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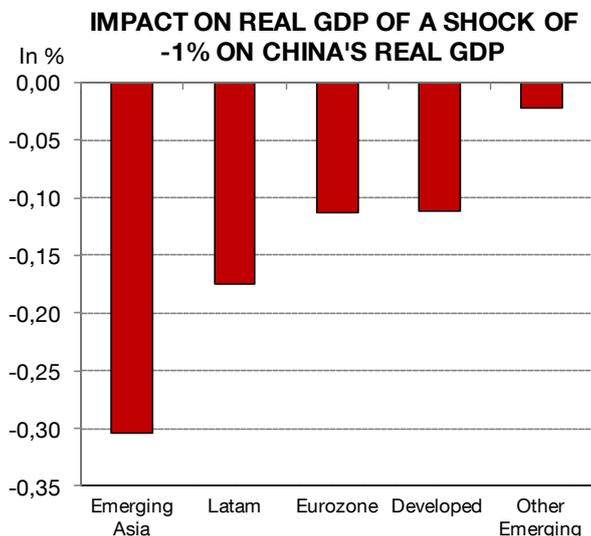
Economic and sectoral studies department

CHINA: ASSESSING THE GLOBAL IMPACT OF A CHINESE SLOWDOWN

— China's economic slowdown and its transition to a new growth model could adversely affect the world economy, due to China's large share in global trade and the high commodity intensity of its economic model.

— This paper assesses to what extent a Chinese slowdown would affect the global economy, with a focus on three transmission channels: trade, commodity prices, and financial markets. To quantify the impact of a China slowdown on the world economy, we use a methodology called “Global Vector Autoregressive (GVAR)” modeling. The model is estimated for 36 countries over the period 1995Q1-2015Q3.

— Our results indicate that Asian and commodity exporters' countries would be the most affected by a Chinese slowdown through slower trade, lower commodity prices, and a confidence shock on global financial markets. Advanced economies would be the least vulnerable to a Chinese slowdown.



Note: Emerging Asia: India, Indonesia, South Korea, Malaysia, Philippines, Thailand; Other emerging: Poland, Russia, Saudi Arabia, South Africa, Turkey; Developed: Australia, Canada, New-Zealand, Norway, Sweden, Switzerland, United States, United Kingdom; Latin America: Argentina, Brazil, Chile, Mexico, Peru; Eurozone: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Spain.

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INTRODUCTION

For the last couple of years, the rebalancing of the Chinese economy to consumption and away from investment and exports has started but at the expense of lower economic growth rate. Given the Chinese commodity-intensive economic model and the growing importance of China in the world economy, the impact of any slowdown and change in the structure of the Chinese economy is likely to have important implications for other economies. The transmission mechanism channels of a Chinese slowdown to the global economy are multiple: trade, commodities and financial. A Chinese slowdown would cause lower exports for China's trading partners; commodity prices would also fall, affecting commodity exporters countries. Depreciation of the Chinese currency would impact countries competing with China in their home market or in third markets, putting downward pressures on their exchange rates. Finally, uncertainties about the ability of the Chinese authorities to ensure a smooth transition to the new growth model could hurt investors' sentiment and risk aversion and translate into heightened global financial volatility.

This article aims to assess how a shock to Chinese growth would affect the world economy. The paper is organized as follows. First, it presents the new China's growth "model" and the observed impact on the world economy. Then, it describes the methodology used to quantify the impact of China's slowdown and details our model. Finally, it presents the response results of a negative shock on Chinese real GDP in the rest of the world, on commodity prices, and on financial variables.

THE NEW CHINESE GROWTH MODEL AND ITS IMPACT ON THE WORLD ECONOMY

THE « NEW NORMAL »

From 1980 to 2006, the Chinese economy enjoyed high economic growth with real GDP expanding by 10% per year on average. This success story was mainly supported by an investment and export growth led model. Over the period, the investment and exports ratios jumped from 30% and 5% of GDP to 40% and 36% respectively. The high rate of investment was explained by three major price distortions in the Chinese economy. First, low interest rates have been a key factor supporting high investment rate. Cheap funding from public banks was made available for investment through financial repression. Second, low wages have boosted Chinese exports. The excess

supply of rural workforce and the "hukou"³ policy have helped to keep low labor costs. Lastly, the undervaluation of the Renminbi (RMB) has also enabled China to boost the price competitiveness of its exports and to gain market shares, as part of its mercantilist strategy.

Since the 2008 global financial crisis and in its aftermath, the Chinese growth model has experienced significant changes⁴. First, the export engine has significantly slowed and it is unlikely to revive in the near future. Weaker external demand from advanced economies combined with losses in terms of price competitiveness arising from an appreciation of the RMB and higher labor costs have weighed on Chinese exports. Second, as a response to the 2008 financial crisis, the Chinese government implemented a huge fiscal stimulus which further raised the investment ratio to 45% of GDP in 2009. This massive investment has translated into rising overcapacities in some industrial sectors (such as copper, coal etc.) as reflected in declining producer prices indexes, but also in the real estate sector as suggested by increasing vacant floor space since 2012. In addition, the investment surge, sometimes in inefficient projects due to resources misallocation, was financed by strong and rapid bank lending growth; so that, the leverage of the Chinese economy sharply rose from 150% of GDP in 2007 to 250% of GDP in 2015.

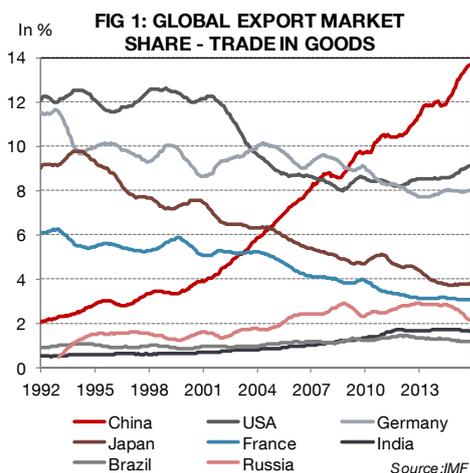
During the Third Plenum which took place in 2013, acknowledging the limits of the growth model, the Chinese authorities announced a reform package attempting to rebalance the economy towards consumption and away from investment. The most advanced reforms have been financial liberalization and capital account opening, but both have faced some pushback in the wake of the stock and foreign exchange markets turmoil in 2015. Since then, China has started to shift from a traditional manufacturing investment-export led model to a new services and consumption driven economy. Yet, this rebalancing has occurred at the expense of lower economic growth. In 2015, the Chinese economy slowed to 6.9%, which was the weakest in 25 years. It is expected to further ease to below 6% by the end of the decade. There remains considerable uncertainty around how smooth this rebalancing will be and there is a risk that growth could slow more sharply than expected.

³ The Hukou is a household-registration system providing access to all public services (education, medical treatment and housing) and social protection (illness and care for the elderly) offered by a specific region/province.

⁴ See O. De Boysson and S Sa: "China: the growth debate"; Econote Société Générale, 2013.

CHINA’S GROWTH SLOWDOWN SPILLOVERS EFFECTS: SOME STYLIZED FACTS

While in the late 1990’s, China accounted for only 4% of the world GDP, it is now the largest economy in the world (on a purchasing power parity basis), representing more than 17% of the world GDP. China has also become now the largest trading nation in the world with Chinese exports accounting for around 14% of global trade in goods from 2% in 1990 (Figure 1).



Given the emergence of China as a global force in the recent decades, any slowdown and/or changes of the composition of its economy could bring about significant spillovers to the world economy mainly through three different channels: a slowdown in global trade, a plunge in commodity prices, and a confidence shock affecting global financial markets.

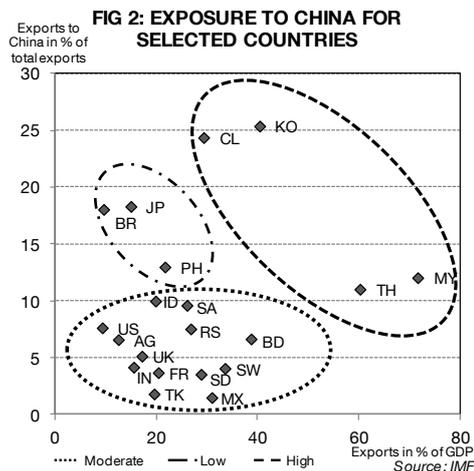
Trade channel

A key transmission mechanism through which a shock to Chinese GDP may spill over to the world economy is international trade. A slowing down of Chinese economic activity would reduce the demand for goods and services produced by the rest of the world, and thus global activity.

The most exposed countries to a slowdown of China through these trade linkages would be the ones with the largest share of their exports towards China in terms of their total exports but also with the highest share of exports in terms of their GDP. Figure 2 shows a first set of countries comprising Chile, Korea, Thailand and Malaysia. These countries present both a high exports over GDP ratio and a high exports to China over total exports ratio. A second set of countries (Brazil, Japan and Philippines) has a moderate trade exposure to China, especially with relatively high exports to China over total exports ratio but small exports over GDP ratio. These two first groups of countries, entirely composed by Asian and Latin American countries, should be more impacted by

a Chinese slowdown than the third set of countries, comprising essentially developed countries.

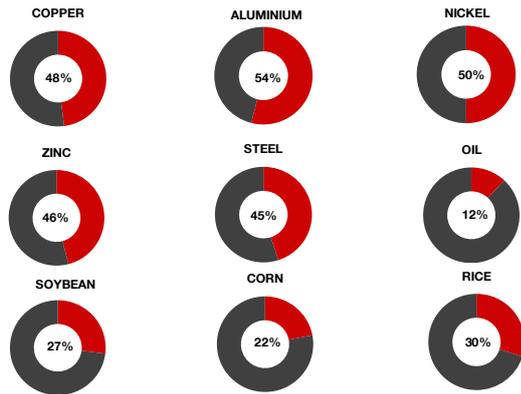
Nevertheless, beyond direct bilateral trade relationships, some countries which have low share of exports to China could be affected by China slowdown through their high share of exports to countries highly dependent of Chinese demand and/or to countries highly exposed to world commodity prices, the so-called “second round” effects.



Commodity prices channel

It is also likely that lower Chinese growth would heavily weigh on world commodity prices and thus on commodity exporters countries. China's rising demand arising from high investment levels and urbanization process has been pointed out as one of the main drivers of the so called "commodity supercycle" over the last decade. China now accounts for 54% of aluminium world demand, roughly 50% of world nickel and copper demand (Figure 3). As a result, commodity prices tend to be very sensitive to Chinese growth developments. In particular, base metal prices are expected to be highly sensitive to a Chinese slowdown given the Chinese investment-led economic model. The impact on oil prices would be more mitigated given the much lower share of China in oil's global consumption (12%). In the context of the Chinese rebalancing towards consumption, it is likely to be higher in the future with the potential of higher Chinese demand for fuel transportation (currently 32 motor vehicles per 1000 people compared to 814 in the US).

FIG 3: CHINA'S SHARE OF GLOBAL CONSUMPTION



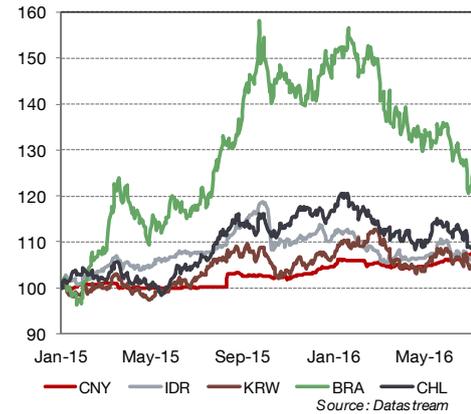
Lower Chinese economic growth rates and the shift from investment towards consumption are likely to exert downward pressures on global commodity prices. This effect would also be exacerbated by efforts undertaken by the Chinese authorities to reduce the environmental damage caused by the high commodity intensity of the Chinese economic model. As a result, commodity exporters' countries (like Brazil, Chile, Angola, and South Africa) with a large exposure to China (in terms of total exports and GDP) are likely to be significantly affected by the Chinese slowdown.

Financial channel

The direct impact of a Chinese economic slowdown on global financial markets (stocks, bonds, and foreign exchange) is likely to be relatively muted given the small international financial integration of China (mainly due to remaining capital controls) compared to its integration into the world trade and economy. However, slowing activity in China and uncertainties regarding the smooth transition to the new growth model could affect international investor confidence and thus indirectly world financial markets notably, foreign exchange and equity markets.

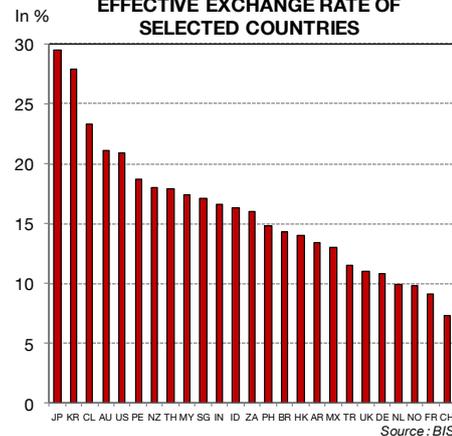
In August 2015, in order to allow greater flexibility to the RMB exchange rate regime, the People's Bank of China (PBoC) initiated a new fixing regime which translated into a mini devaluation of the RMB fixing against the USD by 4% (Figure 4). However, as a result of this de facto RMB depreciation, Asian currencies depreciated even more as markets feared that the PBoC was implementing competitive devaluation.

USD spot rate 2015 = 100
 FIG 4: EXCHANGE RATE VERSUS USD FOR SELECTED COUNTRIES

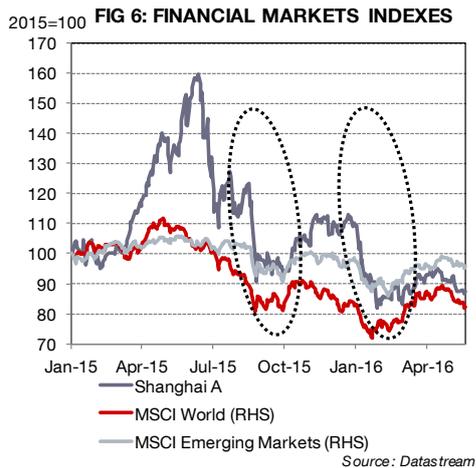


The effective exchange rate defined as the value of a currency against a trade-weighted average of bilateral exchange rates could be a better indicator than bilateral exchange rates to gauge the impact of external shocks (such as a RMB depreciation) on currencies. In this respect, the large weight of the RMB in the effective exchange rate of the Japanese Yen, Korean Won and Taiwanese Dollar suggest that in the case of RMB depreciation these currencies would face strong appreciation pressures. Beyond direct bilateral trade linkages, Japan, South Korea, and Taiwan are also competing with China in third markets (US and Europe) making their currencies strongly exposed to a depreciation of the RMB stemming from slowing Chinese economy.

FIG 5: RENMINBI WEIGHT IN THE EFFECTIVE EXCHANGE RATE OF SELECTED COUNTRIES



The Chinese equity market corrections that took place in August 2015 and in January 2016 (Figure 6) have also affected global asset prices. Excessive global financial market volatility could emanate from developments in China; so that, any shock to China growth outlook might be expected to have significant effects to the world economy through higher global risk aversion.



MODELING SPILLOVERS FROM CHINA: A GVAR APPROACH

THE GVAR METHODOLOGY

Given the economic and financial interdependencies between countries, macroeconomic analysis needs to focus both on domestic and foreign variables. Initially developed by Pesaran, Schuermann and Weiner⁵ (2004) and then extended by Dees, di Mauro, Pesaran and Smith (2007)⁶, the Global Vector Auto-Regressive (GVAR) model is specifically designed to take into account interdependencies between a large number of countries through many different channels of transmission.

Given the rise of China in the global economy, we use a GVAR methodology to quantify the spillover effects of a Chinese economic slowdown on different countries (through real GDP, real effective exchange rate, and equity price index) and on world commodity prices. The GVAR model has key advantages compared to other modeling approaches. First, it allows us to model different types of interactions among a large number of countries thus taking account indirect channels via third countries rather than direct bilateral linkages alone. Secondly, it enables us to model economic (real GDP), financial variables (inflation, real effective exchange rate, equity price index, and interest rates), and world commodity prices jointly, in contrast to the previous literature which typically considers them separately. The procedure for estimating consists in two steps. First, each country of the sample is estimated individually using domestic variables,

⁵ M. H. Pesaran, T. Schuermann, and S. Weine: "Modeling regional inter-dependencies using a global error-correcting macroeconomic model"; *Journal of Business and Economic Statistics*, 2004.

⁶ S. Dees, F. Di Mauro, and M. H. Pesaran: "Exploring the international linkages of the Euro Area: a global VAR analysis"; *Journal of Applied Econometrics*, 2007.

country-specific foreign⁷ variables and global variables which are common to all countries. Second, a global model is constructed combining all the country-specific models and linking them with a matrix of predetermined cross-country linkages.

Several papers using GVAR technique have estimated the negative impact of Chinese slowdown on different regions through different channels of transmission. Using a GVAR model, Gauvin and Rebillard (2015)⁸ predicted the impact of a Chinese hard landing in adopting a commodity focused framework. Besides, Inoue, Kaya and Ohshige (2015)⁹ studied, with a GVAR model, the implications of China's slowdown on the Asia Pacific region. Finally, given the recent surge on global financial volatility, Cashin, Modaddes and Raiss (2016)¹⁰ added a global variable on financial volatility in a GVAR model to investigate how financial volatility is affected by the Chinese slowdown.

MODEL SPECIFICATION

The GVAR model that we specify includes 36 countries (Table 1). We estimate the model with quarterly data for the period 1995Q1 to 2015Q3. Individual country data models include macroeconomic and financial variables namely real GDP, inflation, real effective exchange rate (REER)¹¹, equity price index, short and long term interest rates. We also add three commodity price indices on energy, metals and agricultural prices. We then use impulse response functions to investigate the impact of a Chinese slowdown on real and financial variables as well as on commodity prices.

⁷ In our model, 2015 trade weights are used to aggregate the foreign variables.

⁸ L. Gauvin and Rebillard C : "Toward recoupling? Assessing the global impact of a Chinese hard landing through trade and commodity price channels"; *Banque de France Working Papers*, 2015.

⁹ T. Inoue, D. Kaya, and H. Ohshige: "The impact of China's slowdown on the Asia Pacific region"; *World Bank Working Papers*, 2015.

¹⁰ P. Cashin, K. Mohaddes, and M. Raiss: "China's slowdown and global financial market volatility: is world growth losing out?"; *IMF Working Papers*, 2016.

¹¹ The Real Effective Exchange Rate is the nominal effective exchange rate adjusted by a price deflator or index of costs.

Table 1: Countries in the Global VAR model

Austria	Australia	China
Belgium	Canada	India
Finland	New Zealand	Indonesia
France	Norway	Malaysia
Germany	Sweden	Philippines
Italy	Switzerland	Thailand
Netherlands	United Kingdom	Poland
Spain	United States	Russia
Hong Kong	Argentina	Saudi Arabia
Japan	Brazil	South Africa
Korea	Chile	Turkey
Singapore	Mexico	
	Peru	

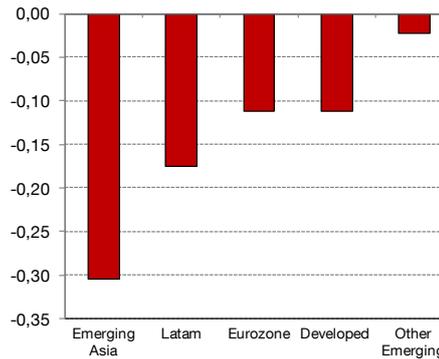
RESULTS OF A CHINESE NEGATIVE GDP SHOCK

This section illustrates the global macroeconomic effect of China's slowdown. We investigate and quantify the elasticities following an one-time negative shock of one percent on China's real GDP¹². We focus our analysis on key variables, namely real GDP, real effective exchange rate and equity price indices for a selection of countries and global commodity prices. We present the impact results obtained four quarters after the shock.

Impact of Chinese slowdown on real GDP in the rest of the world

As expected, we can observe at a regional level (Figure 7) that emerging Asia is the most hit region, with a negative impact on real GDP slightly above - 0.3% one year after the shock. Latin America would be the second most affected region with a negative impact of -0.2%. The most developed regions (Eurozone and Developed countries) are significantly less affected (around - 0.1%).

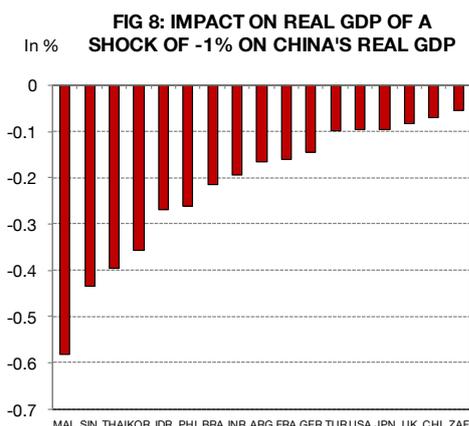
FIG 7: IMPACT ON REAL GDP OF A SHOCK OF -1% ON CHINA'S REAL GDP



Note: Emerging Asia: India, Indonesia, South Korea, Malaysia, Philippines, Thailand; Other emerging: Poland, Russia, Saudi Arabia, South Africa, Turkey; Developed: Australia, Canada, New Zealand, Norway, Sweden, Switzerland, United States, United Kingdom; Latin America: Argentina, Brazil, Chile, Mexico, Peru; Eurozone: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Spain.

We now focus on country-level elasticities. Figure 8 presents the elasticities of output for selected countries. As anticipated, Asian countries are the most vulnerable to a negative shock on China's real GDP. According to our model, Malaysia would be the most impacted economy with a decrease of its real GDP of almost - 0.6% one year after the shock. Singapore, Thailand, and Korea show strong negative reactions, with elasticities around - 0.4%. Indonesia and Philippines seem to be more resilient with output elasticities of about - 0.3%. Surprisingly, Japan's reaction is particularly low despite significant trade links with China. However, the significant share of Japanese exports to the US (19% of total exports similar to the share of Japanese exports to China) and to the Euro Area (8% of total Japanese exports) which are both slightly impacted by the Chinese slowdown could explain the resilience of the Japanese economy thanks to these limited indirect effects. Moreover, as a large commodity importer country (with commodities accounting for 35% of total imports), Japan would also largely benefit from lower world commodity prices arising from Chinese slowdown. Among non-Asian countries, Brazil is the most severely affected by the shock (-0.2%). This result is consistent with the large share of Brazilian exports directed to China (18%) and the high proportion of commodities in Brazilian exports (45% of total exports). Moreover, Brazilian economy is exposed to other economies which are themselves significantly affected by Chinese weaker demand (e.g. Argentina). We identified Chile as one of the most vulnerable country to China in terms of trade but our model suggests that Chile would not suffer, with a negative elasticity of its real GDP growth hardly above zero. The impact of a Chinese slowdown on other countries of our selection, mostly developed countries, would be limited. Thus, France and Germany would be negatively impacted around -0.2% whereas Turkey, USA and UK show a very low reaction, around - 0.1%.

¹² By elasticity, we understand the response (positive or negative) in percentage of the variable (thereafter real GDP, commodity prices, exchange rates and equity price indexes) to a 1% negative shock on China's real GDP. For example, an elasticity of -0.3% for Asia means that its real GDP will be - 0.3% lower one year after the shock.

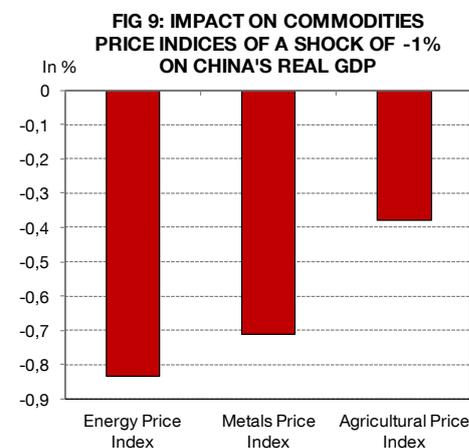


Impact of Chinese slowdown on commodity prices

We now investigate the consequences of this negative shock on the three commodity price indices that we included in our model.

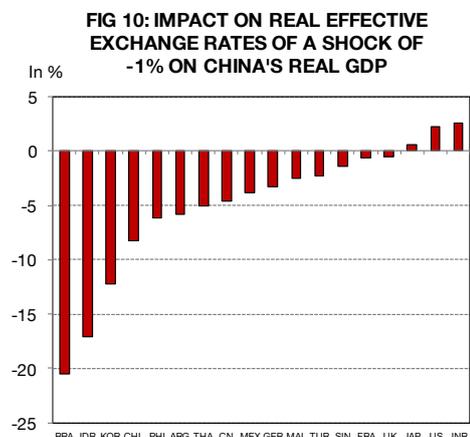
As expected, we observe in Figure 9 that these indicators are particularly affected by the Chinese slowdown. The energy price index is the most adversely hit (-0.9%) which can be explained by the large share of China in coal's world consumption. Moreover, a negative shock on China's GDP is likely to imply negative consequences on metal prices as China has been the main driver of metal prices over the last decades. The negative impact on the metal price index (-0.7%) confirms this intuition. Agricultural price index is the least impacted (-0.4%) despite the high consumption of China for some agricultural commodities (such as rice or soybean).

Even though our results are consistent with previous research papers, the magnitude of the response of commodity prices to a Chinese slowdown is low ranging from -0.9% for energy prices to -0.4% for agricultural prices, and seems counterintuitive given the large presence of China as a key player in commodity markets.



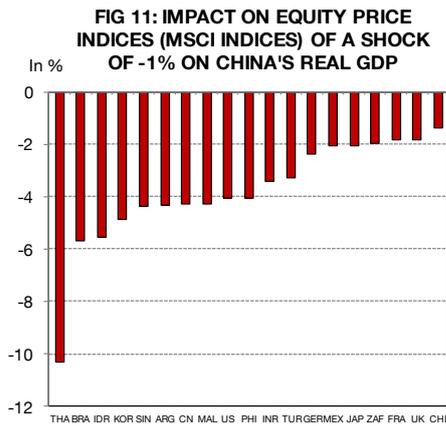
Impact of Chinese slowdown on financial variables

We now focus our analysis on financial variables, real effective exchange rates (Figure 10) and equity price indices (Figure 12). Asian and Latin American economies were the most vulnerable to China in terms of real GDP. We can observe similar results for these two financial variables. The Brazilian REER would be the most impacted with a depreciation of 20%. Indonesian rupiah and Korean won should also suffer from a Chinese slowdown with depreciation of respectively 17% and 12%. A second group of countries, again Asian and Latin American countries (Chile, Philippines, Argentina and Thailand), would see their currency depreciate but more moderately. Again, developed countries would be less affected in terms of REER.



We can observe similar results regarding equity price indices¹³ (Figure 11). Thailand's stock market would be severely impacted (-10%) followed by Brazilian's, Indonesia's and Korean's. A large set of countries' equity markets (including the US) would be significantly hit (around 4%). This result is underpinned by the recent turbulence of Chinese financial market which has globally affected the financial sphere (Figure 7).

¹³ We have used Morgan Stanley Capital International (MSCI) country indices.



CONCLUSION

Using a GVAR model over the period 1995Q1-2015Q3, we quantified the impacts of a Chinese slowdown on 36 (advanced and emerging) economies and on world commodity prices. The GVAR approach allowed us to take into account direct and indirect links among

economies included in the sample. Our results indicate that Asian and commodity exporters' countries would be the most affected by a Chinese slowdown through slower trade, lower commodity prices, and a confidence shock on global financial markets while advanced economies would be less vulnerable.

We have also expanded our analysis by conducting a counterfactual analysis to investigate the transmission of shocks before China's rise into the world economy. We solved the GVAR model by using trade weights in 2000 (rather in 2015) and found that country-specific impacts were significantly lower, confirming the rising interactions between China and the rest of the world over the last 15 years. Thus, if China's role in the global economy was continuing to increase in the medium term, a Chinese slowdown would have a much larger impact on other economies than today.

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