

Implications of China transition for the global economy and the euro area.*

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Abstract

China's rise has been the economic success story of the past four decades but economic growth has been slowing and domestic imbalances have widened. China's size, trade openness, dominant position as consumer of commodities and growing financial integration mean that its transition to sustainable growth is crucial for the global economic outlook. This paper analyses the potential impact of a transition to sustainable growth in China on the global and euro area economies using the ECB-Global model, which features financial interlinkages in addition to trade and oil channels. Simulation analysis suggests that the spillovers to the euro area would be limited in the case of a modest slowdown in China's GDP growth, but significant in the case of a sharp downturn. Sensitivity analysis underscores that the spillovers are dependent on the strengths of the various transmission channels, as well as the policy reaction by central banks and governments.

JEL codes: E21, E22, E27, F10, F47, O11, O53.

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1 Introduction

China's rise has been the economic success story of the past four decades. Output has expanded at close to 10% per year on average since 1980. From an economic backwater, China has become the world's second largest economy. This remarkable increase in the value of economic output has also been accompanied by improved living standards and a sharp decline in poverty rates; the proportion of the population living on less than USD 1.90 per day fell from around 75% three decades earlier to below 2% in 2013. As China's economic size and openness to the global economy have grown, so has its importance for other countries. China became the world's largest trading nation in 2013, surpassing the United States.

However China appears to be reaching a turning point with growth slowing and imbalances increasing. In order to generate sustainable and strong growth in the medium term, some rebalancing, as well as structural reforms, is required. This paper assesses the implications of a transition in China for the rest of the global economy. Section 2 begins by providing a brief overview of the accumulating imbalances in China's economy and the risks they pose. It argues that adjustment in China is necessary and then outlines three possible paths that China could take. A "limited rebalancing" scenario envisages China undergoing a gradual slowdown with only modest steps towards rebalancing the economy, implying that vulnerabilities and downside risks persist. A "swift rebalancing" scenario envisages a more aggressive reform effort, in which authorities accept weaker growth in the short term in order to secure a more sustainable medium-term growth path. An "abrupt adjustment" scenario foresees the downside risks materialising. Section 3 then discusses the implications of China's transition for global and euro area economies. China is now an integral part of the global economy. Any fluctuations in the growth rate of its economy, or – perhaps even more importantly – changes to the structure of its growth, will have important ramifications for every other country in the world. We first examine how China's transition would affect global economic developments, using a range of global macro models. We then use ECB-GLOBAL to underscore that spillovers to other economies are dependent on the strengths of the various transmission channels, as well as the policy reaction by central banks and governments.

2 China's imbalances and transition

China's unbalanced economic structure has been the subject of international policy discussion for many years. In the run-up to the global financial crisis, debate focused on the implications of China's large current account surplus, which peaked at 10% of GDP in 2007. Since then, the current account has narrowed substantially. External rebalancing has, in part, been driven by real exchange rate appreciation over the past decade; the IMF judges that the Renminbi is now broadly in line with fundamentals (IMF, 2016a). But rebalancing on the external side has also reflected a marked shift in demand. The slump in external demand from 2008 onwards was met with a government-directed surge in domestic investment supported by a large credit stimulus – external imbalances diminished but it was at the cost of larger domestic imbalances.

The vulnerabilities associated with China's imbalances have grown over the past decade. The clearest evidence of China's unbalanced structure has been the high reliance on investment and rising indebt-

edness. The consequences of such credit booms are rarely good: credit growth has often been precursor to financial crisis; even countries that avoid full-blown crisis tend to suffer a marked decline in economic growth as credit slows. Increased complexity and leverage in the financial system, with a long tail of riskier smaller institutions, suggests the fragilities associated with rapid financial deepening are growing.

The specific sources of risk and the degree of resource misallocation is difficult to judge from macro data but there are warning signals. These include: severe excess capacities in some heavy industries; the large expansion of infrastructure and borrowing by local governments; very high property prices in large cities and signs of oversupply across many lower-tier cities. Symptoms of an unbalanced economic structure and underlying distortions are also evident in the “propensity for asset price booms” (IMF, 2016), with excess funds fuelled by high savings and rapid credit creation prompting a search for yield that is distorting prices. Recent years have seen a sequence of sharp increases (and occasional reversals falls) in property, equity and bond prices. Large capital outflows during 2015 and early 2016 probably also reflected a similar search for alternative investment opportunities and higher yields.

The unbalanced economic structure reflects deep-rooted distortions in China’s growth model. Imbalances are intertwined by state-direction and market distortions which have been an integral part of China’s growth model and skew incentives towards saving and investment and encourage debt accumulation. Distortions in the markets for factors of production – including in the domestic prices of labour, capital, energy, land and the exchange rate – play a key role in repressing consumption and subsidising production and investment (Huang and Tao, 2011). Demographic trends, driven by the one-child policy, and social policies (including weak welfare and healthcare provision) increase incentives for savings (Choukhmane et al, 2016). Financial repression, a (largely) closed capital account and, for many years, an undervalued exchange rate, channel savings towards domestic investment (Goldstein and Lardy, 2009; Pettis, 2013; Korhonen and Ritola, 2011). The strong role of government, including through state-owned firms and banks, amid a web of implicit and explicit guarantees, further skews economic decisions.

For now, China retains buffers to mitigate the risks. China has high national savings and a current account surplus, which helps to shield it against an external funding crisis. China also retains policy space to cushion against adverse shocks for now. Government debt has been rising fast in recent years but estimates of augmented general government debt, which accounts for contingent liabilities and off-balance sheet local government borrowing, put debt near 70% of GDP providing some space to react to adverse shocks. Moreover, despite slowing growth, the interest rate-growth differential remains favourable (IMF, 2016). The government also has significant public assets including the stock of foreign exchange reserves (despite the declines in the past two years). Monetary authorities also have space to support the economy, with interest rates above the zero lower bound, and reserve requirements still at high levels. The government also retains significant levers to manage the economy, particularly through its close links with SOEs and banks.

However, with growth slowing and imbalances increasing, China appears to be reaching an inflection point. In some respects, the distortions embedded in China’s growth model helped underpin the successful development of past decades. Low interest rates (relative to returns) and financial repression supported brisk capital expansion (Pettis, 2013) and permitted an undervalued exchange rate which allowed China to increase its global export market share, reap the benefits of WTO accession from

2001 (Goldstein and Lardy, 2009), and boost technology transfers by attracting FDI (Xing, 2006). An abundant rural labour supply and limited workers' rights promoted cheap labour, allowing China to become the "world's factory". But China is gradually approaching a turning point (Zhang, 2016). Falling productivity growth and diminishing returns imply that China is bumping against the limits of the 'old' growth model of factor accumulation. Continuing to push against those limits by relying on yet more investment and debt, will only worsen existing imbalances and threaten medium-term growth sustainability (Nabar and N'Diaye, 2013). Rebalancing and renewed reform momentum are needed. Ultimately, a successful transition to a more sustainable growth path will be positive for China and the global economy.

2.1 The outlook – three illustrative scenarios

While China can rely on policy to cushion growth in the near-term, to be sustainable in the medium term, more rebalancing is required. China's outlook, therefore, is contingent on the extent and depth of its reform efforts. Progress with reform and rebalancing is crucial for medium-term sustainability, but in an environment of high imbalances, macroeconomic management will be challenging.

To allow us to understand the global implications of transition in China, this section sketches three stylised scenarios to understand the possible paths for China's rebalancing and the economic outlook. The scenarios illustrate the broad paths that China might take: (1) a "limited rebalancing" scenario in which China undergoes a gradual slowdown with only modest steps towards rebalancing the economy; (2) a "swift rebalancing" scenario involving a more aggressive reform effort in which authorities accept weaker growth in the short term in order to secure a more sustainable medium-term growth path; and (3) an "abrupt adjustment" scenario, which foresees a sharp downturn as downside risks materialise. The scenarios for medium-term growth use the Cobb-Douglas production function (based on Albert et al., 2015). They incorporate different paths for the investment-to-GDP ratio as one – albeit narrow – means of illustrating China's rebalancing challenge (see Table 1).² The probabilities of each scenario occurring are different.³ For example, as discussed above, given that China retains policy space to cushion the economy against shocks, a sharp slowdown is considered a relatively low probability event. Nonetheless, the stylised scenarios demonstrate China's rebalancing challenge.

² Forecasts for labour input are based on UN projections. The baseline forecast assumes that total TFP will continue to grow at a similar pace to recent years. The outlook for capital accumulation depends on assumptions about the investment-to-GDP ratio. To link activity and credit developments in the scenarios, we follow Zhang (2016) in mapping between the profile for investment-to-GDP ratio and the credit-intensity of growth. This simple link does not capture all of the factors driving credit developments – in recent years a large share of new credit has helped fund purchases of existing assets rather than funding fresh capital expenditure – neither does it make assumptions about any attempt to deal with the existing stock of debts associated with non-performing loans.

³ The timing of any particular scenario is also uncertain. The scenarios in this section are intended to provide a discussion of the possible directions for China's economy. The choice of starting each scenario in 2017 is purely for illustrative purposes.

Table 1 - Stylised scenarios for China's outlook

(annual percentage change; ratio to GDP; percent of GDP)

Scenario	GDP growth			Potential growth			Investment-to-GDP			Capital-output ratio			Credit-to-GDP ratio		
	2011-15	2016-20	2021-25	2011-15	2016-20	2021-25	2015	2020	2025	2015	2020	2025	2015	2020	2025
History	7.8			8.3			46.2			2.84			203		
Limited rebalancing		6.1	5.2		6.2	5.1		42.6	40.3		3.04	3.08		240	247
Swift rebalancing		5.4	5.3		5.4	5.3		40.5	34.5		3.10	3.05		232	226
Abrupt adjustment		3.7	4.8		4.8	4.1		38.2	34.6		3.20	3.09		218	205

Sources: National Sources, OECD, IMF, BIS, and ECB staff calculations.

Notes: for growth rates figures show five-year averages over respective periods; for ratios figures show scenario in a particular year.

The “limited rebalancing” scenario assumes a modest slowdown in growth over the medium term as China’s growth model adapts very gradually. Authorities continue to place a strong emphasis on achieving high rates of growth, although progress with structural reforms in some areas (e.g. liberalising the financial sector and supporting household incomes) provides for some limited rebalancing of the economy. Investment is assumed to grow below the pace of overall activity, with the ratio of investment to GDP falling to 40% by 2025, and as a consequence potential growth slowing down. But reliance on the state-owned sector continues and concerns about resource misallocation (high investment and reliance on credit growth) remain. Consequently, imbalances are addressed only gradually, with the capital-output and credit-to-GDP ratios continuing to rise in the near term. While near-term growth is higher in this scenario, vulnerabilities are also likely to continue to rise, increasing the risk of an abrupt adjustment and of falling into a middle-income trap.

In the “swift rebalancing” scenario authorities are assumed to tackle the sources of misallocation across the economy more aggressively. Investment declines more rapidly as a share of output, which weighs on potential growth; but over time this is gradually outweighed by improvements in the efficiency of capital allocation. Credit continues to rise relative to GDP in the near term but stabilises as dependence on capital accumulation wanes. Authorities enact reforms to support consumption, reducing the need to save for retirement, healthcare and education, and cushioning the economy during the transition period. GDP growth nonetheless dips in the interim, falling below potential growth, but recovers thereafter as the economy makes progress towards a more sustainable path and the output gap gradually closes again.⁴ With reduced reliance on investment as a driver of growth, the credit-to-GDP ratio stabilises. Structural reforms progressively boost TFP.

In the “abrupt adjustment” scenario, activity slows sharply as downside risks materialise. Deteriorating confidence in the financial sector causes financial conditions to tighten abruptly. Government measures to support financial firms are insufficient to stem the collapse in confidence and the provision of credit to the real economy. Domestic demand growth declines markedly as investment falls.

⁴ The speed with which structural reforms would yield benefits (e.g. faster GDP growth) depends, in part, on the effectiveness of the reform process. The IMF (2016) also envisages a relatively swift pay-off from reforms for GDP growth.

GDP growth falls sharply in the first year and output remains significantly below potential growth for three years – an experience similar to other economies that have undergone systemic financial crises (Furceri and Mourougane, 2012 and Ollivaud and Turner, 2014). During the downturn, lower potential growth reflects the fall in capital expenditure and lower productivity, as declining credit provision to the more productive private sector affects the efficiency of production. The negative effects on the potential capacity of the economy persist but GDP growth recovers somewhat, driven by cyclical effects as the output gap closes.

The scenarios underscore the challenging transition facing China. First, growth is expected to decline over the medium term in all scenarios. Even in the “limited rebalancing” scenario, potential will fall because labour input is dwindling and the pace of capital accumulation is no longer increasing as rapidly as in the past. Second, consistent with historical experience, faster rebalancing would entail a stronger initial growth slowdown. Third, it will take time to address vulnerabilities. Investment will remain high in most scenarios, suggesting that concerns about resource misallocation could persist.⁵ Even the “swift rebalancing” scenario would still entail an increase in the capital-output ratio in the near term, while the investment-to-GDP ratio, at close to 35% by 2025, would remain high in comparison to many other economies. Moreover, while the “abrupt adjustment” scenario entails lower leverage, it comes at the expense of a sharp drop in activity. With only limited rebalancing, leverage is likely to continue to rise. The “swift rebalancing” scenario allows for a more moderate increase, with the credit-to-GDP ratio levelling off by 2025. Overall, this suggests that even successful rebalancing will entail a long transition and that the downside risks associated with China’s imbalances will persist throughout this transition.

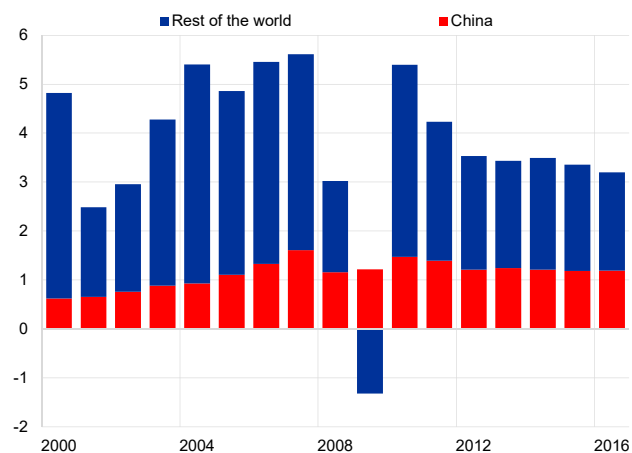
3 China’s spillovers: the impact of China’s transition on the global economy

The course of China’s transition path will affect the global outlook. China has a large global economic footprint. As the world’s second largest economy in 2016, it has made a consistently large contribution to world GDP growth, averaging over 1pp since 2005 – one third of total global growth in that period and more than the combined contribution of advanced economies (Chart 1). China is one of the world’s largest consumers and producers of many commodities. Financial linkages are more limited but growing. Even as the pace of China’s expansion slows, it will continue to make large contributions to global growth and play an important role in global markets through trade, commodity and financial channels (Chart 2).

⁵ In the “limited rebalancing scenario” new investment is assumed in part to be misallocated and thus does not add to the productive potential of the economy. See Albert et al. (2015) for a discussion of capital misallocation and the impact on potential growth. In the “swift rebalancing” scenario the degree of capital misallocation is assumed to diminish gradually over time reflecting the successful effects of reforms to rebalance the economy.

Chart 1
Contributions to global GDP growth

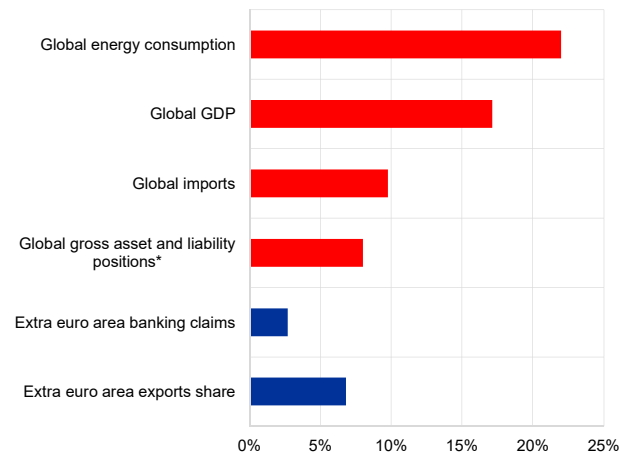
(GDP growth (%) and contributions to global GDP (PP), seven year averages)



Source: IMF.

Chart 2
China's global role and euro area links

(red bars – percent of global totals; blue bars – percent of euro area totals)



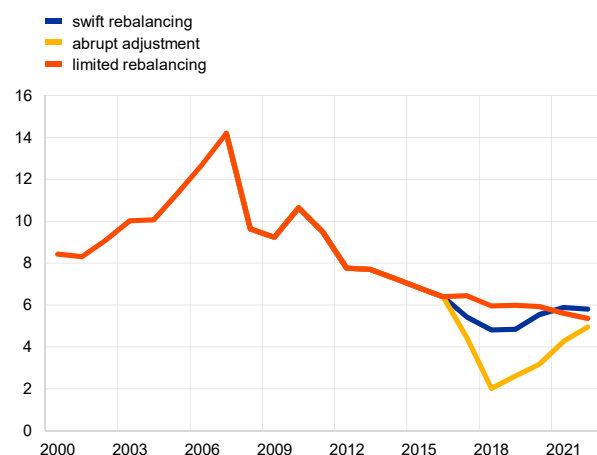
Sources: IMF and IEA.

Note: Figures for 2015. GDP based on PPP; imports based on market exchange rates. Energy consumption as a share of world total primary energy supply. Euro area banking claims percent of extra euro area claims.*Include Hong Kong.

China's size, trade and growing financial openness, as well as its dominant position as a consumer of commodities, mean that its transition is crucial for the outlook of the global economy and the euro area. This section considers the global repercussions of China's transition using a range of global macro-models. Model evidence can help in understanding China's role in the global economy, allowing spillover channels to be disentangled and quantified and the effects of policy responses to be considered.

Chart 3 - China GDP growth scenarios

(annual percentage changes in GDP)



Sources: CEIC and ECB staff calculations.

Note: starting the scenario in 2017 is purely illustrative.

ing that puts upward pressures on bond yields and risk premia. Output remains significantly below

This section illustrates the potential effects of rebalancing in China by comparing the “limited rebalancing” scenario, in which China undergoes only a very gradual slowdown, with the “swift rebalancing” scenario, which envisages a more aggressive reform effort to address existing fragilities and put China on the path towards a more sustainable growth trajectory. In effect, it treats the “limited rebalancing” scenario as a baseline and compares the impact of the additional slowdown entailed by the “swift rebalancing” scenario, which amounts cumulatively to GDP that is about 3% lower in China over three years (Chart 3).⁶ In a subsequent step, the implications of the “abrupt adjustment” scenario are studied. This entails a sharp financial tightening

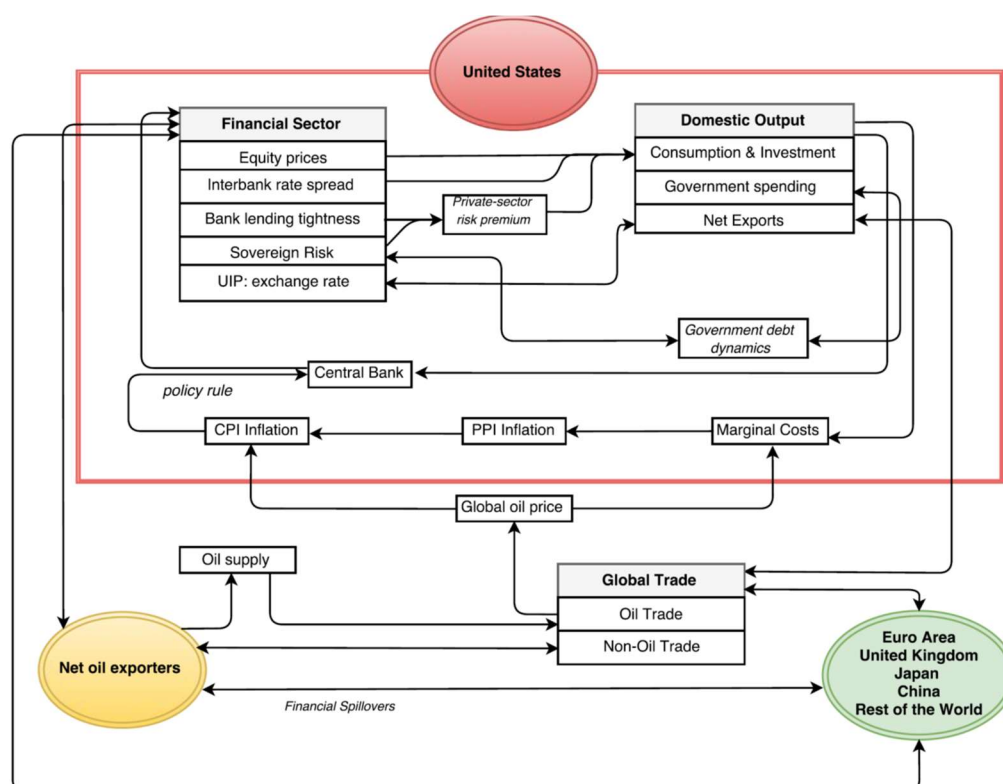
⁶ This is simulated via a negative domestic demand shock, driven primarily by slower investment, an endogenous tightening of credit and bank-lending conditions.

potential for three years, with China’s real GDP around 9% lower after three years compared with the “limited rebalancing” scenario, and a rather slow recovery thereafter (Chart 3).⁷ Finally, the section turns to understanding the role of different assumptions about the transmission channels and policy reactions in estimates of China’s spillovers for the rest of the world.

3.1 Description of ECB Global

The primary source of analysis is the ECB-Global Model (Dieppe et al., 2017), the ECB’s new global macroeconomic model: a rich quarterly multi-country model for the euro area, the US, Japan, the UK, China, oil-producing economies, and the rest-of-the-world, featuring diverse cross-border spillover channels through real and financial interlinkages.⁸

Figure 1 - Stylised description of ECB-Global



The development of ECB-Global follows a semi-structural approach to combine the advantages of fully structural models and those composed of reduced-form equations. Specifically, the advantage of the reduced-form aspect of ECB-Global is that it facilitates modifying the model in a flexible manner so that it can be adapted relatively straightforwardly, which allows us to address quickly-changing

⁷ Modelled as a tightening of financial conditions via an increase in interbank spreads, which leads to a fall in equity prices and a rise in risk premium. In this section, the spillover effects are discussed over a three-year horizon. However, the scenarios are modelled over six years.

⁸ The version of the model used here is the one that appears in the ECB working paper series (see reference list). The model has been since then updated to include an additional country block (emerging Asia). The new version of the model has been published in Economic Modelling.

issues in the policy discussion. Moreover, the additional reduced-form elements improve the empirical fit of ECB-Global. The parameterization of ECB-Global is based on a combination of institutional knowledge as well as an limited information impulse response matching procedure. One key aspect of the model is that in addition to having “traditional” cross-country spillovers via trade and the oil sector, it also features endogenous financial spillovers and a financial accelerator mechanism in the spirit of Bernake et al. (1999).

Figure 1 offers a stylised description of the model. Domestic output consists of consumption and investment, government spending and net exports, while domestic inflation is a combination of producer price inflation (determined by marginal costs) and imported oil price inflation. The central bank of each economy acts to stabilise inflation and output by setting its policy rate, which in turn affects the financial sector. The domestic financial sector determines equity prices, the short-term interbank credit spread, bank-lending tightness and sovereign risk premia. The interbank credit spread drives a wedge between the central bank’s policy rate and short-term interbank rate, and the private-sector risk premium is defined as the sum of bank-lending tightness and the sovereign risk premium. These financial variables are important determinants of domestic output as they act as financial accelerators and the sovereign risk premium interacts with government spending and government debt dynamics. Finally, net exports will respond to changes in the exchange rate, which is modelled via the uncovered interest rate parity (UIP) condition. Real spillovers are based on countries being interlinked via global trade, which consists of oil and non-oil trade as two separate channels. All economies import and export non-oil goods, whereas only the oil-exporting country block produces and exports oil. The price of oil is determined by oil trade which equates oil demand (endogenous to global output) and oil supply (exogenously set by the oil-exporting countries). A key feature of the model is that we ensure consistency of global trade such that exports equal imports. Financial spillovers in ECB-Global occur through four channels: equity prices, the interbank rate spread, bank lending tightness and sovereign risk premia. International financial spillovers arise endogenously in ECB-Global in the sense that changes in foreign financial variables transmit to domestic financial variables through contagion, with the relative magnitude of financial spillovers largely dependent on financial shares.

The structural detail and complexity in ECB-Global is limited in several dimensions, for example by the pooling of private consumption and investment, by the rather stylized fiscal block, and the lack of incomplete exchange-rate pass-through or local-currency pricing. Albeit featuring some degree of heterogeneity, several key parameters are homogenous across countries, as well as the core structure of most of the countries, with the exception for the net-oil producers and China.

In order to account for the China’s peculiar economic structure, ECB-Global features some fundamental differences in the modelling of this country as compared to the rest of the countries in the model. In particular, China features a different monetary policy setting and a modified UIP condition. The rest of China’s economy is modelled symmetrically to that of the other countries in the model. However, a key difference is that the China’s financial block is parameterised to shield China from changes in financial conditions in the rest of the world economies. This has been done to take into account the relatively limited financial linkages between China and the rest of the world.⁹

Monetary policy - China’s monetary policy setting is characterised by the presence of a policy rule based on short-term interest rates. Specifically, monetary authorities steer the interest rate in response

⁹ This assumption is relaxed in the simulations implemented in section 3.6.

to changes in CPI inflation from its target and in the output gap. The interest rate reacts only gradually in response to deviations of the target variables as standard in policy rules in the DSGE literature.

The policy rule for China diverges from that of other countries in the model for it includes a response to changes in the nominal exchange rate in order to ensure limited variations in the external value of its currency. Furthermore, monetary authorities in China can resort to an additional policy instrument: the reserve requirement ratio, which, borrowing from the Global Projection Model, is also set according to a Taylor-rule type relationship. Its equation is similar to that of the policy rate for it includes a smoothed response to deviations in expected CPI inflation from target and in the current output gap.

Exchange rate regime - In ECB-Global, real exchange rates are defined through a risk-adjusted uncovered interest parity condition: the home economy's net foreign asset position relative to GDP enters as a premium on holdings of foreign debt. The premium on foreign debt captures the costs for domestic agents of engaging in transactions in the international asset market and ensures the stationarity of the net foreign asset position. In order to allow Chinese authorities to follow a managed exchange rate regime, we modify the UIP equation for China by adding a parameter that limits the exchange rate to deviate from its trend.

The results from ECB-Global are cross-checked with a range of structural and non-structural global models including the IMF's Global Integrated Monetary and Fiscal Model (GIMF), Oxford Economics' Global Economic Model, the Global Vector Auto-regressive model (GVAR) and for the euro area the ECB's New Multi-Country Model (NMCM). Each model has a varying level of detail and country coverage.¹⁰

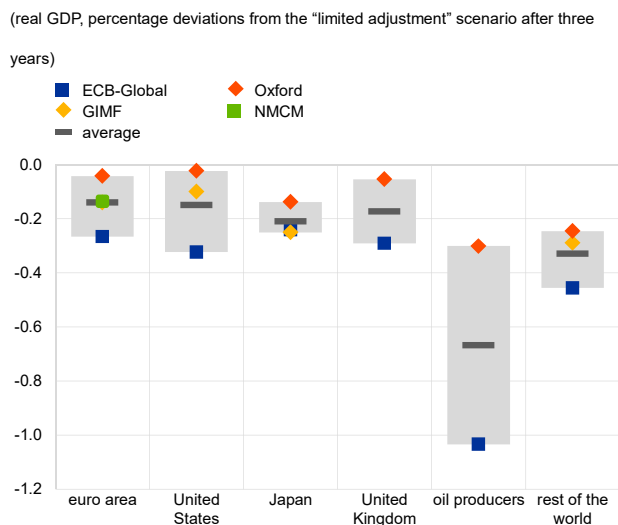
3.2 Spillovers from a China Slowdown

To demonstrate the importance of different spillover channels, the simulations start with some key assumptions that are subsequently relaxed. In particular, it is initially assumed that: (a) trade and financial linkages are in line with past averages; (b) commodity markets react endogenously; (c) monetary policy is fixed in China, with authorities following a managed exchange rate regime; and (d) the spillovers from Chinese financial markets and capital flows are limited.¹¹ By subsequently relaxing these assumptions, the analysis can show how the effects of different policies and spillover channels from China's slowdown spread to the rest of the world.

¹⁰ The key features of the models are outlined in Appendix 1. A further key assumption is that monetary policies are unconstrained outside China. In addition the simulations assume there is no fiscal stimulus beyond the functioning of automatic fiscal stabilisers. The scenarios rule out effects from shifts in global uncertainty or confidence effects, or contagion to other EMEs.

¹¹ These assumptions are not included in the GVAR. Note that it is also assumed that monetary policy outside China can also react to slowing activity and falling inflation – i.e. it is assumed that the zero lower bound is not binding or that monetary policy will normalise at a slower pace. This issue is discussed in more detail below.

Chart 4 - Spillovers from China – “swift rebalancing” scenario



Sources: CEIC and ECB staff calculations.
Note: averages are for the macro- models.

still impinges on global financial conditions. In ECB-Global this results in negative, but limited, financial spillovers to both advanced economies and the rest of the world.¹³ In contrast, in GIMF, Oxford, and NMCM there is only limited modelling of the financial side of the economy, which implies less pronounced global spillovers than in ECB-Global. Furthermore, the Oxford model has a strong negative price reaction, which helps to mitigate the negative growth effects. Yet, despite these differences, the results from the (semi) structural models are broadly similar (see Chart 4). By contrast, the only non-structural model – the GVAR – produces very different results, with substantially larger spillovers. The key difference is that, while the structural models assume that China’s monetary policy is unchanged and the exchange rate is broadly pegged to the US dollar, the GVAR assumes monetary policy and exchange rates to be endogenous. If China’s exchange rate depreciates following the economic slowdown, the impact on other economies through competitiveness channels would be much greater. This highlights the sensitivity of model results to key underlying assumptions on policy responses.

Despite some variation across models, the effect of the slowdown in China on activity and inflation in advanced economies, including the euro area, is relatively limited. The demand-driven slowdown in activity in China dampens export demand for these countries.¹⁴ However, activity growth in oil-importing advanced economies is supported by falls in commodity prices as well as looser monetary policy. In models with financial channels, the spillover effects are to a limited degree also amplified by financial markets – the rise in interbank spreads and the fall in the Chinese equity prices directly lead to a modest decline in global equity prices and an increase in global interbank spreads and risk premia. Overall, the range of model results suggests that output in advanced economies, including the

Under these assumptions, the near-term implication of the “swift rebalancing” scenario is that global activity slows down. The slowdown in China is estimated to lower output across many regions of the world (see Chart 4). However, spillover effects vary widely. The trade channel plays a prominent role in determining global spillover. Countries with closer trade linkages, such as those in emerging Asia, are therefore more affected by negative shocks from China. Oil producers’ output is also affected strongly by the decline in oil prices. However, for commodity importing economies, the decline in commodity prices helps to cushion demand.¹²

Differences across the global models reflect variations in model structure, particularly in the role of financial spillovers. Although China has a relatively closed capital account the financial sector

¹² This is confirmed by Furceri et al. (2017) and Blagrove and Vesperoni (2016).

¹³ Appendix 1 provides a detailed breakdown using ECB-Global.

¹⁴ The spillovers would be different if a structural slowdown in China (caused by slower productivity growth) was considered rather than a demand-driven shock, as it would also imply a reduction in China’s exports (World Bank 2016).

euro area, is up to 0.3% weaker after three years for the macro-models and double that for the GVAR. These effects are broadly in line with the literature, which provides a range of estimates depending on model and scenario specification.¹⁵ There is also rather limited downward pressure on inflation. Lower domestic and manufacturing cost pressures push China's producer price inflation down. This, combined with the drop in oil and non-energy commodities prices as China's demand slows, results in some downward pressure on advanced economies' inflation.

However, the abrupt adjustment scenario, driven by significant financial tightening in China entails relatively larger negative spillovers. This scenario envisages a deeper decline in output growth in China, which inevitably has a larger impact on the rest of the world. However, the different nature of the shock also affects the size of the spillovers. To understand that point, Chart 5 compares the global spillovers from the abrupt adjustment scenario modelled in two different ways in ECB-Global: (1) as a slowdown driven by a domestic demand shock in China; and (2) as a downturn triggered by a significant financial tightening in China. Despite the relatively modest financial linkages with the rest of the world, given its important role in the global economy, tighter financial conditions in China are assumed to raise global risk premia.¹⁶ The shock in China therefore propagates both via the trade channel (through lower domestic demand) and the financial channels. As a consequence, the relative impact on the rest of the world is larger.¹⁷

Variations across models emphasise that the spillovers from a slowdown in China depend on assumptions about the transmission channels and the reaction of policy in different economies. The following discussion, examines the implications of relaxing some of the key assumptions underlying the scenarios listed above. It starts by examining the effects of different assumptions about the strength of key transmission channels: including (a) the commodity price channel; (b) trade linkages; and (c) financial linkages. It then examines the impact of alternative assumptions about policy reactions, including: (d) the exchange rate regime and monetary policy response in China. This sensitivity analysis is undertaken using ECB-Global as the reference model to provide a framework for exploring the channels in a consistent manner.

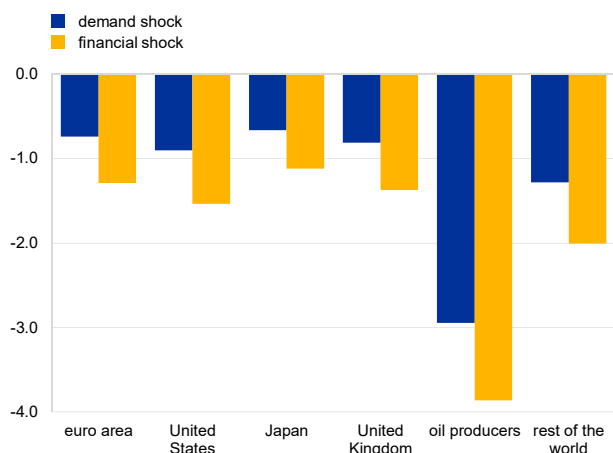
¹⁵ Dizioli et al. (2016) reach a similar conclusion in which a fall in public investment in China equivalent to 1.5 percent of GDP each year for five years triggers a global fall in GDP of less than 0.1%. The OECD (2015) finds that a decline of 2 percentage points in the growth rate of domestic demand in China for two years would lead to a spillover of between 0.1 to 0.7 percentage points for OECD economies depending on the specification. Furceri et al. (2017) using a panel VAR approach find that a 1 percentage point negative shock to China's final demand growth (in one quarter) would reduce export growth rates by 0.1-0.2 percentage points over the course of a year. Huidrom et al. (2017) find that a 1 percentage point shock to China's GDP would lower GDP growth in other emerging and frontier market by around 0.6 percentage points.

¹⁶ Economies in the rest of the world hold Chinese assets to some extent, particularly when Hong Kong is included (as foreigners are exposed to the offshore bond and H-shares in HKEX).

¹⁷ This is consistent with Kalemli-Ozcan et al. (2013) where financial shocks led to higher cross-country co-movement than real shocks.

Chart 5 - Spillovers from China – “abrupt adjustment” scenario

(real GDP, percentage deviations from “limited adjustment” scenario after three years)

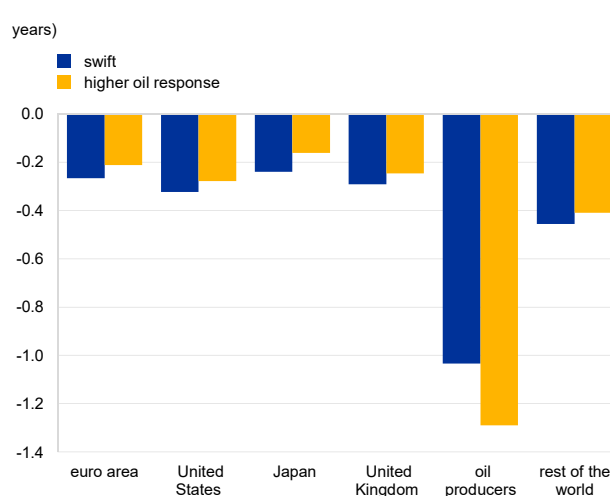


Source: ECB-Global.

Notes: Chart shows fall in GDP from abrupt-adjustment scenario driven by: (1) a domestic demand shock in China; and (2) a financial tightening in China.

Chart 6 - Spillovers from China – “swift adjustment” scenario with stronger oil response

(real GDP, percentage deviations from “limited adjustment” scenario after three years)



Source: ECB-Global.

Note: oil price decline is 5.9% in swift and 11.8% in higher response scenario.

3.3 Commodities

Uncertainty about China’s effect on commodity prices could affect the size of spillovers. China plays a dominant role as a key global importer of commodities, so this is potentially an important channel for understanding the spillover effects on growth and inflation in other economies. However, the range of estimates from the literature of the impact of a slowdown in China’s growth on oil and non-oil commodity prices is large. In the “swift rebalancing” scenario, ECB-Global simulations found oil prices to be nearly 6% lower after three years, which is on the low side of other estimates (see Section 4). To quantify the effects of the commodity price channel, Chart 6 presents a scenario in which oil prices (as a proxy for commodity prices) are assumed to be twice as responsive to shifts in Chinese demand. With commodity prices falling further, activity in commodity importing advanced economies is cushioned to a somewhat greater, albeit limited, extent following China’s slowdown.¹⁸

3.4 Trade linkages

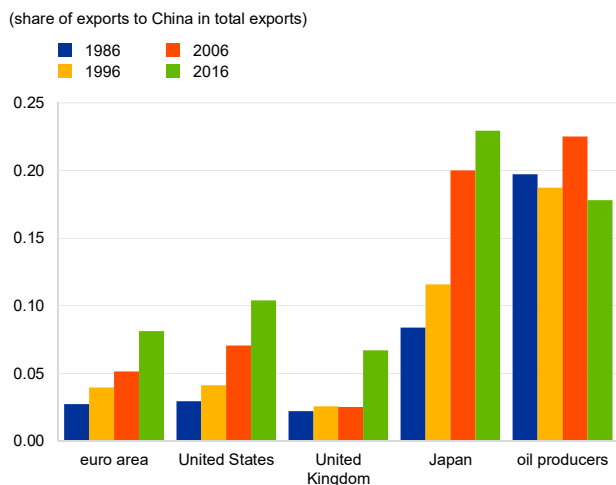
The greater openness of China’s trade can also affect potential spillovers. There has been a rapid increase in global trade linkages with China, with the country more than doubling its share in global trade in the last 15 years (see Chart 7). However, global macro-models typically use an average of bilateral trade linkages over the past few years.¹⁹ As China’s role in global trade grows, so will its global impact. To illustrate this point, Chart 7 shows the estimated spillovers under the swift scenario using ECB-Global with different trade weights corresponding to China’s trade with other countries at

¹⁸ There are differences across models of the contribution of lower commodity prices to supporting growth. Furthermore, the effects of commodity price shifts may have changed for the United States, as the country is now a major oil producer.

¹⁹ For example, the trade weights used in ECB-Global are averaged over the period 2009-15.

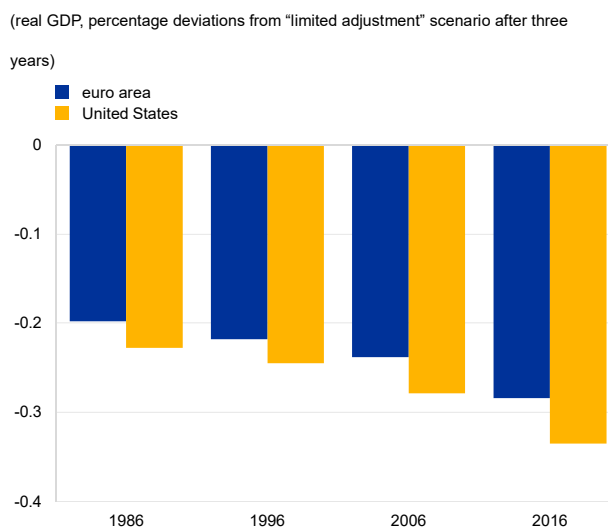
different points in time.²⁰ The impact of shocks in China on the euro area and the United States are estimated to have risen slightly as China's trade has increased.²¹ This suggests the model spillover estimates through the trade channel should be considered as a lower bound.

Chart 7 - Trade shares by country



Source: IMF's Direction of Trade Statistics database.

Chart 8 - Swift adjustment scenario with alternative trade shares



Source: ECB-Global.

Note: bars show impact on euro area and United States using trade shares based on data for years shown on horizontal axis.

3.5 China's exchange rate regime and monetary policy response

Spillovers also depend crucially on the exchange rate regime and monetary policy response in China. The "swift rebalancing" scenario assumes that China's monetary policy does not react as the economy slows and the exchange rate is essentially a "managed float" against the US dollar. In this case, even as demand slows, market interest rates rise in China as risk premia increase, which leads to a slight appreciation of the renminbi rate. However, there have been recent reforms to liberalise the exchange rate.²² To understand the effects of an alternative exchange rate regime and monetary policy response, Charts 9 and 10 assume that following the downturn in the economy, the Chinese monetary authorities partly counteract the shock by lowering policy rates. With interest rates in China falling relative to the rest of the world, the renminbi exchange rate depreciates vis-à-vis the currencies of other economies.²³ The associated gains in China's price competitiveness would partly offset the adverse implications of the swift rebalancing on activity in China. The scenario is adjusted accordingly; it calibrates a combination of gains in price competitiveness and lower demand (in response to the reform efforts),

²⁰ For this exercise, spillovers arising from the oil channel are switched off and financial spillovers are assumed constant over time to isolate the effect of higher trade linkages.

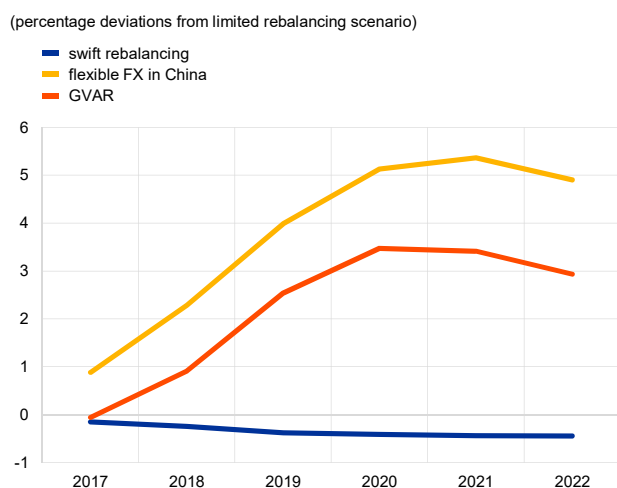
²¹ This is consistent with Furceri et al. (2017) and Cashin et al. (2017) who find spillovers from China have only slightly increased over the past decade.

²² After targeting a stable RMB/USD rate, the Chinese authorities have liberalised the Renminbi and now target a basket of currencies.

²³ The renminbi falls by nearly 5% against the US dollar after three years in real terms.

which still generates GDP that is 3% lower in China over three years.²⁴ In this case, advanced economies would lose competitiveness. For the euro area the effect would double the decline in euro area GDP compared to the swift rebalancing scenario where monetary policy is assumed to be unresponsive in China.²⁵ This scenario is broadly comparable to simulations with the GVAR model, which allows for both monetary policy and the exchange rate of China to react endogenously.²⁶ Nonetheless, there is significant uncertainty on the extent that exchange rates movements affect growth.

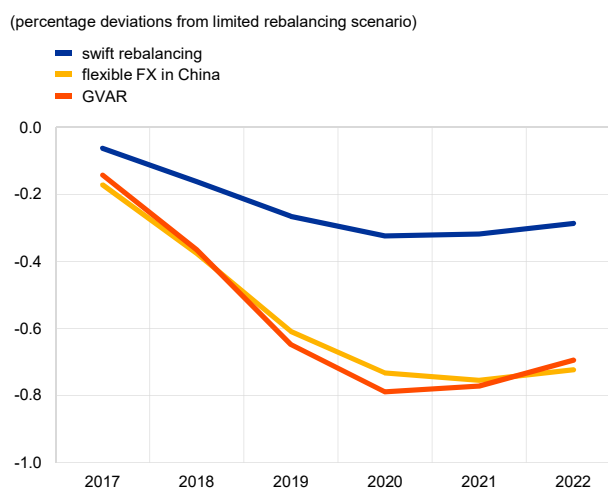
Chart 9 - Alternative paths for renminbi real exchange rate against the US dollar



Sources: ECB-Global and GVAR.

Notes: a negative is a depreciation of the Renminbi; in the flexible FX scenarios monetary policy is allowed to react in China.

Chart 10 - Spillovers for euro area GDP under alternative assumptions about exchange rate path



Sources: ECB-Global and GVAR.

Note: in the flexible FX scenarios monetary policy is allowed to react in China.

3.6 Financial linkages

The degree of financial linkages also influences the impact of any slowdown in China. The main simulations have relatively limited financial linkages between China and the rest of the world, with small financial spillovers arising through contagion effects.²⁷ However, as Section 4.3 discussed, China's financial integration with the rest of the world is increasing and events during the summer of 2015 illustrate the potential for China to affect global financial markets. To understand the implication of stronger financial linkages with China, Charts 11 and 12 present the effects of a five-fold increase in financial linkages with China.²⁸ For each economy, the share of financial exposures to China is in-

²⁴ However, the impact depends on which interest rates drive exchange rate movements. If exchange rates react endogenously to shifts in market rates, the exchange rate response is somewhat lower than the scenario reported where exchange rates are modelled to reflect differences in central bank policy rates.

²⁵ The euro appreciation vis-à-vis the renminbi would also further reduce inflationary pressure.

²⁶ Casin et al. (2017) and Feldkircher and Korhonen (2014) found similar results using a GVAR model.

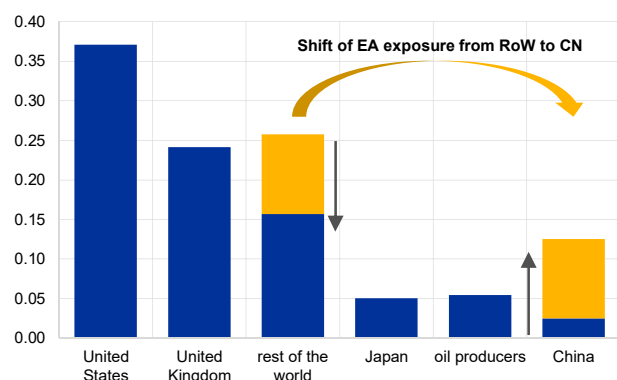
²⁷ The swift slowdown scenario implies a fall in Chinese equity prices by 2.0% and the interbank rate increases by nearly 150 basis points by 2019 in ECB-Global.

²⁸ This implies China and Hong Kong combined would have financial linkages with the rest of the world that correspond to average financial linkages between other economies.

creased fivefold and, correspondingly, the share of their financial exposures to the rest of the world reduces (see Chart 11). With stronger financial linkages, negative spillover effects for GDP in advanced economies more than double (see Chart 12).

Chart 11 - Euro area financial exposure

(shares of euro area assets to other countries/regions)

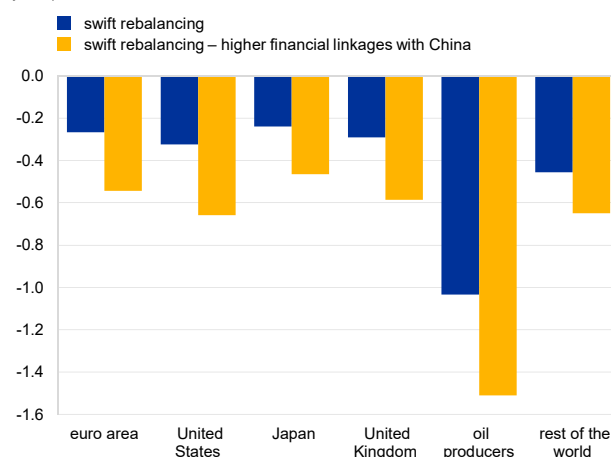


Sources: IMF Coordinated Portfolio Investment Survey (CPIS) and ECB staff calculations.

Note: ECB-Global takes into account that resident in the euro area and other economies hold to some extent assets in China and Hong Kong by using financial weights that are averaged over 2009-15. As an alternative we consider a reduction in financial links with the Rest of the World and an increase in links with China – as illustrated in this chart for the euro area.

Chart 12 - Spillovers with higher financial exposure to China

(real GDP, percentage deviations from "limited adjustment" scenario after three years)



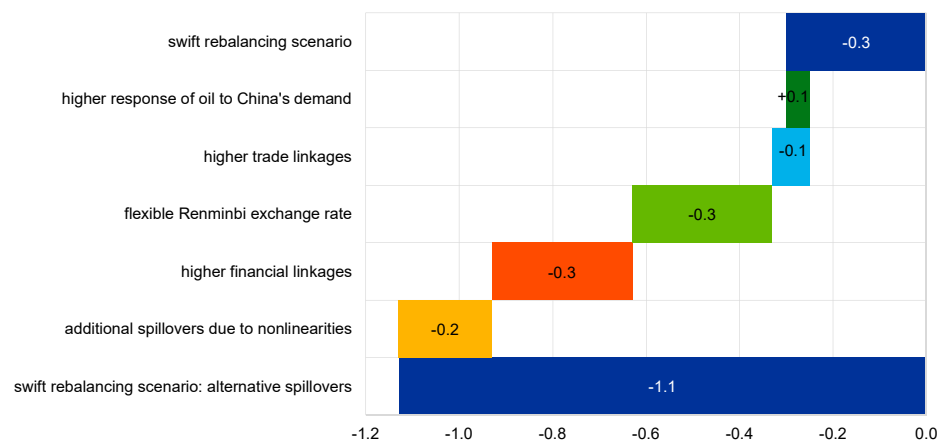
Source: ECB-Global.

4 Conclusions

Overall, the sensitivity analysis underscores that spillovers are complex and dependent on the strengths of the various channels as well as the policy reaction by central banks. Model evidence suggests that trade links are one key transmission channel. However, model simulations tend to be based on historical averages of cross-country linkages. With China's role in global trade having increased over time, the improved interconnectedness could suggest that the spillover effects presented here provide a lower bound. Moreover, with increased financial integration of the Chinese economy in the global market, financial spillovers are likely to be rising. On the other hand, if commodity prices were to react more strongly, the effect of China's slowdown on oil importing economies would be cushioned to a greater extent. Finally, spillovers from China are dependent on the policy responses in China. A depreciation of the renminbi would help China to gain competitiveness at the expense of other economies. As Chart 13 illustrates, the cumulative effect of these different assumptions would be to increase spillovers substantially. For example, for the euro area, the model simulations suggest that China's cumulative slowdown of 3.3% of GDP after three years would lower euro area GDP by nearly 0.3%. Assuming a larger impact on commodity prices, stronger trade linkages, and a more aggressive policy response in China leading to a depreciation of the renminbi, this figure would double to 0.6%. In addition, assuming higher financial linkages would increase the effects further to around 0.8%. Taking into account the non-linearities that arise from the combination of increased interlinkages and different policy reactions, implies euro area GDP could decrease by up to 1.1%.

Chart 13 - Spillovers from China under alternative assumptions

(euro area GDP percent deviations from "limited rebalancing scenario" after three years)



Source: ECB-Global

Notes: the scenarios are conditioned on the same slowdown in China's GDP (the "swift rebalancing scenario"). The left-hand bar shows the deviation of euro area real GDP from the limited rebalancing scenario after three years. Each block to the right shows the effect of changing an assumption underlying that spillover analysis: (1) a doubling of the response of the oil price to fluctuations in China's demand; (2) a doubling of the trade linkages; (3) the assumption that China's exchange rate reacts flexibly to the slowdown in output; (4) a five-fold increase in China's financial linkages with the rest of the world; and (5) the additional non-linearities arising from combining blocks together. The bar on the right-hand side shows the cumulative effect of these alternative assumptions on the spillovers for euro area GDP.

Moreover, there is the potential for spillovers to be even larger than accounted for in the model simulations. The simulations make important assumptions about policy reactions across the world. They assume that conventional monetary policy in advanced economies is not constrained by the zero-interest-rate floor. If the effective lower bound was binding in advanced economies, spillovers would be larger.²⁹ At the same time, policy support in China via fiscal stimulus could theoretically cushion any slowdown. A worsening outlook in China could also trigger a synchronised downturn across EMEs if it raised doubts about the sustainability of their economic prospects, or could lead to a generalised increase in uncertainty and other non-linearities. However, the source of the shock is critical: a "swift rebalancing" whereby authorities push through large-scale reforms and deal with the vulnerabilities outlined in this paper would largely remove a large tail risk to the global economy. Indeed, the transition of China towards a more sustainable growth trajectory could be positive for the global and euro area economies. In such a situation, positive confidence effects could create a much more benign financial market reaction, which could mitigate some of the negative spillovers. This would also potentially reduce the likelihood of non-linearities, amplifying the effects from the weaker near-term growth outlook in China to the rest of the world.

²⁹ In the euro area, the swift rebalancing scenario sees interest rates fall by between 10 to 60 basis points compared with the limited rebalancing scenario (see Appendix 2), which substantially cushions the decline in both output and inflation. See Ahmed (2017) for large spillovers under a strict zero lower bound constraint for monetary policy.

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6 Appendix

6.1 Description of models used in spillover analysis

ECB-Global is a semi-structural multi-country model which features both real and financial cross-country spillovers. This model attempts to strike a balance between theoretical consistency and tractability. Although not explicitly derived from micro-founded optimisation problems, the model equations are inspired by the literature on dynamic stochastic general equilibrium (DSGE) models. As a result, ECB-Global equations can be given a structural interpretation such as a Phillips curve, an IS equation or a central bank reaction function, making it easier than in fully reduced-form models to trace the transmission of shocks through the economy. The GIMF model (Kumhof et al., 2010 and Anderson et al., 2013) is a fully structural, micro-founded model developed by the IMF. It includes bilateral intermediate trade spillovers along with a detailed fiscal block. Spillovers mainly operate through trade, net foreign assets, and the exchange rate channel as well as via changes in the global long-term interest rate. Oxford is a semi-structural backward looking model with a detailed set of variables and countries, but with limited financial spillovers. The GVAR (Dees et al. 2007) is an estimated model covering 36 countries and is apt at capturing cross-country spillovers. However, the estimated shocks lack a structural interpretation and the model includes only a limited set of variables per country (GDP, Investment, Exports, Inflation and the bilateral exchange rate vis-à-vis the USD).

Table 2 - Global models – summary

Model	Type	Country coverage	Advantages over other models
ECB-Global	Semi-structural	US, the euro area, China, Japan, UK, Oil exporters, emerging Asia and rest of the world	Balance between theoretical consistency and tractability
GIMF	Structural	Six regions (US, euro area, Japan, emerging Asia, China and the rest of the world)	Includes intermediate trade, and detailed fiscal block
Oxford	Semi-structural	Large set of countries	More countries and more variables

Sources: Dieppe et al. (2017), Kumhof et al.,(2010), Anderson et al. (2013) and Oxford Economics

For analysing specifically the spillover effects to the euro area, we also use the New-Multi Country Model (NMCM) (Dieppe et al., 2012 and 2013), a semi-structural model covering Germany, Spain, France, Italy, and the Netherlands. The impact of a rebalancing scenario on the global economy is studied using ECB-Global and then the spillovers from the external environment to the euro area economy are assessed using the NMCM, which are conditioned on China and the global variables from ECB-Global.

6.2 Detailed scenario results from ECB Global

Swift Rebalancing			
% deviations from baseline (unless specified differently)			
	Year 1	Year 2	Year 3
Real GDP			
Global GDP	-0.23	-0.51	-0.79
Euro area	-0.06	-0.15	-0.25
US	-0.07	-0.19	-0.30
Japan	-0.05	-0.12	-0.21
UK	-0.07	-0.18	-0.29
China	-1.04	-2.21	-3.39
Oil producers	-0.37	-0.83	-1.20
Emerging Asia	-0.14	-0.32	-0.50
Rest of the World	-0.13	-0.30	-0.46
CPI Inflation (ppts deviations)			
Euro area	-0.05	-0.10	-0.13
US	-0.05	-0.11	-0.14
Japan	-0.05	-0.10	-0.14
UK	-0.05	-0.10	-0.13
China	-0.22	-0.54	-0.82
Oil producers	-0.05	-0.13	-0.18
Emerging Asia	-0.06	-0.13	-0.17
Rest of the World	-0.06	-0.11	-0.15
PPI Inflation (ppts deviations)			
Euro area	-0.02	-0.05	-0.09
US	-0.02	-0.06	-0.10
Japan	-0.02	-0.06	-0.09
UK	-0.02	-0.05	-0.09
China	-0.17	-0.49	-0.76
Oil producers	-0.05	-0.14	-0.19
Emerging Asia	-0.03	-0.08	-0.13
Rest of the World	-0.02	-0.07	-0.11
Nominal policy rates (annualized bps)			
Euro area	-11	-28	-47
US	-12	-32	-53
Japan	-10	-26	-44
UK	-12	-30	-50
China	0	0	0
Oil producers	-24	-79	-136
Emerging Asia	-16	-45	-75
Rest of the World	-15	-41	-68
Real Exports			
Euro area	-0.24	-0.57	-0.89
US	-0.32	-0.75	-1.16
Japan	-0.34	-0.81	-1.26
UK	-0.16	-0.40	-0.62
China	-0.44	-0.85	-1.34
Oil producers	-0.69	-1.51	-2.26
Emerging Asia	-0.41	-0.92	-1.41
Rest of the World	-0.29	-0.68	-1.03
Real Imports			
Euro area	-0.22	-0.50	-0.78
US	-0.22	-0.48	-0.75
Japan	-0.33	-0.74	-1.15
UK	-0.09	-0.20	-0.33
China	-1.42	-3.11	-4.74
Oil producers	-0.40	-0.93	-1.39
Emerging Asia	-0.27	-0.61	-0.94
Rest of the World	-0.07	-0.16	-0.25
Commodity prices			
Oil prices	-1.75	-3.86	-5.91
Euro area			
GDP	-0.06	-0.15	-0.25
Consumption+investment	-0.03	-0.09	-0.18
Imports	-0.22	-0.50	-0.78
Foreign demand	-0.24	-0.57	-0.89
CPI	-0.05	-0.10	-0.13
PPI	-0.02	-0.05	-0.09
Equity prices	-0.03	-0.07	-0.11
Annualized nominal policyrate	-11	-28	-47
Annualized nominal interbank rate(EONIA) (bps)	-6	-15	-25
Nominal effective exchange rate (€)	0.00	0.00	0.01
Nominal bilateral exchange rate USDEUR	0.00	0.00	0.00
EA competitors' export prices	-0.04	-0.11	-0.18
China			
GDP	-1.04	-2.21	-3.39
Consumption+investment	-1.84	-4.00	-6.11
Imports	-1.42	-3.11	-4.74
Foreign demand	-0.44	-0.85	-1.34
CPI	-0.22	-0.54	-0.82
PPI	-0.17	-0.49	-0.76
Equity prices	-0.63	-1.32	-2.03
Annualized nominal policyrate	0	0	0
Annualized nominal interbank rate (bps)	38	95	149
RRR	0.00	0.00	0.00
Real bilateral exchange rate USDCN	-0.18	-0.32	-0.49