Common Drivers in Emerging Market Spreads and Commodity Prices

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Abstract

This paper presents and evaluates the hypothesis that emerging countries specialized in commodity production are prone to experience non orthogonal commercial and financial shocks. Specifically, we investigate a set of global macroeconomic variables that, in principle, could simultaneously determine in opposite direction commodity prices and bonds spreads in commodity-exporting emerging economies. Employing common factors techniques and pairwise correlation analysis we find a strong negative correlation between commodity prices and emerging market spreads. Moreover, the empirical FAVAR (Factor Augmented VAR) model developed to test our main hypothesis confirms that this negative association pattern is not only explained by the fact that commodity prices are one of the most relevant fundamentals for commodity exporters bond spreads. In particular, we find that reductions in international interest rates and global risk appetite; rises in quantitative global liquidity measures and equity returns; and US dollar depreciations, tend to diminish spreads of emerging economies and strengthen commodity prices simultaneously. These results are relevant in order to improve our knowledge regarding the reasons behind some typical characteristics of emerging commodity producers, such as their tendency to experience high levels of macroeconomic volatility and procyclicality, or their propensity to be affected from exchange rate overshooting, external crisis and sudden stops. Concerning policy lessons, a key conclusion is the difficulty in disentangle challenges coming from financial openness and structural considerations in emerging economies, such as the lack of diversification of the productive structure or the difficulties of a growth strategy solely based on natural resources. It would be profitable to internalize the connection between these two key variables in formulating and conducting economic policy.

JEL Classification: F32, F42, O13

Introduction

Casual observation is enough to notice that the performance of emerging economies (EEs), whose productive structure relies mainly on the production of commodities and which are simultaneously open to capital flows, is largely determined by the events of the global economy.

In fact, there is a relative consensus that, regardless of the potentially beneficial effects of capital flows into emerging economies, they tend to exacerbate volatility and pro-cyclicality of the receiving economies, simultaneously impacting sharply on the real exchange rate (RER).

Likewise, numerous studies suggest that for emerging economies concentrated in commodity production, changes in the terms of trade also tend to increase volatility, pro-cyclicality and tendencies towards exchange rate overshooting, creating on some occasions undesirable effects such as those associated to Dutch disease, in addition to impacts on other key variables such as inflation or income distribution.

However, a connected and less-studied hypothesis, which this paper intends to develop and test, is that what happens with commodity prices and capital flows may be substantially explained on the basis of the same set of international exogenous variables. Thus, they would be concurrent expressions of the same fact: two symptoms produced by the same cause.

Therefore, our hypothesis argues that there are common exogenous determinants behind these two critical variables contributing to generate a positive and significant correlation between capital flows and commodity prices.

Traditionally, when the interdependence between a small economy and the rest of the world is studied, two shock transmission channels are frequently considered: the commercial and the financial channels. In the theoretical models and in the analysis of emerging economies, these channels tend to be thought of as orthogonal, in the sense that shocks transmitted through one of the channels (in this case, commodity prices changes in the commercial channel) are independent from the shocks transmitted through the other (such as a change in the net inflow of foreign currency or a change in EEs risk premium). If we can effectively establish that the same set of global factors influence capital flows and commodities simultaneously in the same direction (i.e. when commodity prices go up, there is capital inflow and country risk premium go down, and vice versa), there would be then an important link between the commercial and the financial channels.

Similarly, if there is evidence of a positive correlation between the availability of external finance and the international export prices in EEs commodity producers, then new and important questions for economic policy will arise.

Moreover, evidence in this direction would be a powerful explanation behind trends towards volatility, pro-cyclicality and exchange rate overshooting in EEs: the combined effect of experiencing strongly-correlated commercial and financial shocks.

This raises a complex scenario for economic policy, especially when the number of policy tools available is limited. Thus, some common problems of emerging countries, such as the existence of an undiversified productive structure or the failure to grow steadily based on

natural resources, should not be analyzed separately from the challenges posed by a higher level of financial integration.

In this sense, the recommendations would point in two directions. On the one hand, to expand the number of available policy instruments, due to higher (non-orthogonal) interrelation between commercial and financial shocks. Particularly, since the rationale for capital flows regulation is reinforced. The second recommendation, closely related to the first one, is to strengthen the counter-cyclical nature of key macroeconomic policies. The results provided by this paper also help to reconsider the challenges that the international context raises for a development agenda focused on knowledge-based structural change, as stated, for example, in Cimoli, Dosi and Stiglitz (2008).

Regarding methodology, the empirical evidence is presented in two stages. The first one includes common factors techniques to find summary measures that could be identified in a set of bonds returns of commodity exporters EEs. Then, the same technique will be used to isolate the common factors for a selected group of the most representative international commodity prices. The second stage will consist in the construction of an error-correction autoregressive vector model. This approach is framed within the so-called FAVAR or FAVEC models (factor augmented VAR-VEC models), introduced by Bernanke, Boivin and Eliasz (2005) and Stock and Watson (2005), and extended by Banerjee and Marcellino (2009), and Banerjee, Marcellino and Masten (2010).

This paper is organized as follows. The next section describes the theoretical framework, explaining the channels where we expect to find an association between commodity prices and external financing access. In this section, the focus is on reviewing the empirical papers that have studied, though unconnectedly so far, the determinants of these variables.

The second section analyzes the evidence gathered when applying common factors techniques to a group of sovereign risk indices of commodity exporters and to a set of representative commodities prices, respectively. The methodological advantage of this technique lies in that it allows getting summary measures for the evolution of these variables putting extra weight to the individual series that better describe the joint variability. This is to say, these summary measures will tend to minimize the idiosyncratic component of each series, prioritizing the underlying common dynamics.

Following this, an analysis of the co-movement between commodities and spreads factors is made, which leads to the recognition of a strong statistical association between them. To check the hypothesis that this significant correlation may be explained by the same set of international exogenous variables, which impact simultaneously on commodities prices and country risk premium, preliminary statistical evidence will be presented in the third section looking for stylized facts.

The fourth section presents the econometric model that includes both the common factors obtained as from the commodities and risk premium series and the global macroeconomic variables.

The main variables included here are the global liquidity condition, taking into account both the international interest rates and a quantitative measure of liquidity, the dollar real exchange rate, a proxy trying to capture the extent of risk “appetite” or risk “aversion”, and an indicator of an alternative return to commodities and emerging spreads, such as Standard & Poor’s

stock index. In all cases, the results obtained confirm the idea that the global variables impacting positively on commodity prices tend also to reduce sovereign risk and vice versa.

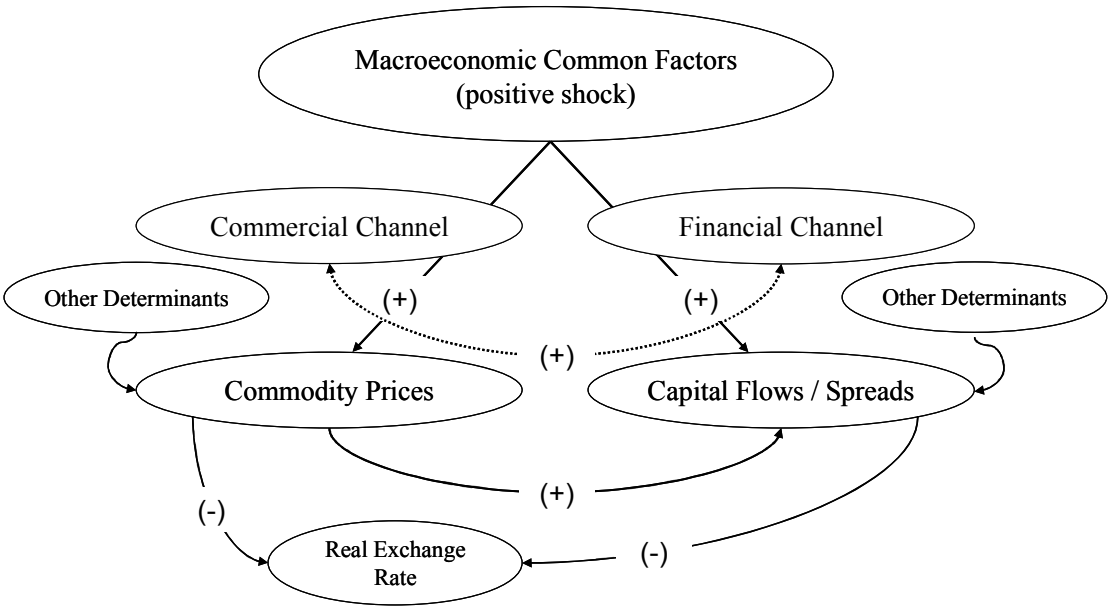
The fifth and last section includes the conclusions, some suggestions for future research and a brief discussion of the main implications for economic policy.

1. Global factors, capital flows and commodity prices in emerging economies

The hypothesis of this paper is based on the critical analysis of two (mainly empirical) branches of literature, in constant progress in recent years largely due to their relevance for emerging economies.

On the one hand, the contributions seeking to understand the determinants of risk premium and capital flows into EEs and, on the other, the studies aimed at explaining the underlying reasons behind erratic and volatile commodity price movements. So far, both branches have made progress in an independent fashion. The joint treatment of both branches is precisely the central contribution of this paper. Figure 1 shows a stylized illustration of the hypothesis of interconnection between the variables of interest.

Figure 1. Stylized representation of the link between capital flows, commodity prices and common global factors in commodity exporters



In the next two subsections, we will discuss in depth the set of elements to be included in the group of international exogenous macroeconomic variables depicted in the upper part of Figure 1. Let us assume for the moment that we are dealing with a global liquidity shock, quantified via a reduction of the international interest rate. At a theoretical level[1], this shock is expected to transmit positively to emerging countries that export primary goods, resulting in a

[1] The next section will detail the theoretical reasons for the expected signs of both the interest rate and the remaining variables grouped at the top of Figure 1.

commodity price increase and simultaneously driving capital flows into these economies or, alternatively, reducing the returns on the investment of such countries' assets.

Now, this direct effect may potentially create by itself a positive correlation between variables and, therefore, between the shocks on the commercial and the financial channels (illustrated with the dotted line). But we should also add to this reasoning the effect that commodity price increases has on the availability of external financing in emerging economies that rely strongly on commodities.

The improvement in export prices of these economies brings about important consequences. Added to the relaxation of external restriction, there is a higher level of private expenditures and fiscal resources due to the expansionary effects on tax and non-tax revenues (for example, due to the existence of exports taxes or through public property of resources such as mines or oil camps). In addition, they are associated to a positive impact on economic activity and consumption levels in the short term and potentially to higher savings and investment levels in the long term. As a result, *ceteris paribus*, the international investment position and the sustainability of public and external debt of these countries would tend to improve.

These reasons explain why an increase in export prices is a relevant signal of the relative strength in the fundamentals of commodity producer EEs. This signal is taken into account by investors at the time of making a decision on these countries' assets. In addition, it is also likely that international investors may decide to take positions in commodities as an indirect way of increasing their exposure to the emerging countries that produce these goods, especially if the number of financial instruments available in these countries is small or is restricted by controls and/or regulations. This direct correspondence is illustrated in Figure 1 with the solid line with a positive sign from commodity prices to the financial flows (the sign would be negative if the effect on spreads were considered). Therefore, as it can be observed, there is a mutually reinforced link between the direct channel (the causality of which would go from prices to financial flows) and the indirect correlation channel coming from the international variables.

Finally, as an illustration, we have included in Figure 1 the joint effect that the combined shock would cause on the domestic variables. A particularly relevant variable is the real exchange rate (RER). The empirical evidence has already established that both the increase in the terms of trade and the capital inflows tend to appreciate the RER. Thus, in case of a global shock with the above-mentioned characteristics, two price signals will arise. The increase of commodity relative prices against the remaining tradable goods tends to strengthen the bias towards productive specialization (primarization) in sectors with comparative advantages. Another signal of relative prices adds up, i.e. the change in the real exchange rate, which tends to favor non-tradable production. Thus, the correlation between commercial and financial shocks increases the challenges associated with the Dutch disease, such as transforming the productive structure of EEs or closing the productivity gap with industrial nations.

As illustrative as the previous example would be an analysis of the combined effects of interconnected commercial and financial shocks on GDP cycle. If external shocks tend to be synchronized, it is straightforward to expect wider amplitude of GDP fluctuations (more volatility) and, therefore, more difficulties for anti-cyclical policy tools to smooth output or employment.

Based on this general framework, the links of capital flows and commodity prices with the global macroeconomic variables are analyzed in the next two subsections.

1.1 The effect of global macroeconomic factors on capital flows and risk premium

The analysis of capital flows literature in the last two decades raises a relevant and widely discussed question: the extent at which financial flows could be explained by idiosyncratic factors, intrinsic to the receiving country or, rather, by exogenous variables (originated in the international context) and on which no direct influence may be exerted.

In this sense, in what is already an usual distinction, which started with the works by Calvo, Leiderman and Reinhart (1993), Chuhan, Claessens and Mamingi (1993), Cantor and Packer (1996), and Fernandez-Arias (1996), two types of categories are considered for capital flow determinants, the so-called push and pull factors.

Push factors refer to the external determinants of capital flows from advanced countries to developing economies, such as the interest rate, global risk aversion or the industrialized countries' activity level.

In contrast, pull factors are related to domestic variables which are presumably taken into account by international investors when deciding portfolio shares to be assigned to developing countries, such as economic growth, the political context, domestic interest rates, macroeconomic stability, exchange rate regimes, inflation rates, fiscal and current account surplus, debt levels international reserves, etc.

Determining the relative weights of push and pull variables is much more than an empirical or theoretical challenge: it is key information in order to decide each country's position regarding the desirable level of financial integration. If a large part of the financial movements to EEs is explained by the exogenous variables of the global context, then the fundamentals of the receiving country would be just partially relevant. There will be a threshold beyond which the improvement in domestic indicators will not translate into a higher stability and predictability of these inflows.

Likewise, determining the degree of relevance of the domestic conditions for the volatility of flows is useful in establishing the level of exposure of each emerging country to problems such as a sudden stops or an exchange rate overshooting. This determination is also useful to analyze the measures required to mitigate these risks ex ante and minimize their costs later on, if these risks are materialized. Thus, in addition to improving the "fundamentals", policy-makers should also take into account the desirable degree of exposure to global factors, mainly because financial integration may be a channel of contagion coming not only from other developing economies but also from advanced countries, as the 2008 crisis has already shown.

Literature on push and pull variables is relatively abundant and includes the studies by Taylor and Sarno (1997), Eichengreen and Mody (1998), Kim (2000), Dasgupta and Ratha (2000), Mody, Taylor and Kim (2001), Ying and Kim (2001), Hernández, Mellado and Valdés (2001), Hartelius, Kashiwase and Kodres (2008), Ciarlone, Piselli and Trebeschi (2009) or Fratzscher (2011), among others.

Among the potential push factors identified in the above-mentioned contributions, global liquidity stance plays a significant role.

In the study of global liquidity, one of the possibilities consists in employing international interest rates, which are used as proxies of risk-free assets returns. The underlying idea is that this variable summarizes the global liquidity stance and probably should have a positive correlation with emerging countries' spreads (or a negative correlation if flows are observed in terms of volumes). A current discussion on the effect of the international rates is the hypothesis stating that an excess of global liquidity would have contributed since the early 2000s (after the stock market bubble) to narrow the spreads of the emerging countries (Hartelius et al., 2008).

Alternatively, an option or a complement to interest rates variables is the use of liquidity quantitative measures, such as the growth rate of some monetary aggregate (see, for example, Rüffer and Stracca, 2006 or Brana and Lahet, 2010). In relation with this issue, from 2008 international crisis on it is increasingly evident that monetary policy state cannot be properly summarized by the nominal rate under situations of liquidity trap; therefore, it is also relevant to have global quantitative measures to characterize the state of this variable.

The empirical applications frequently work with the US interest rates or, on some occasions, the interest rates of other developed countries. Both short-term rates, such as the Fed Funds rate or, alternatively, longer-term rates for which Treasury bonds are taken as benchmark have been employed. Some papers also analyze the impact over financial flows to EEs of variables such as international interest rate volatility or the slope of the yield curve (term structure). Quantitative liquidity measures are rather uncommon in these studies about push and pull factors. In this respect, an exception is the paper by Matsumoto (2011) who, following the practices of policy-makers and financial market analysts, constructs a liquidity proxy (in the sense of funds availability in perceived safe assets[2]), by adding up the monetary base of the United States and the world total reserves of the remaining countries.

Another aspect to consider in relation with the potential push factors is related to market "sentiments".

It is quite evident that both the subjective perceptions and the collective behavior of investors are critical to explain the evolution of asset prices. However, in order to proxy these aspects in an empirical model, we need operationally to construct quantifiable measures of these "sentiments", and this is problematic since, even though widely used, these are vague notions. In this respect, one of the most popular concepts is the global risk aversion/appetite related, for example, to investors' behaviors such as the so-called "flight to quality".

In this case, the intuitive idea is that the average investor may experience sudden changes in their risk preference, leading to sharp portfolio rebalancing where safe assets (typically government bonds or corporate bonds with top credit ratings of countries deemed as safe) gain or lose relative share in favor of, or to the detriment of, risky assets such as emerging countries' bonds, equity or commodity contracts, among others.

[2] Following the discussion found in the economic literature, Matsumoto (2011) states that, beyond this criterion, it is also valid to associate liquidity to the availability of funds in risky markets or assets.

Thus, the empirical estimations have tried to account for this type of behavior via a proxy for measuring risk. Generally speaking, the preferred variable used in these studies is the VIX index, constructed on the basis of implied volatilities of a wide range of options of the S&P 500.[3] Therefore, it is expected that as this indicator increases, capital flows into emerging countries (especially, portfolio flows) will drop and sovereign bond spreads will go up. To analyze the evolution of the liquidity stance during several stress periods such as the one the world economy has been experiencing in recent years, the proposal is to supplement the traditional risk measures with other variables such as the TED spread, i.e. the difference between the 3-month Treasuries and the interest rates on interbank loans at the LIBOR rate, which proxies the short-term credit risk or default premium (Gonzáles-Hermosillo, 2008; Fratzscher, 2011).

Thus, global liquidity and risk measures are the basic specification of push variables in econometric models available in the economic literature. The list of additional variables as from this set of reference starts to differ among studies. Other usual controls are the returns on alternative investments to emerging countries' bonds (mainly equities) or measures of world aggregate demand.

It is not the main objective of this paper to discuss a comprehensive list of potential push variables which, on the other hand, necessarily needs to be adjusted to the specific problem under analysis, either due to conceptual measures such as the characteristics of the economies being analyzed, the type of flow or yield being considered or the sample period, or due to operational issues such as the data frequency or the limitations and restrictions resulting from the selection of the specific econometric model.

However, it is important to emphasize that in the empirical estimations included in the fourth section of this paper, we have only focused on the specification of push variables, without this implying that we are playing down the role of domestic factors; in fact, there are several reasons that justify our decision to concentrate on these exogenous determinants.[4]

First and foremost, because the purpose of this paper is to study common trends in spreads and they can only be reasonably explained to the extent that they respond to some general and shared determinants inherent in the emerging countries of the sample. Likewise, when applying common factors techniques to the return series, the weight of pull factors will tend to be significantly reduced, since the summary measure obtained with such methodology minimize the relevance of the idiosyncratic components.

Additionally, and due to the fact that literature points out that the relative weight of push factors tends to be very high, a focus on these factors would explain a substantial part of capital flows dynamics and risk premium of commodity producer EEs. For example, Kim (2000), and Ying and Kim (2001) estimate that push variables such as the business cycle and the international interest rates account for more than 50% of capital flows into Mexico and

[3] Nevertheless, the list of variables that may be potentially associated to the idea of risk is quite long. A comprehensive list of financial indicators to proxy risk appetite may be found in ECB (2007).

[4] This is due to the fact that in order to analyze the relevance of pull variables it is critical to count on variability data on the cross section dimension, so as to introduce a group of variables inherent in each country. These differences among countries will be important to understand the reasons for spread discrepancies among EEs. Capturing this element would require an alternative econometric approach to the time series model used in this paper.

Korea. In line with this result, Hartelius, et al. (2008) estimate that exogenous factors such as the risk appetite reflected in the VIX Index and the Federal Funds rate account for 56% of spread changes in a wide sample of emerging countries. Similarly, a paper by González Rozada and Levy Yeyati (2006) reveals that push factors explain 41% of the emerging countries' spread variability for the full sample under analysis (1993-2005) and over 50% if the analysis focuses on the 2000-2005 sub-sample. Diaz Wiegel and Gemmill (2006) have analyzed the role of global, regional and idiosyncratic variables, and have found that the latter only accounts for 8% of the total variance of the distance to default, an implied measure of spreads. In a similar line, Audzeyeva and Shenk-Hoppé (2010) have studied a sample with daily data for Brazil, Mexico and Colombia and conclude that if all the different global determinants are added, then their quantitative relevance is higher than the sum of the regional and individual effects, even though relative weights change across countries and in the different sampling sub-periods.

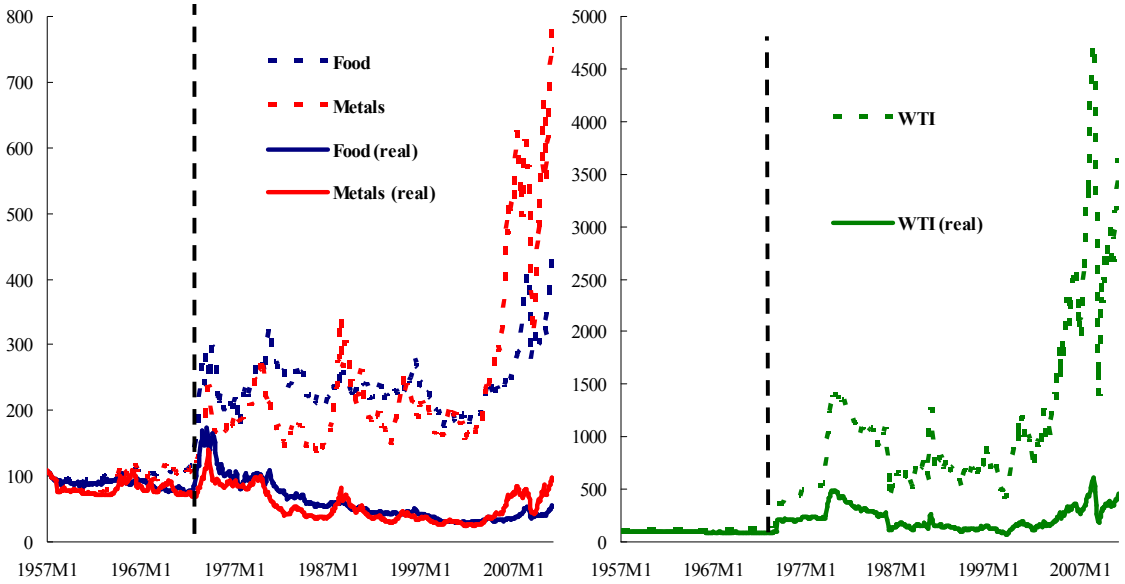
1.2 Global macroeconomic factors and commodity prices

From Prebisch's pioneering work (1949) on, there has been an intense debate about the key role played by the configuration of the international division of labor in the determination of trend commodity prices. In the two decades after Prebisch's contribution, prices of the main commodities remained relatively stable in nominal terms –at least according to the current stability standards– and have declined in real terms (Ocampo and Parra, 2003), within an international context of fixed exchange rates in the "Central" countries, controls on cross-border capital movements, as well as regulations and limits to the banking and financial activities.

The reconfiguration of the world macroeconomy during the 1970s, with the first oil crisis; the fall of the Bretton Woods regime and the abandonment of the post-war accumulation pattern started to add volatility to commodity prices. A simple visual inspection of Figures 2 and 3 confirms the idea of a structural change around 1973.[5] As a result, the explanations that would allow accounting for mid-term fluctuations, cyclical patterns and volatility, beyond any secular trend, gained an increasing room in the literature. This was the beginning of a study field focused on the role of international macroeconomic determining commodity prices.

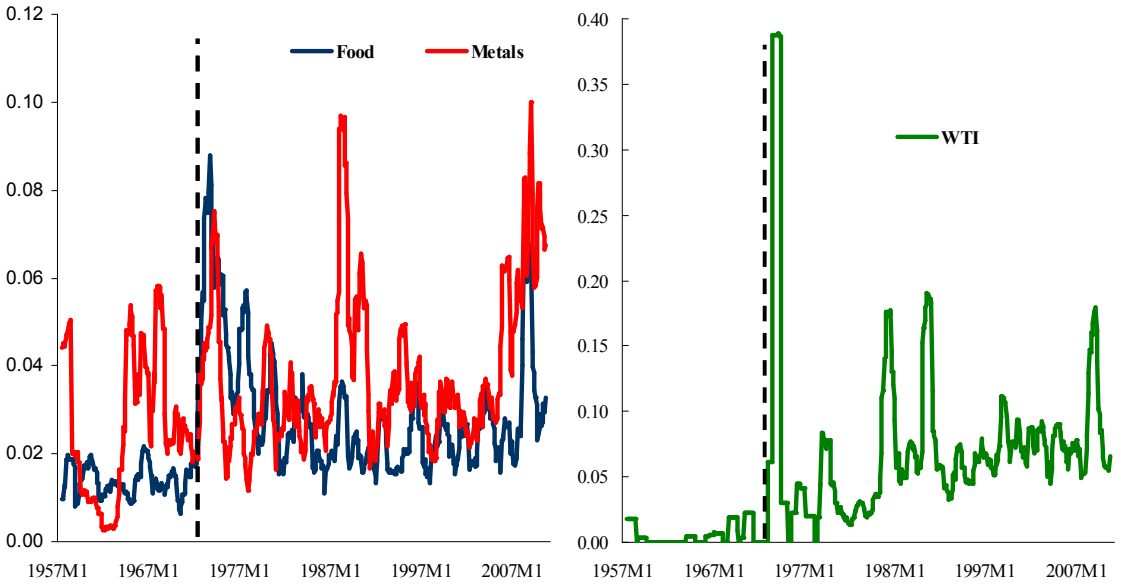
[5] The long-term data study by Cashin and McDermott (2002) provides conclusive econometric evidence on the change entailed by the abandonment of the Bretton Woods regime for commodity price volatility.

Figure 2. Nominal and real commodity prices in dollars for food, metals and oil, 1957-2011 (basis 1957=100)



Source: Author's calculations based on IMF data. Real prices were calculated by deflating nominal prices in dollars using the US Consumer Price Index.

Figure 3. Commodity price volatility for food, metals and oil, 1957-2010 (basis 1957=100)



Source: Author's calculations based on IMF data. Volatility was calculated as the standard deviation of nominal prices variation rates within a 12-month rolling window.

In this agenda focused on macroeconomic factors initiated in the 1970s, the first attempt was to relate basic goods' price variability with movements in exchange rates of the main currencies started in 1973.

In fact, the pioneering work of Ridler and Yandle (1972) states that a fall in the US dollar real value (i.e. a real depreciation of the US exchange rate) should result in a commodity price hike measured in US dollars.[6] This effect was further refined by Dornbusch (1985) who, using a two-country model, obtains an analytical expression of commodity relative price elasticity to the US dollar real exchange rate, which depends on demand elasticities of and the share of each country in commodity world trade. Borensztein and Reinhart (1994) have extended Dornbush's model to include a role for aggregate supply. Thus, on the empirical front, these studies have tended to confirm the negative association between these variables.[7]

More recently, and with a remarkable intensity as from the international financial initiated in 2007, the macroeconomic aspects related to commodity dynamics have gone beyond the traditional channels linked to global demand and supply of primary goods and have focused on the effect of monetary and financial macroeconomic factors.

In this sense, the issue of "commodity financialization" is not only related to the increasing space that financial assets related to primary goods have acquired for investors or to the increase in the volume of new instruments and derivatives, but it also makes reference to the increasing weight of the global financial aspects on price determination. One of the hypotheses associated to this research line is the one that argues that these goods have become more sensitive in recent years to financial investors' portfolio rebalancing (Inamura, Kimata, Kimura and Muto, 2011).

Thus, as in the case of capital flows to EEs, one of the crucial issues is related to the impact of international liquidity (rates and/or monetary aggregates) on prices.

On a theoretical level, the link between interest rate and commodity prices has been documented in Hotelling's classical article (1931) for the case of non-renewable resources with a fixed supply. Frankel (2006) finds three channels through which an interest rate increase may be expected to impact on prices: i) by increasing the incentive to extract (or produce) in the present rather than the future; ii) by reducing companies' intention to hold inventories, and iii) by encouraging speculators to sell futures contracts and purchase Treasuries. These three channels would tend to reduce spot prices.

Along this line, empirical estimations do not provide conclusive evidence about the hypothesis of a negative correlation between the international real interest rate and the real price of primary goods. Bastourre, Carrera and Ibarlucia (2010) have used a smooth transition equilibrium correction model and have found that the US real rate impacts negatively on prices, both in the short and the long term, regardless the size of commodity price misalignment with respect to their "fundamental" equilibrium. Likewise, Akram (2008) concludes, resorting to a structural VAR, that there is a transmission of interest rate shocks with negative sign to commodities and, in the special case of oil and raw materials, there is also a price overshooting pattern in the short term. On the contrary, this relationship does not seem to be robust in the study of Frankel and Rose (2009), where the effect of the international rate is studied together with other macroeconomic variables for eleven

[6] This effect is intuitively explained by a higher purchasing power in dollars of the remaining countries and the resulting pressure on the demand for commodities.

[7] About this point, and in addition to the already mentioned references, it would be useful to see the results reported by Gilbert (1989), De Gregorio, Gonzáles and Jaque (2005), or Bastourre, Carrera e Ibarlucia (2008).

individual commodities. Although in seven out of the eleven cases, a negative association is found, the variable is significant only in the equations of two individual commodities.[8] For the specific case of oil, Anzuini, Lombardi and Pagano (2010) have found that the interest rate shock can only explain a small portion (around 5%) of its price variability.

However, at this point, the economic literature faces a difficulty similar to that found in the studies about spread determinants, since it is difficult to uphold that interest rates adequately summarize the liquidity stance, especially at times of financial stress.[9]

In this sense, we have also found contributions including other liquidity proxies in the statistical and/or econometric analysis, such as Inamura et al. (2011), which is highly illustrative in this sense. In that paper, the authors seek to associate to prices both an international interest rate gap (measured as a weighted average of the difference between the real interest rate and the potential growth rate in a broad set of developed and developing countries) and a gap of the M1/GDP ratio against its trend value. In a study about the impact of global variables on two highly dissimilar commodities, such as premium wine and oil, Cevik and Sedik (2011) use as excess liquidity measure the difference between monetary base growth and the estimated demand for money in the United States, Japan, United Kingdom and the Euro Zone, and conclude that this variable may have a remarkable econometric value which the authors attribute to the indirect effect of liquidity on demand. Another example is the empirical specification used by Bastourre et al. (2008), where both a global real interest rate and an international real liquidity measure are used, the outcome of which is that both variables are significant and have the expected sign.

Now, if we are interested in analyzing commodities from a financial perspective, any basic portfolio model where commodities are introduced as "assets" would lead us to think that the shares to be assigned to them in a portfolio will not depend exclusively on the risk-free rate or on liquidity availability. The interactions (covariances) with the remaining risky assets or with the international context where financial markets operate will also be relevant. Contributions such as those of Gorton and Rouwenhorst (2004) or Erb and Harvey (2005) have been important to characterize the features of commodities as financial assets. Econometric estimations about the macroeconomic determinants of prices, such as those of Vansteenkiste (2009) or Bastourre et al. (2010), have considered the proposal of introducing international equity return indicators as global determinants.

In this research line related to the incidence of global financial variables on price determination, we consider that it is relevant to include a variable to proxy risk. To the best of our knowledge, this global factor has not been examined in this literature, contrary to what we have seen in the contributions about emerging debt spreads, where financial risk is a critical element. If there is a component in the demand for commodities that is related to the desire of holding a diversified financial portfolio, then it would be intuitive to expect a negative association between commodity prices and risk appetite, since speculative demand would tend to reduce in contexts of high volatility and uncertainty. This reasoning does not apply to the

[8] The result is repeated in a panel data regression including eleven commodities, where the sign is the expected one but the variable is not statistically significant.

[9] In fact, in forums such as the G-20 or in the international lending organizations, there is at present an ongoing discussion on the most appropriate variables to summarize and monitor the international liquidity stance.

specific case of gold, which is usually seen by investors mainly as a protection during episodes of widespread financial instability and uncertainty.

As evidenced by the analysis and summary of the different contributions included so far in this paper, there is a set of highly similar global determinants used in the econometric models seeking to explain both emerging risk premium and commodity prices. In the remaining sections, we will explore if a strong negative correlation can be found in the data and analyze if that co-movement may be attributed to global exogenous variables with an empirical framework seeking to integrate both branches of the literature.

2. Risk premium, emerging countries and commodity prices: common factors analysis results

The purpose of this chapter is to generate summary indicators of the behavior of emerging countries' risk premium and commodity prices, both measured in real terms, using common factors techniques. These measures will be indistinctly called common factors, since this is the name used in the literature.[10] The objective of common factors analysis is to explain a set of observed variables by means of a reduced number of latent or unobserved variables (the factors). The measures obtained when employing this technique will allow us to extract one component from a set of correlated series group and, on this basis, generate an index to summarize the common variability implied in the set.

Following the definition provided by Tucker and MacCallum (1997), it may be stated that in any given domain of observable variables, there is a small number of common factors (which are latent or unobservable) that may potentially influence those variables. More accurately, there would be three explanatory sources in the co-variation (correlation) of the observable variables given by: i) the common factor that would simultaneously affect more than one of the observables series, ii) the specific (or idiosyncratic) factors , the so-called "uniqueness" affecting each of them individually and iii) the measurement errors resulting from the previous calculation.

2.1. Sovereign risk premium in the commodity producer emerging countries

In the risk premium analysis, we will restrict our study to the emerging countries where commodity production has an important weight since our hypothesis adjusts in particular to this sub-group, as illustrated in Figure 1.

To focus on this point, we decided to use a sample made up by thirteen emerging countries that participate in the EMBI-G[11] Index, selected on the basis of their export structure. The distinctive characteristic of these economies is that their primary exports have accounted for at least 20% share of their total (including agricultural products, raw material, food, metals and fuels) in the last two decades. For the sample average, commodity exports account for

[10] Perhaps, this might lead to some semantic confusion, since in the previous section we have talked about global common factors or variables which are macroeconomic determinants affecting both spreads and commodities simultaneously.

[11] The EMBI Global Index is an indicator released by JP Morgan that takes into account the total return of the instruments denominated in dollars that are issued by sovereign states and quasi-sovereign entities of emerging markets.

53% of the total. Figure 4 shows individual countries data and the composition according to large sectors within the group of primary goods.

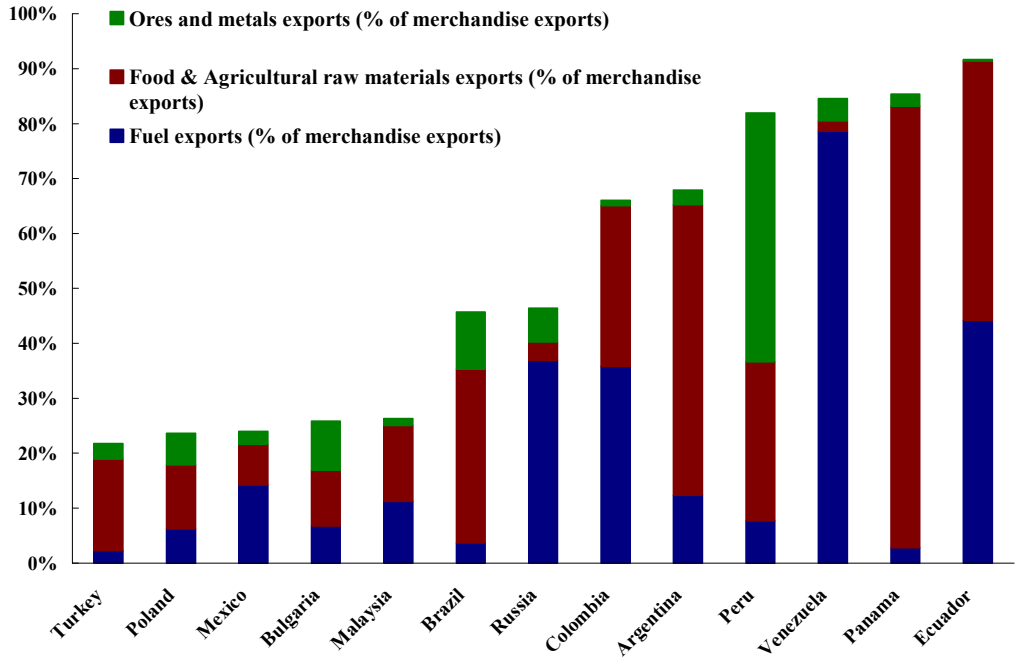
Another restriction is the minimum number of years for which sovereign spreads data are available. A broader sample (starting with the first data available since late 1991) would have restricted the analysis to just three countries (Mexico, Brazil and Venezuela), while a shorter time period would have allowed us to include other relevant cases, such as Chile spreads series since 1999 or South Africa since 2002, but it would have meant an important loss in the time dimension. Taking account those issues, the year 1997 represented a reasonable balance for this trade-off between the maximum length of the time series and the highest amount of countries to be included in the analysis. As a result of this, the sample covers the period between December 1997 and March 2011.

To make the common factors analysis, we have used the EMBI-G monthly series for each country in natural logarithms and deflated by US Consumer Price Index (CPI) so they are expressed as a real return in dollars. We then applied the Augmented Dickey-Fuller unit root test (ADF) and the Phillips-Perron unit root test (PP) to the thirteen return series we had constructed. The application of these tests revealed that all series were integrated of order one I(1).[12]

Although there are several methods to obtain common factors, we have used the maximum likelihood method across this paper since it is widely used in the economic literature.

[12] Even though the common factors analysis is commonly used on stationary series, the technique may be applied without inconveniences if it is assumed that the non-stationarity of the series results from the fact that common factors have a unit root (Dufrenot y Yehoue, 2005). In our case, we have verified that the common factors calculated in this section, for both sovereign returns and commodity prices, show the characteristic of being I(1), by application once again of ADF and PP tests. This topic will be timely discussed in the fourth section.

Figure 4. Commodity export percentage of the countries included in the sample and their composition by large sectors, average 1990-2009



Source: Authors´ calculation based on World Bank data.

Likewise, one of the most relevant decisions within this methodological approach is the selection of a criterion to define the number of factors (see Zwick and Velicer, 1986; Jackson, 1993 or Preacher and MacCallum, 2003). Regarding to this point, it is also possible to use several criteria to make such selection. These criteria tend to weight in a different way a typical underlying trade off between the highest proportion of the explained variance and the minimum number of factors, since the latter facilitates a more parsimonious calculation. Even though there is no limit on the explained variance indicating goodness fit model's measure, some papers, including Breitung and Eickmeier (2006), suggest that an explained variance ratio of around 40% is an acceptable value when using panels with macroeconomic variables.

In this paper, we followed the criterion of using as many factors as necessary to explain at least 70% of the respective series group variability (i.e. both for the set of sovereign spreads and commodities). This guide is also complemented with an analysis of the results of the different statistical criteria so as to reach a final conclusion.

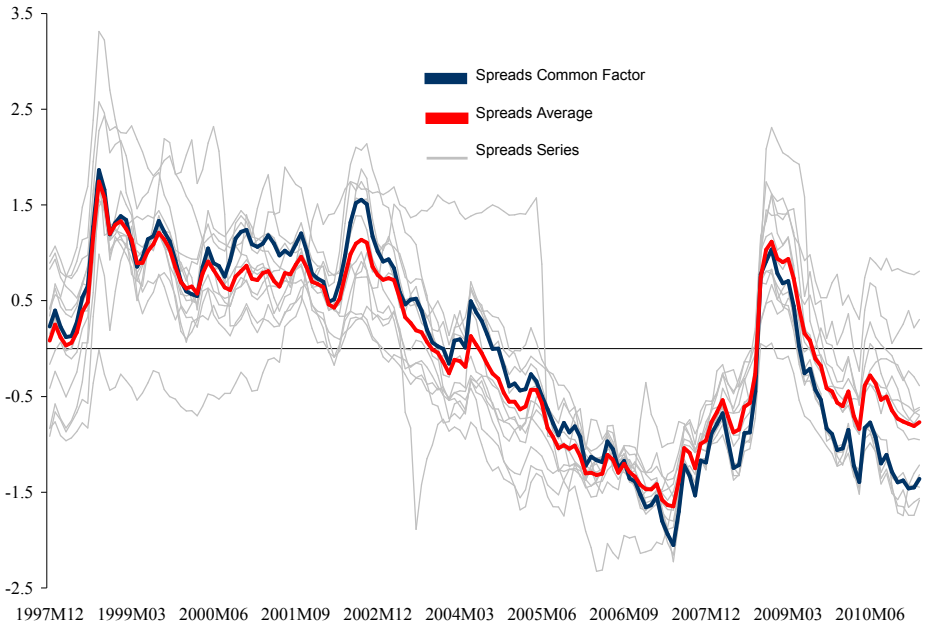
In the case of the emerging countries' risk premium, the use of the above-mentioned minimum threshold has helped us to find that one single factor manages to explain 74% of the real spread movements variability of the thirteen EEs considered.

Regarding the selection criteria, we have found that the so-called Kaiser-Gutman criterion (the most widely used in literature) suggested the presence of two factors, even though the first one accounted for 85% of the model variability, which is to say the first factor accounted for almost the entire portion of the explained variance. This result was also obtained when the minimum eigenvalue with a threshold equal to one was used. Given the high proportion of variance explained by the first factor, we proceeded to use this result, which also allows for a simple economic interpretation when it is associated to commodity prices first and to the

global macroeconomic variables later on.[13] Other studies where the common factors technique is used to assess return behavior in emerging countries also select typically one significant factor with a high explanatory value (see, for example, McGuire and Schrijvers, 2003 or Ciarlone, et al., 2009).

Consequently, Figure 5 illustrates the 13 sovereign spreads with gray lines, as well as the common factor obtained (blue line) and a red line with the arithmetic mean. Let us remember, then, that these series have been constructed as the standardized log of real spreads.

Figure 5. Bond spreads in commodity producer EEs, common factor and simple average



As illustrated in Figure 5, the spreads of these 13 commodity-exporting emerging countries are pretty similar between each other, as it would be expected if we effectively believe that there are underlying trends which are common to the individual dynamics. It is also worth noting that the arithmetic mean and the spreads' common factor (which, in practical terms, is a weighted sum where the weights are provided by the score coefficients or "weight factors") show a close path. However, it is significant that the common factor series stands systematically above the line representing the average until mid 2006 approximately while, as from there and until March 2011, it always stands below that benchmark.

As regards evolution through time, three differentiated stages are noticeable along the period under consideration. From 1997 to 2002, the highest records are found, which is consistent with the sequence of financial crises that hit several EEs of our sample. Since then and until mid 2007, we observe a phase of persistent and systematic decline of these countries' risk. Nevertheless, as from 2008, a marked jump is experienced as a result of the global financial crisis which reverts in 2009, with a relatively quick decline until the end of the sample, in March 2011.

[13] In addition, the goodness of fit given by Kaiser measure sampling adequacy, which is common within this methodology, provides a value of 0.87 in a 0-1 scale and this is generally considered as "meritorious".

In order to analyze in deep the results of the factor analysis technique to bond spreads, we have included in Table 1 the data corresponding to three key and relevant aspects for each country. In the first column, we find the factor loadings that intuitively represent the partial correlation of each individual series with the common factor obtained. The second column illustrates the communality, corresponding to the proportion of the variance explained by the common factor. In turn, the uniqueness, i.e. the unexplained portion of the variance, is found in the third column.

Table 1. Bond spreads common factor analysis: loadings, communality and uniqueness

	Loadings	Communality	Uniqueness
Argentina	0.478	0.228	0.772
Brazil	0.945	0.892	0.108
Bulgaria	0.813	0.662	0.338
Colombia	0.966	0.933	0.067
Ecuador	0.712	0.507	0.493
Malaysia	0.785	0.617	0.383
Mexico	0.888	0.789	0.211
Panama	0.980	0.961	0.039
Peru	0.989	0.977	0.023
Poland	0.684	0.468	0.532
Russia	0.840	0.705	0.295
Turkey	0.934	0.873	0.127
Venezuela	0.629	0.396	0.604
Average		0.693	0.307

As illustrated in Table 1, the partial correlation between the series and the summary measure obtained is very high and exceeds 0.9 in five cases, including Brazil, Colombia, Panama, Peru and Turkey. In turn, it is below 0.5 only for Argentina, a country with the particular characteristic that its sovereign debt was in default during part of the time under analysis. The communality results similar, which is self-evident if we consider that it is calculated simply by adding up the squares of each correlation with the factors. On average, 70% of the individual series' variance may be explained by the common part and the remaining 30% by the idiosyncratic components.

2.2. Common factor technique on commodity prices

In this subsection, we will apply the same techniques of the previous one to commodity prices. Among previous contributions, we find the work by Vansteenkiste (2009) which postulated that one single factor may be sufficiently representative to explain joint variability of prices, based on different criteria such as those contributed by Forni, Giannone, Lippi and Reichlin (2007), Bai and Ng (2005), and Stock and Watson (2005). This paper assesses a group of 32 primary goods including food, raw material and metals but excluding energy products. Likewise, Lombardi, Osbat and Schnatz (2010), have established that two common

factors account for a substantial part of total variability in a sample of 15 commodities made up by food and metals.

Taking into account these studies, our analysis includes a set of 14 commodity prices series in real terms during the period December 1991-March 2011, and the representative sample includes commodities related to food, metals and oil.[14]

Thus, using the first suggested criterion to explain at least 70% of total variance of the series, we have found that two factors may account for 73% of the joint variability. In addition, different selection criteria support this conclusion. The Minimum Average Partial method reveals that the first two factors explained 76% of the model variance, while the minimum eigenvalue methodology (cut-off equal to one as threshold) produces a similar result; two factors explaining up to 81% of the model variability. Using the Kaiser-Guttman criterion, we obtain the same result.

As a conclusion, we may say that, based on different criteria inspection, a total of two common factors seem to be sufficiently representative to capture the underlying dynamics of the commodities set under consideration. In addition, the Kaiser measure of sampling adequacy to assess the goodness of fit provides a value of 0.82 in a 0-1 scale, a highly acceptable value according to this literature.[15]

Then, Table 2 illustrates the main results of the common factors analysis, including each commodity in the rows and the information related to the rotated loadings[16] corresponding to the first and second factors (communality and uniqueness) in columns.

[14] The complete list includes: aluminum, rice, sugar, coffee, copper, cacao, iron, corn, nickel, WTI oil, lead, soybean, wheat and zinc.

[15] See footnote 13.

[16] In the cases where we are working with more than one factor, it is possible to facilitate their interpretation in a graphic format by making a rotation (that may be either orthogonal or oblique) but keeping the original characteristics. In this paper, we have used the orthogonal rotation of maximum variance (varimax), which turns out to be the most widely used method in practice. For more detailed information on this topic, see Jennrich (2001, 2002) where different algorithms are detailed for orthogonal and oblique rotations by minimizing the target functions.

Table 2. Commodity prices common factor analysis: rotated loadings, communality and uniqueness

	Rotated Loadings		Communality	Uniqueness
	First Factor	Second Factor		
Aluminum	0.712	0.214	0.553	0.447
Copper	0.898	0.403	0.969	0.031
Iron	0.714	0.380	0.654	0.346
Nickel	0.921	0.110	0.860	0.140
Lead	0.838	0.436	0.892	0.108
WTI Oil	0.865	0.075	0.754	0.246
Zinc	0.800	0.199	0.680	0.320
Rice	0.288	0.805	0.731	0.269
Sugar	0.289	0.607	0.451	0.549
Coffee	0.173	0.581	0.368	0.632
Cacao	0.288	0.628	0.477	0.523
Corn	0.217	0.906	0.869	0.131
Soybean	0.184	0.888	0.823	0.177
Wheat	0.349	0.796	0.756	0.244
Average			0.703	0.297

As illustrated by Table 2, there are several relevant points to consider. To begin with, it is worth mentioning a clear pattern in which the first factor, accounting for 77% of total variability of the model, shows very strong partial correlations with metals and oil, and lighter (though statistically significant[17]) correlations with the food-related commodity group. In turn, the second factor accounts for the remaining 23% of the total explained variability and exhibits an opposite pattern to the first one, i.e. it presents high comovements with food and lower, though significant, co-movements with metals and oil. Figure 6 presents a practical way of seeing these results putting the values of the rotated loadings in a two axes diagram. The graph reveals a grouping pattern of metals and oil on the one side, and food on the other.

Other significant aspect is related to the communality and uniqueness of the series under consideration. Here, we can differentiate several groups of commodities in terms of the relevance of their individual dynamics with respect to both common factors. Thus, the highest communality values for metals correspond to copper, nickel and lead, while the lowest coefficient corresponds to aluminum. Regarding to the food series, two groups can be clearly mentioned: the first one corresponding to temperate climate crops shows a lower preponderance of idiosyncratic components (especially corn and soybean), while the products related to tropical weather (coffee, cacao and sugar) show the highest uniqueness levels within the sample under study. In the special case of oil, a relatively high level of communality is observed, higher than the average series. Concluding, we can state that the variability portion of each commodity explained by both common factors is slightly over 70%.

[17] For the sample size used in this paper, a correlation higher than 0.12 (either positive or negative) is statistically significant at 5% significance level.

In the next two sections, we will proxy the commodity price dynamics using the first factor. This summary measure may capture the joint underlying patterns by weighting more strongly the series that are more representative of the group. This decision is supported by the analysis results since we must remember that the first factor accounts for a very high percentage of the model's variability and this measure shows positive partial correlations (statistically significant) with all prices under analysis. Therefore, in Figure 7, we illustrate the commodity prices first common factor, the sample average and, with grey lines, the individual series.

Unlike Figure 5 analyzing the emerging countries' spreads, the commodity prices standardized series show a higher variability among them. Likewise, even though there are higher differences between the sample average and the first factor of commodities, the association between them is high, with a correlation coefficient of 0.74.

Figure 6. Rotated loads of common factors in commodity prices

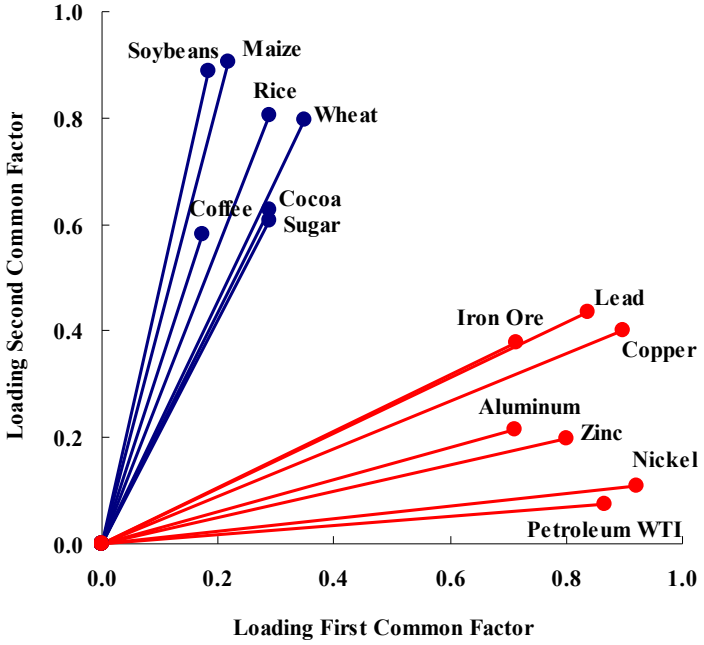
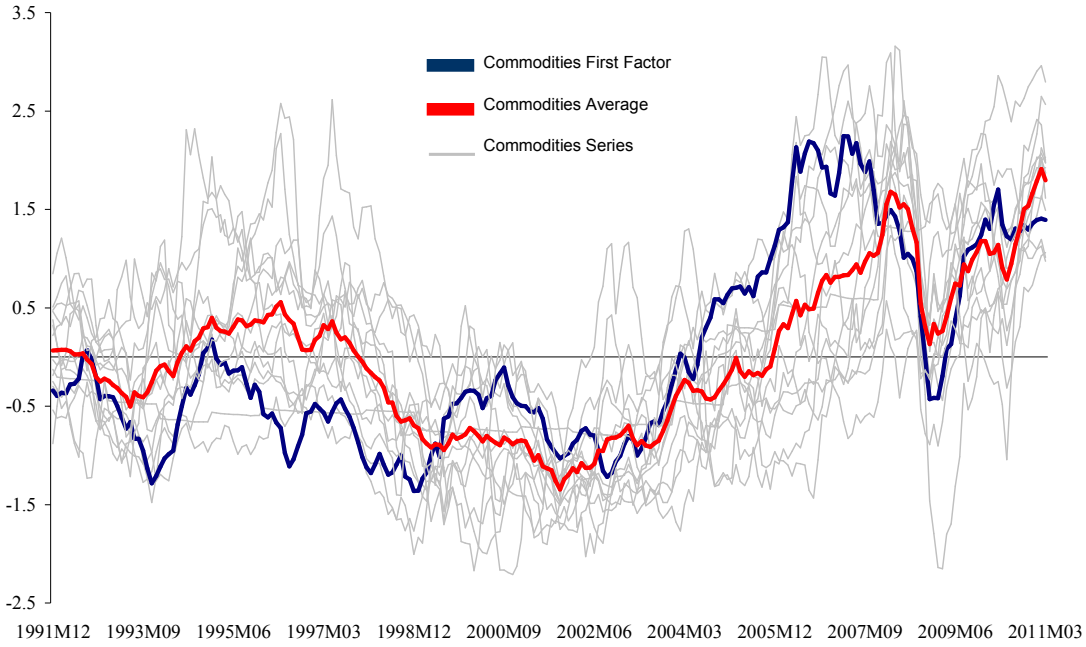


Figure 7. First common factor of commodity prices, simple average and individual series



3. Emerging countries spreads and commodity prices: stylized facts

Before analyzing the evidence about the association between the commodity exporters' sovereign spreads and commodity prices, it is appropriate to make a clarification about the sample period under analysis.

In fact, the relevant period for this document would be the time spam when EEs start to actively participate in the financial globalization process.[18] For this reason, it would be ideal to have data as far as from the early 1990s, since this date is usually taken as the starting point of this period, especially after the Brady Plan[19]. In the statistical analysis of this section and in the empirical model developed in the next one, we will use a common factor series of the spreads beginning December 1991, which was recovered on the basis of the common factors analysis since 1997 illustrated in subsection 2.1.

In this sense, it is worth remembering that a binding condition of our analysis has been the fact that few commodity exporters emerging countries with spread data available since the early 1990s, as a result of which the common factors analysis was calculated from December

[18] It is important to point out here that even though many developing countries stood relatively closed to international financial flows up to such date, several Latin American economies already had a first failed experience with financial globalization, which came to an end with the traumatic financial crises of the early 1980s.

[19] This plan begins in March 1989 when the then US Secretary of the Treasury, Nicholas Brady, submitted an external debt restructuration program for a group of countries known as Low Development Countries (LDC). The purpose of this plan was to restructure the debts whose payments were already in default after the 1982 crisis. According to data provided by EMTA (Emerging Markets Traders Association), Brady bonds accounted for 61% of the debt trading of emerging markets in 1994. By 2005, such percentage went down to approximately 2%.

1997 onwards. Nevertheless, we do have spread data for some of the countries since 1991 (while in others the information available begins between that date and 1997), we deemed it advisable to extend the common factor obtained backwards, using the results provided by this technique. Thus, we proceeded to construct the series up to December 1991, using the score coefficients to this; as each country ceased to have available data, we proceeded to re-weight backwards on the basis of the scores obtained.

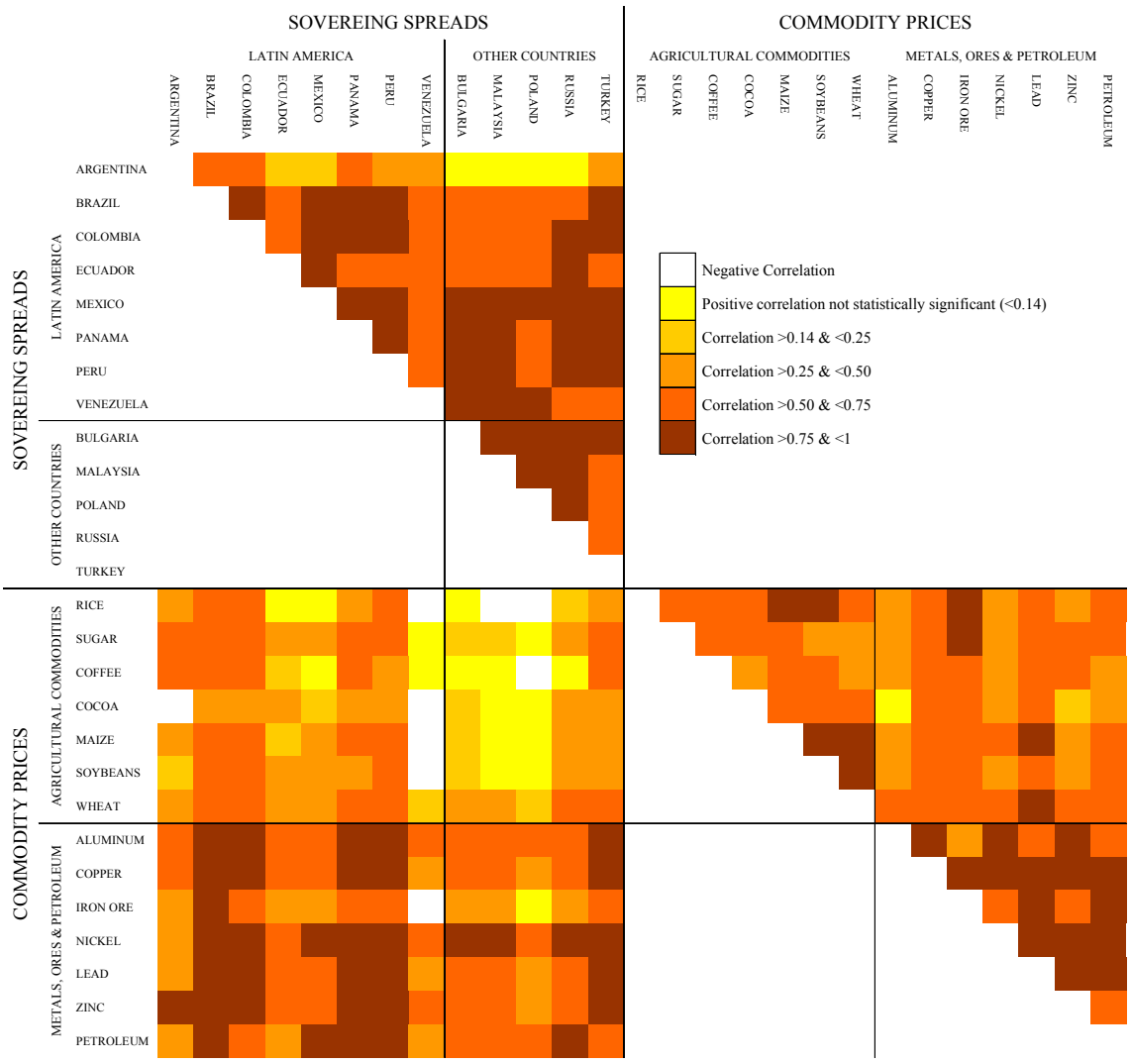
Mentioned this point, a first and revealing exercise consists in computing the pairwise correlations among all spread and commodity prices under analysis, both measured in standardized logarithms and in real terms as in the previous section. It must be considered that from the common factors analysis and the visual inspection of Figures 5 and 7 we would typically expect to find positive correlations whenever the pairs analyzed correspond to a pairwise of commodity-commodity or spread-spread. Likewise, based on the theoretical framework and on our main hypothesis, we would expect to find a negative correlation for the cross pairs between commodity prices and spreads. For this reason, in order to homogenize the correlation matrix, when the measure is computed for a pair containing one spread and one commodity price, we have multiplied the result by (-1) to facilitate the comparison within Figure 8, where the result of the exercise is shown.

To facilitate the interpretation of the results obtained in Figure 8, it is convenient divide the figure into three large areas (two triangles and one rectangle) that include internal subdivisions.

On the top left-hand portion of the matrix, the correlations between the real spreads of the EEs under analysis are shown. All these correlations are positive and very high on average. In turn, the subdivision between Latin American countries and the remaining countries shows slightly more intense correlations within each group. In the series corresponding to Argentina, for example, the correlations are positive and significant with all their neighboring countries of the region, but largely non-significant though positive with the rest of the EEs.

In the second triangle (bottom right-hand quadrant), it is possible to observe the associations among the series expressed in logs related to the commodity groups in real terms; here, we can distinguish two subsets, the agricultural group on the one hand and the metals, minerals and oil group on the other. Once again, all correlations are positive and only one of the 91 possible combinations it is non-significant. Regarding their values, we can clearly see that they are high on average, even though the intensity, when they are globally compared to those corresponding to interest rate differentials, is slightly lower. This pattern is consistent with the observations of Figures 5 y 7 and also with the general results of the common factors analysis.

Figure 8. Correlation matrix of spreads and commodity prices at individual level



Lastly, in the bottom left-hand quadrant of the correlation matrix, we find the correlations of highest interest between each spread and each commodity. Our hypothesis regarding to a negative correlation (in Figure 8, it appears as positive because it was multiplied by -1) explained by global variables finds here a first test, even though still indirect.

As a preliminary conclusion, we can notice that in most cases the correlation sign is the one we would expect to find if our hypothesis were right. Even more, the only correlations with an opposite sign against the expected one involve Venezuela (a country whose spread has a low "communality" with the rest, as it can be seen in Table 1) in relation with agricultural commodities and iron (and not with oil, which is the most relevant commodity in this particular case). The other correlations with an opposite sign (regarding to the expected one) occur with cross pairs where the commodity under consideration is not a typical product of those countries, such as cacao in Argentina, coffee in Russia and rice in Poland and Russia. The only case in the whole sample where the opposite sign (though non-significant) might be unexpected corresponds to rice in Malaysia because even though it is not the predominant commodity, it does have some relevant weight for this economy (Malaysia is the 23rd largest

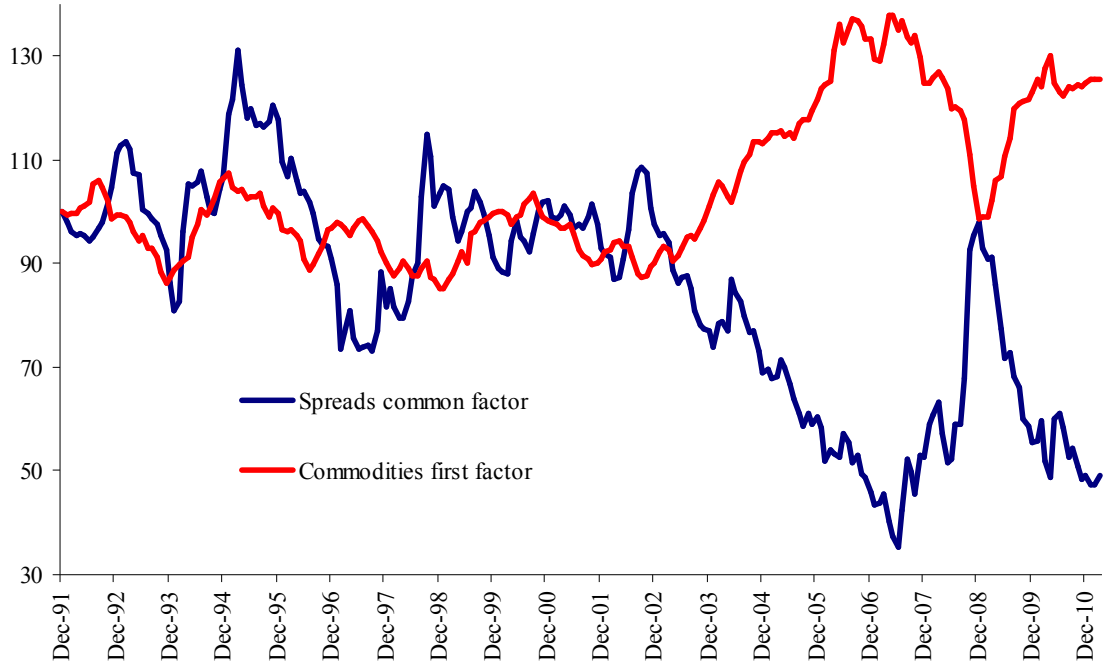
producer of this good, according to FAO data as of 2009). Anyway, it is also important to underline that out of the nine correlations with an opposite sign against the expected one, only one of them is statistically significant.

Regarding to the correlations with the expected sign, according to the hypothesis, but non-significant, we can see that in most cases correspond to combinations between agricultural commodities and emerging countries outside Latin America. Likewise, in general terms, we may also come to the conclusion that, on average, metals, minerals and oil are more correlated with spreads than agricultural goods. This result is interesting because, as pointed out in the section about common factors techniques, the association of the first common factor, which captures most of the joint variability, is stronger with metals, minerals and oil.

Therefore, in overall terms, we conclude that out of 186 pairs of correlations, a total of 160 (86%) show the expected sign (negative in data, positive in the matrix so as to facilitate the comparison) and are significant. In 100 out of these 186 pairs, this measure is at least 0.5; while in 36 cases it is above 0.75. Consequently, all together, we may conclude that even though, evidently, the canonical correlation analysis does not provide an idea of causality or an explanation of the reasons behind the statistical association, it clearly poses an stylized fact that the pattern of data does not go against the central hypothesis of this paper. If the global determinants analyzed here effectively impacted with opposite signs on spreads and commodities, then we should ex post expect a negative association between these series.

The same conclusion is supported by Figure 9, where we present the common factor of emerging countries' returns and commodity prices, series that will be used for the econometric analysis in the next section.

Figure 9. Association between spreads common factor and the first common factor of commodity prices (indices Dec-91=100)



The negative association pattern between both summary measures is quite clear in Figure 9. For the entire sample, the correlation stands at -0.81, but it is more intense in the period beginning in the 1995 financial crisis. Once we have managed to show the existence of this association in the data, we still have to figure out the reasons behind this effect and to assign the corresponding relative weights to the different channels explained in the first section. This will be the objective of the econometric section.

However, as a last preliminary exercise, we have calculated in Table 3 the correlation coefficient for both spreads and commodity prices with different global macroeconomic variables which we consider as potential determinants based on the literature review. Therefore, the conclusion of this exercise is all international macroeconomic and financial variables deemed as explanatory factors of the spreads and the commodity prices show associations with opposite signs. This is a preliminary confirmation of our intuition about the reason behind the clear statistical association pattern of Figures 8 and 9, related to international shocks transmission. Annex 1 includes a detailed description of the global variables.

Table 3. Correlations between the spreads common factor and the first common factor of commodity prices with global determinants (from 1991-12 to 2011-2)

Variables	Real EEs spreads (common factor)		Real commodities prices (first common factor)	
	Correlation	p-Value	Correlation	p-Value
Real global liquidity	-0.78	0	0.75	0
International real interest rate (1 year)	0.37	0	-0.32	0
International real interest rate (3 years)	0.47	0	-0.43	0
International real interest rate (5 years)	0.52	0	-0.48	0
Real S&P 500 Index	-0.43	0	0.23	0
Real Dow Jones Index	-0.53	0	0.31	0
VIX Volatility Index	0.09	0.18	-0.24	0
US real exchange rate	0.16	0.02	-0.39	0

4. Econometric analysis

In this section, we will evaluate the central hypothesis of the paper by means of econometric techniques. This hypothesis suggest that commodity prices and capital flows into emerging markets exporting commodities are affected by a common set of global variables especially related to the international financial context. This means that the same variables that would promote an improved access to international credit markets would simultaneously contribute to an increase of commodity prices and vice versa.

The econometric analysis is based on monthly data for the period 1991M12 to 2011M2. To check the hypothesis, we have studied the interrelations between commodity price factors and sovereign spread factors of the emerging countries group under consideration (whose calculation is detailed in the second section) and a set of global variables capturing the state of the international financial context discussed in the theoretical review in the first section of this paper: United States' RER, the international real interest rate, a quantitative measure of the world real liquidity, the S&P 500 stock index in real terms and the VIX Index as an indicator of the global degree of risk aversion (Annex 1 includes a complete description of each variable).

The combination of common factors techniques and econometric models is a relatively recent literature, based on the pioneering works of Stock and Watson (2002), Bernanke and Boivin (2003) and Bernanke et al. (2005). One of the main advantages of these methodologies is the possibility of introducing a higher amount of relevant information into economic estimations (compared to standard methods) because they diminish the loss of degrees of freedom caused by the reduced dimension of the estimated systems. In addition, they also lessen the problem of an arbitrary selection of observable series capturing theoretical concepts of a diffuse empirical definition.

In this paper, we have specifically adopted the approach developed by Bernanke et al. (2005), which combines a traditional VAR structure with the introduction of common factors (FAVAR models). However, since we are especially interested in the long-term relation between the variables under study, we have resorted to the extension made by Banerjee and Marcellino (2008) and Banerjee et al. (2010), which consider the potential cointegration of the series (FAVEC models).

Thus, the general structure of the estimated model has the following error correction specification:

$$\begin{pmatrix} \Delta F_t \\ \Delta X_t \end{pmatrix} = \begin{pmatrix} \gamma_F \\ \gamma_X \end{pmatrix} \delta' \begin{pmatrix} F_{t-1} \\ X_{t-1} \end{pmatrix} + A_1 \begin{pmatrix} \Delta F_{t-1} \\ \Delta X_{t-1} \end{pmatrix} + \ldots + A_q \begin{pmatrix} \Delta F_{t-q} \\ \Delta X_{t-q} \end{pmatrix} + \begin{pmatrix} \varepsilon_{Ft} \\ \varepsilon_{Xt} \end{pmatrix} \qquad (1)$$

Where F_t are commodity price and sovereign spread factors, X_t is the matrix containing the global variables, and ε_{Ft} and ε_{Xt} are the errors. The first term on the right side represents the variables adjustment to the imbalances regarding to the long-term relations, while the remaining terms capture the short-term dynamics and random errors.

There are two approaches to estimate these types of time series models that incorporate common factors techniques. On the one hand, we found in the literature the two-stage method proposed by Stock and Watson (1998, 2002), consisting of a first step where factors are computed via common factors techniques, some of which have been mentioned in the second section of this paper. Further on, the system is estimated using time series standard methods, and treating the previously extracted factors as another series.

The alternative approach consists in estimating the model in only one stage through the application of Bayesian techniques. Otrok and Whiteman (1998) developed this methodology within the context of only one dynamic factor, while Kose et al. (2003) extended their application to multiple-factor models.

In the our empirical model, we have implemented the two-stage approach. Bernanke et al.

(2005) point out that its main advantage lies in the simplicity, in addition to the fact that the results obtained are qualitatively similar to those found using Bayesian techniques. The following subsection includes the results of the estimation model.

4.1 Results

The estimation of the common factors was discussed in the second section of the paper. Therefore, we will proceed now to implement the second step, which consists in the application of standard time series econometric techniques considering the estimated factors as observed variables.

As we have already mentioned, one the main objective of the empirical evaluation is to establish whether there is a long-term relation between commodity and sovereign spread factors and the international financial variables.[20] In order to achieve this, we have carried out the Johansen cointegration test (1995) from a level VAR using 14 lags. With this specification, the system residuals result homoskedastic and they are not autocorrelated. In addition, the null hypothesis of error normality is not rejected at 1%, but it is rejected at 5% due to an excess kurtosis. However, Gonzalo (1994) proves that Johansen methodology is robust under these circumstances.

Both the trace and the maximum eigenvalue test suggest the existence of four long-term relations among the variables. However, Juselius (2006) points out that the determination of the cointegration range should not be exclusively based on these tests, due to the power problems they usually present. Therefore, he suggests that the economic interpretation of the results should also be considered, in addition to the stationarity of the cointegration vectors.

Given the fact that our objective is to model sovereign spread and commodity prices equations simultaneously, based on the references provided by literature about the global determinants of these variables, we have opted for estimating the system by means of two cointegration vectors, prioritizing the economic interpretation.

As a result, the specification of the model is consistent with a VEC with two long-term relations and 13 lags for the variables in differences. The evaluation of the system estimated in this way finds residuals with a good behavior[21] and, according to the ADF tests, the two cointegrating vectors are effectively stationary.

Table 4 describes the estimated coefficients of sovereign spread and commodity price long-term relations with the international variables. The standardization selected for long-term relations was also based on the literature review and the economic interpretation of the results. For this reason, we have decided to exclude the US RER in the sovereign spread equation and to keep it for commodity prices.

[20] Global variables are expressed in logs. The series unit root tests suggest that they are non-stationary.

[21] The residuals of the system are homoskedastic, not autocorrelated and do not follow a normal distribution due to an excess kurtosis. Consequently, as already mentioned, Johansen methodology is robust (Gonzalo, 1994).

Table 4. Estimation of long-term relations

Variables	EEs real sovereign spreads		Real commodity prices	
	Coefficient	p-Value	Coefficient	p-Value
Real commodity prices	-8.81	0.07089	-	-
Real global liquidity	-10.04	0.4035	1.59	0.0000
International real interest rate	968.20	0.0000	-0.92	0.8900
Real S&P 500	-24.90	0.0000	1.13	0.0011
VIX volatility index	0.980	0.9282	-1.89	0.0000
US real exchange rate	-	-	-3.68	0.0039
Constant	325.49	-	1.37	-
Adjustments coefficient				
Sovereign spreads relationship	-0.26	0.0000	-0.00	0.9730
Real price of commodities relationship	-2.84	0.0865	-0.14	0.0086

It is worth mentioning that all coefficients signs, both in the sovereign spread equation and the commodity price equation, are consistent with the theoretical predictions discussed in the first section and also with the unconditional correlation analysis of the previous section. Regarding the statistical significance, we have also found that most variables are significant at the usual significance levels.

Then, when these estimations are analyzed more carefully, we can observe that they provide empirical support to the hypothesis we have suggest in this paper. On the one hand, commodity price sign in sovereign spread equation is negative (-8.82) and significant at 10%. This is evidence in favor of the direct impact of improved commodity prices facilitating access conditions of commodity exporters EEs to international credit markets, a channel illustrated in Figure 1.

This sign might account for the negative association between our variables of interest, previously documented. However, the remaining results will reveal that this correlation is not only due to this channel. This means that the effects go beyond the direct impact of higher commodity prices on the financing cost of commodity exporters; the association is also explained by the global determinants.

In fact, an improvement in international liquidity conditions, captured through a decrease in the interest rate and an increase in the liquidity quantitative measure generates both a commodity price hike and a drop of emerging countries' sovereign spread.

It is also noticeable that the signs associated to liquidity measures are the expected ones according to the theory, even though in the interest rate differential equation the quantitative measure is not statistically significant and the same happens in the commodity price equation with the international interest rate. This situation proves the debate complexity about the most

adequate method to proxy the international liquidity level, as already mentioned in the first section.[22]

As pointed out there, the incorporation of the global liquidity level into a quantitative measure analysis is currently more frequent, since the international crisis has clearly shown that under some scenarios the state of monetary policy is not fully captured by interest rates, such as under situations of liquidity trap. Thus, Bastourre et al. (2008) and Cevik and Sedik (2011) have found a positive and statistically significant association between the volume of international means of payment and commodity prices. Even though the inclusion of these quantitative indicators has not been the rule in the literature about push and pull factors of capital flows, recently Matusmoto (2011) has found a significant relation between these variables.

Regarding the non-statistical relevance of the interest rate impact on commodity prices, this is also a result documented in Frankel and Rose (2009). On the contrary, this variable appears in literature as a highly relevant factor for the dynamics of sovereign spreads (Kim, 2000; Ying y Kim, 2001; Hartelius et al., 2008), in line with our estimations.

When assessing the role played by "market sentiments" in the determination of the variables under examination, we have found that an improvement in investors' confidence and a drop in the global risk aversion, which we have identified here, respectively, with increases in the S&P 500 index and drops in VIX index (a measure of its volatility), are related simultaneously with higher commodity prices and lower sovereign spreads. However, the effect of the VIX index on the latter is not statistically significant, such as we have found in the pairwise correlations of Table 3, calculated in the third section.

Finally, it is noticeable that an appreciation in the US real exchange rate generates a fall in commodity prices, in line with the findings of other studies such as Akram (2008), Bastourre et al. (2008, 2010), Vansteenkiste (2009) and Lombardi et al. (2011).

Regarding the estimations of adjustment coefficients to misalignments in the long-term relations, it is worth mentioning that they also support the selected specification and the interpretation developed. On the one hand, we have confirmed that commodity prices do not respond to spread deviations (small and non-significant coefficient) but they do respond to the commodity price misalignment (-0.1420). On the contrary, sovereign spreads adjust to both deviations. In particular, when commodity prices are above what their fundamentals would suggest, the interest rate differential faced by emerging economies decreases even more. These results are consistent with the transmission channels proposed in Figure 1, where commodity prices directly affect sovereign spreads.

In addition, it is important to point out that we have also tried, as robustness measure, an alternative standardization of the cointegration vectors by replacing in the spread equation the commodity price with the US real exchange rate, so that both long-term relations are symmetrical in the sense they have the same group of global variables as determinants. In Table A1 of Annex 2, we can see that the outlook of the results does not change. The US RER does not have a statistically significant effect on spreads, even though its positive sign is in

[22] In section 3, the unconditional analysis of the relations between sovereign spreads and commodity prices with both liquidity measures gave consistent results with the theoretical predictions, in addition to being statistically significant.

line with the idea that global variables increase the pro-cyclicality of the current and capital accounts shocks. Thus, an appreciation of the RER would lead to an increase of sovereign risk and a decrease of commodity prices. This result is in the same direction as in the pairwise correlation analysis of Table 3. It is also worth mentioning that under this alternative standardization, the VIX series still keeps the expected sign but, in addition, it becomes a statistically significant determinant of spreads. Additionally, the international liquidity quantitative measure is significant for both equations and not just for the commodity price equation.

To conclude this section, we will analyze from a different perspective how our model accounts for the strong and significant negative correlation between sovereign spreads of emerging countries that export basic goods and a set of commodity prices. To this effect, we will use as input the commodity real prices and the interest rate differentials estimated series and their respective misalignments (calculated as the differences between the effectively observed values and the estimated ones), illustrated in Figures 10 and 11.

Figure 10. Sovereign spreads and commodity prices: estimated series

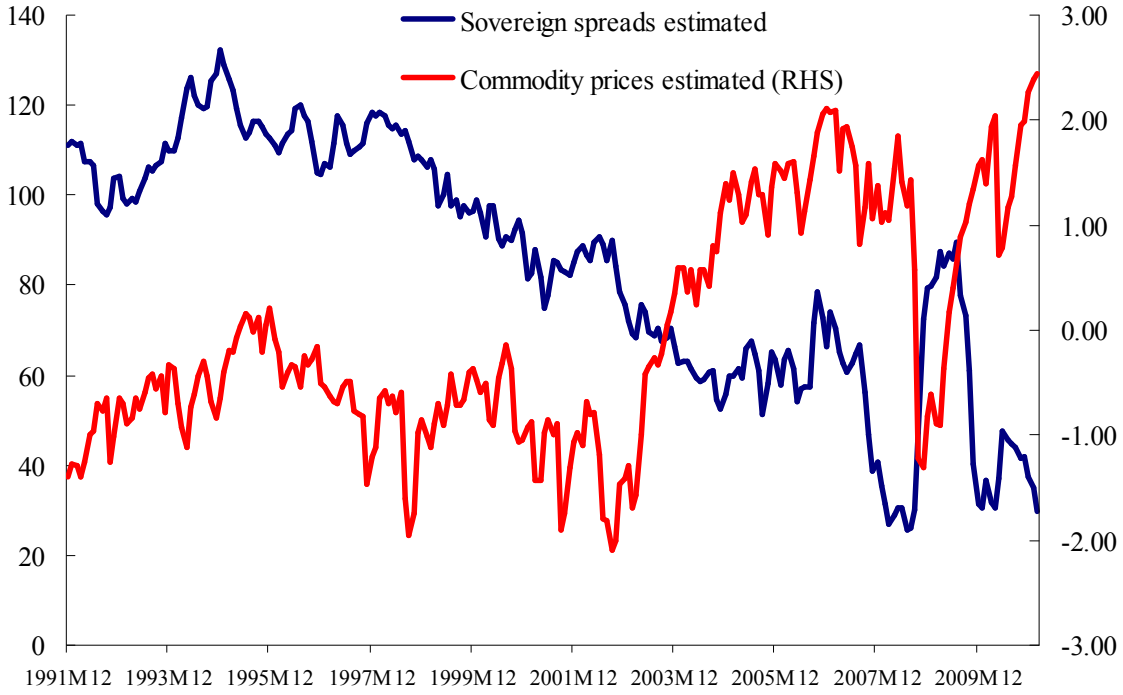
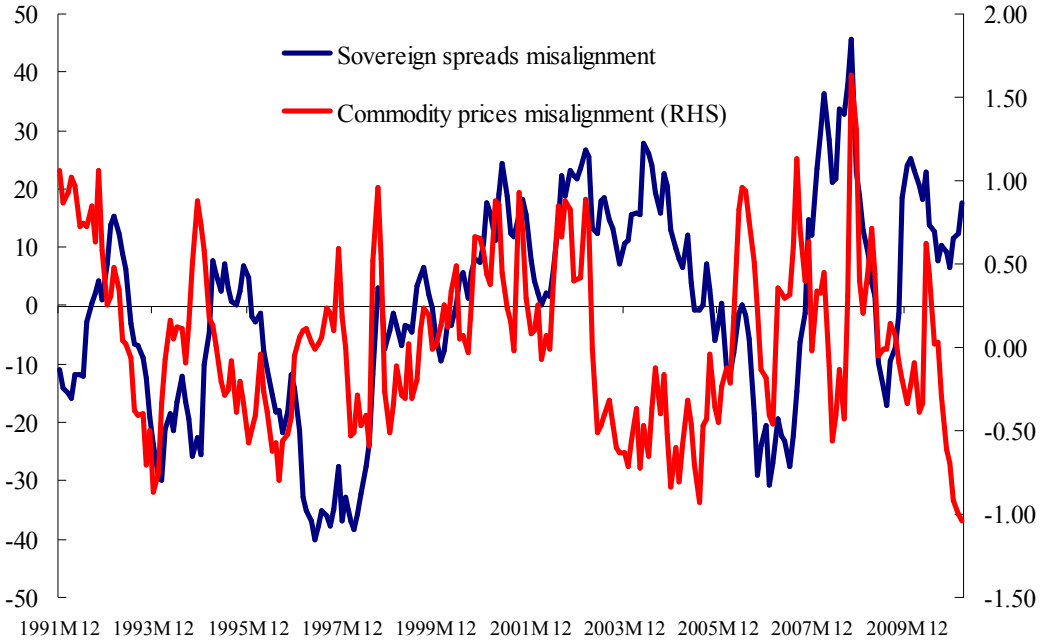


Figure 11. Sovereign spreads and commodity prices: misalignments



From these series, Table 5 shows a set of partial correlations that allow us to complete the analysis. Firstly, there is a positive correlation between the observed series and their respective estimations (0.88 for commodity prices and 0.76 for sovereign spreads), which suggests a good adjustment of the model for these equations.

Table 5. Partial correlations and statistical significance

	Observed commodity price	Observed spreads	Estimated commodity price	Estimated spreads	Spreads (misalignment)
Observed commodity price	1.0000				
Observed spreads	**-0.8145** 0.0000	1.0000			
Estimated commodity price	**0.8857** 0.0000	-0.8221 0.0000	1.0000		
Estimated spreads	-0.7224 0.0000	**0.7588** 0.0000	**-0.6993** 0.0000	1.0000	
Commodity price (misalignment)	-	-	-	-	**0.0658** 0.3197

Note: The first line represents the partial correlation and the second line to p-value.

As already mentioned in section 3, the second issue to be highlighted is the strong negative correlation (-0.81) between commodity prices and sovereign spreads of the emerging countries commodity exporter group. However, the information included in this table allows us to give a step forward. The estimated series present a very high negative correlation (-0.70 approximately) while the linear association of the respective misalignments is practically null (0.066) and statistically non-significant. This suggests that the model's global variables explain virtually the entire correlation between commodities prices and the external indebtedness differential cost of the countries under analysis.

As a conclusion, we may say that the evidence of Table 5 and the regression analysis complements the findings obtained from the unconditional analysis of the previous section, giving empirical support to the idea that there is a common set of global factors related to the international financial context that lead to a negative correlation between commodity prices and cost of the external financing for the commodity exporters, thus reinforcing the pro-cyclicality of the external shocks on these economies through the current account and the capital account.

5. Conclusions

Capital flows and commodity prices are two key factors determining the performance of emerging economies whose export structure is based on commodities and their capital account is opened to international financial transactions. The vast literature on the study of the

behavior of both variables is clear evidence of their relevance.

When research works on the determinants of capital flows, on the one hand, and the commodity prices, on the other, are reviewed, it is possible to identify the presence of a common set of global variables especially related to the international financial context, such as the global liquidity level, financial markets "sentiments" or the US real exchange rate, among others.

Based on this observation, this paper suggests a hypothesis which has not been empirically evaluated so far. We claim that this common set of global factors not only accounts for the performance of commodity prices and capital flows into emerging countries that export commodities but it is also responsible for deepening the pro-cyclicality of external shocks through the capital and current account into these economies. This means that the same variables associated to an improvement in the conditions to international credit markets (proxy through a drop in sovereign spreads) would simultaneously increase commodity prices.

Since the scope of this hypothesis is restricted to general trends and not necessarily to the idiosyncratic movements that may be inherent in both sovereign spreads and commodities prices, we have used common factors techniques to identify the underlying joint dynamics of these variables, isolating the specific shocks affecting country's risk or commodity prices.

The common factors analysis confirms the presence of these global common trends both in spreads and commodity prices. Thus, we have established that one single factor explains 85% of interest rate differentials joint variability in the emerging countries group under analysis, while over 80% of the commodity price variability is explained by two factors, one associated to the behavior of metals and oil, and the other, to agricultural products.

The first piece of evidence in favor of this paper's main hypothesis is captured by the pairwise correlation analysis. On the one hand, out of 186 pairs of potential correlations between spread and commodity price individual series, 160 (i.e. 86%) are statistically significant and show the expected sign (positive between series of the same type, whether return or price differentials, and negative for the respective spreads-prices cross pairs).

On the other hand, and prior to the econometric analysis, we performed an unconditional analysis between the common factor of spreads and commodities with a group of selected global variables reflecting international financial conditions. There, once again, the values found are in line with the central hypothesis developed in this paper.

In the fourth section, we have modeled simultaneously, using a FAVEC specification, the long-term relations between sovereign spreads and commodity prices with the US real exchange rate, the international interest rate, the global liquidity, the S&P 500 stock index and the VIX volatility index as risk proxy.

The results of the estimations give empirical support to the hypothesis raised in this paper. Firstly, there is evidence supporting the direct impact of commodities price hikes on the access to international credit markets conditions by emerging economies exporting these products. Then, we have verified that an improvement in international liquidity, captured through a decrease in the interest rate and an increase in the liquidity quantitative measure, generates both an increase in commodity prices and a reduction in emerging countries sovereign spreads.

When assessing the role played by the "market sentiments" on the determination of the variables that are the purpose of this study, we found that an improvement in investors' confidence and a drop in the global risk aversion, which we have identified here with a rise in the S&P 500 index and a decline in the VIX index, respectively, are simultaneously related to high commodity prices and reduced sovereign spreads.

Finally, when we break down and analyze the correlations on the basis of estimated series, we find that the model's global variables explain virtually the entire correlation observed in the commodities prices and the differential cost of the external indebtedness of the countries under consideration.

Before proceeding to discuss some policy lessons drawn from the results mentioned, we consider it appropriate to suggest some potential extensions of the present paper that appear to be relevant mainly to confirm the extent at which the results may become more generalized.

A first alternative would consist in adding to the analysis, data of the effective volume of the gross and/or net capital flows into emerging countries, instead of using sovereign spreads as indicators of international credit market conditions. In this kind of analysis, it would also be potentially useful to make a distinction according to the type of flow, since literature has found, for example, that the weight of push and pull determinants changes according to the type of financial transaction. Another extension might be related to the use of a technique allowing the inclusion of pull factors when modeling interest rate differentials, such as the use of panel data. An indirect test would consist in using a control group, made up by an industry-based set of emerging countries that are commodities net importers. If our hypothesis is correct, we should observe in this group a less clear relation between their rate differentials and the set of commodity prices.

In fact, in relation with the last point, the main implication of the evidence included herein for economic policy design is that the transmission of the business cycle in central countries to emerging countries is not homogenous, depending on whether the latter are commodity producers-exporters or importers.

Changes in the international financial context tend to increase the amplitude of the cycle in the case of commodity exporter countries. For example, higher global liquidity generated as a result of a loose monetary policy in advanced economies results in a price increase of the commodities exported by this group of emerging countries and in a reduction of their external financing cost, thus encouraging capital inflow. Both factors have an expansive effect on GDP.

On the contrary, in commodity importer countries, the shock effects by the current and capital account on the GDP would tend to offset which, all other things being equal, would reduce the magnitude of the economic fluctuations. The price hikes of the raw material imported by these countries result in terms of trade deterioration, thus impacting negatively on the GDP. However, an improved international financial situation facilitates their access to capital markets and enables them to "finance" the current account negative shock.

The asymmetrical impact of external shocks on the emerging economies casts doubts over whether it is advisable to make the same recommendations for all of them regarding capital flows regulations, as it is usually done. The evidence found suggests that a more active management of the capital account has a particularly relevant role in the case of commodity

exporters, given their higher vulnerability to fluctuations in the international context.

In addition, given that negative global shocks seem to affect these countries through the real and financial channel simultaneously, the failures of the international financial architecture —particularly those related to the absence of a lender of last resort when the international private credit market disappears—, tend to produce amplified negative consequences in these cases. For this reason, a self-insurance strategy including accumulation of international reserves and a counter-cyclical fiscal policy should be part of their policy mix, among others.

Concerning the design of the counter-cyclical fiscal policy, it would be worth assessing the possibility of issuing bonds with a return positively associated to the international price of the commodities exported by these countries, in addition to considering the creation of sovereign funds.

To conclude, another important challenge facing the commodity exporter countries is associated to the movements of their real exchange rate. When the global context is favorable, these economies face significant appreciation pressures operating both through the current account (high commodity prices) and the capital account (strong capital inflows). Therefore, it is crucial to pay attention to this phenomenon when selecting the foreign exchange and monetary regime and also when designing prudential regulations for capital flows.

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Annex 1. Construction of the series used and information sources

International real interest rate: Source Bloomberg. The implied rates of US government bonds at different terms (1, 3 and 5 years) are used and then deflated by the US retail price index. Variable expressed in logs.

Global real liquidity: Source: IMF and US Federal Reserve. It represents the addition of the international reserves at world level and the US monetary base, deflated by the US retail price index. Variable expressed in logs.

Real S&P 500 Index and Real Dow Jones Index: Source: Bloomberg. Series measuring the evolution of the financial markets deflated by the US retail price index. Variable expressed in logs.

VIX Volatility Index: Source: Bloomberg. It measures the risk-aversion based on the volatility of a selected group of equities. Variable expressed in logs.

US multilateral real exchange rate: Source: US Federal Reserve. This index is made up by the 26 leading trading partners of the United States, excluding oil import and the export of weapons and gold for the calculation.

Annex 2. Alternative standardization for the long-term relation

Table A.1. Alternative (symmetric) estimation of long-term relations

Variables	EEs real sovereign spreads		Real commodity prices	
	Coefficient	p-Value	Coefficient	p-Value
Real global liquidity	976.31	0.0001	-0.92	0.8930
International real interest rate	-24.06	0.0123	1.59	0.0000
Real S&P 500	-34.88	0.0039	1.13	0.0039
VIX volatility index	17.67	0.0000	-1.89	0.0000
US real exchange rate	32.41	0.5270	-3.68	0.0151
Constant	-313.40	-	-1.37	-
Adjustment coefficient				
Sovereign spreads relationship	-0.26	0.0000	-0.00	0.9730
Real commodity prices relationship	-5.12	0.0078	-0.14	0.0216