68)	(−4.61)	(−4.62)	(−3.77)
2. e_t	0.55		9.60^{***}					9.39^{***}	7.95^{***}	8.41^{***}	7.33^{***}	5.80^{***}
			(5.70)					(4.77)	(5.48)	(5.43)	(4.75)	(4.02)
3. a_t	0.23			1.71^{***}					1.49^{**}	2.79^{***}	2.03^{***}	1.49^{***}
				(2.82)					(2.36)	(4.30)	(3.41)	(2.55)
4. m_t	−0.09				-4.94^{***}					-5.81^{***}	-3.31^{***}	-5.33^{***}
					(−3.75)					(−5.06)	(−2.54)	(−3.66)
5. wu_t	−0.06					-24.48^{***}					-22.10^{***}	-28.51^{***}
						(−4.07)					(−4.17)	(−5.12)
6. cli_t	0.67						0.42^{***}					0.14^{*}
							(3.24)					(1.34)
R^2		0.08	0.09	0.13	0.11	0.08	0.09	0.16	0.24	0.30	0.33	0.37

	$corr(f,gdp)$	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$Intercept$		4.59^{***}	4.80^{***}	4.66^{***}	4.45^{***}	4.47^{***}	4.58^{***}	4.61^{***}	4.60^{***}	4.49^{***}	4.43^{***}	4.52^{***}
		(51.55)	(53.33)	(59.16)	(58.19)	(68.83)	(50.97)	(59.47)	(57.95)	(70.08)	(68.14)	(57.68)
1. u_t	−0.29	-0.18^{***}	-0.10^{***}	-0.18^{***}	-0.13^{***}	-0.16^{***}	-0.12^{***}	-0.19^{***}	-0.06^{***}	-0.19^{***}	-0.10^{***}	-0.11^{***}
		(−3.80)	(−3.88)	(−4.13)	(−4.81)	(−4.45)	(−4.13)	(−3.90)	(−2.79)	(−4.20)	(−3.92)	(−3.37)
2. e_t	0.55	11.42^{***}	8.31^{***}	9.67^{***}	8.64^{***}	6.98^{***}	8.82^{***}	8.45^{***}	8.18^{***}	6.36^{***}	7.12^{***}	6.80^{***}
		(6.92)	(4.87)	(4.85)	(5.92)	(4.80)	(5.93)	(5.20)	(5.27)	(4.01)	(5.41)	(4.81)
3. a_t	0.23				1.62^{***}	1.60^{**}				2.03^{***}	1.66^{***}	
					(2.60)	(2.37)				(3.23)	(2.64)	
4. m_t	−0.09	-8.33^{***}					-7.40^{***}	-8.69^{***}		-5.96^{***}		-9.09^{***}
		(−6.56)					(−5.71)	(−6.07)		(−4.38)		(−6.42)
5. wu_t	−0.06		-14.80^{***}		-8.49^{**}		-27.06^{***}		-22.86^{***}		-12.75^{**}	-38.93^{***}
			(−3.12)		(−1.76)		(−5.26)		(−3.66)		(−2.36)	(−6.95)
6. cli_t	0.67			0.42^{***}		0.20^{**}		0.46^{***}	−0.06	0.38^{***}	−0.04	0.10
				(3.22)		(2.02)		(3.23)	(−0.83)	(2.89)	(−0.45)	(0.96)
R^2		0.24	0.21	0.21	0.28	0.29	0.28	0.29	0.26	0.34	0.33	0.33

Table B4: **IR-Based Robustness Check: 60-Month Rolling Window**

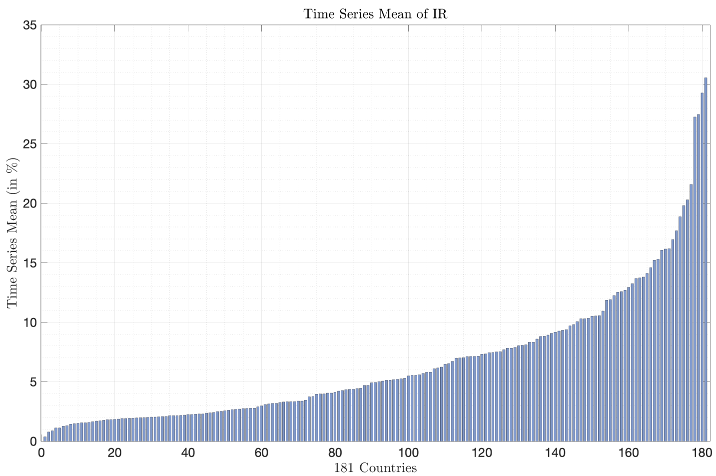
This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of 181 Inflation Rate (IR) series on additional nine factors (seven procyclical factors: commodity prices of crude oil oil_t, food $food_t$, grains $grain_t$, raw materials raw_t, timber $timber_t$, as well as production of total industry mei_t, consumer confidence index cci_t; two countercyclical factors: world uncertainty-simple average wus_t, and exchange rate ex_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
$Intercept$		5.51^{***}	5.31^{***}	5.28^{***}	5.35^{***}	5.50^{***}	5.37^{***}	5.63^{***}	5.51^{***}	5.22^{***}
		(49.15)	(48.70)	(49.55)	(47.87)	(48.72)	(48.52)	(53.27)	(48.32)	(41.52)
7. oil_t	0.54	8.03^{***}								
		(4.13)								
8. $food_t$	0.21		2.40^{***}							
			(3.31)							
9. $grain_t$	0.15			5.24^{***}						
				(3.81)						
10. raw_t	0.20				2.39^{***}					
					(4.92)					
11. $timber_t$	0.07					2.02^{***}				
						(4.09)				
12. mei_t	0.88						0.99^{***}			
							(2.47)			
13. cci_t	0.55							0.04^{**}		
								(2.26)		
14. wus_t	-0.10								-8.15^{***}	
									(-3.42)	
15. ex_t	-0.02									-8.78^{***}
										(-6.65)
R^2		0.12	0.15	0.14	0.13	0.13	0.10	0.10	0.10	0.12

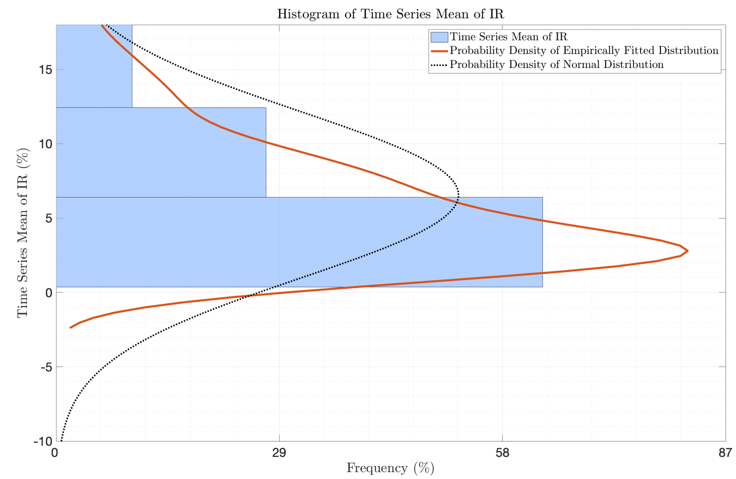
Table B5: **IR-Based Robustness Check: 90-Month Rolling Window**

This table presents the factor lambda estimates from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of 181 Inflation Rate (IR) series on additional nine factors (seven procyclical factors: commodity prices of crude oil oil_t, food $food_t$, grains $grain_t$, raw materials raw_t, timber $timber_t$, as well as production of total industry mei_t, consumer confidence index cci_t; two countercyclical factors: world uncertainty-simple average wus_t, and exchange rate ex_t). The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 90-month rolling window. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

	$corr(f, gdp)$	**7′**	**8′**	**9′**	**10′**	**11′**	**12′**	**13′**	**14′**	**15′**
$Intercept$		4.94^{***}	4.68^{***}	4.81^{***}	4.84^{***}	5.13^{***}	5.00^{***}	5.22^{***}	5.15^{***}	4.94^{***}
		(50.69)	(50.39)	(56.28)	(51.59)	(57.13)	(56.78)	(64.80)	(57.38)	(49.15)
7. oil_t	0.54	11.82^{***}								
		(5.98)								
8. $food_t$	0.21		1.35^{**}							
			(1.90)							
9. $grain_t$	0.15			3.59^{***}						
				(2.89)						
10. raw_t	0.20				1.87^{***}					
					(3.46)					
11. $timber_t$	0.07					2.77^{***}				
						(5.36)				
12. mei_t	0.88						0.50^{*}			
							(1.44)			
13. cci_t	0.55							0.04^{**}		
								(2.14)		
14. wus_t	−0.10								-13.23^{***}	
									(−5.03)	
15. ex_t	−0.02									-7.94^{***}
										(−5.75)
R^2		0.09	0.11	0.12	0.11	0.09	0.06	0.08	0.08	0.09



(a) Sorted Time Series Mean of IR



(b) Time Series Mean of IR Histogram

Table B1: **Time Series Mean of Inflation Rate (IR)**
The 181 countries of countries are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.

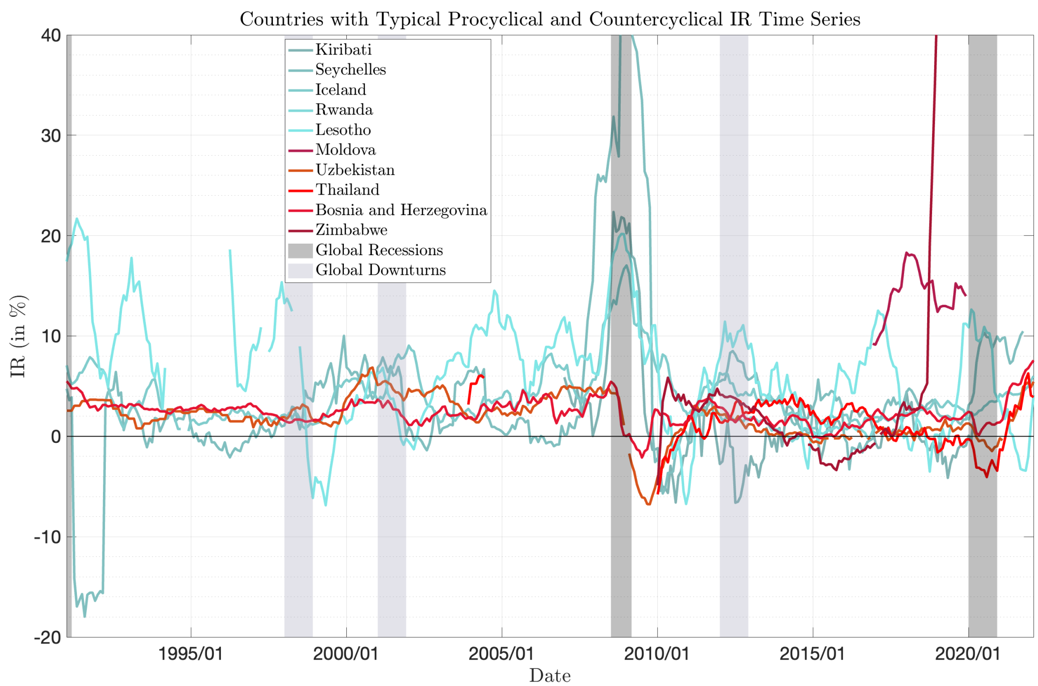
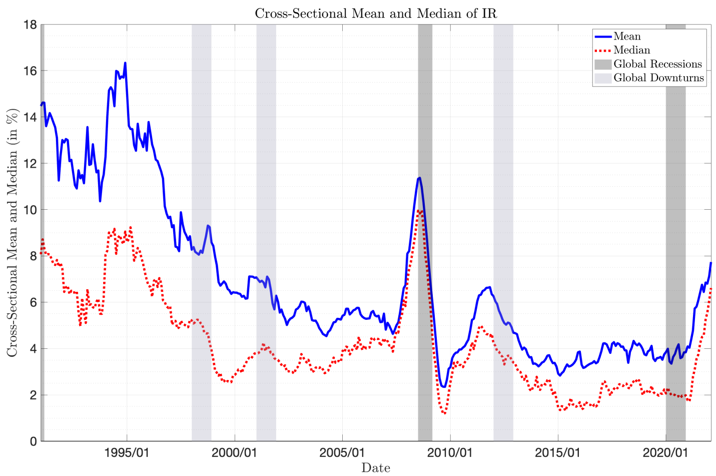
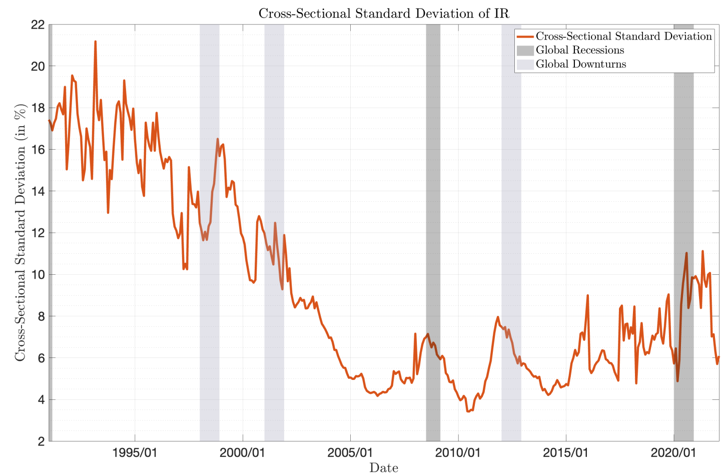


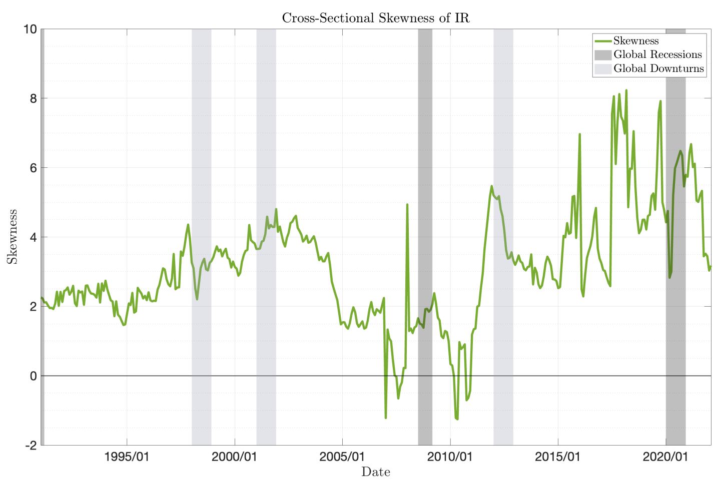
Table B2: **Countries with Typical Procyclical and Countercyclical IR Time Series**
This figure plots the time series of the most procyclical IR of five countries (red series), and the most countercyclical IR of five countries (blue series) based on their correlation with global real GDP growth. Data are annualized monthly, from January 1991 to February 2022.



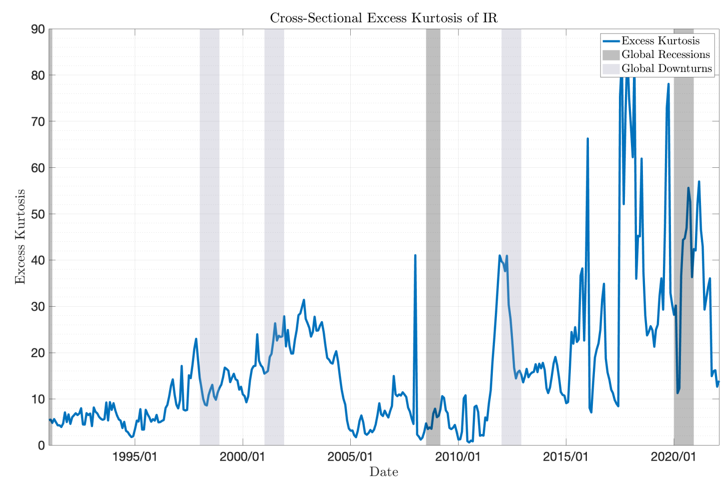
(a) Cross-Sectional Mean and Median of IR



(b) Cross-Sectional Standard Deviation of IR



(c) Cross-Sectional Skewness of IR



(d) Cross-Sectional Excess Kurtosis of IR

Table B3: **Time Series Plots of Cross-Sectional Moments of Inflation Rate (IR)**
The 181 countries of their IR are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1991 to February 2022.