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Nº 006 - 2023

Documento de trabajo
ISSN 1688-7565

IFCI-SA: An International Financial Conditions Index for South American Economies☆

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Documento de trabajo del Banco Central del Uruguay 006-2023

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Disponible en línea: 6/7/2023

Resumen

El escenario financiero internacional surgido tras la invasión de Rusia a Ucrania al comienzo de 2022 se vio alterado por una ola de aversión al riesgo. Sin embargo, en contraste con eventos previos, las economías emergentes de América del Sur experimentaron un impacto limitado de este ambiente financiero global más restrictivo. Para evaluar las condiciones financieras de estas economías a lo largo del tiempo, en particular Brasil, Chile y Uruguay, la investigación propone un Indicador de Condiciones Financieras Internacionales para economías Sudamericanas (IFCI-SA), construido a partir de un Modelo Factorial Dinámico. Este indicador incluye las variables habituales que recoge la literatura, a las que se agregan el riesgo soberano y los precios de los commodities más importantes para estas economías. Se utiliza el indicador para investigar la influencia de los precios de los commodities en las condiciones financieras de las economías sudamericanas entre octubre 2007 hasta mayo de 2022, y se presta particular atención a las implicancias financieras derivadas del conflicto en Ucrania.

JEL: F30, F34, F37, G15, G17
Palabras clave: Condiciones Financieras Internacionales, Economías Sudamericanas, Economías Emergentes, Modelo Factorial Dinámico.

Abstract

The Russian invasion of Ukraine in early 2022, triggered a wave of risk aversion in the global financial markets. However, in contrast to previous events, South American emerging economies experienced limited impact to this more restrictive global financial environment. To assess the financial conditions of these economies over time, particularly Brazil, Chile and Uruguay, we propose an International Financial Conditions Index for South American economies (IFCI-SA), built from a Dynamic Factor Model. This index includes standard variables provided by the literature, along with sovereign debt risk premia and the most relevant commodity prices for these economies. We use our indicator to study the influential role played by commodity prices in the financial conditions of South American emerging economies from October 2007 to May 2022, paying particular attention to the financial implications stemming from the conflict in Ukraine.

Keywords: International Financial Conditions; South American Economies; Emerging Economies; Dynamic Factor Model.

☆ We would like to thank Miguel Mello, Leonardo Vicente, Fernando Zimet, José Mourelle and the Macroeconomic Models Department of the BCU, Andrés Masoller and the Short-Term Economic Analysis Depardment (BCU), for useful comments. We are also very grateful to the BCU's library staff. The opinions and conclusions presented in this paper are exclusively those of the authors and do not necessarily reflect the position of the BCU.

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1 Introduction

The international financial scenario that emerged after Russia's invasion of Ukraine, characterized by the loss of confidence in the riskiest assets, led to a new hardening of the financial conditions relevant for Emerging Economies (EEs). Like in other episodes of financial stress, such as the Global Financial Crisis (GFC) or the outbreak of the COVID-19 pandemic, this situation led to increases in sovereign risk premia (RP) and exerted downward pressure on most domestic currencies against the US dollar. The prevailing risk aversion and decline of confidence at a global level also generated greater volatility and significant losses in the stock markets of Advanced Economies (AEs).

However, this time, contrary to what happened in other periods of tightening global financial conditions, most commodity prices showed an upward trajectory. This trend was particularly pronounced in food and energy prices, which were further impacted by preexisting supply restrictions resulting from the COVID-19 pandemic, and were subsequently exacerbated by the Russo-Ukrainian War.

Conditions to access external credit are particularly relevant for monitoring the monetary policy of the EEs, due to their vulnerability and the impact these conditions have on economic growth, inflation and financial stability. Considering that South American economies are very sensitive to the evolution of international commodity prices, to the point of being decisive in the activity level, tax revenues and, therefore, their capacity to repay external obligations, the price of some of these products should be included to understand the conditions of access to credit in these economies.

Reviewing existing literature on this topic, we find precedents focusing on certain blocks of individual AEs and EEs. However, there is a notable gap when it comes to specific research conducted on a block of South American economies.

In this paper, we focus on external financial conditions of a set of these EEs, affected by similar external shocks, and with some common features in their productive structures. With the aim of evaluating the external financial conditions of South American economies, particularly Brazil, Chile and Uruguay, this paper proposes an International Financial Conditions Index (IFCI-SA). In addition to the usual financial variables considered by the literature, our indicator incorporates the RP of the sovereign debt of some countries, and the prices of their most relevant commodities.

The variables chosen for building the index can be classified in two groups: (1) global variables, which show the degree of global risk aversion (risk-free rates, stock market indices, Real Emerging Market Economies Dollar Index); and (2) variables linked to regional issues, i.e. sovereign RP and specific commodity prices. To build our synthetic indicator from previous observable series we use a Dynamic Factor Model (DFM) where the dynamics of each variable in the system is determined by a common factor plus an idiosyncratic component. Both the common factor, which captures the co-movement among all the variables, and the idiosyncratic component are unobservable variables. We will interpret the common factor as the international financial conditions representing the degree of trust that agents have in these EEs. Therefore, the IFCI-SA is associated to the common factor that governs the evolution of a set of observable variables. The advantage of using a DFM against, for example, principal components, is that it allows for short-term forecasts of the observable variables used in the model construction. This capability is particularly valuable for the central banks of the EEs, as it facilitates the characterization of forecasting scenarios, considering the significant impact of the external framework on these economies.

Once the IFCI-SA is obtained, we use it to characterize different relevant periods from October 2007 to May 2022. This tool makes it possible to assess the external financial context for South American economies, even when some variables evolve favorably and others negatively. Specifically, we evaluate the financial conditions of the South American economies during the months after the Russian invasion of Ukraine, and we use the DFM to measure the impact on the variables that make up the indicator of the supply shock associated with this conflict.

The empirical analysis highlights the following key findings: (1) the importance of building specific indicators of financial conditions tailored for different economies; (2) the relevance of using multivariate financial indicators that consider several risk approaches; and (3) the usefulness of incorporating certain commodity prices to evaluate the financial conditions of South American EEs.

The paper is organized in six sections. Section 2 reviews the literature on financial indicators for different economies. It also provides background information regarding the empirical evidence on the relationships between the variables used to estimate the IFCI-SA. The main shocks affecting capital flows to and from Latin American economies are explained in Section 3. Section 4 is divided into three parts. First, we delve into the details of the DFM. Second, we present the data used for estimation purposes. Last, we provide the estimates and the construction of the proposed index. Section 5 focuses on the analysis conducted using the IFCI-SA, studying the role played by commodity prices in the financial conditions of South American EEs from 2007 to 2022, with specific emphasis on the financial implications arising from the Russo-Ukrainian war. Finally, Section 6 concludes.

2 Background

We will separate the literature review in two groups. The first group includes papers that built and analyze financial indicators, i.e. Financial Conditions Indexes (FCI) and Financial Stress Indexes (FSI), for different economies. The second group of papers lends support to the selection of variables included in our synthetic indicator, and provides explanations of the economic relationships among them.

2.1 Recent Financial Indicators

The GFC and the European sovereign debt crisis revealed the need for synthetic indicators that allow one to evaluate the financial conditions in quasi-real time. These indicators serve as early warning systems, alerting us to the growing probability of a crisis. As a consequence, from central banks, private financial institutions and academics, abundant literature has emerged on this subject. These indicators permit to assess the liquidity and solvency conditions and reflect the risk aversion level in the international financial markets.

In this regard, there are mainly two types of financial indicators. On one hand, the FCI, which focus on evaluating the conditions of accessing financing, considering factors such as costs and availability. On the other hand, the FSI, which are devised to monitor financial instability, with an increasing value indicating a higher probability of a crisis. While FCI are generally used to monitor the financial impact on classical objectives of monetary policy, such as activity and inflation, FSI are more suitable for monitoring financial stability, see Arrigoni et al. (2020). Beyond this conceptual difference, the literature does not clearly distinguish between both types of financial indicators. In practice, the differences are observed in the variables (and their frequency) used to estimate the indicator and the way they are aggregated. Both, FCI and FSI, are tools to gauge the impact of financial conditions on different macroeconomic variables. While their application is widespread in measuring this influence, their significance in the realm of financial stability, especially as early-warning signals, has also been emphasized. These indicators play a crucial role in identifying potential vulnerabilities and signaling the need for proactive measures to mitigate risks.

In general, the financial indicators discussed by the literature are built from variables that capture the state of financial markets. These variables encompass quantities (credit flows, monetary aggregates, use of liquidity facilities, debt stocks), asset prices (indexes of stock prices, housing price indexes, exchange rates), interest rates and spreads (at different terms and markets), and quality indicators (typically, the willingness to make loans). For more details, the reader may consult Nelson and Perli (2007) and Hatzius et al. (2010).

Although the literature offers various approaches for aggregating the variables, the most frequently encountered methods are: (1) the variance equal weighting procedure (Illing and Liu, 2006); (2) the weighted-mean procedure, which can be based on (2.1) equal weights (Illing and Liu, 2006), (2.2) the weight of each financial market that is considered in the indicator, which is an ad hoc weighting according to the relative importance that the researcher assigns to the variables in question (Arrigoni et al., 2020); (2.3) the weight the impact that each financial variable has on GDP growth (Guichard and Turner, 2008), (3) through factors obtained with principal components (Angelopoulou et al., 2014; Kapetanios et al., 2018; Hakkio and Keeton, 2009; Darracq-Paries et al., 2014; Krzak et al., 2014; Guihuan and Yu, 2014; Cevik et al., 2013; Koop and Korobilis, 2014) and, finally, (4) through a DFM (Matheson, 2012; Auer, 2017; Brave and Butters, 2012; Guihuan and Yu, 2014; Cevik et al., 2016; Koop and Korobilis, 2014).

From a regional viewpoint, most of financial indicators are built for the United States. Some examples are the Kansas City Financial Stress Index (KCFSI, see, Hakkio and Keeton, 2009), the Saint Louis Financial Stress Index (STLFSI, see, Kliesen et al., 2012) and the National Financial Conditions Index from the Federal Reserve Bank of Chicago (NFCI and adjusted NFCI, see Brave and Butters, 2012). The ANFCI, adjusted NFCI, is of special interest for our paper as it allows for the isolation of a specific component of financial conditions that is unrelated to economic conditions. This provides valuable insights into how financial conditions alone compare to the current state of the economy.

In Section 5.1 we will present a comparative analysis between the ANFCI and the index proposed here.

Numerous organizations, both multilateral and private financial institutions, have developed their own FCI to assess the financial situation in the US. Among the multilateral organizations, the International Monetary Fund and the Organization for Economic Co-operation and Development have their respective FCI (see Hatzius et al., 2010; Guichard and Turner, 2008, respectively). In the realm of private financial institutions, various entities such as Bloomberg (Rosenberg, 2009), Citibank (D'Antonio, 2008), Deutsche Bank (Hooper et al., 2007, 2010) and Goldman Sachs (Dudley and Hatzius, 2000; Dudley et al., 2005) have constructed their own indicators to evaluate the US financial conditions.

Additionally, Koop and Korobilis (2014) have derived an FCI for the US using a Factor Augmented Vector AutoRegressive model with Time Varying Parameters. This approach involves estimating the FCI factor within the model, incorporating observable financial variables and considering relevant macroeconomic factors such as GDP growth, inflation, and unemployment.

Similar indicators have been developed to monitor financial situations in other regions. For example, indicators for the European Monetary Union (EMU) have been proposed by Darracq-Paries et al. (2014) and Holló et al. (2012). The United Kingdom (Kapetanios et al., 2018) and Canada (Illing and Liu, 2006) also have their specific indicators. Angelopoulou et al. (2014) propose an FCI for the Eurozone, including individual countries from both the core (Germany) and the periphery (Greece, Ireland, Portugal, and Spain). Additionally, Matheson (2012) develops an FCI for both the US and the EMU.

Central and Eastern European countries have their unique financial indicators as well. Auer (2017) suggests an FCI for Poland, Hungary, and the Czech Republic. Krzak et al. (2014) propose an FSI for Poland, Kyrgyzstan, Ukraine, Georgia, Moldova, and Belarus. Similarly, Ho and Lu (2013) construct an FCI specifically for Poland.

Particularly interesting is the contribution by Arrigoni et al. (2020), who propose a set of financial indicators, FCI and FSI, for 18 AEs and EEs, and evaluate their behavior with different criteria of monetary policy and financial stability.[1]

Recent literature also provides us with financial indicators for Asian economies. For instance, Cevik et al. (2016) yields a FSI for 5 Southeast Asian economies, while Guihuan and Yu (2014) presents two FCI for China. All of them are built applying factor analysis.

Finally, we also find an FSI for Turkey, which has the particularity of being regularly exposed to pressure in the foreign exchange market. For this reason, Cevik et al. (2013) includes a variable that measures this pressure on the factorial model used to build the FSI.

As shown, the literature review reveals a limited number of studies focusing on EEs, specially in the South American EEs. This paper aims to fill this gap by providing an International Financial Conditions Index relevant for South America to assess the

[1]The 12 AEs considered in the study are the USA, Germany, UK, France, Italy, Canada, Australia, Sweden, Norway, Japan, South Korea, and New Zealand. In turn, the 6 EEs are China, India, Russia, Turkey, Mexico and Brazil.

external financial conditions of Brazil, Chile, and Uruguay. Moreover, in addition to standard variables found in the literature, our index takes into account the RP of the sovereign debt of the previous countries as well as the price of their key commodities. The next section lends support to the inclusion of these variables in the creation of the index.

2.2 Financialization of commodities

Empirical evidence shows that when risk aversion declines globally, riskier financial assets tend to appreciate. This phenomenon is observed in assets like equities in AEs, as well as in equities, government bonds, and domestic currencies in EEs. Similarly, commodity prices also tend to show an upward trend in such economic context.

In fact, in the last years there is evidence of the co-movement between the performance of the riskiest financial assets and the price of many commodities. This correlation is due to two complementary facts: (1) certain drivers that influence the trajectory of commodity prices also impact the evolution of prices for risky financial assets; and, (2) since the early 2000s, commodities have become increasingly integrated into investment portfolios, a phenomenon known as the *financialization* of commodities.

In support of the aforementioned relationship, Adams et al. (2020) show that, since the mid-2000s, the evolution of commodity prices has been more closely linked to financial considerations rather than traditional supply and demand factors. Similarly, Ma et al. (2021) find that non-fundamental factors, specifically *financialization*, play an important role in the co-movement of commodity prices. Their research suggests that this effect is more pronounced in energy commodities than in agricultural and metal commodities. In the same line, Salisu et al. (2019) demonstrate that commodity prices serve as a good predictor of the stock market returns' in the G7 countries. Additionally, Gagnon et al. (2020) reveal that the *financialization* of commodities has a positive impact on risk diversification.

Several studies have examined the relationship between stock prices and commodity prices. For example, Bianchi et al. (2020) employ a quantile regression methodology to demonstrate that the nature of this relationship varies across energy, metals, and agricultural products. However, the results of this study are inconclusive on the benefits of diversification with energy-dominated indices. On the other hand, Aït-Youcef (2019) identifies a stronger link between agricultural commodity prices and stock market returns during periods of extreme price movements, suggesting a heightened correlation between these variables under volatile market conditions.

Other papers examine the relationship between international oil prices and stock prices across global markets. The findings reveal asymmetric relationships that depend on the type of shock driving the movements and, in some cases, time-varying dynamics (see Arampatzidis et al., 2021; Aromi and Clements, 2019; Mensi et al., 2021; Mokni, 2020).

As shown in Fernández et al. (2018), commodity prices play a significant role in explaining the economic cycles of EEs. Thus, the RP of sovereign securities in these economies are often correlated with commodity prices. Boehm et al. (2021) shed light on this relationship, finding that higher commodity prices are associated with lower RP values.

3 Risk aversion and emerging economies capital flows

A well-known stylized fact in financial markets is the existence of a positive relationship between risk and return. This means that assets with higher risk typically require higher returns to attract investors. Additionally, higher liquidity generally corresponds to lower risk and, consequently, lower returns.

Bearing the aforementioned relation in mind, let us assume a determined "asset allocation", characterized by a certain triplet return-risk-liquidity for different financial assets in the international markets. The initial configuration of this allocation is influenced by the level of confidence that investors have in these assets. As financial markets are inherently forward-looking, economic shocks that cause financial market participants to revise their future returns expectations are quickly embedded in current asset prices, and then transmitted to the rest of the financial and real economy (see, e.g. Kliesen et al., 2012). These shocks have an impact on the confidence level of market participants, leading to adjustments in the initial asset allocation. Consequently, the conditions for accessing financing, in terms of quantity (flow, demand) and price (rates), are modified. EEs are particularly affected by these changes, which are ultimately reflected in the evolution of the financial variables that will be used to estimate our IFCI-SA.

Table 1 presents some examples of typical shocks that have a significant impact on capital flows. For instance, it illustrates that a drop in confidence in the performance of an EE implies a reduction in capital inflows and higher financing costs. As investors anticipate higher risk, they require higher returns. Consequently, EEs experience lower capital inflows, resulting in increased sovereign debt risk premia, currency depreciation against the dollar, and if the EE in question is a big one (like China), could also result in a decline in international commodity prices. The latter is the result of two mechanisms that are directly related to each other: (1) the lower expected demand, and (2) the strengthening of the dollar, *numeraire* of the relative prices.

In turn, in cases where the loss of confidence in EEs originates from a shock in AEs during a period of heightened global risk aversion, it is common to observe declines in the prices of the riskiest assets in the AEs, such as equities, accompanied by increased price volatility. In this context, investors often seek refuge in safer and more liquid assets, resulting in higher prices for government securities issued by AEs and a decrease in their yields. Arrigoni et al. (2020) explain how a monetary expansion in the US affects financial conditions all over the world. Similarly, Miranda-Agrippino and Rey (2020) show that the presence of a "Global Financial Cycle" determines the international transmission of the US monetary policy worldwide through asset prices and financial intermediation.

Conversely, when a shock boosts confidence in the EEs, it results in increased capital inflows and reduced financing costs. Financial variables move in the opposite direction of the previous scenario: risk premia decrease, the dollar weakens against emerging currencies, and commodity prices rise. If the shock that causes lower risk aversion originates in

Shock type	EEs' confidence	Transmission chanel	EEs' capital flows
(A) Financial crises in AEs	−	Agents prioritize security and liquidity, sacrificing profitability.	Reduction in capital flows and increase in their financing costs.
(B) Global monetary expansion	+	Agents seeks profitability, underestimating risks.	Increase in capital flows and reduction in their financing costs.
(C) Supply shocks in commodities.	+	Commodity appreciation; higher growth outlook for EEs; increases payment capacity for commodity producing countries (in general Emerging).	Increase in capital flows and reduction in their financing costs.
(D) Economic crisis in a relevant EE.	−	Depreciation of the currency and securities of that EE; agents restructure their portfolio of assets, and get rid of other securities and currencies of EEs.	Reduction in capital flows and increase in their financing costs.
(E) Political crisis in a relevant EE.	−	Low willingness to fulfill commitments by the country in question is percibed; agents restructure their portfolio of assets, and get rid of other securities and currencies of EEs.	Reduction in capital flows and increase in their financing costs.
(F) Higher inflation expectations in AEs	−	(F.1) Negative supply shock; rise in monetary policy rates is transferred to long-run rates; lower discount factor of EEs assets; lowers their prices.	Reduction in capital flows and increase in their financing costs.
	+	(F.2) Higher growth expectations; rise in monetary policy rates is transmited to long-run rates; decline in discount factor of EEs' assets is more than offset by higher expected cash flows; Increased demand for more profitable and/or short-term assets.	Increase in capital flows and reduction in their financing costs.
(G) Lower inflation expectations in AEs	−	(G.1) Lower economic growth expectations. The drop in the expected policy rate is transmited to long-term rates, and an inverted YC can be observed; increase in the asset discount factor is more than offset by lower expected cash flows: greater demand for safer and long-run assets.	Reduction in capital flows and increase in their financing costs.
	+	(G.2) Easier supply conditions; lower expected rate reduction. Increased demand for profitable assets.	Increase in capital flows and reduction in their financing costs.

Table 1: Shocks characterization and corresponding capital flows

the AEs, it leads to higher prices for the riskiest assets in those economies, lower volatility, and increased yields of public securities.

In addition to global confidence in emerging markets, the behavior of all these variables also responds to idiosyncratic factors. For some periods, relevant financial variables for EEs may deviate from what is expected based solely on the evolution of global confidence. For instance, a political crisis in a specific EE could result in an increase in its sovereign RP, even without triggering a global contagion effect. Thus, the behavior of the sovereign RP would be associated with a specific event affecting only that particular economy, rather than reflecting an increase in global risk aversion, see Arellano (2008) and Mourelle (2020).

There may also be an increase in the price of certain agricultural commodities as a result of a supply restriction due to climatic or logistic issues. In such a case, this increase would not respond to a higher expected demand derived from greater global confidence either.

Finally, increases in inflation expectations in the AEs may be attributed to negative supply shocks rather than agents' forecasts of higher economic growth. In this scenario, one would observe a rise in the long-term interest rate of the AEs, resulting in a drop in the discount factor not offset by higher future income flows, as no significant growth is expected. Consequently, the increase in the long-term interest rate of the AEs would not indicate a heightened agents' confidence at a global level.

Although confidence and its counterpart –risk aversion– are unobservable variables, it is possible to estimate their evolution from the co-movement of the set of financial variables mentioned in the previous sections. We will do so by means of a DFM. Thus, the evolution of the observable variables is modeled by the estimated common factor (the unobserved degree of confidence in emerging markets), and the idiosyncratic factors inherent in each of them. This methodology is presented in the next section.

4 Methodology, data and estimation

This section contains three parts. First, we detail the DFM used to build the index proposed. In the second part, we present the data used for estimation purposes. Finally, we provide the estimates of the model and reconstruct the level of the index.

4.1 The Dynamic Factor Model

According to the literature and given the features of the indicator, the DFM is considered a convenient model. Contrary to principal components, it has the advantage of allowing the variables that make up the indicator to be forecast. The DFM assumes that each variable in the vector of observable variables, denoted by $\mathbf{z}_t$, can be split into two components: the common factor and the idiosyncratic component specific to each variable. This decomposition is represented by the following measurement equation:

$$\mathbf{z}_t = \boldsymbol{\beta} f_t + \mathbf{u}_t, \tag{1}$$

where $\mathbf{z}_t$ is a vector that contains the values at period t of the k financial variables considered, f_t corresponds to the component that is common to all these variables, and $\mathbf{u}_t$ is a $k-$vector that includes the idiosyncratic component of each indicator. Vector $\boldsymbol{\beta}$ captures the k loading factors of the model, which measure the degree of dynamic correlation or the sensitivity of each observable variable to changes in the estimated common factor.

We will assume, for the moment, that there is only one common factor and that both, the common and the idiosyncratic components can be represented by autoregressives of order p and q, respectively, as in Equations (2a) and (2b).[2] Let us denote by ϕ_i $(i = 1, ..., p)$ the scalars that capture the dynamics of the common factor and by $\mathbf{\Phi}_j$ $(j = 1, ..., q)$ the $k \times k$ matrices that represent the dynamics of the idiosyncratic components. Equations (2a) and (2b), are sometimes called transition or state equations:

$$f_t = \phi_1 f_{t-1} + \phi_2 f_{t-2} + ... + \phi_p f_{t-p} + v_{1t}, \tag{2a}$$
$$\mathbf{u}_t = \mathbf{\Phi}_1 \mathbf{u}_{t-1} + \mathbf{\Phi}_2 \mathbf{u}_{t-2} + ... + \mathbf{\Phi}_q \mathbf{u}_{t-q} + \mathbf{v}_{2t}. \tag{2b}$$

We assume that the innovations in (2a), v_{1t}, are independently and identically normally distributed with zero mean and σ_f^2 variance, and the innovations in (2b), $\mathbf{v}_{2t}$, are independently and identically normally distributed with mean equal to the null vector, and variance matrix equal to $\Sigma_u^2 = \text{diag}(\sigma_1^2, \sigma_2^2, ..., \sigma_k^2)$.

We present the model in its state-space representation as it is adequate to be estimated by maximum likelihood and extract the unobservable components by means of the Kalman filter.

4.2 Data description

Based on the relationships presented in Section 2.2 and the rationale of the capital flows to and from the EEs exposed in Section 3, next we introduce the observable variables that will conform the vector $\mathbf{z}_t = [\mathbf{z}_{1t}, \mathbf{z}_{2t}]^\top$.

The first set of variables, included in $\mathbf{z}_{1t}$, will represent global risk aversion. This is the case of the Standard & Poors-500 ($SP500_t$), the main stock index in the US, the *VIX* index that measures the volatility of the previous indicator (VIX_t), the yield of the 10 years US Treasury Bonds ($Tr10Y_t$), and the Real Emerging Market Economies US Dollar Index ($DolEm_t$). In a context of lower risk aversion, it is expected that international financial agents undo positions in safer assets and seek out riskier ones in pursuit of higher returns. Consequently, this behavior exerts upward pressure on stock prices ($SP500_t$ rises), reduces volatility in that market (VIX_t falls), leads to an increase in $Tr10Y_t$, and results in a real appreciation of emerging currencies against the dollar ($DolEm_t$ falls).

The second set of variables, included in $\mathbf{z}_{2t}$, reflects the level of risk aversion towards the assets of some South American EEs, specifically Chile, Brazil, and Uruguay. It contains the sovereign RP of these three economies, denoted by $ChiRP_t$, $BraRP_t$, and $UruRP_t$, respectively, expressed in basis points. Additionally, it incorporates the prices of some key commodities exported by these countries, e.g. meat ($Meat_t$), soybean (SB_t), whole milk powder ($Milk_t$), rice ($Rice_t$), oil ($Brent_t$) and copper (Cop_t).[3] When risk aversion towards assets of EEs decreases, investors shift their attention towards their public securities, leading to a decrease in the risk premia. This shift in the investors'

[2]These may seem like strong assumptions, but we will show in the estimation section that this model is complex enough to capture the dynamics of the data.

[3]Commodity prices are all denominated in US dollars. In the case of oil, we consider prices for Brent Europe oil.

sentiment has a positive impact on the commodities exported by these economies. The appreciation of these commodities is driven by their status as risky financial assets and the weakening of the US dollar against emerging currencies. However, it is worth noting that the rise in commodity prices itself improves the prospects for compliance with the obligations assumed by the agents of these economies and, therefore, also improves the conditions of access to new financing.

To estimate our model, we use monthly data from October 2007 to May 2022.[4] To induce stationarity in the time series, we apply specific transformations. For the variables $SP500_t$, VIX_t, $DolEm_t$, and commodity prices, we use the log difference transformation. As for the sovereign risk premia and $Tr10Y_t$, we only apply the first differences. This helps to stabilize the series and make them suitable for applying the DFM. Finally, the vector of observable variables $\mathbf{z}_t$ is defined as:

$$\mathbf{z}_t = [\mathbf{z}_{1t} \quad \mathbf{z}_{2t}]^\top, \tag{3}$$

$$\mathbf{z}_{1t} = \begin{bmatrix} \nabla \ln DolEm_t & \nabla Tr10Y_t & \nabla \ln SP500_t & \nabla \ln VIX_t \end{bmatrix}, \tag{4}$$

$$\mathbf{z}_{2t} = \begin{bmatrix} \nabla BraRP_t & \nabla ChiRP_t & \nabla UruRP_t & \nabla \ln Brent_t & \nabla \ln Cop_t & \dots \\ \dots & \nabla \ln Meat_t & \nabla \ln SB_t & \nabla \ln Rice_t & \nabla \ln Milk_t & \end{bmatrix}. \tag{5}$$

Additionally, the vector of idiosyncratic shocks is denoted by:

$$\mathbf{u}_t = \begin{bmatrix} u_{1t} & u_{2t} & u_{3t} & \dots & u_{12t} & u_{13t} \end{bmatrix}^\top,$$

where u_{it} represents the idiosyncratic shock affecting each of the observable variables of the vector $\mathbf{z}_t$.

4.3 Model estimates and level reconstruction of the IFCI-SA

We estimate the state-space representation of the DFM discussed in Section 4.1 by the maximum likelihood method. The unobservable components are extracted using the Kalman Filter. Detailed information on the estimation procedure, the Kalman Filter and computer programming can be found in Casals et al. (2016).

Table 2 displays the point estimates of the model parameters, along with their corresponding standard deviations and statistical significance, measured using Student's t-test (see Appendix). The estimates show that the loading factors ($\boldsymbol{\beta}_i$, with $i = 1, \dots, k$) are statistically significant and have the expected signs in accordance with economic theory, as discussed in Sections 3 and 4.2. Furthermore, the parameter estimates governing the dynamics of the common factor have polynomial lags with imaginary roots, indicating that the IFCI-SA presents a cyclical behavior. The roots of this polynomial and those of the idiosyncratic components lie outside the unit circle, ensuring the stationarity of the model.

[4]Data sources are Bloomberg database, Federal Reserve Bank of Saint Louis, Instituto Nacional de la Leche (INALE, Uruguay), Instituto Nacional de Carnes (INAC, Uruguay), and Banco Central de República Dominicana.

To analyze the evolution of the proposed index and compare it with a standard alternative such as the ANFCI (Brave and Butters, 2012), we perform the reconstruction of its level. We do so in two steps. First, we calculate y_t recursively from $y_t = y_{t-1} + \hat{f}_t$, where $\hat{f}_t$ is the common factor obtained by applying the Kalman Filter in the maximum likelihood estimation of the model (1-2a-2b). Without loss of generality we start from $y_0 = 100$. Second, we proceed to remove the trend component from the series y_t, thereby focusing solely on the cyclical fluctuations and the noise. This detrending step allows for a meaningful comparison between the IFCI-SA (detrended y_t) and the ANFCI, which will be performed in the following section.

5 Empirical evidence

In this empirical section, we conduct a comparative analysis between the IFCI-SA and the ANFCI, and discuss the evolution of our indicator from November 2007 to May 2022. Moreover, we investigate the impact of the Russo-Ukrainian war on the financing conditions of some South American economies using the information provided by the index proposed.

5.1 Discussion of the evolution of the IFCI-SA

Now we will examine the trajectory of the IFCI-SA during the study period and compare it with that of the ANFCI, which serves as a benchmark for global financial conditions for the AEs. Figure 1 displays the evolution of both the IFCI-SA and the ANFCI from November 2007 to May 2022. The figure also presents the median value of the indicators over this period. This value represents a normal financial environment for the given period, where conditions are neither particularly favorable nor unfavorable based on historical data. The median is chosen as a benchmark for normal conditions, as it is less influenced by outliers compared to the average. To facilitate the comparison, the chart has been plotted so that the median of both indexes coincides.

Figure 1 clearly depicts three significant peaks in the evolution of the IFCI-SA, reflecting a pronounced deterioration of global financial conditions. These peaks correspond to the following events: (1) the GFC, following the collapse of Lehman Brothers in September 2008, (2) the Chinese stock market turbulences in 2015-2016, and (3) the COVID-19 pandemic from March 2020, triggered by the implementation of global restrictions on mobility to combat the spread of the virus.

After episodes (1) and (3), sharp downfalls are observed in IFCI-SA as well as in the ANFCI. After both shocks, ultra-dovish monetary policies were carried out by central banks in order to mitigate the adverse effects of the crises. In the case of the recession caused by COVID-19, expansionary fiscal policies were also implemented, contributing to the improvement of global financial conditions.

The GFC, whose results are reflected in Figure 1 from October 2008 to mid-2009, exemplifies a financial crisis started in an AE, categorized as a type (A) shock in Table

Figure 1: IFCI-SA and ANFCI

1. The pandemic crisis (3) was an atypical event with different characteristics. However, although it initially stemmed from a supply shock due to mobility restrictions, it rapidly evolved into a financial crisis. Consequently, financial variables and commodity prices behaved as in the GFC, and so the features of a type (A) shock predominates.

We can find some similarities in the behavior of the variables in these three shocks in which risk aversion increased. In all of them, major global stock market indices fell, stock markets volatility rose, yields on risk-free assets fell due to higher prices (increased demand), the US dollar appreciated against other currencies (specially EEs' ones), sovereign risk premia increased in EE, and commodity prices declined.

Another common feature among the three shocks is the greater worsening of financial conditions in South American EEs compared to AEs. The observable disparity between the peaks of both the IFCI-SA and the ANFCI can be attributed to this greater impact. It is worth noting that in shock (2), although financial conditions also deteriorated in the AEs, the difference between the two indicators was much larger compared to the other two shocks. This divergence was expected by the fact that the core of this shock was centered in the EEs.

Figure 1 also illustrates smaller shocks that occurred between 2010 and 2012, which correspond to the three waves of the European crisis. In mid-2013, the effects of the so-called "Bernanke Talking" can be observed, and by the end of 2018, the impact of the US-China trade tensions becomes apparent. In all these shocks, financial conditions deteriorated the same as or more in the South American EEs than in the AEs. This result justifies the use of the IFCI-SA for specific EEs.

In contrast, during periods of favorable global financial conditions, South American EEs tend to experience a greater improvement than the AEs. This may be attributed to investors' increased risk appetite in such periods, leading to a higher demand for risky assets at the expense of safer assets. Figure 1 illustrates this trend, with the IFCI-SA consistently below the ANFCI when both lines are below the median level that indicates a better global financial environment.

Interestingly, towards the end of the sample period, after the pandemic crisis, peak (3) in Figure 1, we observe that South American EEs were in a more favorable financial environment than AE. This period also concurs with a sharp increase in commodity prices. Thus, commodity prices worked as an amplifier for favorable financial conditions during this period.

However, it should be noted that commodity prices do not always amplify the global financial conditions for South American EEs. Prior to the GFC, for example, we observe a greater worsening in AEs compared to South American EEs. This suggests that even during a period of already restrictive financial conditions for both groups (as the IFCI-SA and ANFCI were above the median), South American EEs were in a relatively better financial environment compared to AEs, see Figure 1. A closer examination of the commodities during that period reveals a significant upward trend in their prices, indicating that they worked as a buffer on South American EEs' financial conditions in that case.

To deepen in the impact that commodity prices may have on global financial conditions for South American EEs, in the next section we will analyze the effect of Russia's invasion of Ukraine. This recent shock combines an increase in commodity prices (type C shock in Table 1) and higher inflation expectations in the AEs (type F.1 shock in Table 1), both due to a negative supply shock.

5.2 The impact of the Russian invasion of Ukraine

This section presents an empirical analysis aimed to evaluate the impact of the Russian invasion of Ukraine on the IFCI-SA and the variables used for its estimation. The procedure for assessing this impact is as follows.

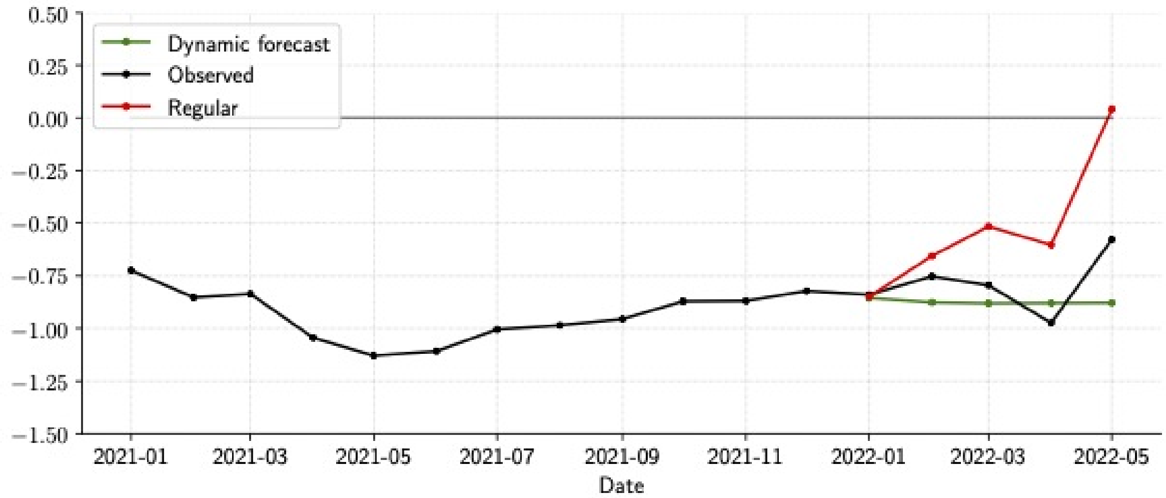
First, we establish a "Dynamic forecast" scenario, which uses data up to a certain date and assumes no additional shocks occurring after that date, either to the common factor or the idiosyncratic components of observable variables. This kind of forecast will serve as a benchmark for comparison with other scenarios. In this case, we estimate the model presented in Section 4.1 using data up to January 2022, one month prior to the invasion. Subsequently, we build the "Dynamic forecast" scenario for the IFCI-SA and the observable variables by forecasting recursively up to May 2022.

Second, we simulate another scenario denominated "Regular" financial shock, where all the variables included in the IFCI-SA follow the expected direction outlined by the model in situations of heightened financial stress, i.e. as in shock (A) in Table 1. We employ the estimated parameters with the data up to January 2022 to capture the relations between the different financial variables during the estimation period. In this scenario, we use the real trajectory of all the global financial variables ($\mathbf{z}_{1t}$ in Section 4.2) from February 2022 to May 2022 except for *Tr10Y*, which behaved in this period contrary to what was expected. During a regular financial crisis, investors typically increase their allocation to risk-free assets such as 10-Year US Treasury Bonds to safeguard their portfolios against market volatility, leading to a decrease in *Tr10Y*. However, in the case of a supply shock, such as the one caused by the Russian invasion, inflation expectations rise significantly, leading the central banks raising the monetary policy rates to address inflationary pressures. According to the expectations' theory, long-term rates like *Tr10Y* respond to expected movements in short-term rates, such as monetary policy rates. Thus, to complete our "Regular" financial shock scenario, we generate predictions for *Tr10Y* as well as the rest of the variables associated with the degree of risk aversion towards assets in South American EEs ($\mathbf{z}_{2t}$ in Section 4.2), namely sovereign risk premia and commodity prices.

Finally, we denote as "Observed" the IFCI-SA whose parameters have been estimated with data up to January 2022, but the index has been computed with data spanned to May 2022. For the observable variables, "Observed" just denotes real data up to May 2022.

Upon comparing the three scenarios, see Figure 2, we observe that the "Observed" IFCI-SA exceeds the "Dynamic forecast" in almost every month, but remains below the simulated path for the "Regular" financial shock. This indicates that the South American EEs experienced a tightening of financial conditions with the onset of the war, albeit to a lesser extent than what would have been expected in a standard financial crisis.[5]

Figure 2: The Impact of the Russian invasion of Ukraine on the IFCI-SA. Comparison of different scenarios.

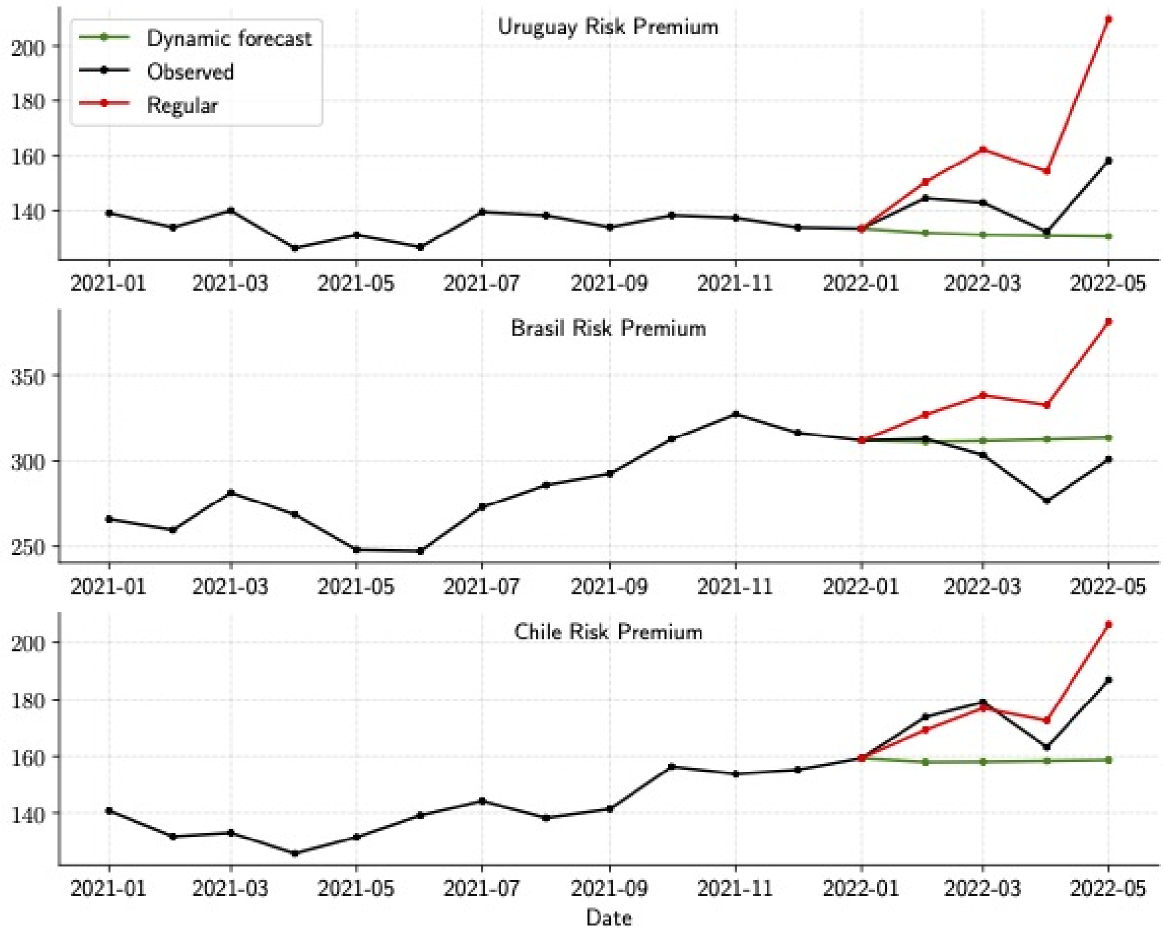


The model also facilitates a comparison between the trajectory of the observable variables for the three scenarios. During this period, the sovereign RP were lower than what would have been expected in a "Regular" financial shock scenario, see Figure 3. This divergence can be attributed primarily to the prevailing shock during that period, as well as idiosyncratic factors specific to each country. Additionally, the supply shock experienced by South American EEs resulted in commodity prices being higher than the

[5]Note that this exercise assumes the conflict as the only significant event since February 2022. The break observed in April 2022 may be attributed to the peace negotiations that took place in that month and the dovish tone expressed by certain Federal Open Market Committee members.

trajectory associated with a "Regular" financial shock, see Figure 4.

Figure 3: The Impact of the Russian invasion of Ukraine on South American sovereign RP

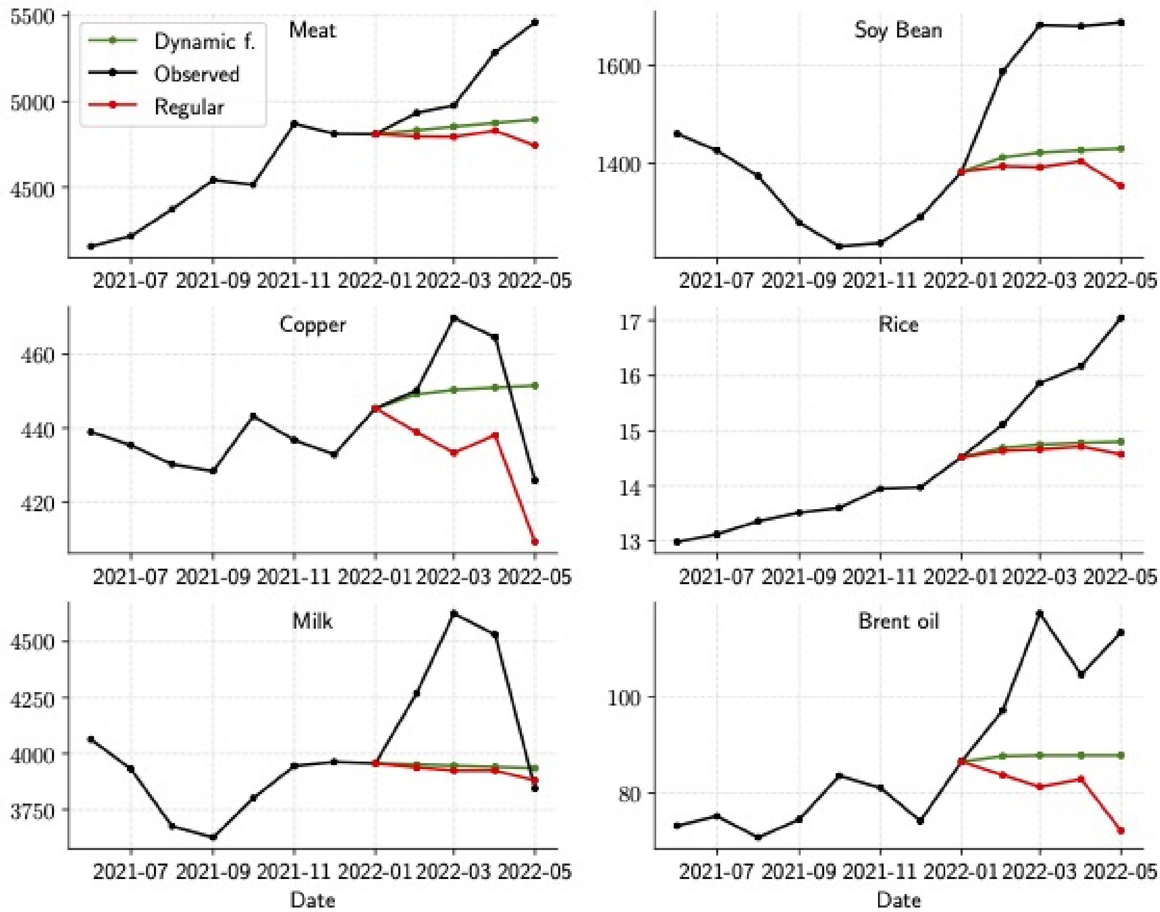


This case study emphasizes the importance of a specialized indicator to assess the financial conditions of South American economies. This index not only incorporates common global financial variables but also considers the price of crucial commodities and the sovereign debt risk premium of specific countries.

6 Conclusions

The international landscape following Russia's invasion of Ukraine in early 2022 witnessed prospects of lower growth and higher inflation, leading to increased risk aversion in global financial markets. However, South American EEs experienced a mitigated impact from this more restrictive global financial cycle due to the significant surge in commodity prices following the war. Given the sensitivity of these economies to commodity price movements, which directly affects their external debt obligations, it becomes crucial to incorporate commodity prices to assess their international financial conditions.

Figure 4: The Impact of the Russian invasion of Ukraine on some commodity prices



Reviewing previous literature on this matter, we do not find anything focused on South American EEs. For this reason, we propose an International Financial Conditions Index for South American EEs (IFCI-SA), particularly Brazil, Chile and Uruguay. In addition to the usual financial variables provided by the literature for building this kind of indexes, the IFCI-SA incorporates the risk premia of the sovereign debt of the previous countries, and the prices of their most relevant commodities. As we only aim to capture the common external framework, domestic financial variables are not included in the indicator.

To estimate the IFCI-SA from previously chosen observable variables, we use a Dynamic Factor Model. In our model, the dynamics of each system observable variable is determined by a single common factor, which represents the co-movement of all the variables, and an idiosyncratic component.

Once the IFCI-SA is obtained, we identify different relevant periods to characterize the financial conditions for South American EEs, from October 2007 to May 2022. This evaluation tool can be used even when some variables evolve favorably and others negatively. Specifically, we evaluate the financial conditions of the South American economies during the months after the Russian invasion of Ukraine, and we use the DFM forecasts to measure the impact on the variables that make up the indicator of the supply shocks associated with this conflict.

The empirical analysis based in our IFCI-SA indicates three important aspects: (1) the relevance of building indicators of financial conditions tailored for specific economies; (2) the value of using a multivariate financial indicator, which consider different risk approaches; and (3) the usefulness of incorporating certain commodity prices in order to assess the financial conditions for the EEs. In fact, we find that, in different periods of the sample, commodity prices have served both as amplifiers and buffers to global financial conditions.

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Appendix

Parameter	Estimate	SE	$t-$statistic
β^{DolEm}	1	—	—
β^{Tr10Y}	-.50	.11	-4.37
β^{SP500}	-1.18	.11	-10.27
β^{VIX}	.95	.11	8.84
β^{Brent}	-.91	.11	-8.16
β^{COP}	-.84	.11	-7.67
β^{Meat}	-.31	.11	-2.81
β^{SB}	-.49	.11	-4.40
β^{Rice}	-.14	.11	-1.22
β^{Milk}	-.09	.11	-0.85
β^{BraRP}	1.21	.11	10.81
β^{ChiRP}	1.23	.11	11.08
β^{UruRP}	1.26	.11	11.20
ϕ_1	.43	.08	5.22
ϕ_2	-.15	.08	-1.79
Φ_1^{DolEm}	.32	.08	4.26
Φ_1^{Tr10Y}	.25	.07	3.41
Φ_1^{SP500}	.57	.04	16.27
Φ_1^{VIX}	-.11	.08	-1.38
Φ_1^{Brent}	.06	.08	.71
Φ_1^{COP}	.21	.08	2.75
Φ_1^{Meat}	-.02	.08	-.22
Φ_1^{SB}	.29	.07	3.93
Φ_1^{Rice}	.28	.07	3.81
Φ_1^{Milk}	.41	.07	6.00
Φ_1^{BraRP}	.03	.09	.28
Φ_1^{ChiRP}	-.09	.09	-.98
Φ_1^{UruRP}	.21	.10	2.24
σ_f^2	.65	.06	10.51
σ_{DolEm}^2	.65	.04	18.53
σ_{Tr10Y}^2	.97	.05	18.65
σ_{SP500}^2	.57	.04	16.27
σ_{VIX}^2	.72	.04	17.67
σ_{Brent}^2	.75	.04	17.88
σ_{COP}^2	.74	.04	17.97
σ_{Meat}^2	.88	.05	18.53
σ_{SB}^2	.88	.05	18.24
σ_{Rice}^2	.96	.05	18.70
σ_{Milk}^2	.90	.05	18.70
σ_{BraRP}^2	.51	.03	15.46
σ_{ChiRP}^2	.49	.03	14.75
σ_{UruRP}^2	.44	.03	13.84

Table 2: Parameter Estimates