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THE INS & OUTS OF CHINESE MONETARY POLICY TRANSMISSION

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ABSTRACT

Using a novel indicator for the People's Bank of China monetary policy stance, we estimate a policy rule that accounts for the dual nature of its price stability mandate---encompassing domestic inflation and the exchange rate---and for the evolution of its operational framework. The "Ins": The domestic transmission follows textbook patterns, with exceptions due to the active management of the renminbi and the financial account. The "Outs": International spillovers are powerful and affect commodity markets, global production and trade. The pass-through to foreign (US) prices is substantial. Financial spillovers are second-order, and mostly derivative from trade spillovers.

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1 Introduction

One of the most consequential phenomena of the past few decades has been the remarkable ascent of China as a global economic powerhouse, making it one of the largest economies in the world.[1] A striking way to visualise the associated transformation of the global economic landscape is to trace China's positioning within the network of international trade—from a small, peripheral player to a dominant, central actor in the span of just two decades (Figure 1).[2] Much has been written to analyse the features of this unprecedented economic miracle (see e.g. Prasad and Rajan, 2006; Song, Storesletten and Zilibotti, 2011; Zhu, 2012). Yet, we still know surprisingly little about the mechanics of shocks transmission in China, and of their potential international spillovers.

Monetary policy is no exception. The gradual yet fundamental institutional changes initiated with the country's "opening-up" reforms have led to a dramatic evolution of the Chinese economic paradigm, with the progressive liberalisation of Chinese financial markets being a prime example. In turn, this has led to a continuous adaptation and transformation of the operating framework of the People's Bank of China (PBC), which over the years has transitioned across multiple policy targets, and a continuously changing arsenal of instruments and intermediate targets. The complexity of this institutional setup and of its evolution over the past few decades have made the study of monetary policy in China a particularly challenging endeavour.

Our paper is a first attempt at providing a comprehensive analysis of the monetary policy of the PBC, and at characterising and quantifying its transmission both domestically and internationally.

Two main developments are key to our effort. First, we use a novel composite monetary policy indicator to gauge the PBC monetary policy stance against the backdrop of a continuously evolving operating framework that went from being essentially quantity-based, to one increasingly centred on market interest rates. Second, we estimate an endogenously switching monetary policy rule for the PBC that is consistent with its

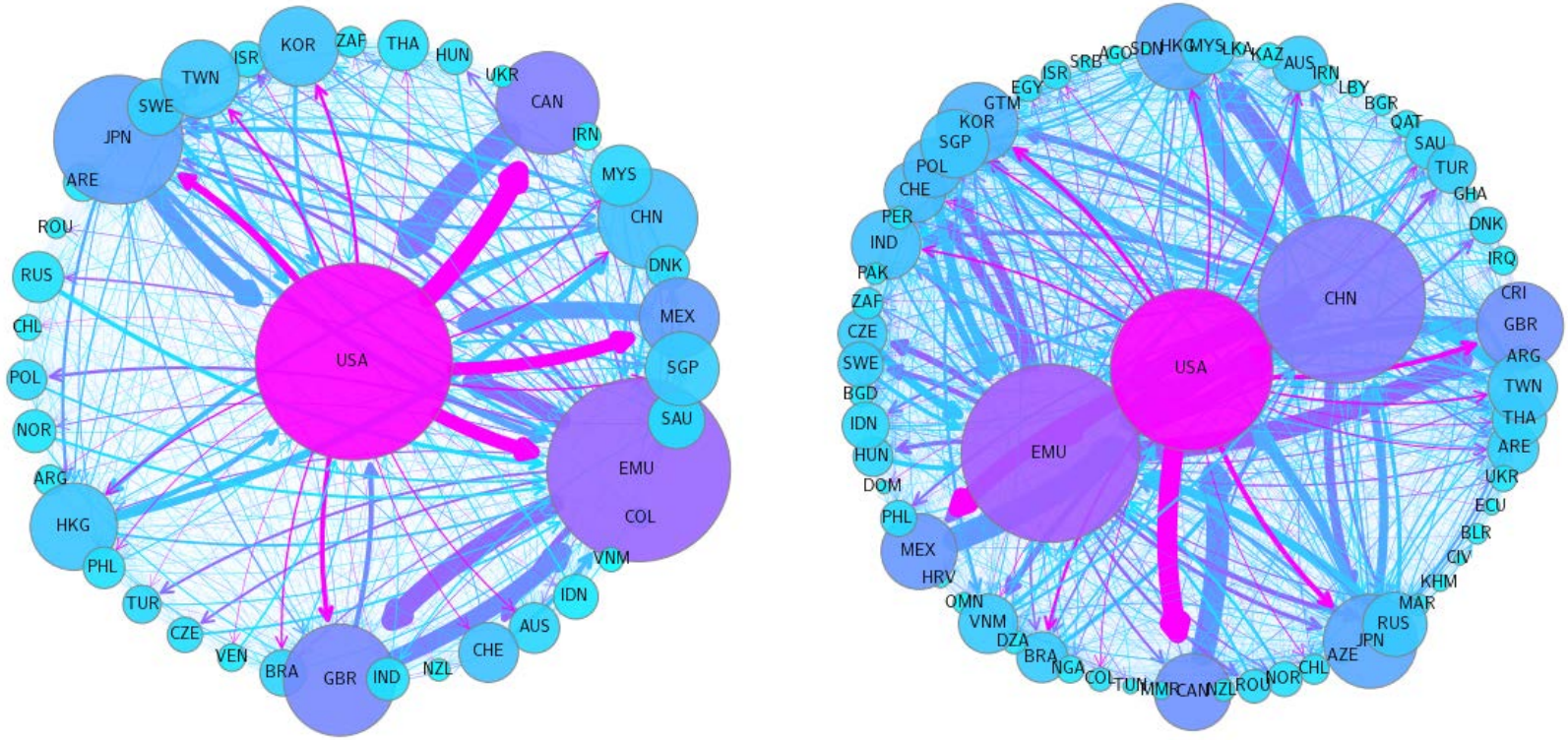
[1] China is second only to the US when using nominal GDP at market exchange rates. A ranking based on the purchasing power parity (PPP) of its currency would place it in first place. See https://www.imf.org/external/datamapper/PPPSH@WEO/OEMDC/ADVEC/WEOWORLD.

[2] Conversely, the growth of China's footprint in international finance (e.g. as captured by cross-border portfolio investments) has been more muted, in line with the slow liberalisation of the exchange rate and financial account (see Appendix D).

Figure 1: China's Position in the Global Trade Network

(A) 2000

(B) 2019



Notes: Directed network of bilateral goods exports, as reported in the IMF Direction of Trade Statistics (DOTS). Mirror data is used to fill missing bilateral trade whenever available. European Monetary Union (EMU) trade with non-EMU countries only consolidated into a single node. The node size is scaled to reflect the sum of each country's gross external trade as a share of world total trade (gross exports and imports). We focus only on nodes that have either total exports or total imports of at least USD 10 billion. The edge width also captures the value of gross trade between each pair of countries (nodes), and is normalized between 0 and 20. For comparability, the USA node is positioned in the centre of the graph. Position of the remaining nodes is determined using the Fruchterman-Reingold force-directed algorithm, implemented through the Python NetworkX package. The color scale reflects the eigenvector centrality of each country in the network, ranging from magenta for the most central node (USA), through purple for other nodes with high centrality (e.g. EMU, CHN in 2019) and dark blue for less central nodes (e.g. TWN), to cyan for the many peripheral nodes.

mandate of facilitating the Chinese government achieving its growth objectives, while maintaining price stability. Importantly, the rule explicitly accounts for the dual nature of the price stability mandate, therefore encompassing both domestic inflation and stability of the value of the renminbi in a context where capital controls are prevalent.

The composite monetary policy indicator (CMPI) builds on the work of Xu and Jia (2019). It summarises information from a variety of both price- and quantity-based policy tools that influence monetary and credit aggregates as well as interest rate targets, to reflect the transformation that the PBC operating framework underwent over the past few decades. In the earlier part of the sample, the CMPI comoves with the growth rate of M2 and of total credit—also known as total social financing—as well as with lending rates and reserve requirement ratios, that served as the preferred intermediate targets and policy instruments at the time. In the latter part of the sample, it is more closely related to interest rates, such as the 7-day repo and reverse repo rates, the 3-month Shibor, and the 1-year loan prime rate (LPR).

Our specification of the policy rule for the PBC builds on the seminal work of Chen, Ren and Zha (2018)—CRZ henceforth. CRZ propose a policy rule with the following two key characteristics. First, it is specified against the official Chinese government's targets for growth and inflation that are announced at the beginning of every year during the plenary assembly of the National People's Congress. Second, it features an endogenously switching response of monetary policy to growth depending on whether output overshoots or undershoots the government's annual target. Relative to CRZ, we introduce two main innovations. First, we add an explicit term that targets fluctuations in the value of the renminbi, to reflect the dual nature of the PBC's price stability objective and the importance that currency management has beyond its effects on domestic inflation (Yi, 2018). To do so, we reconstruct a monthly effective exchange rate for the Chinese yuan using the official China Foreign Exchange Trade System (CFETS) trade weights and central parity exchange rates, that are used as a gauge for the objective of keeping the "exchange rate basically stable at an adaptive and equilibrium level" (Yi, 2018). Second, we use the CMPI as a policy indicator, in place of the growth rate of M2 used by CRZ. This allows us to specify a single policy rule that encompasses all the alternative policy instruments and targets that the PBC has used to achieve its policy objectives over the

course of the last few decades. Moreover, it alleviates concerns related to conflating the effects of both monetary and fiscal policy due to the tight link that exists between government-sponsored investment and the money supply (Han, Song, Yuan and Zhao, 2023).

We use the policy rule's residuals to identify Chinese monetary policy shocks and to study their domestic (the *Ins*) and international (the *Outs*) transmission.

The *Ins* The identified monetary policy shock leads to an increase in Chinese interest rates, with those at shortest maturity reacting the most. This qualifies the identified shock as a short-term monetary policy contraction, or in other words, as a conventional monetary policy tightening. The 7-day repo rate, a key market interest rate targeted by the PBC since the introduction of the interest rate corridor, contracts significantly on impact. The pass-through to other short-term lending rates is almost full, with the short-term interbank Shibor contracting to a similar degree. The shock affects interest rates up to a 2-year maturity, while the longer end of the Chinese yield curve is largely unresponsive.

Higher borrowing costs are paired up with a persistent contraction in aggregate lending, and lead to an equally protracted contraction in economic activity, which drags down Chinese imports as well. The contraction in imports is twice as large as that in domestic output. Chinese exports eventually contract to a similar extent but respond more slowly, suggesting that additional measures to incentivise exports may be in place. The inflation response is initially likely pushed upwards by increased housing costs, which make up a significant component of consumer prices in China.

Collectively, these responses point to a domestic transmission mechanism for Chinese monetary policy that is to a large extent in line with what is documented for advanced economies. Important differences however arise when considering the response of the exchange rate and of the financial account.

Despite the presence of capital controls, the response of gross and net Chinese capital flows points to a retrenchment in *risky* investment into China, which materialises with a delay consistent with the weakening in the domestic economic outlook. Especially, Chinese gross portfolio outflows and banking inflows contribute to the overall cross-border

flight of capital. In net terms, FDI inflows also contract significantly. The reduction in private foreign investments is counteracted by a progressive reduction of official foreign exchange reserves in the medium run, which mimics the patterns highlighted in e.g. Avdjiev, Hardy, Kalemli-Özcan and Servén (2022). The effective exchange rate does not respond on impact but a gradual and muted appreciation eventually follows, consistent with a heavily managed exchange rate.

As noted in e.g. Das (2019), the current exchange rate regime in China is best understood as a de facto crawling peg against the US dollar, combined with a more flexible management against the remaining currencies in the official CFETS basket. Our results highlight this duality very clearly. The non-dollar CFETS exchange rate appreciates slightly at medium horizons, and accounts for virtually all of the movements in the CFETS renminbi index. Conversely, the bilateral CNY/USD rate is kept mostly stable after the shock hits and, if anything, it slowly depreciates over time. These dynamics suggest that the short-term exchange rate adjustment policy highlighted in Jermann, Wei and Yue (2022) has in fact significantly more persistent effects.

The *Outs* The international transmission of Chinese monetary policy shocks seems to operate primarily through trade channels, with an important amplification mechanism through commodity markets and integrated production networks. Conversely, our results point to a relatively minor role for financial channels. The domestic contraction in Chinese production, and particularly of Chinese imports, sets out a potent chain reaction that leads to a strong contraction in both global production and trade. The large role that China plays not only in the context of global trade of final goods, but also as a key actor in production networks worldwide means that Chinese spillovers are material for the global growth outlook.

Consistent with the heightened global macroeconomic risk and with flight-to-safety motives that lead to a stronger dollar in risk-off scenarios when global output is lower, the US dollar appreciates with delay (see e.g. Gourinchas and Rey, 2022; Obstfeld and Zhou, 2023). At the same time, the contraction in Chinese production kicks off a material fall in the demand for raw materials, which results in a significant albeit delayed fall in commodity prices, despite the US dollar appreciation. This is particularly true for indus-

trial metals, heavily utilised in manufacturing processes (see also Gazzani and Ferriani, 2024). Global financial conditions are largely unaffected, but some mild deterioration is noted in conjunction with the stronger dollar and with weaker commodity prices at medium horizons. The delayed response of global asset prices to a Chinese policy shock suggests that real effects rather than financial ones are the primary channels responsible for their decline (see also Miranda-Pinto, Pescatori, Prifti and Verduzco-Bustos, 2023). This puts these results in stark contrast with those documented in e.g. Rey (2013) and Miranda-Agrippino and Rey (2020, 2022) on the amplification of the global transmission of US monetary policy through the Global Financial Cycle.

The absence of an international risk-taking channel for the transmission of Chinese monetary policy does not prevent some countries from suffering adverse consequences through financial flows. In particular, we show that emerging market economies that rely heavily on Chinese demand for raw materials also experience a liquidity shock as a result of the Chinese contraction, due to a fall in inflows of foreign capital.

Lastly, we show that as one of China's largest trading partner, the US economy too is vulnerable to Chinese spillovers. The US trade balance deteriorates in response to the Chinese shock, dragged down by a substantial fall in US exports. US industrial production falls by roughly the same amount as Chinese industrial output, albeit with more delay. The price spillovers are also significant. The fall in commodity prices leads to a fall in US import price inflation, with significant pass-through to US producer and consumer price inflation alike.

Related Literature Our paper contributes to a growing literature that studies the features and transmission of Chinese monetary policy. Chen, Chen and Gerlach (2013); Jones and Bowman (2019) and Kim and Chen (2022) analyse and discuss the implementation of Chinese monetary policy, and the evolution of the operating framework in detail. Fernald, Spiegel and Swanson (2014) is an early empirical study of the domestic Chinese monetary policy transmission that shows that increases in reserve requirements and interest rates reduce activity and inflation, suggesting that the transmission of monetary policy in China may be akin to that in Western market economies. Similarly, McMa-

hon, Schipke and Li (2018) show that while not used as an active policy tool as done in other major central banks, official PBC communication has been increasingly picked up by market participants in recent years. Still within the domestic context, Chen, Ren and Zha (2018) analyse the role that shadow banking credit plays in the transmission of monetary policy, and its interaction with more traditional bank lending.

An important feature of the Chinese policy landscape is the active management of the renminbi. A useful description of the evolution of the Chinese exchange rate regime is found in Das (2019). The more recent reforms concerning the renminbi stabilisation goal are studied in detail in Jermann, Wei and Yue (2022), while Bahaj and Reis (2024) study the interaction between the onshore and offshore yuan, and the role played by the latter in the implementation of capital controls, another prevalent feature of Chinese policy.

The progressive move from a quantity-based to a price-based monetary policy framework for the conduct of Chinese monetary policy has motivated a number of studies to explore alternative ways to both measure the policy stance, and identify policy shocks. Chen, Ren and Zha (2018) emphasise quantity-based instruments, and single out the growth rate of M2 as the intermediate policy target for the PBC between 2000 and mid-2016. Similarly, Barcelona, Cascaldi-Garcia, Hoek and Van Leemput (2022) elect the changes in the flow of total social financing as an encompassing indicator to summarise monetary, fiscal, and credit policies. Funke and Tsang (2021) focus instead on interest rates only, and measure the Chinese monetary policy stance as the factor common to the 7-day reverse repo rate, the reserve requirement ratio, the PBC's open market operations, and the interest rates on the Medium-Term Lending Facility (MLF) and the Pledged Supplementary Lending (PSL) Facility. While relevant over particular sample periods, neither of the quantity-based variables is sufficient to capture the complex evolution into the interest-based framework that is in place currently. Equally, focusing exclusively on interest rates is likely to downplay earlier years when policy was conducted by setting lending quotas and targets for aggregate lending. The composite monetary policy indicator that we use in this paper and that encompasses both price and quantity measures is novel, and builds on the work of Xu and Jia (2019).

Our rule-based identification builds on the work of Chen et al. (2018). Alternative methods have been devised in e.g. Sun (2018), that constructs a narrative measure based

on the author's reading of PBC communication about the monetary policy stance, and in Sun (2020), that exploits reactions to particular announcements in standard event-study fashion. Kamber and Mohanty (2018); Das and Song (2022); Shieh (2024) use high-frequency changes in interbank rates around PBC announcements to identify shocks to Chinese monetary policy in a manner consistent with a line of work using such high-frequency surprises to study monetary policy transmission in advanced economies (e.g. Gürkaynak, Sack and Swanson, 2005). This approach is only applicable to the very recent period, when interest rate swap markets become sufficiently liquid and market interest rates take over as a more dominant target of Chinese monetary policy. Even then, focussing on a single interest rate relies on a strong assumption that there is a stable relationship between interest rates in different segments of Chinese financial markets, which requires passing judgement on how effective the interest rate liberalisation reform has been in reducing market fragmentation (Chow and Perkins, 2014).

Studies of the international spillovers of Chinese policy are still limited. Barcelona et al. (2022) find some tentative evidence of spillovers to both real activity and financial conditions from what they dub a Chinese "credit impulse" that may be due to a combination of monetary, fiscal and industrial policies. Shieh and Sanyal (2024) study how spillovers of Chinese monetary policy shocks identified using high-frequency surprises to 7-day repo rates vary across international stock markets depending on the production network links with China. Ma, Rebucci and Zhou (2025) discuss a nascent channel for Chinese international monetary policy Transmission via financial markets. Similarly to us but using the M2-based policy shocks of Chen et al. (2018), Gazzani and Ferriani (2024) documents powerful spillovers of Chinese monetary policy to global commodity markets.

The paper is organised as follows. Section 2 describes the evolution of the PBC monetary policy framework and of the related exchange rate regime. Section 3 introduces our novel monetary policy indicator, and we estimate the non-linear policy rule for the PBC in Section 4. Sections 5 and 6 contain our main results. Section 5 focuses on the domestic transmission of Chinese monetary policy, while international spillovers are presented in Section 6. Section 7 concludes. Additional results are reported in the Appendix.

2 The Chinese Monetary Policy Framework

The People's Bank of China (PBC) has operated as the Chinese central bank since 1983. Its official mandate, enshrined in the 1995 Law of the People's Republic of China on the People's Bank of China, defines the objective of the prudent monetary policy as *"to maintain the stability of the value of the currency, and thereby promote economic growth"*.[3] Differently from inflation targeting central banks, this formulation of the mandate effectively encompasses two distinct policy targets. Specifically, as described by former governor Gang Yi, "to maintain currency stability has two tiers of meanings: internally it means to maintain prices stable and externally it means to keep [the renminbi] exchange rate basically stable at an adaptive and equilibrium level" (Yi, 2018).

The framework for the implementation of this broad mandate has undergone profound changes since the 1990s (see e.g. Chow and Perkins, 2014). Largely driven by the gradual liberalisation of Chinese financial markets, the policy framework has progressively transitioned away from quantity-based monetary policy instruments and intermediate targets, and towards a system predominantly centred on market interest rates (see e.g. Fernald, Spiegel and Swanson, 2014; Kim and Chen, 2022). In parallel, the Chinese authorities have also undertaken a progressive liberalisation of the exchange rate regime, which has evolved from a strict US dollar peg into a more flexible management with respect to a broader basket of currencies.

We briefly review these developments in what follows. This serves as a background to motivate the novel measure for the PBC monetary policy stance that we introduce in the next section.

Domestic Monetary Policy Framework. At the turn of the century, the PBC had just transitioned away from directing lending via credit quotas—a practice prevalent during the 1990s—to utilising a monetary aggregate (M2) as an intermediate target for monetary policy (Yi, 2018). Credit provision however remained central in the conduct of the PBC's policy. The benchmark lending and deposit rates, set by the PBC, provided an anchor for interest rates across the country. And, in the same spirit, starting from the mid-2000s the PBC began using changes in the reserve requirement ratios (RRR)

[3] See http://www.pbc.gov.cn/en/3688229/3688299/3688302/index.html.

for Chinese banks as an additional quantity-based instrument to regulate the amount of available liquidity (Jones and Bowman, 2019).

This system remained largely in place until the financial crisis of 2008. Between 2009 and 2015, the non-bank financial sector started playing an ever greater role in Chinese credit allocation. Over that period, and while the PBC was intent to unwind the stimulus injected in response to the financial crisis by restricting the money supply, shadow bank lending soared (Chen, Ren and Zha, 2018). The resulting divergence between total credit and M2 induced the PBC to place a greater emphasis on aggregate financing to the real economy (AFRE)—also known as total social financing (TSF)—as the primary quantity target starting from 2012 (Yi, 2018).

At the same time, the Chinese authorities were also managing a progressive liberalisation of interest rates, which eventually culminated with the benchmark lending and deposit rates being officially phased out in 2013 and 2015, respectively. In their place, the PBC resolved to affect market-based interest rates by establishing a series of new monetary operations and lending facilities (Yi, 2021). In the current interest rate based framework, two policy rates have emerged as key—the 7-day reverse repo rate (R007), and the Medium-Term Lending Facility (MLF) rate.

The PBC 7-day reverse repo rate sits at the centre of the interest rate corridor system that was established in 2015. In conjunction with the interest rate on excess reserves (the floor) and the Standing Lending Facility (SLF) rate (ceiling), it aims to control the interbank 7-day repo rate (DR007), and short-term interbank funding conditions more broadly. The 7-day repo rate has become a key policy target rate since the introduction of the corridor system, and in the aftermath of the liberalisation of the lending and deposit rates. In addition, in order to better align actual lending rates with the policy rate, in August of 2019 the PBC instructed Chinese banks to quote their Prime Lending Rates (LPR)—i.e. the lending rates offered to their highest-quality customers—as a spread over the official MLF rate (Yi, 2021). As a result, the LPR now tracks the policy rate on the medium-term lending facility more closely, and it has replaced the phased-out benchmark rates as the reference rate for new bank loans (Jones and Bowman, 2019).

To summarise, over the past two decades monetary policy implementation in China has progressively placed less weight on quantity-based instruments (quotas, RRR) and

targets (M2, TSF growth) in favour of price-based instruments (corridor system, R007, MLF rate) and targets (interbank lending rates). Furthermore, it has moved away from directly steering commercial financial institutions, e.g. through the benchmark deposit and lending rates, to indirectly affecting market-based interest rates via a broad set of lending facilities and monetary operations.

Before moving on to a more formal measurement of the Chinese monetary policy stance in the next section, we note that the conduct of monetary policy in China cannot be considered in isolation from the exchange rate management policy that we review in greater detail below. Crucially, to retain monetary policy independence while also managing its exchange rate, China implements strict capital controls. Like the monetary policy framework, the capital flow management framework has also undergone a series of important reforms (see Bahaj and Reis, 2024).

Exchange Rate Regime. China's exchange rate regime and its implementation have also changed considerably over the past two decades.

Until the first half of 2005, the Chinese yuan (CNY) was pegged to the US dollar, at 8.2765 yuan per USD. On the 21st of July of the same year, the Chinese authorities announced a transition to a managed floating exchange rate regime, based on market supply and demand, and with reference to a broader basket of currencies. On that date, the yuan was revalued against the US dollar by 2.1%.[4] This transition was implemented by allowing the CNY to trade within a narrow range around a central parity rate calibrated based on the previous day's closing rate against the US dollar. Over the following decade, the trading bands have been progressively loosened, and the yuan has been allowed to gradually appreciate against the US dollar in a manner consistent with a *de facto* 'crawling peg' (Das, 2019).[5] Managing this gradual yuan appreciation has required considerable FX interventions, together with sustained growth in Chinese reserves (Das, 2019; Adler, Chang, Mano and Shao, 2021).

On the 11th of August 2015, the PBC unexpectedly announced a further change in

[4]See http://www.pbc.gov.cn/english/130721/2831438/index.html.

[5]The initial trading band was +/-0.3% against the USD, while it was wider around non-dollar currencies at +/-1.5%. The non-USD trading band was widened to 3% in September 2005. The USD band was then also widened to +/-0.5% in 2007, 1% in 2012, and 2% in 2014.

the CNY/USD central parity quotation mechanism, which was accompanied by a 1.9% depreciation of the yuan. While turbulence ensued in the immediate aftermath of the announcement, as market participants interpreted the move as a signal of more depreciation to come, the PBC later clarified the nature of the reform as a move towards targeting a wider trade-weighted basket of currencies. Accordingly, in December of 2015 the China Foreign Exchange Trade System (CFETS)—a PBC subsidiary—started publishing weekly series of renminbi effective exchange rate indices. These include an index constructed using in-house currency trade-based weights, as well as alternative public exchange rate weights from the Bank for International Settlements (BIS) and the Special Drawing Rights (SDR) basket.[6]

Jermann, Wei and Yue (2022) show empirically that the reform established a central parity rate for the RMB exchange rate against the dollar that gave roughly equal weights to maintaining a stable exchange rate against the CFETS basket, and allowing the dollar bilateral rate to reflect market forces by tracking the previous day's CNY/USD closing rate.[7] Effectively, the exchange rate regime transitioned to a half-way point between a currency basket peg, and a flexible adjustment to market forces subject to a daily trading band. Notably, the 2015 reform also established a formal basis behind the monetary authority's objective of maintaining the "RMB exchange rate basically stable at an adaptive and equilibrium level." And effectively implied that the PBC's exchange rate target could be accurately captured by the renminbi exchange rate against the CFETS currency basket.

As noted, the implementation of the managed RMB exchange rate regime inevitably involved considerable foreign exchange interventions, especially during the period of gradual appreciation against the dollar, from 2005 to 2014. Left unsterilised, FX purchases can and do alter the domestic supply of RMB, thus directly affecting the monetary policy

[6]The CFETS currency basket initially consisted of 13 currencies, and was expanded to cover 24 currencies as of 2017. For details, see the initial calculation methodology at https://iftp.chinamoney.com.cn/english/bmkidxrud/20151211/1989.html; changes effective as of January 2017 at https://iftp.chinamoney.com.cn/english/bmkidxrud/20161229/2048.html; and from January 2020 at https://iftp.chinamoney.com.cn/english/svcnrl/20191231/1496901.html.

[7]The PBC has on several occasions leaned against pressures on the yuan by adjusting the central parity quotation mechanism, e.g. via the temporary addition of a countercyclical factor in May 2017. These deviations can be thought of as a temporary reduction of the weight placed on market-based adjustments (Jermann et al., 2022).

stance. In order to limit the effects of FX interventions on the domestic money supply, China uses both sterilisation and capital controls. While generally very effective, sterilisation may however not have been full at all times (Wang, Li, Huang and Wang, 2021).[8] Thus, a study of monetary policy in China should explicitly incorporate the managed renminbi regime to capture the interplay between domestic liquidity and the exchange rate, as discussed in detail in the next section. In addition, since the sterilisation is achieved through different tools often used simultaneously—e.g. open-market operations, PBC bill issuance, RRR adjustments—capturing the monetary policy stance also requires keeping track of these multiple tools (see Wang et al., 2021).

3 Measuring the Chinese Monetary Policy Stance

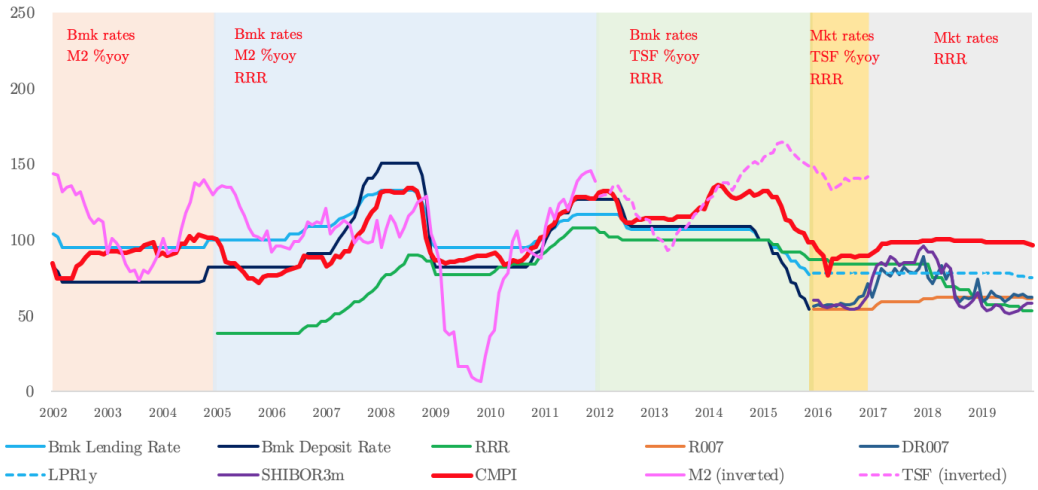
The gradual yet profound reforms to the Chinese monetary policy framework and exchange rate regime discussed previously make measuring the Chinese monetary policy stance in a systematic and coherent way particularly challenging. In particular, the ever changing set of policy instruments and intermediate targets implies that no single aggregate is likely to be a sufficient measure of the PBC policy stance throughout the years.

To capture this evolving policy framework in a parsimonious way that can be tractably used for empirical analysis, we use a composite monetary policy indicator (CMPI) that encompasses all the multiple instruments used by the PBC. The indicator builds on the work of Xu and Jia (2019) and we have followed the guidance of Yandong Jia (PBC School of Finance) to ensure that it accurately reflects the policy stance of the PBC. The CMPI summarises a variety of Chinese policy instruments—both policy interest rates, and quantity-based tools such as the RRRs. These enter with time-varying weights, allowing us to keep track of the changing nature of the primary policy targets and instruments over time, as described in the previous section.

Concretely, the CMPI is an index constructed as a weighted average of 36 publicly available monetary policy tools—both price- and quantity-based ones—as listed in Ap-

[8]Sterilisation was limited until the early 2000s, whilst stringent capital controls were in place, but increased from mid-2002 primarily through the sale of PBC bills (Glick and Hutchison, 2009). As the sheer amount of bills made them harder to place, the PBC started to rely less on bill issuance and more on "reserve requirement increases and greater window guidance" for sterilisation purposes (Wang et al., 2021). Sterilisation has been close to full apart from a hiatus around the global financial crisis.

FIGURE 2: CHINESE COMPOSITE MONETARY POLICY INDICATOR (CMPI)



Note: The chart plots the key policy instruments and targets used by the PBC to conduct monetary policy between 2002 and 2019. All series expressed as an index, December 2015=100.

pendix Appendix A.[9] The price-based components span different tenors of interest rates on official PBC operations and lending facilities (repo and reverse repo, standing lending facility, short-term liquidity operations, medium-term lending facility, pledged supplementary lending, financial institutions' deposits at the central bank), as well as central bank bill rates, benchmark deposit and lending rates, and loan prime rates. The quantity-based indicators are the required reserve ratios for large, small and medium-sized deposit-taking financial institutions. The CMPI is normalised such that an increase corresponds to a tightening of the policy stance, and is plotted as the red solid line in Figure 2 from 2002–2019.

To highlight how the reforms to the monetary policy framework shape the PBC stance captured by the CMPI, we plot this measure against key instruments and targets of Chinese monetary policy by period. Following the narrative of events discussed in the previous section, the chart highlights five main phases, each characterised by the different combination of instruments and intermediate targets that were relevant over that period.[10] The early 2000s (pale-red block) were characterised by a focus on the 1-year benchmark lending and deposit rates, with the annual growth rate of M2 as the inter-

[9]This indicator is similar in spirit to the shadow interest rate proposed in Lombardi and Zhu (2018) to summarise the US monetary policy stance at the zero lower bound.

[10]To make the series comparable, we express them in index points, with December 2015 set to 100.

mediate target. Starting from 2005, the PBC started making more systematic use of the required reserve ratios (RRR), which are added to the mix as a further quantity-based monetary policy instrument (blue block). From 2012 (green block), the PBC responds to the growth in shadow banking by targeting broader credit supply as measured by total social financing (TSF), which from that point onwards replaces M2 as the intermediate target. The 1-year benchmark loan rates were changed for the last time in November 2015, and replaced thereafter by the market-based interest rates influenced by the PBC's open market operations and liquidity facilities. The orange block delineates this phase by introducing the 7-day interbank repo and PBC reverse repo rates (DR007, R007), the 1-year loan prime rate (LPR1y), and the interbank unsecured lending rate (3-month Shibor) in place of the benchmark rates. During this phase, changes in banks' reserve requirements remain an active tool in the PBC arsenal, and growth in credit quantities (TSF) continues to play a role as a policy target along with the aforementioned market rates. Finally, the last phase of Chinese monetary policy reform (in grey) removes total social financing to emphasise the greater weight placed on interbank repo rates relative to total credit or money growth since 2017. This final shift reflected the prescriptions of China's 13th Five-Year Plan (2016-2021), which identified a more market-based operational framework as a policy priority (Jones and Bowman, 2019). The CMPI closely tracks the developments in these key monetary policy tools and targets in each of the phases of the framework's transformation.[11]

Both the CMPI and individual indicators in Figure 2 reveal a sharp easing in Chinese monetary policy in response to the global financial crisis (GFC) at the end of 2008. This is reversed in 2010–2011, with monetary policy held relatively tight until 2015. The PBC countered the slowdown of Chinese growth from 2015 by easing to a degree comparable with its response to the GFC, albeit at a slightly more gradual pace. This easing episode ended in early-2016 as the economy rebounded and the PBC needed to correct the market's perception of the 2015 exchange rate reforms as heralding further devaluation of the currency.

[11] In fact, an exercise that takes a simple average of these key policy instruments and targets produces a correlation with the CMPI of 0.87 during the sample period.

4 A Policy Rule for the PBC

The composite monetary policy indicator introduced in the previous section serves as a useful metric to quantify the overall monetary policy stance of the PBC. But, as ever, central banks operate and set their stance primarily in response to changes in the macroeconomic outlook, and in a way that facilitates achieving their objectives. The PBC is no exception. Therefore, we must account for the systematic component of policy to isolate plausibly exogenous variation that can be used to study the transmission of Chinese monetary policy to the broader economy.

To summarise the PBC's reaction function, we build on the seminal work of Chen, Ren and Zha (2018)—CRZ henceforth. CRZ propose a non-linear monetary policy rule for the PBC, consistent with the policy objective of supporting the government's drive to promote economic growth. Specifically, CRZ assume that controlling the money supply is the primary policy instrument of the PBC, and specify the following rule at quarterly frequency:

$$\Delta M_t = \phi_0 + \phi_M \Delta M_{t-1} + \phi_\pi(\pi_{t-1} - \pi^*_\tau) + \phi_{y,t}(y_{t-1} - y^*_\tau) \ , \tag{1}$$

where ΔM_t denotes the quarterly growth rate of M2, π_t is the CPI inflation rate, and y_t is the growth rate of output, all annualised. Notably, and differently from the case of inflation targeting central banks, the rule in Eq. (1) is specified against the official Chinese government's goals for output growth (y^*_τ) and inflation (π^*_τ) that are set at the end of every year during the Central Economic Work Conference, and announced thereafter at the National People's Congress plenary meeting.[12] The rule's coefficient associated with the growth objective is allowed to be time-varying. In particular, CRZ posit that the PBC may wish to respond more forcefully when realised growth falls short of the government's objective for that year. Formally,

$$\phi_{y,t} = \begin{cases} \phi_{y,H} & \text{if } y_{t-1} - y^*_\tau \geq \bar{y} \\ \phi_{y,L} & \text{if } y_{t-1} - y^*_\tau < \bar{y} \ , \end{cases} \tag{2}$$

[12] Note that the policy targets for output growth and inflation are annual, and apply to all observations within a given year. To distinguish the different frequencies present in Eq. (1) we use τ to denote the annual targets, and t for the rule's inputs and frequency of the estimation.

where $\bar{y}$ is set to be equal to zero. In CRZ the inflation goal (π^*_τ) is assumed to be constant and equal to 3.5% throughout the sample.

To account for the most salient features of the Chinese monetary policy framework discussed earlier, we generalise the CRZ policy rule along several dimensions. In particular, relative to the original rule, we introduce: (i) the composite monetary policy indicator (CMPI) of Section 3 in place of M2, to reflect the evolving nature of the set of instruments and targets used by the PBC since the beginning of the framework reform; (ii) an additional term that tracks the value of the renminbi against the evolving basket of currencies officially targeted by Chinese officials; (iii) a threshold value $\bar{y}$ for the GDP gap that is allowed to be different from zero; and (iv) time-varying official inflation objectives. Finally, we estimate this generalised policy rule at monthly frequency.[13]

Other than the monetary policy indicator, the most substantive departure relative to CRZ is the introduction of an explicit term that captures fluctuations in the value of the renminbi. The discussion in Section 2 makes it clear that the exchange rate enters the decision rule of the PBC above and beyond its effects on consumer price inflation. In turn, this suggests that explicitly separating the "two tiers of meanings" (Yi, 2018) of the price stability mandate is warranted. To capture the desire of keeping the exchange rate "basically stable at an adaptive and equilibrium level", we add to the rule the monthly change in the RMB nominal effective exchange rate calculated using the official CFETS trade weights and central parity exchange rates (ΔCPR_t). As discussed earlier, the quotation rules for central parity rates were reformed in 2015 to clarify the desired balance between a stable exchange rate against a basket of currencies, and flexible market adjustments in the RMB. A further effect of the reform was that of redirecting the spotlight on the gap between the spot and central parity rates, as an indicator of the Chinese authorities' inclination to lean against the market-implied appreciations or depreciations (Jermann et al., 2022). With the aim to formulate a policy rule flexible enough to capture this evolving exchange rate framework while retaining tractability, we interact the central parity rate fluctuations with this gap for the period since the CFETS

[13]For the estimation of the rule we make use of a monthly Chinese GDP series developed by Groen and Nattinger (2020) and available since January 2002. The rule is estimated with Maximum Likelihood using the same algorithm developed in CRZ.

central parity rates were introduced.[14] The exchange rate pillar of the PBC policy rule thus emphasises that a recent RMB appreciation (depreciation), coupled with a positive (negative) gap between the spot and central parity rate, may lead to further appreciation (depreciation) pressures, thus inducing a stronger PBC reaction. The interaction between the central parity rate and the related gap introduces a further nonlinearity in the PBC policy rule relative to the original formulation of CRZ.

Allowing for a flexible threshold that triggers the regime switch in the monetary policy rule is motivated by the observation that Chinese growth is seldom in a shortfall regime as defined by CRZ (i.e. below the government goal) over the sample at hand (see Appendix B). In other words, the CRZ shortfall regime is visited only in a handful of occurrences, which implies that very few observations are effectively used to estimate the rule coefficients over that regime. Finally, while the Monetary Policy Committee of the PBC meets officially only once a quarter, the stance of monetary policy is adjusted at much higher frequency, with announcements related to e.g. open market operations, reserve requirement ratios, and lending facilities at times occurring multiple times within a month. This suggests that a quarterly rule as in CRZ may potentially disregard relevant variation at higher frequency.[15]

One key characteristic of our policy rule, which we inherit from the setup of CRZ, is that the rule's inputs enter the specification with a lag, which makes the policy reaction function entirely backward-looking. This is a point of departure relative to specifications for central banks in advanced economies that instead rely on expected deviations of output and inflation from targets. But it is consistent with the Chinese institutional features. Chen et al. (2018) note that the PBC's monetary policy committee (MPC) meets officially at the end of each quarter to set policy based on current economic developments. Moreover, and differently from other central banks, the PBC does not publish official forecasts of main economic variables. Indeed, the targets themselves are sometimes interpreted as

[14] Central parity rates for a narrow set of currencies (USD, EUR, JPY, HKD) are available from January 2006, with more currencies added over time to reach a total of 25 central parity rates as of mid-2024. Prior to 2006 the RMB was pegged to the US dollar. During this period we set the central parity rates for all bilateral exchange rates in the RMB index at the levels required to maintain the peg to the US dollar at 8.2765. That is, we rescale the spot dollar bilaterals by the CNY/USD pegged rate.

[15] Additionally, due to the very short life span of most Chinese time series, switching to a higher sampling frequency is beneficial to gain power in the estimation of the rule coefficients and for the purpose of shocks identification.

quasi-forecasts (Jones and Bowman, 2019). In practice, while changes to monetary policy can and do take place outside of quarterly MPC meetings—which justifies estimating the rule at higher frequency—substantive monetary policy decisions have to be vetted and approved by the State Council, which impairs their timeliness (Huang, Ge and Wang, 2018). Consistently, and while some forward-looking content has appeared in the most recent years, the coverage of official PBC communication released within the quarterly Monetary Policy Report, and intended to provide a rationale for the most recent policy decisions, has historically been mostly backward-looking (McMahon, Schipke and Li, 2018). The limited operational independence of the PBC also constrains the extent to which any form of forward guidance can be used, such that even broader communication (e.g. press releases, speeches and press conferences) generally has a backward-looking or at best contemporaneous orientation. Taken together, these institutional features make it unlikely that Chinese monetary policy is forward-looking in practice.[16,17]

In our baseline specification, we estimate the generalised policy rule over the sample 2002:01-2019:12, due to the excessive macroeconomic volatility during the Covid-19 pandemic. The estimated coefficients and associated t-statistics are[18]

$$CMPI_t = \begin{cases} \underset{\substack{0.954\\(54.538)}}{\phi_M}\ CMPI_{t-1} + \underset{\substack{0.026\\(3.469)}}{\phi_\pi}\ \tilde{\pi}_{t-1} + \underset{\substack{-0.036\\(-1.831)}}{\phi_x}\ \tilde{x}_{t-1} + \underset{\substack{0.002\\(0.392)}}{\phi_{y,t}}\ \tilde{y}_{t-1} & \text{if } \tilde{y}_{t-1} \geq \bar{y} \\ \underset{\substack{0.954\\(54.538)}}{\phi_M}\ CMPI_{t-1} + \underset{\substack{0.026\\(3.469)}}{\phi_\pi}\ \tilde{\pi}_{t-1} + \underset{\substack{-0.036\\(-1.831)}}{\phi_x}\ \tilde{x}_{t-1} + \underset{\substack{0.069\\(2.579)}}{\phi_{y,t}}\ \tilde{y}_{t-1} & \text{if } \tilde{y}_{t-1} < \bar{y}\ , \end{cases}$$

where $\tilde{\pi}_t = (\pi_t - \pi^*_\tau)$ and $\tilde{y}_t = (y_t - y^*_\tau)$ are, respectively, the inflation and GDP gaps against the official government's objectives as in CRZ, and the exchange rate term is

[16]We thank Tao Zha for providing corroborating evidence on this point. One concern with this specification of the rule is that it may leave open the possibility that rule deviations may correlate with current economic conditions. As we show in the next section, this is not an empirically relevant concern, as estimated impact effects are statistically zero. In robustness tests we have included expected global growth as an additional control. This did not produce any appreciable difference in the estimated responses. See Appendix C.

[17]In further robustness, we have estimated the policy rule also using contemporaneous inputs. The correlation between the two residuals is equal to 0.98. Moreover, the IRFs identified using either are virtually indistinguishable. See Appendix C.

[18]We omit the intercept for notational brevity. We report full estimation results over different samples and across different specifications of the rule in Appendix B.

defined as $\tilde{x}_t \equiv \Delta CPR_t \times \mathbb{I}_{t>2006:01}(RMB_{spot,t} - CPR_t)$. The GDP gap threshold ($\bar{y}$) is estimated to be 1%.[19]

The estimated coefficients suggest a strong degree of policy inertia, and show that the Chinese authorities respond to roughly similar degrees to both inflation overshooting the annual target, and to a depreciation in the value of the domestic currency. In the context of the rule, the objective of promoting economic growth translates into the PBC effectively not counter-acting above-goal growth in any meaningful way. Conversely, periods in which the GDP gap falls below the threshold—or GDP is indeed below the government's target—warrant further additional stimulus, with the coefficient associated with the GDP gap more than twice as large as that of the inflation or exchange rate gaps. To put these numbers in context, we normalise the CMPI to have the same sample standard deviation of the one-year primary lending rate.[20]

The estimated rule residuals capture well the aggressive loosening implemented by the PBC in the wake of the 2008 global financial crisis (see Appendix B). The PBC started cutting interest rates in August 2008; a large ¥4 trillion ($586 billion) stimulus package then followed in the spring of 2009, and continued to be disbursed in 2010 (Yueh, 2010). The loosening in response to the Chinese slowdown of 2015-16, on the other hand, takes the form of consecutive negative values of the policy rule residuals. A further notable episode is the easing surprise of early 2016, abruptly reversed shortly thereafter, in line with accounts of the PBC's comprehensive actions to counter market expectations of RMB devaluations discussed in Section 2. This also coincides with the process of interest rate liberalisation culminating with the removal of the ceiling on deposit rates, and the introduction of the interest-rate corridor (see e.g. Das and Song, 2022).

As with the estimation of any monetary policy rule, a question remains whether all policy-relevant developments are indeed captured by the deviations from the stated objectives included in the specification. Stated differently, a question remains whether the rule residuals can be predicted by variables not included as inputs of the rule, but

[19]The threshold is estimated by minimising the sum of squared residuals of the rule over a grid of different threshold values. See Appendix B. We note that the estimated coefficients for the GDP gap are not particularly sensitive to the value of the threshold, but increasing the threshold makes the estimates more precise.

[20]While the CMPI allows to keep track of the different policy instruments and targets over time, it lacks a clearly interpretable unit. The rescaling allows to interpret the estimated coefficients in terms of changes in a hypothetical synthetic policy rate.

Table 1: Predictability of PBC monetary policy rule residuals

Variable	Coef	SE	Adj. R^2	Obs.
Global Output	0.015	(0.027)	0.105	213
Expected Global Growth 12 months ahead	-0.009	(0.010)	0.105	213
Commodity Price Index	0.015	(0.009)	0.147	213
Global Financial Conditions	-0.126***	(0.045)	0.218	213
CBOE Volatility Index: VIX	-0.013**	(0.006)	0.188	213
Nominal Broad USD EER	-0.020	(0.017)	0.123	213
US 1-year rate	0.139	(0.110)	0.118	213
US Industrial Production Index	-0.006	(0.029)	0.103	213
US Real GDP	0.048	(0.100)	0.106	213
China Exports/GDP	-0.002	(0.007)	0.103	213
China Net exports/GDP	-0.001	(0.006)	0.103	213
China General Government Balance/GDP	-0.002	(0.002)	0.104	213

Notes: Each row corresponds to a regression of the monetary policy rule residual on one lag of each of the listed variables, a constant and two lags of the dependent variable. Robust SE in parentheses, * p<0.1, ** p<0.05, *** p<0.01

that are nevertheless likely to warrant a systematic response from the PBC. To address this point, we test for the predictability of the rule's residuals using a broad array of global as well as domestic variables. Results are reported in Table 1.

Variables related to global or US growth—whether realised or expected—are not significant predictors of the rule residuals. Similarly, there is no evidence that US interest rates, the broad dollar exchange rate or commodity prices affect the rule residuals in any meaningful way. An important concern relates to the fact that due to the PBC limited operational independence, and more generally to the inclusion of monetary policy within the broader range of macroeconomic policies set by the State Council, the rule residuals may in fact capture coordinated policy shocks, rather than monetary policy alone. We note that other aspects of government policy—whether related to fiscal policy (measured using general government surplus/deficit) or to industrial and trade policy (as captured by exports as a share of GDP and the trade balance)—do not contaminate the residuals. Finally, we note that as it is the case for other central banks in advanced economies, also for the PBC tighter global financial conditions tend to call for looser monetary policy than the rule inputs alone would warrant. Without taking an explicit stance on how

Table 2: Correlation with US and Euro Area Monetary Policy

Monetary Policy Surprise	(1)	(2)
US monetary policy surprise (FF4)	-0.190	
	(0.573)	
Lagged	-0.336	
	(0.396)	
EA monetary policy surprise (3-month EONIA)		-0.012
		(0.010)
Lagged		-0.003
		(0.005)
Adj. R^2	-0.005	0.024
Obs.	215	215

Notes: Each regression includes the respective monetary policy shock's contemporaneous value and one-month lag, as well as a constant. Data on US monetary policy surprises are from Gürkaynak et al. (2021); while those for the ECB are from Altavilla et al. (2019). Robust SE in parentheses, * p<0.1, ** p<0.05, *** p<0.01.

considerations around financial stability enter the PBC's decision rule, in the analysis of monetary transmission that follows we will discuss robustness of our results to controlling for the Global FCI.

Lastly, we confirm that the PBC rule residuals do not correlate with other major economies' monetary policy surprises. Table 2 shows that neither the contemporaneous nor one-month lag of high-frequency surprises around Fed and ECB monetary policy announcements correlate significantly with the Chinese monetary policy rule residuals.

In what follows, we use the estimated rule residuals to identify monetary policy shocks in China, and to study their domestic and international transmission.

5 Domestic Monetary Policy Transmission: The *Ins*

In this section we focus on the transmission of Chinese monetary policy to domestic aggregates. Our intent is to provide a comprehensive assessment of how the Chinese economy responds to monetary policy, as well as of how the Chinese authorities adjust their numerous policy levers to ensure that the main policy objectives remain on sight.

We estimate the effects of monetary policy using monthly Vector Autoregressive (VAR) models identified using the rule residuals of Section 4 as an instrumental vari-

able. Formally, we use the rule residuals as an internal instrument, included in the VAR and ordered first. In this respect, our approach follows very closely that of Romer and Romer (2004), with the exception that we do not impose additional constraints on the impact responses of the remaining variables of the VAR.

The baseline sample for our estimates goes from January 2003 to December 2019. The sample is constrained by official TSF data on one end, and by a desire to avoid confounding due to the pandemic and post-pandemic period on the other. For the specifications that make use of interest rates and capital flows, we use a restricted sample that starts in 2006 due to data availability, and for consistency with the chronology of the liberalisation of financial and capital markets in China. To measure Chinese output at monthly frequency we use the index of industrial production released by the National Bureau of Statistics in China. This variable is released in year-over-year growth rates to account for the strong and variable seasonal patterns induced by the Chinese New Year falling in either January or February of every year.[21] For consistency, we transform all the variables in the VAR in year-over-year growth rates, with the exception of those already expressed in percentage points such as interest rates.[22]

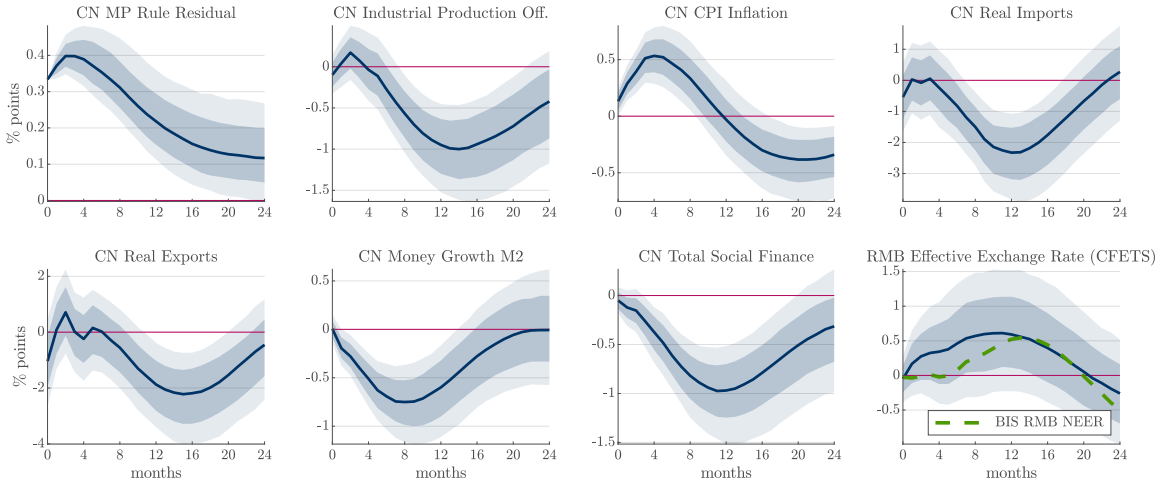
Due to the relatively short sample available, we estimate the VARs using six lags and standard macroeconomic priors (Giannone, Lenza and Primiceri, 2015). The results are reported in terms of impulse responses (IRFs) to a contractionary monetary policy shock. Since the CMPI and its residuals do not have a straightforwardly interpretable unit, we normalise all the IRFs such that the peak response of domestic output is equal to -1ppt annualised. In addition to the CMPI residual, our baseline VAR includes industrial production, consumer prices, real imports and exports, the money supply and total credit, and the exchange rate.[23] To be able to study the effects of Chinese monetary policy on a larger number of variables, we estimate a battery of VARs where we keep a core of seven

[21] In practice, the National Bureau of Statistics partially accounts for this seasonality by effectively releasing a single number that accounts for industrial production growth over the months of January and February combined. We retrieve this series from Haver Analytics and adopt their convention whereby the same number is used in the first two months of each year.

[22] We verify that this transformation does not meaningfully affect our results by estimating our baseline VAR with variables in log levels and using the alternative level index for Chinese output estimated by Groen and Nattinger (2020) used in Section 4.

[23] See Appendix A for details on data and sources. Results are robust to including the Global FCI in the VAR and to ordering it first (see Appendix C).

FIGURE 3: DOMESTIC RESPONSES TO CHINESE MONETARY POLICY



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). The green dashed line is obtained by replacing the CFETS EER with the BIS NEER. 2003:01-2019:12.

variables fixed and rotate in other variables of interest in place of the exchange rate.[24] We use different colours in the figures to highlight when the estimates are obtained from different VARs.

The responses of the baseline VAR are reported in Figure 3. The monetary tightening induces a delayed but significant contraction of economic activity. Industrial production does not respond in the immediate aftermath of the monetary policy shock, but declines steadily to reach its peak response shortly after a year. A similar dynamic characterises the response of external trade, but, importantly, the magnitude of the adjustment is in this case decisively larger, with peak contractions in the order of 2ppt yoy for both imports and exports. The timing of the adjustment of Chinese exports is noteworthy. Relative to the contraction in output and imports, the peak fall in exports is realised with some extra delay. This is in principle compatible with a tendency of Chinese authorities to support domestic growth by promoting exports.

The monetary contraction leads to a decline in consumer price inflation only with a lag, while the short-term reaction is positive. A plausible explanation for this price puzzle is the considerable weight of housing-related costs (both rental payments and

[24] When in place, exceptions are highlighted in the notes to the figures.

owner-occupied equivalent) in the Chinese CPI index. We provide some evidence that this channel is at play by showing that the residential CPI sub-index rises even more than the overall CPI in the short run, and remains positive for longer.[25]

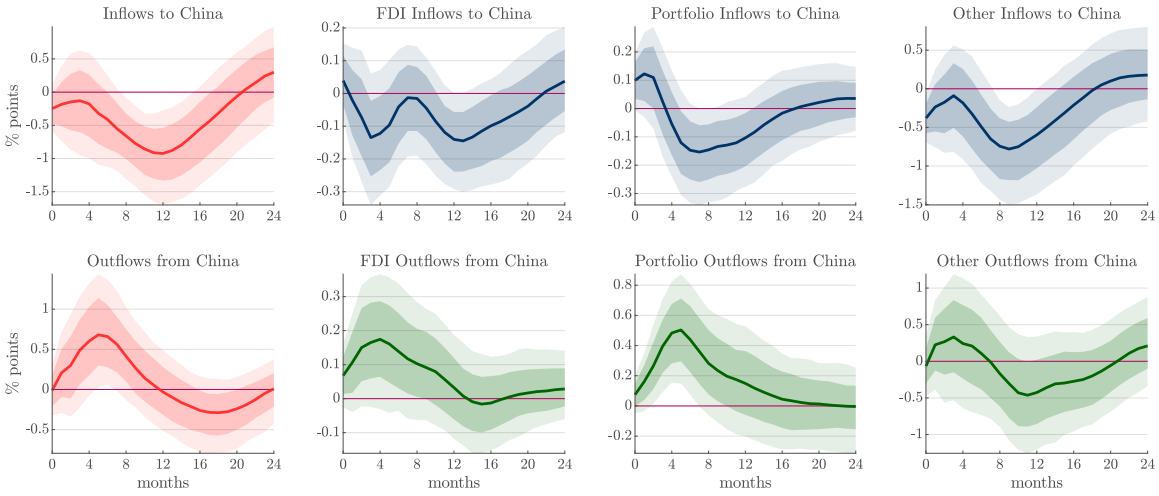
The contractionary nature of the shock is corroborated by the gradual but persistent decline in the supply of both money and total credit, that decrease by about the same amount and following a similar dynamic. Both responses point to a meaningful tightening of domestic financing conditions in the medium run. Large state banks play an important role in the Chinese provision of credit (Chen, Xiao and Zha, 2025), and account for half of total aggregate lending, with the four largest banks alone supplying around 40% of total loans. While disaggregated lending data are only available since 2009, the large footprint of state banks implies that these plausibly play an important role in curbing lending, and hence in the transmission of domestic monetary policy to the real economy.

The muted initial response of money growth and of total social financing reinforce the notion that the identified monetary policy shock is unlikely to be picking up a combination of different types of government policies, including government investment (Han et al., 2023) and directed credit to strategic sectors of the Chinese economy. To further corroborate this point, we re-estimate the VAR by including also the Chinese government balance as one of the variables. Results show that the Chinese fiscal balance does not significantly respond to the identified monetary policy shock on impact, but that it deteriorates as the effects of the monetary policy tightening hit the real economy after around a year—consistent with either a fall in tax revenues due to lower growth, or with fiscal policy actively offsetting some of the monetary tightening (see Appendix C). Similarly, we find that following the monetary contraction, investment in real estate—one of the key strategic economic sectors—declines. While with some important caveats related to data quality, we document a persistent decline in the value of real estate investment, and in the price of new dwellings (see Appendix C). Again the contraction is delayed, suggesting that this acts as an amplifier of the effects rather than a concomitant policy.

A notable difference relative to the monetary policy transmission observed in most

[25] See Appendix C. While the National Bureau of Statistics of China does not publish the actual CPI weights, estimates put the contribution of housing at above 20% (e.g. https://www.bloomberg.com/professional/insights/trading/china-insight-cpi-basket-decoded-food-dominates-services-key/). To the best of our knowledge, a CPI index that excludes housing costs is not available for China.

FIGURE 4: RESPONSES OF CAPITAL FLOWS



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Each colour corresponds to a different VAR. Common variables as in Figure 3 excluding CFETS EER. VARs include Global FCI. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2006:01-2019:12.

advanced economies with a floating currency, is the essentially muted response of the RMB index throughout. The results in Figure 3 show that despite the presence of some pressures for the renminbi to appreciate, the response is delayed and overall not significant at conventional levels. While the dynamics are somewhat different, we obtain a similarly muted response when we substitute the central parity rate constructed using the official CFETS weights with the nominal exchange rate index calculated by the BIS (green dashed lines). The muted response of the exchange rate is consistent with the value of the renminbi being strictly managed by the Chinese authorities, and particularly so in the earlier years of our sample that include the strict dollar peg, as discussed in Section 2.

To shed more light on the underlying mechanisms that are relevant for the exchange rate dynamics, we report in Figure 4 the response of gross Chinese capital flows, and in Figure 5 the response of the components of the CFETS central parity rate, of foreign exchange reserves and interventions, and of the required reserve ratios imposed on domestic banks. These responses are estimated from 2006 onward, which coincides with the onset of the Chinese financial liberalisation journey, the end of the dollar peg, as well as with the date at which capital flows data become available.

Total private capital flows into and out of China point to a delayed flight of capital

(Figure 4). In net terms, this capital flight is also visible in the net inflow responses in Appendix Figure C.10. Rather than higher policy rates attracting capital inflows, these dynamics are more consistent with risky investment reacting to the deteriorating domestic outlook and tightening of domestic financial conditions documented in Figure 3. The lack of deep and open financial markets for safe short-term investments such as deposits and fixed income products likely tilts the composition of Chinese cross-border flows towards riskier assets and underpins these dynamics. Yet, there exists some heterogeneity across types of foreign investments. FDI inflows, which constitute the lion's share of private foreign inflows into China, do not respond in the short run, and decrease somewhat in the medium run although this response is not very precisely estimated. Banking (other) flows are the most volatile, and their contraction is significant and protracted, with a peak decline almost 5 times as large as that of FDIs. As economic activity contracts, so do portfolio inflows in the medium run. This is even more evident in the estimated responses of net portfolio inflows in Appendix Figure C.10.[26] Capital outflows by residents are largely muted with the exception of portfolio flows. These correspond to a very small share of China's foreign assets but do signal some degree of domestic capital flight despite China operating capital controls. In net terms, the contraction in net capital inflows is significant and protracted, and overall driven by riskier asset classes—FDI and portfolio investment (see Appendix C).[27]

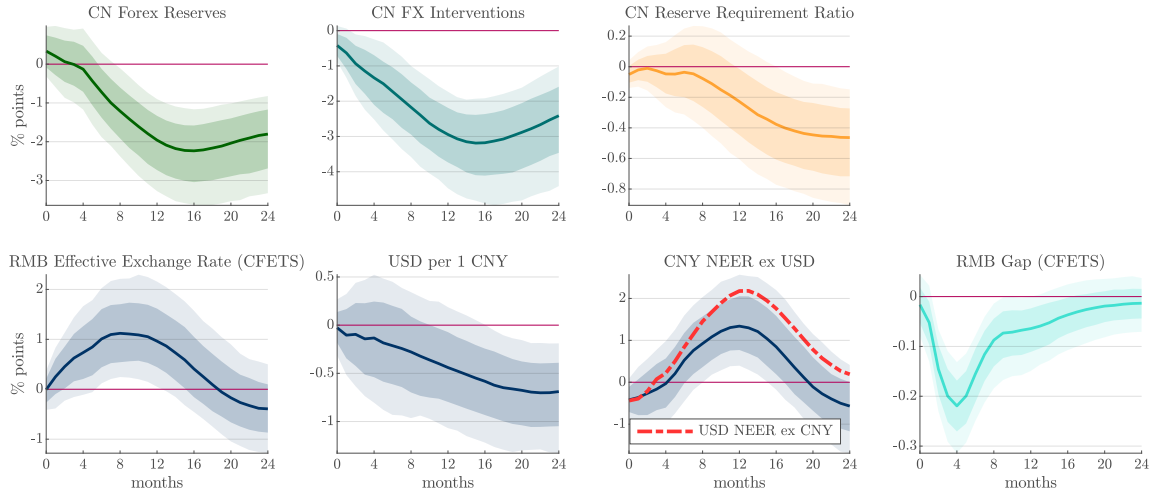
This flight of risky private capital is to some degree countered by official intervention. The panels in the first row of Figure 5 focus on flows within the Chinese balance of payments, by examining the response of two alternative measures of currency reserve accumulation, as well as of the RRR imposed on Chinese banks. Our preferred measure of foreign exchange reserves combines the official FX reserves reported by the State Administration of Foreign Exchange (SAFE), as well as the net foreign asset positions of the state-owned banks.[28] A second measure of foreign reserves (second panel of the figure) is given by Adler et al. (2021), who remove estimated income and valuation effects from the

[26] Controlling for global financial conditions in Figure 4 resizes the response of foreign investments and makes them less precisely estimated (see Appendix C for the responses without the FCI control).

[27] For a discussion of the capital flows management see Miao and Deng (2019).

[28] There exists some suggestive evidence that state banks may be playing a significant and ever greater role in the accumulation of foreign exchange reserves in China. This is particularly true since 2015, when official reserves seem to stabilise around a plateau. That said, results are unchanged when using only official reserves.

FIGURE 5: RESPONSES OF FX, FX RESERVES, RRR



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Each colour corresponds to a different VAR. Common variables as in Figure 3 excluding CFETS EER. Blue IRFs also exclude M2 and TSF. Red IRFs replaces CNY NEER ex USD with USD NEER ex CNY. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2006:01-2019:12.

stock of FX reserves. The gradual but significant fall in FX reserves is consistent with Chinese authorities managing their FX reserves to counter the depreciation pressures on the renminbi due to the marked decline in all private inflows at medium horizons. This countercyclical use of public capital flows to offset private flows is consistent with the management of a fixed exchange rate in an environment of imperfect capital mobility (see e.g. Avdjiev et al., 2022). As noted in Section 2, reserve requirement ratios have often been used by Chinese authorities as a tool to sterilise interventions in foreign exchange markets. Consistently, RRR are relaxed in the medium term, in line with the decline in official FX reserves which, if left unsterilised, would tighten domestic monetary conditions.

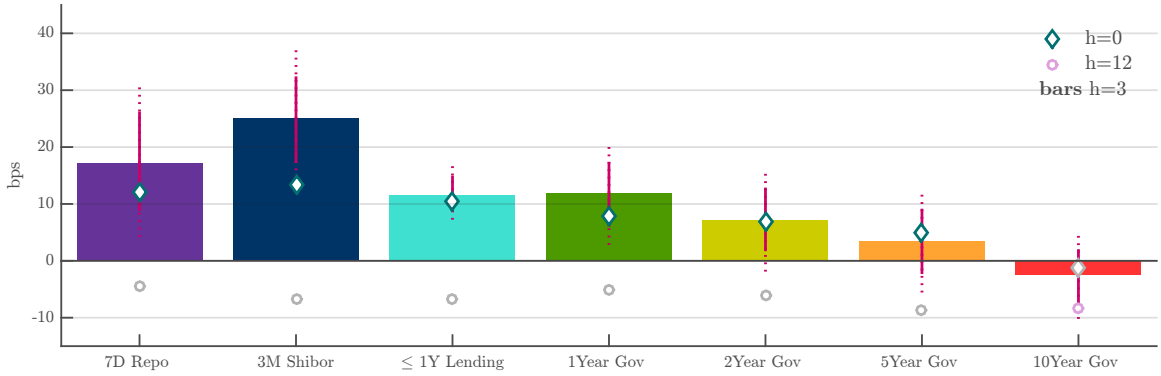
These observations on the external adjustment help us to interpret the response of the Chinese currency to the monetary tightening. The panels in the bottom row of Figure 5 report the response of the central-parity-based exchange rate against the official CFETS basket, and of the three main components of the Chinese exchange rate regime: the bilateral exchange rate against the US dollar, the non-dollar renminbi index, also computed using the official CFETS weights, and the gap between the spot RMB and central parity rate against the entire CFETS basket.

There are important differences between the dynamics of the bilateral CNY/USD exchange rate, of the CFETS exchange rate and of the CNY NEER ex USD. Compared to the response estimated over the full sample, we note that the delayed appreciation of the renminbi against the CFETS basket becomes more precisely estimated when starting in 2006, consistently with the strict US dollar peg regime falling out of the estimation sample. The CNY is kept stable against the USD, and even slowly and moderately *depreciates* in the medium run—consistent with the net outflows of most types of private investment, and despite the official interventions in FX markets. Notably, the appreciation of the USD goes beyond the bilateral rate with the CNY, as the dollar gains value against a broader basket of currencies as well (red dash-dotted line).[29] In the next section we return to the response of the USD and the general equilibrium effects in greater detail. Conversely, the appreciation of the CNY is fully accounted for by the non-USD index. Currencies other than the USD depreciate in a significant and delayed way against the CNY with a peak response around 12 months. This dual pattern suggests that the negative gap that opens up between the spot exchange rate and the central parity rate (last panel of the figure) reflects mostly pressures for the RMB to depreciate against the USD, and which the Chinese authorities lean against in the short run. Stabilising the RMB exchange rate against the USD while at the same time ensuring it returns towards its parity rate target vis-à-vis the broader CFETS basket of currencies could explain the tendency of the Chinese authorities to let the RMB appreciate against other currencies.

Finally, we turn to the response of domestic interest rates in Figure 6. The figure cuts across the term structure, and highlights the responses at the 3-month horizon (bars)—which coincides with the peak response of the market interest rates—as well as the responses on impact (diamonds) and one year after the shock (circles). The response of Chinese interest rates mirrors that found in most advanced economies. Interest rates respond strongly and on impact, and particularly so at short maturities. This clarifies the nature of the identified monetary policy shock as a tightening of the short-term policy stance. Or what we would label a "conventional" monetary policy shock in advanced economies. Figure 6 shows that the monetary policy tightening leads to roughly a 15bps

[29]The tendency of the CNY basket against non-USD currencies to comove strongly with the broad dollar index is also noted in Jermann et al. (2022) at higher frequencies.

FIGURE 6: RESPONSES OF INTEREST RATES



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Selected horizons. Bars denote responses at $h = 3$ months. Diamonds and circles denote responses at $h = 0$ and $h = 12$ respectively. Grey markers are for non-significant responses at 90% level. Each bar colour corresponds to a different VAR. Common variables as in Figure 3 excluding the CFETS EER. Error bands correspond to 68% (solid) and 90% (dotted) posterior credible sets. Monthly BVAR(6). 2006:01-2019:12.

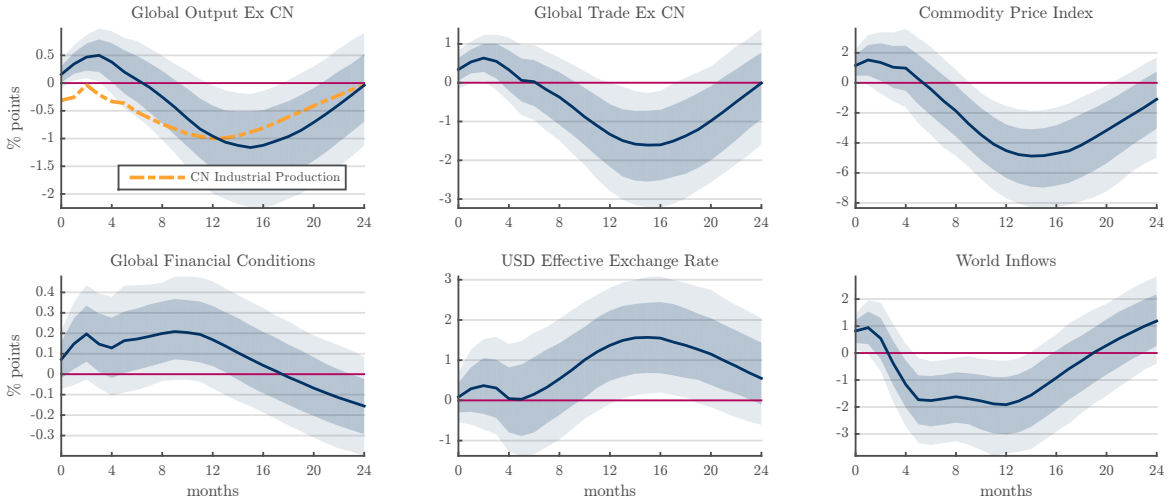
increase in the 7-day Repo—the market counterpart to the R007 policy rate introduced in Section 2. The 3-month interbank rate (Shibor) responds to a similar degree on impact, to roughly double its climb over the first quarter. The adjustment in the PBC-controlled one-year lending rate is more limited at around 10bps. The response of the Chinese yield curve is fairly standard, with government bond benchmark rates responding primarily at the short end and with impacts declining monotonically as the maturity increases. The response of interest rates is broadly reabsorbed in the span of a year. Higher borrowing costs pair well with the deteriorating credit conditions documented in Figure 3, and confirm that lending is a powerful channel for the domestic transmission of Chinese monetary policy.

6 International Spillovers of Chinese Policy: The *Outs*

The increasingly large footprint of the Chinese economy on the global scene makes it likely that the reverberation of Chinese shocks may be felt well beyond the national border. In this section we explore the extent to which this is the case, and the transmission channels through which the global spillovers of Chinese policy are likely to be enabled.

The setup in this section mimics that of Section 5. To facilitate the comparison

FIGURE 7: GLOBAL SPILLOVERS OF CHINESE MONETARY POLICY



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Orange dash-dotted line denote responses of additional variables included in the same VAR. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

between the domestic and global effects, we continue to normalise the identified Chinese monetary policy shock such that the peak contraction in domestic industrial production equals 1ppt yoy. As before, all variables not already expressed in percentage points enter the VARs in year-over-year growth rates. The estimation sample goes from February 2002 to December 2019, which coincides with the sample over which we estimate the policy rule.

The global spillovers of Chinese monetary policy are depicted in Figure 7. The VAR includes the Chinese index of industrial production, global output and trade excluding China, a global index of financial conditions, the commodity price index, the US dollar exchange rate index, and a measure of global inflows expressed as a share of world GDP. Global output is measured in terms of industrial production, while global trade encompasses both imports and exports growth.[30] The response of the Chinese industrial production index is superimposed to that of global production to facilitate the comparison between the two effects.

The responses in Figure 7 show that Chinese spillovers can be sizeable, and that global trade, commodity prices, and production networks are the main channels through which

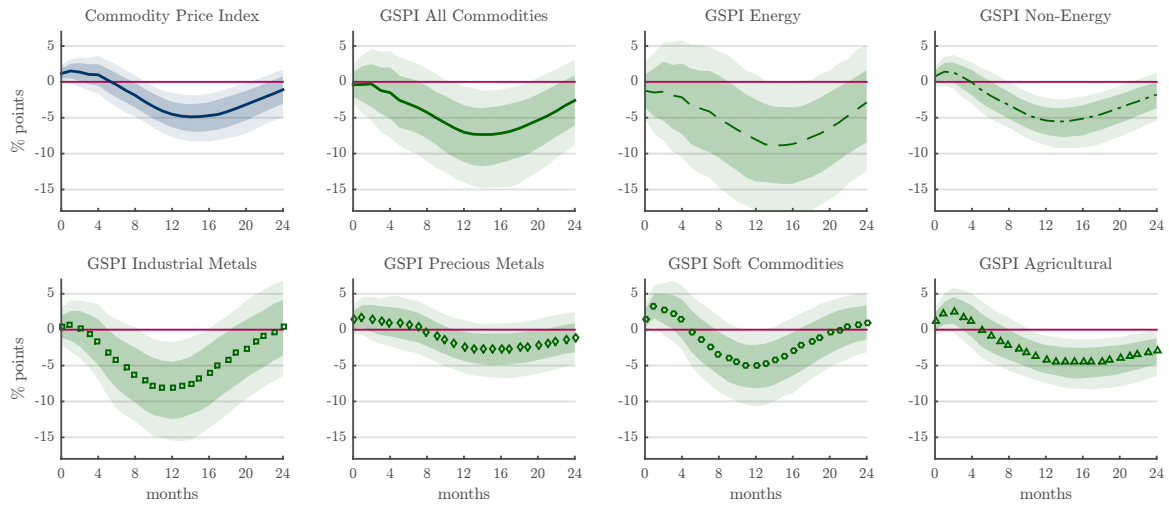
[30]See Appendix A for details on data and sources.

they are most likely to materialise. The domestic contraction in Chinese production, and particularly of Chinese imports, sets out a potent chain reaction that leads to a strong contraction in both global output and trade. The magnitudes of the effects are important. Global output contracts by about the same amount as domestic output, but the peak adjustment occurs somewhat later. Similarly, global trade slows down significantly reaching a trough of about 2ppt yoy, that is again equivalent to the trough in domestic trade. The size and importance of China in the global commodity market is such that a slowing Chinese production has a detrimental effect on commodity prices, which contract by about 4ppt in annual terms. One way to rationalise these responses is to think of the role that China plays not only in the context of global trade of final goods, but also as a key actor in production networks worldwide. Against this backdrop, it is easy to see how a fall in Chinese output would naturally lead to a contraction in the global demand of raw materials—which lowers their prices—and to disruptions in global production which, together with the contraction in global trade, leads to a fall in global output. It is important to bear in mind that commodities are typically priced in US dollars. Therefore, the contraction in Chinese output leads to commodity prices to fall substantially despite the appreciation of the US dollar. The delayed response of commodity prices to the Chinese contraction is consistent with real effects rather than financial ones being the primary channels responsible for their contraction (see also Miranda-Pinto, Pescatori, Prifti and Verduzco-Bustos, 2023; Gazzani and Ferriani, 2024).

Further evidence of the prevalence of real effects in the international transmission of Chinese monetary policy can be found in the differential responses across commodity categories, which we report in Figure 8.[31] The first subplot is the reaction of the CRB commodity price index from our baseline specification. The second subplot shows the comparable albeit somewhat less precisely estimated response of the S&P GSCI commodity index, for which we have subindices by commodity group. An energy vs non-energy split of commodity prices in the third and fourth subplots emphasises the more significant response of non-energy commodities. Of the latter, industrial metals have the most pronounced response, as seen in the second row of plots. This is consistent with the

[31] Commodity prices are rotated in one by one in place of the CRB commodity price index from the global specification in Figure 7.

FIGURE 8: COMMODITY PRICE SPILLOVERS OF CHINESE MONETARY POLICY



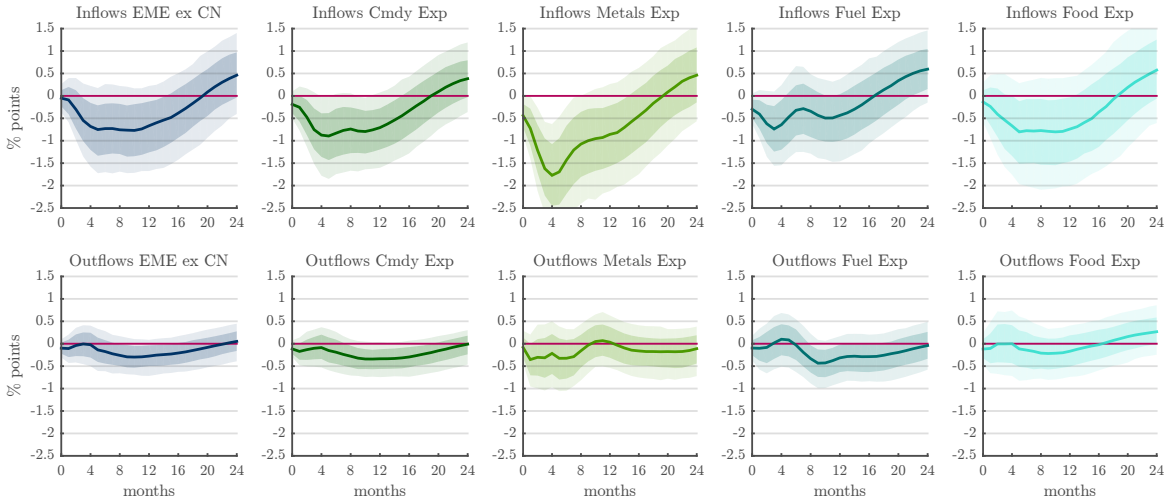
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Different line styles for the median IRFs correspond to VARs with different commodity price indices. Common variables as in Figure 7 except for CRB commodity price index. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

contraction in Chinese manufacturing affecting disproportionately raw material prices, and aligns with findings in Gazzani and Ferriani (2024).

The response of the US dollar that was already noted in the previous section is best understood as a response to the deteriorating global outlook (Figure 7). Indeed, the appreciation is not sudden, and its timing coincides with the trough of the global slowdown. The US dollar appreciation is consistent with the heightened global macroeconomic risk and flight-to-safety motives that lead to a stronger dollar in risk-off scenarios, and with the retrenchment in global trade and commodity prices (see e.g. Gourinchas and Rey, 2022; Obstfeld and Zhou, 2023). The US dollar appreciation also puts the bilateral depreciation of the RMB documented in Section 5 into context. A broader risk-off environment is consistent with the net outflow of risky investment from China, the fall in commodity prices and in global trade. Finally, the appreciation of the dollar is also likely to be responsible for the modest, delayed and ultimately not economically significant tightening of global financial conditions.[32]

[32]The global FCI enters the VAR in standardised levels such that the peak response in Figure 7 can be read as a fifth of a standard deviation. Results are unchanged if we condition the responses on the Global FCI. See Appendix C.

FIGURE 9: SPILLOVERS TO CAPITAL FLOWS FOR COMMODITY PRODUCERS



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% at peak. Different line styles for the median IRFs correspond to VARs with capital in- and outflows for different country groupings. Common variables as in Figure 7. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

The finding that Chinese monetary policy does not have a meaningful impact on global financial conditions puts these results in stark contrast with those documented in e.g. Rey (2013) and Miranda-Agrippino and Rey (2020, 2022) on the global transmission of US monetary policy. However, the absence of an international risk-taking channel for the transmission of Chinese monetary policy does not imply that financial markets would be insensitive to the worsening of the global outlook initiated by the Chinese shock. Indeed, the delayed responses of both the US dollar and of commodity prices are a case in point. Figure 9 reports the response of capital flows in and out of emerging markets that rely heavily on commodities.[33] We fix the y-axis in all the subplots to highlight the difference in the magnitude of the responses. Outflows from these countries are barely affected. Conversely, capital inflows, i.e. foreign investment in these commodity producing countries, contract in a manner proportional to the commodities that are mostly affected by the Chinese shock. The fall in demand for hard commodities such as industrial metals, heavily used in manufacturing, leads to a contraction in private foreign funding for the countries that are rich in these materials. Therefore, while global financial

[33]These are obtained by substituting in the alternative measures of capital flows in place of world inflows in the VAR. See Appendix A for details on the country classification.

conditions are not significantly affected, countries that rely heavily on Chinese demand for raw materials also experience a liquidity shock as a result of the Chinese contraction.

Overall, and despite the progressive liberalisation of Chinese financial markets and the gradual opening of China's capital account, the international transmission of Chinese monetary policy shocks seems to operate primarily through fundamentally standard trade channels. With an important amplification mechanisms being played out by commodity markets and potentially also by integrated production networks. Conversely, our results point to a relatively minor role for financial channels—such as e.g. financial intermediaries' risk taking behaviour (see e.g. Borio and Zhu, 2012; Bruno and Shin, 2015; Bauer, Bernanke and Milstein, 2023)—over the sample considered. Going forward, it is likely that the global footprint of China in international financial markets may become bigger, as China expands its international lending activities to surpass other institutional creditors such as World Bank and the IMF (Horn, Reinhart and Trebesch, 2021). For example, Jiang (2025) documents that developing countries that rely more on China's international lending—some of which overlap with our sample of emerging market commodity producers—may be less exposed to US monetary policy shocks and the associated gyrations in the Global Financial Cycle.

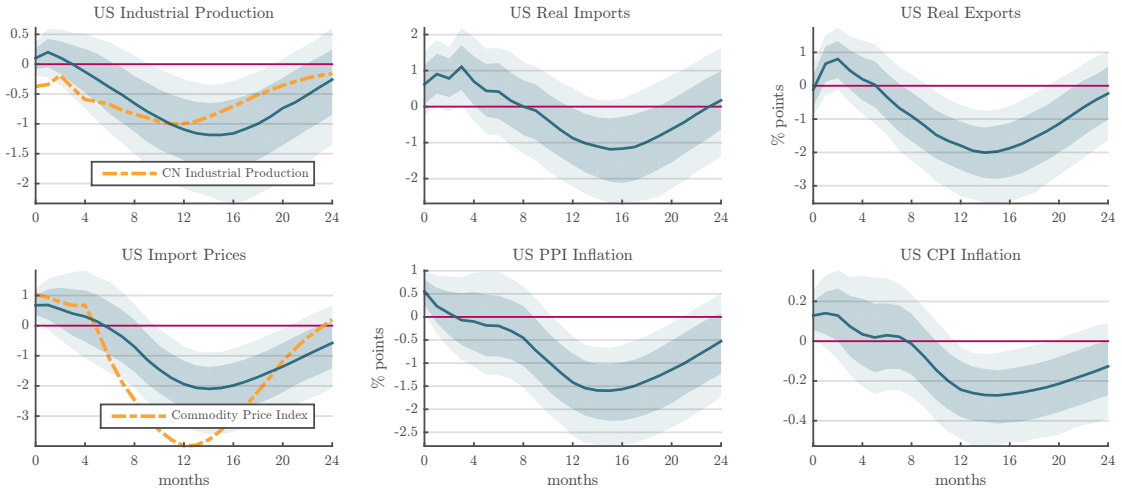
The pattern of responses in Figure 7 suggests that, as China's largest trading partner, the US economy may be particularly exposed to Chinese spillovers. Particularly so given the effects that we have documented on both commodity prices and the US dollar.

To further explore the bilateral spillovers, Figure 10 reports the direct response of US industrial production, trade balance, and price indices to the Chinese monetary policy contraction. To facilitate the comparison of the magnitudes and speed of adjustments, we superimpose the effects that the same shock has on Chinese production and on the commodity price index (orange dash-dotted lines).[34]

While US imports appear to be relatively insensitive throughout, US exports decline substantially in response to the Chinese shock, implying that the net effect is a deterioration of the US trade balance. The broad US dollar appreciation and the large fall in Chinese imports documented in the previous section are both likely to play an important

[34]The VAR also includes global output and trade excluding both the US and China, whose peak negative response is equivalent to that reported in Figure 7 for global output and trade excluding China alone, global FCI and the USD effective exchange rate. See Appendix C.

FIGURE 10: SPILLOVERS OF CHINESE MONETARY POLICY TO THE US



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% at peak. Orange dash-dotted line denote responses of additional variables included in the same VAR. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

role in explaining the adjustment dynamics of US exports, which decline by about 2ppt yoy at peak. In addition, the global contraction in demand that results from the Chinese slowdown may further contribute to the diminished demand for US goods. Production in the US also slows down considerably, and by roughly the same amount as Chinese production. Similar to the dynamics of global production, also in this case the peak is reached with some delay. To put these responses into context, it is important to note that bilateral US-China trade in intermediate goods has been rising steadily over our sample, and settling at around 12% of total US trade in intermediate goods between 2015-2020. Moreover, exports of intermediate goods from the US to China account for 60% of total US exports into China, while imports of intermediates is 40% of total imports from China.[35] Consistently, on net a fall in Chinese demand leads to an overall deterioration of the US trade balance, as well as a slow down in production. It is important to note that the fall in US industrial production does not translate into an equivalent fall in US GDP, which remains largely stable following the shock (see Appendix C).

The price spillovers to the US are even more striking, and as such especially relevant for monetary policymakers in the US. Despite the dollar appreciation, the fall in commodity

[35]Source: OECD Trade in Value Added (TiVA) 2023.

prices leads to a fall also in US import price inflation, that reaches a peak contraction of about 2ppt after a year. Around half of the commodity price fall reaches US producer price inflation (PPI), which falls by about 1.5% in annual terms. The nearly full pass-through from import to producer prices is remarkable, and puts the fall in domestic US production under new light. All else equal, US industrial output declines despite sensibly cheaper production costs, suggesting that the softening of global demand may be the prevalent driver. Finally, the fall in commodity prices trickles all the way to affect US consumer inflation as well, which is 30bps lower after a year.[36]

7 Conclusions

This paper develops a simple yet rich approach to characterise the stance of China's monetary policy and estimate its transmission inside and outside China. This is a challenging endeavour given the multiple policy targets and instruments utilised by the PBC, as well as the continuous evolution of the policy regime over the past three decades. We use a novel composite monetary policy indicator to capture the broad scope of Chinese monetary policy actions. Innovations to the endogenous policy stance are extracted by means of an estimated policy rule tailored to the multiple targets that Chinese monetary policy seeks to meet.

Domestically, the monetary policy transmission works following textbook patterns. And leads to a rise in borrowing costs, a contraction in credit, and a severe contraction in production and external trade. But—unlike for advanced economies—the effects on China's exchange rate take time to materialise, and are consistent with the duality of the Chinese exchange rate regime whereby a de facto crawling peg with the US dollar is associated with a more flexible management of the yuan against the reminder of the CFETS currency basket.

International Chinese monetary policy spillovers operate through different channels compared to US policy spillovers, but are very powerful. Internationally, China's policy tightening leads to a strong contraction in global trade and output. Reduced demand for raw materials plunges their price following the shock. The US dollar appreciates with

[36] Results are robust to controlling for expected global growth. See Appendix C.

delay as a result of heightened global macroeconomic risk, and flight-to-safety motives. The delayed reaction of global asset prices points to real effects being significantly stronger than financial ones, and to global asset prices reacting to the global slowdown rather than amplifying monetary policy spillovers, as it is the case instead for US policy spillovers. As China's largest trading partner, the US economy is vulnerable to Chinese policy spillovers. With US output and inflation both significantly affected.

Despite the complexity of China's monetary policy regime with its plethora of targets and instruments, the domestic transmission is well established. International spillovers are also powerful. They operate primarily through China's key position in global value chains and strong demand for commodities and raw materials. The effects on commodity markets, trade and inflation reverberate through advanced and emerging market economies alike. Going forward, China's changing position in global production and financial networks is likely to determine how its monetary policy footprint may evolve.

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A Data Appendix

Table A.1: Composite monetary policy indicator for China: List of constituent series

#	Variable	From	Weight
1	Repo Rate: 14 Days	2002-01	$1/\|N_t\|$
2	Repo Rate: 21 Days	2007-01	$1/\|N_t\|$
3	Repo Rate: 28 Days	2002-01	$1/\|N_t\|$
4	Repo Rate: 91 Days	2002-01	$1/\|N_t\|$
5	Repo Rate: 182 Days	2002-01	$1/\|N_t\|$
6	Repo Rate: 364 Days	2002-07	$1/\|N_t\|$
7	Reverse Repo Rate: 7 Days	2002-01	$1/\|N_t\|$
8	Reverse Repo Rate: 14 Days	2002-01	$1/\|N_t\|$
9	Reverse Repo Rate: 21 Days	2005-02	$1/\|N_t\|$
10	Reverse Repo Rate: 28 Days	2002-01	$1/\|N_t\|$
11	Reverse Repo Rate: 91 Days	2002-01	$1/\|N_t\|$
12	Treasury Cash Management Bank Fixed Deposit: Auction Rate: 3 Months	2006-12	$1/\|N_t\|$
13	Treasury Cash Management Bank Fixed Deposit: Auction Rate: 6 Months	2007-04	$1/\|N_t\|$
14	Treasury Cash Management Bank Fixed Deposit: Auction Rate: 9 Months	2010-03	$1/\|N_t\|$
15	Standing Lending Facility (SLF) Rate: Overnight	2014-01	$1/\|N_t\|$
16	Standing Lending Facility (SLF) Rate: 7 Days	2014-01	$1/\|N_t\|$
17	Standing Lending Facility (SLF) Rate: 1 Month	2016-02	$1/\|N_t\|$
18	Short-term Liquidity Operations (SLO) Injection Rate	2013-10	$1/\|N_t\|$
19	Central Bank Bills: Issue Interest Rate: 3 Months	2002-08	$1/\|N_t\|$
20	Central Bank Bills: Issue Interest Rate: 6 Months	2002-06	$1/\|N_t\|$
21	Central Bank Bills: Issue Interest Rate: 1 Year	2002-07	$1/\|N_t\|$
22	Central Bank Bills: Issue Interest Rate: 3 Years	2004-12	$1/\|N_t\|$
23	Time Deposit Rate: 1 Year	2002-01	$1/\|N_t\|$
24	Time Deposit Rate: 3 Months	2002-01	$1/\|N_t\|$
25	Deposit Rate of PBC to Financial Institutions: Statutory Reserve	2002-01	$1/\|N_t\|$
26	Deposit Rate of PBC to Financial Institutions: Excess Reserve	2002-01	$1/\|N_t\|$
27	Medium- to Long-term Lending Rate: 1 to 3 Years (Inclusive)	2002-01	$1/\|N_t\|$
28	Medium- to Long-term Lending Rate: 3 to 5 Years (Inclusive)	2002-01	$1/\|N_t\|$
29	Medium-term Lending Facility (MLF) Rate: 3 Months	2014-10	$1/\|N_t\|$
30	Medium-term Lending Facility (MLF) Rate: 6 Months	2016-02	$1/\|N_t\|$
31	Medium-term Lending Facility (MLF) Rate: 1 Year	2016-02	$2/\|N_t\|$
32	Pledged Supplementary Lending (PSL) Rate	2016-02	$1/\|N_t\|$
33	Loan Prime Rate (LPR): 1 Year	2014-09	$1/\|N_t\|$
34	Loan Prime Rate (LPR): 5 Years	2019-08	$1/\|N_t\|$
35	RRR: Large Deposit-taking Financial Institutions	2002-01	$1/\|N_t\|$
36	RRR: Small and Medium-sized Deposit-taking Fin'l Inst.	2019-08	$1/\|N_t\|$

Notes: This table lists all components of the composite monetary policy indicator (CMPI) for China. All variables are publicly available and sourced from either WIND or Datastream with monthly fre-

quency. Each variable is standardized using its full sample mean and standard deviation. The CMPI is constructed by taking an average of these standardized series, with the month from which each variable enters the CMPI listed in the third column and their weight in the CMPI shown in the last column (expressed as a ratio of the number of CMPI constituents as of each month, $|N_t|$).

Table A.2: VARs of Section 5

Label	Variable	Source
CHINDPRO	Chinese IP Official YoY Growth	CEIC+HA
CHCPIINFL	Chinese CPI Inflation YoY Index, previous year = 100, SA	CEIC
CNCPIres	Chinese CPI, Residence Index	CEIC
CHIMP	Real Chinese Imports Volume, SA	CPB
CHEXP	Real Chinese Exports Volume, SA	CPB
CHM2	M2 China Levels	CEIC
CHTSF	Total Social Financing Levels	CEIC
RMBCPR1	RMB CFETS Central Parity Rate Index, end-2015=100	CFETS
RMBNEER	Nominal Broad E.E.R., RMB Index, NSA	BIS
INFLCHfdi	FDI Inflows to China, Percentage of GDP	IFS + OC
INFLCHp	Portf. Inflows to China, Percentage of GDP	IFS + OC
INFLCHo	Other Inflows to China, Percentage of GDP	IFS + OC
OUTFCHfdi	FDI Outflows from China, Percentage of GDP	IFS + OC
OUTFCHp	Portf. Outflows from China, Percentage of GDP	IFS + OC
OUTFCHo	Other Outflows from China, Percentage of GDP	IFS + OC
CHFOREXR	China Foreign Exchange Reserves Levels (USD Billions)	SAFE
CHFXI	China Foreign Exchange Interventions (spot), (USD Billions)	Adler et al. (2021)
CHRRR	China RRR, Average of small and medium banks	DS
USDperCNY	USD per 1 CNY	RE
CNYEERexUSD	CHY NEER ex USD Index, 2010=100	RE + BIS + OC
USDEERexCNY	USD NEER ex CNY Index, 2010=100	RE + BIS + OC
RMBGAP1	RMB gap based on CFETS RMB Index, Percent	CFETS
CHDR007	China 7 day Repo rate DR007	DS
CH3MSH	China 3month Shibor	HA
CH1YR	China 1Yr Rate, End of month	DS
CH2YR	China 2Yr Rate, End of month	DS
CH5YR	China 5Yr Rate, End of month	DS
CH10YR	China 10Yr Rate, End of month	DS

Notes: HA = Haver Analytics; CPB = CPB Netherlands Bureau for Economic Policy Analysis, World Trade Monitor; CFETS = China Foreign Exchange Trade System; BIS = Bank for International Settlements; IFS = IMF International Financial Statistics; SAFE = State Administration of Foreign Exchange; DS = Datastream; RE = Refinitiv Eikon; OC = OC.

Table A.3: VARs of Section 6

Label	Variable	Source
CHINDPRO	Chinese IP Official YoY Growth	CEIC+HA
WORLDIPXC	Global Output Excluding China, Production Weights, SA	CPB
WORLDIPXU	Global Output Excluding U.S. and China, Production Weights, SA	CPB
GTRADEXC	Global Trade Excluding China, Trade Weights, SA	CPB
GTRADEXU	Global Trade Excluding U.S. and China, Trade Weights, SA	CPB
GSFCI	Global Financial Conditions Index, NSA	GS
USDNEER	Nominal Broad E.E.R, USD Index, NSA	BIS
WORLDINFL	World Inflows, Percentage of GDP	IFS + OC
CRBPI	CRB Commodity Price Index Index, NSA	CRB+HA
GSCI	S&P GSCI Commodity Nearby Index (AVG, Jan-02-70=100)	HA
GSCIENERGY	S&P GSCI Energy Commodities Nearby Index	HA
GSCINONENERGY	S&P GSCI Non-Energy Commodities Nearby Index	HA
GSCIINDUSTRIAL	S&P GSCI Industrial Metals Nearby Index	HA
GSCIPRECIOUS	S&P GSCI Precious Metal Commodities Nearby Index	HA
GSCISOFT	S&P GSCI Softs Index	HA
GSCIAGRI	S&P GSCI Agricultural & LiveStock Index	HA
INFLEMExCN	Inflows to EMEs ex. China, Percentage of GDP	IFS + OC
OUTFEMExCN	Outflows from EME ex. China, Percentage of GDP	IFS + OC
INFLEMEcomdtyexp	Inflows to Comdty Exporters Percentage of GDP	IFS, UNCTAD + OC
INFLEMEmetal	Inflows to Metals Exporters Percentage of GDP	IFS, UNCTAD + OC
INFLEMEfuel	Inflows to Fuel Exporters Percentage of GDP	IFS, UNCTAD + OC
INFLEMEfood	Inflows to Food Exporters Percentage of GDP	IFS, UNCTAD + OC
OUTFEMEcomdtyexp	Outflows from Comdty Exporters Percentage of GDP	IFS, UNCTAD + OC
OUTFEMEmetal	Outflows from Metals Exporters Percentage of GDP	IFS, UNCTAD + OC
OUTFEMEfuel	Outflows from Fuel Exporters Percentage of GDP	IFS, UNCTAD + OC
OUTFEMEfood	Outflows from Food Exporters Percentage of GDP	IFS, UNCTAD + OC
USINDPRO	US Industrial Production Index Index, SA (INDPRO)	FRED
USIMP	Real US Imports Volume, SA	CPB
USEXP	Real US Exports Volume, SA	CPB
USIMPPRICE	US Import Price Index: All Commodities Index, SA	HA
USCPI	US CPI Index, SA (CPIAUCSL)	FRED
USPPI	US PPI Index, NSA (PPIACO)	FRED

Notes: HA = Haver Analytics; CPB = CPB Netherlands Bureau for Economic Policy Analysis, World Trade Monitor; GS = Goldman Sachs; BIS = Bank for International Settlements; IFS = IMF International Financial Statistics; CRB = Commodity Research Bureau; UNCTAD = UN Trade and Development; FRED = Federal Reserve Economic Data, St. Louis Fed; DS = Datastream.

Table A.4: Classification of Commodity Exporter EMEs

All	Metals	Fuel	Food
Argentina	Bolivia	Azerbaijan	Argentina
Azerbaijan	Brazil	Bolivia	Brazil
Bolivia	Chile	Colombia	Chile
Brazil	Kazakhstan	Egypt	Costa Rica
Chile	Mongolia	Kazakhstan	Guatemala
Colombia	Peru	Malaysia	Honduras
Kazakhstan	Russia	Mexico	Hungary
Malaysia	South Africa	Qatar	India
Mexico	Ukraine	Russia	Malaysia
Mongolia		Saudi Arabia	Peru
Peru		Venezuela	Poland
Qatar			South Africa
Russia			Thailand
Saudi Arabia			Türkiye
South Africa			Ukraine
Uruguay			Uruguay
Venezuela			

Notes: Emerging market countries based on the IMF World Economic Report classification. We exclude China from all emerging market aggregates to focus on spillovers from Chinese monetary policy. Commodity exporters of each type (All, Metals, Fuel, Food) are a subset of emerging markets with positive net exports of the respective commodity, on average over 1995–2023. Trade data by commodity is from UNCTAD annual merchandise trade matrix statistics (expressed in USD, at current prices) for the following four product categories: Primary commodities (SITC 0 + 1 + 2 + 3 + 4 + 68); Ores and metals (SITC 27 + 28 + 68); Fuels (SITC 3); Food, basic (SITC 0 + 22 + 4).

B Additional details on the PBOC Policy Rule

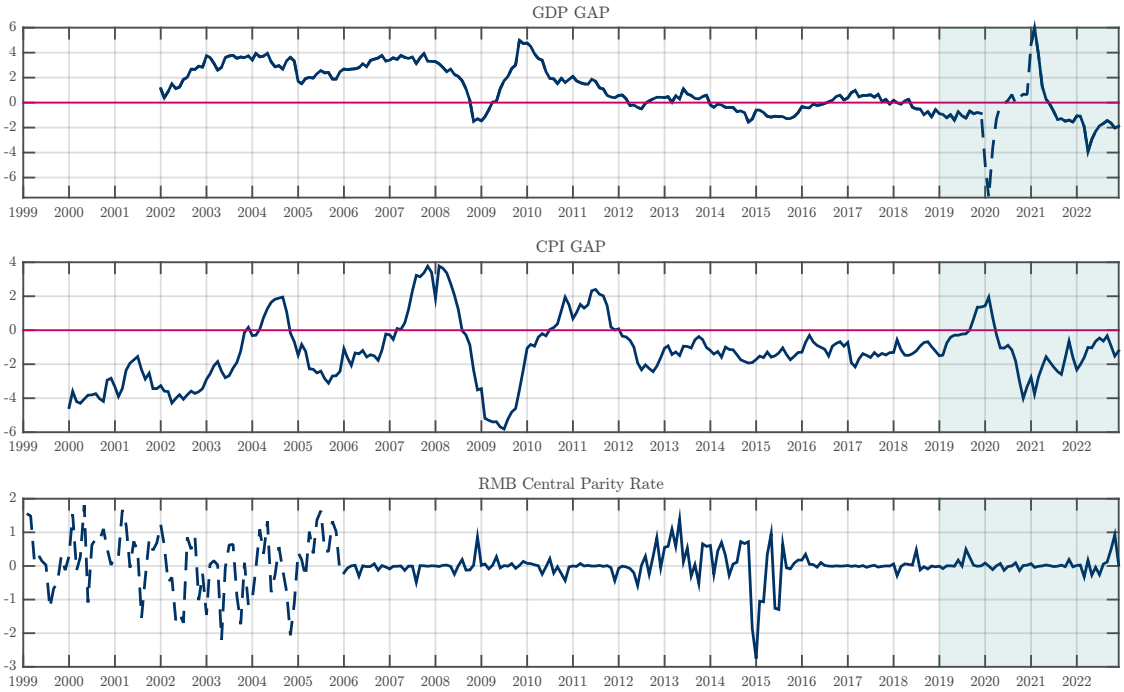
Figure B.1 plots the inputs to the PBOC monetary policy rule. The GDP and CPI gaps are computed as in Chen et al. (2018) using the official time-varying annual targets set by the Chinese government obtained from Haver Analytics. To accommodate the monthly frequency, for the GDP gap we use a measure of monthly Chinese GDP developed by the FRBNY and constructed to match the official growth rates of output. Prior to 2006 the RMB was pegged to the US dollar. During this period we set the central parity rates for all bilateral exchange rates in the RMB index at the levels required to maintain the peg to the US dollar at 8.2765. That is, we rescale the spot dollar bilaterals by the CNY/USD pegged rate.

Table B.1 reports the estimated rule coefficients across different specifications of the PBOC policy rule.

Figure B.2 reports the estimate of the rule threshold for the coefficient associated with the GDP gap, obtained by minimising the rule's SSR over a series of threshold grid points.

Figure B.3 plots the rule residuals used to identify monetary policy shocks in China throughout the paper.

Figure B.1: Inputs to PBOC Policy Rule



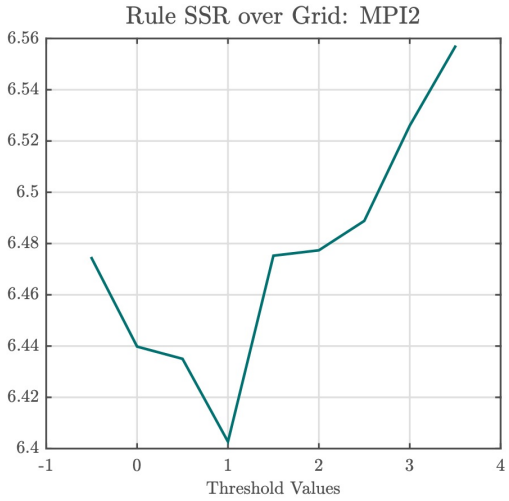
Notes: The GDP and inflation gaps are expressed in annualised/year-on-year percentage points. Chinese officials did not release a target for growth in 2020. The dashed line in the top panel is obtained by assuming a target growth of 6% for 2020, same as in 2019 and 2021. The central parity rate is in monthly percent changes. The dashed line is used during the US dollar peg regime. The shaded areas highlight the years not included in our baseline estimation. See main text for details.

Table B.1: PBOC policy rule estimates

	(1) CMPI	(2) CMPI	(3) CMPI	(4) CMPI	(5) CMPI	(6) CMPI	(7) M2
Own Lag	0.961***	0.954***	0.964***	0.956***	0.948***	0.954***	0.980***
	(0.018)	(0.017)	(0.017)	(0.017)	(0.018)	(0.018)	(0.021)
CPI Gap	0.024***	0.026***	0.027***	0.025***	0.031***	0.030***	-0.154***
	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.040)
GDP Gap	0.013						
	(0.008)						
GDP Gap +		0.002	0.003	-0.002	0.005	0.007	-0.014
		(0.009)	(0.009)	(0.011)	(0.010)	(0.010)	(0.064)
GDP Gap -		0.069**	0.099***	0.083**	0.071***	0.048	-0.248*
		(0.027)	(0.027)	(0.036)	(0.028)	(0.029)	(0.129)
RMB Gap						0.072*	
						(0.038)	
CPR x RMB Gap	-0.028	-0.036*	-0.015	-0.033	-0.015		0.046
	(0.020)	(0.020)	(0.019)	(0.020)	(0.033)		(0.106)
Intercept	0.011	0.036	0.039*	0.049*	0.049**	0.044*	0.122
	(0.020)	(0.022)	(0.021)	(0.027)	(0.023)	(0.023)	(0.250)
Observations	215	215	215	215	168	168	215
Threshold	–	1%	1%	0%	1%	1%	1%
Lagged Inputs	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE

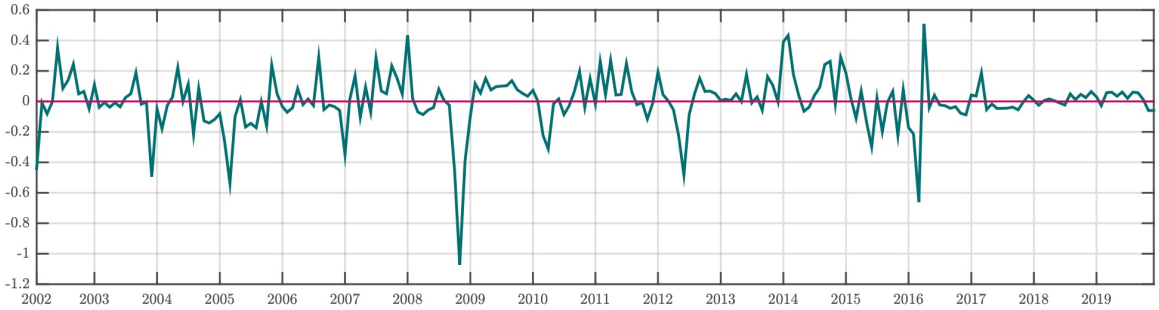
Notes: (1) linear rule; (2) baseline rule used in the paper; (3) rule with contemporaneous inputs; (4) rule with GDP gap threshold as in CRZ; (5) baseline rule estimated from Jan 2006; (6) rule without RMB interaction term estimated from Jan 2006; (7) rule with M2 as policy variable. All monthly. SE in parentheses, * p<0.1, ** p<0.05, *** p<0.01

Figure B.2: Rule SSR over Threshold Grid



Notes: Sum of square residuals of the estimated policy rule over different values of the threshold $\bar{y}$.

Figure B.3: Policy Rule Residuals



Notes: Residuals of the generalised monetary policy rule for the PBOC.

C Additional VAR Results

Figure C.1 reports IRFs to the identified Chinese monetary policy shock in baseline domestic VAR. 2003-2019.

Figure C.2 reports IRFs to the identified Chinese monetary policy shock in baseline domestic VAR that also includes the Global FCI. 2003-2019.

Figure C.3 reports IRFs to the identified Chinese monetary policy shock in baseline domestic VAR with Global FCI ordered first. 2003-2019.

Figure C.4 reports IRFs to the identified Chinese monetary policy shock in baseline domestic VAR identified using the CMPI rule residuals as external instrument. 2003-2019.

Figure C.5 reports IRFs to the identified Chinese monetary policy shock in baseline domestic VAR. Residuals from rule estimated with contemporaneous inputs. 2003-2019.

Figure C.6 reports IRFs to the identified Chinese monetary policy shock in baseline domestic VAR that replaces CPI with housing costs. 2003-2019.

Figure C.7 reports IRFs to the identified Chinese monetary policy shock in batteries of baseline domestic VARs that replaces the exchange rate with real estate sector variables. 2003-2019.

Figure C.8 reports IRFs to the identified Chinese monetary policy shock in baseline domestic VAR that also includes Global FCI and fiscal balance of the Chinese government. 2003-2019.

Figure C.9 reports IRFs to the identified Chinese monetary policy shock to Chinese inflows and outflows without controlling for Global FCI. 2006-2019.

Figure C.10 reports IRFs to the identified Chinese monetary policy shock to Chinese net capital flows (inflows from foreign residents minus outflows from domestic residents), controlling for Global FCI as in Figure 4. 2006-2019.

Figure C.11 reports IRFs to the identified Chinese monetary policy shock in baseline global VAR with Global FCI ordered first. 2003-2019.

Figure C.12 reports IRFs to the identified Chinese monetary policy shock in baseline global VAR. Residuals from rule estimated with contemporaneous inputs. 2003-2019.

Figure C.13 reports IRFs to the identified Chinese monetary policy shock in baseline global VAR with expected global growth ordered first. 2003-2019.

Figure C.14 reports IRFs to the identified Chinese monetary policy shock in US spillovers VAR. 2003-2019.

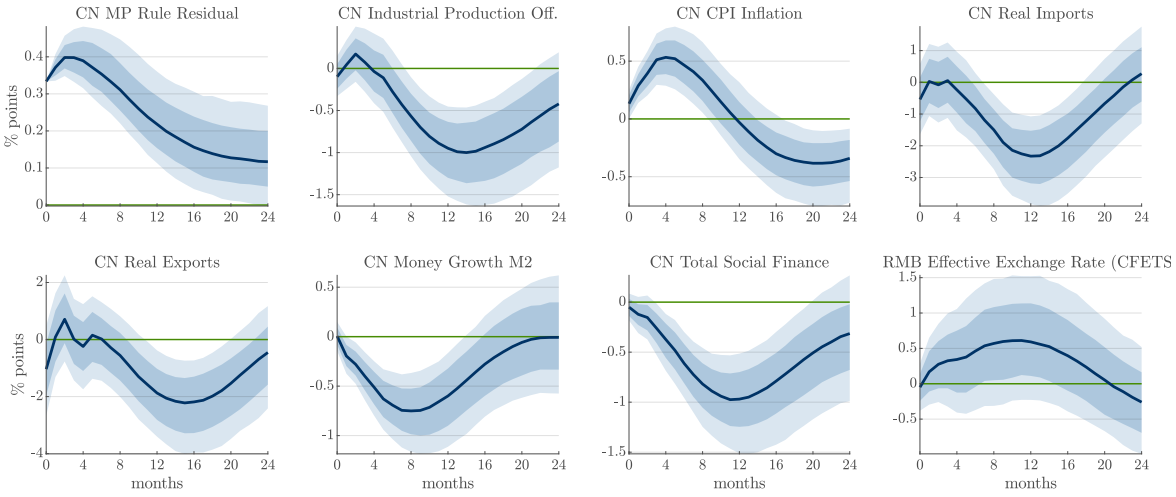
Figure C.15 reports IRFs to the identified Chinese monetary policy shock in US spillovers VAR where US GDP replaces US industrial production. 2003-2019.

Figure C.16 reports IRFs to the identified Chinese monetary policy shock in US

spillovers VAR with Global FCI ordered first. 2003-2019.

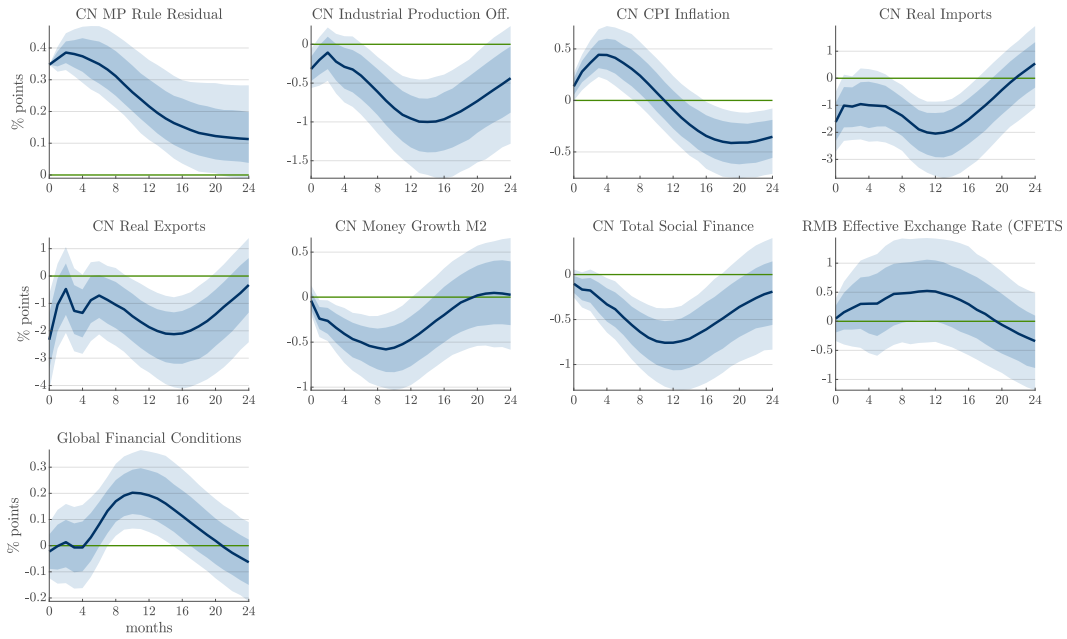
Figure C.17 reports IRFs to the identified Chinese monetary policy shock in US spillovers VAR with expected global growth ordered first. 2003-2019.

Figure C.1: Baseline Domestic Responses: No Global FCI



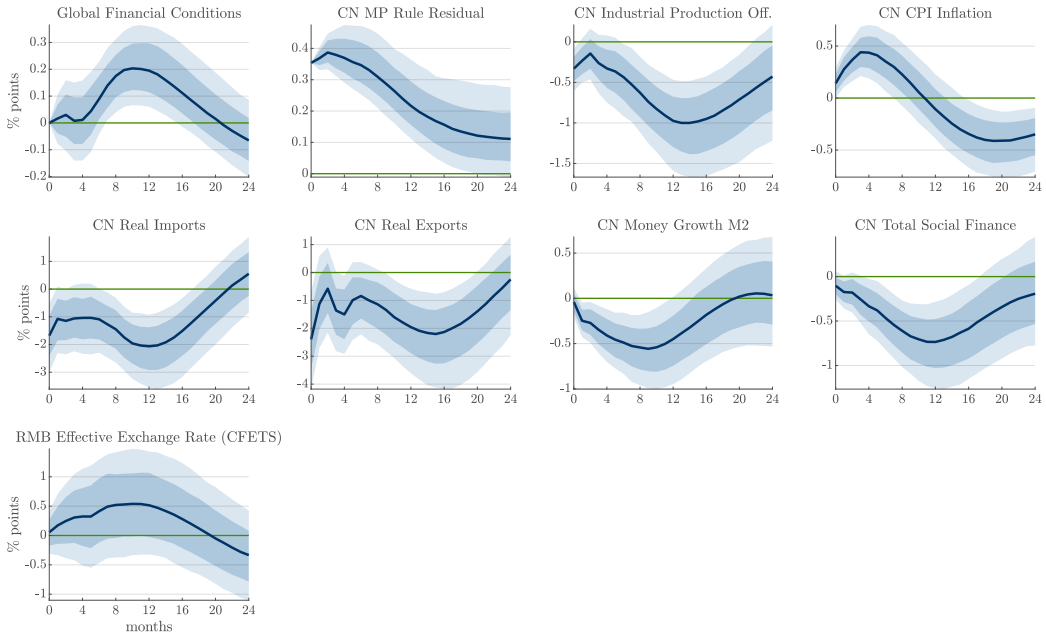
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2003:01-2019:12.

Figure C.2: Baseline Domestic Responses: Global FCI in VAR



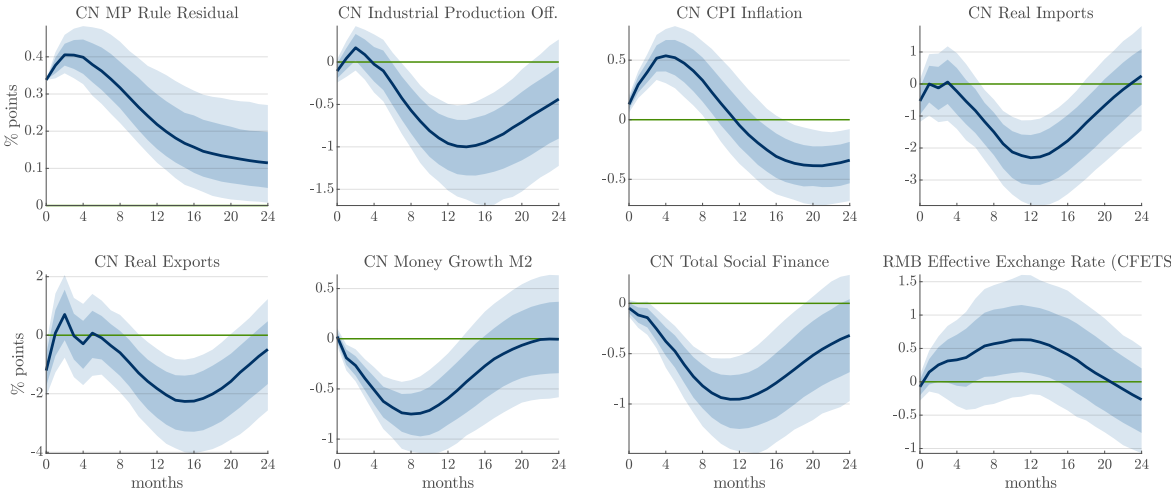
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2003:01-2019:12.

Figure C.3: Baseline Domestic Responses: Global FCI ordered first



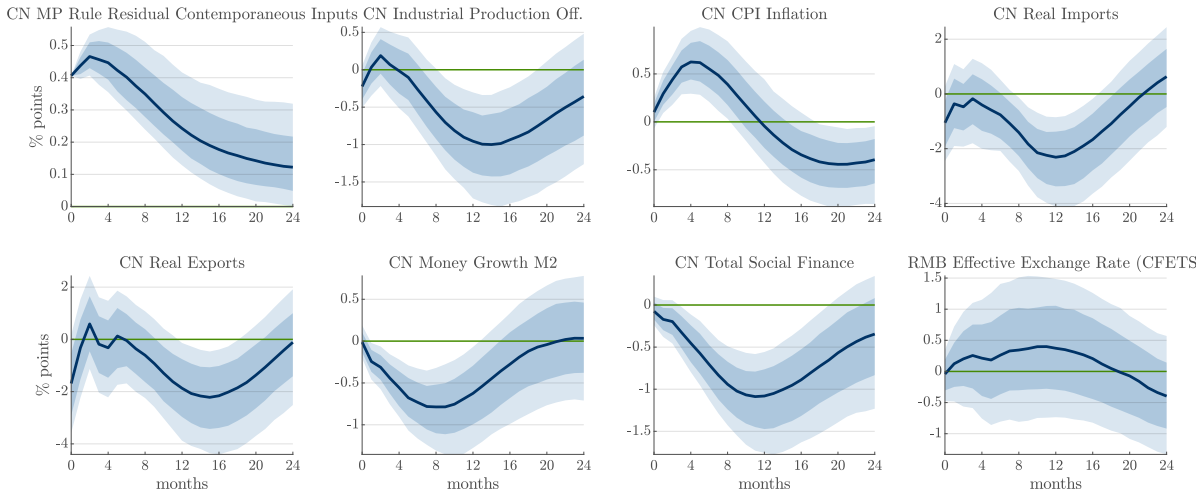
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2003:01-2019:12.

Figure C.4: Baseline Domestic Responses: rule residual as external instrument



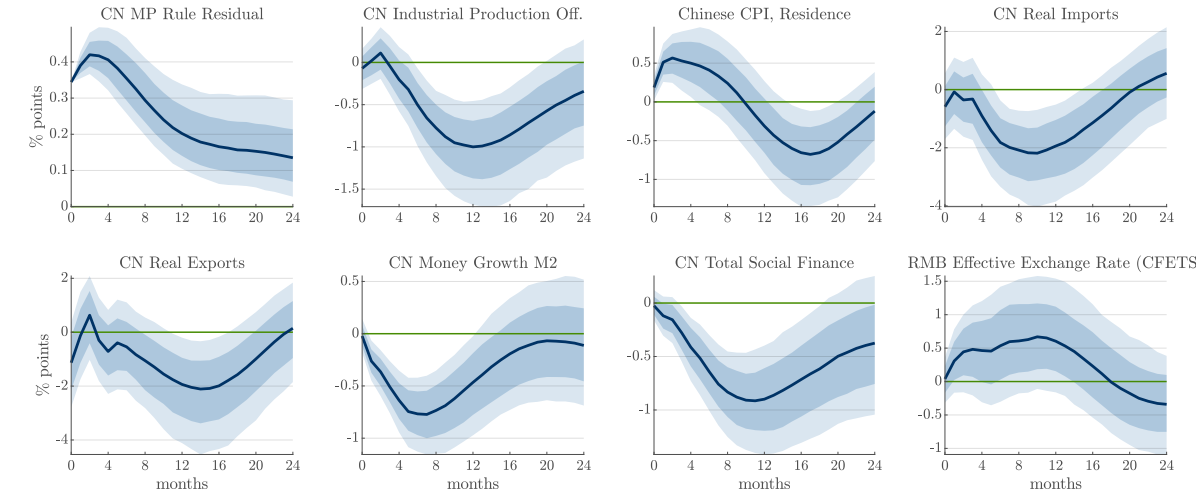
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2003:01-2019:12.

Figure C.5: Baseline Domestic Responses: rule with contemporaneous inputs



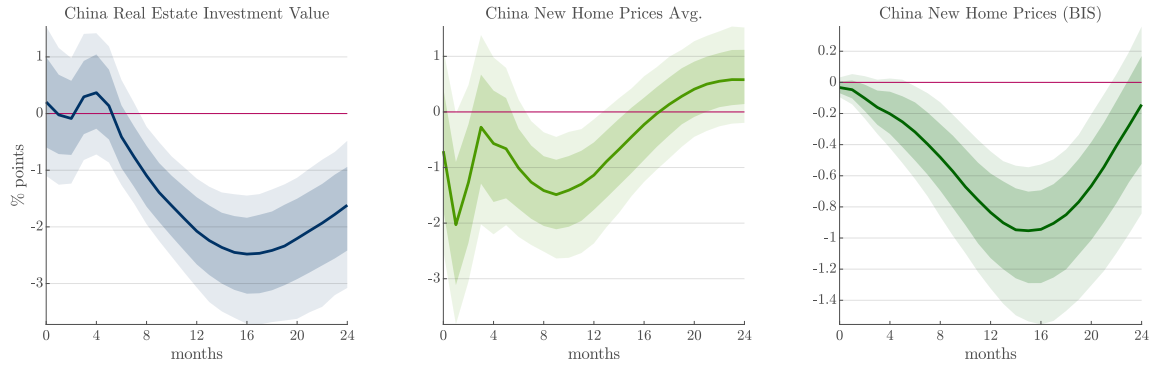
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2003:01-2019:12.

Figure C.6: Baseline Domestic Responses: housing costs



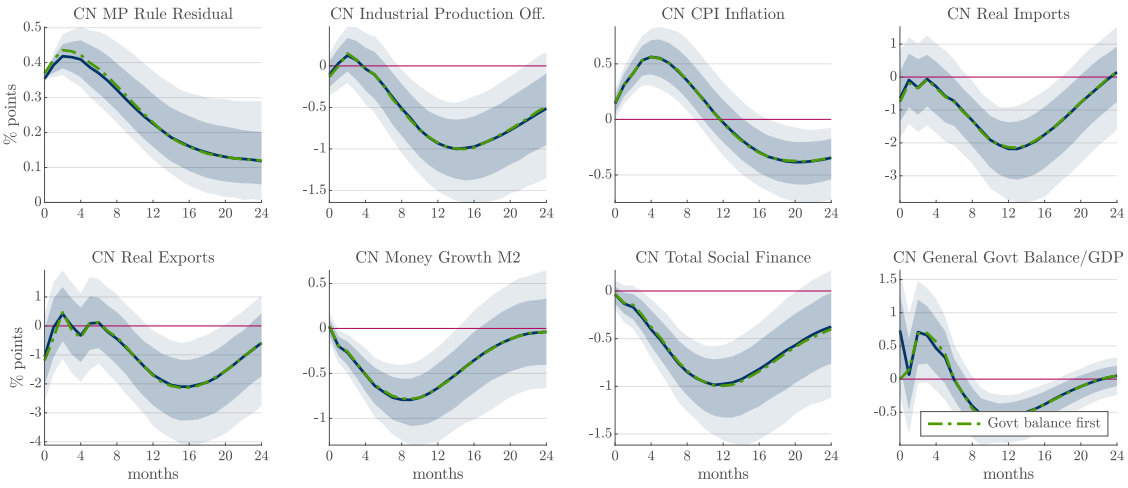
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2003:01-2019:12.

Figure C.7: Baseline Domestic Responses: real estate sector



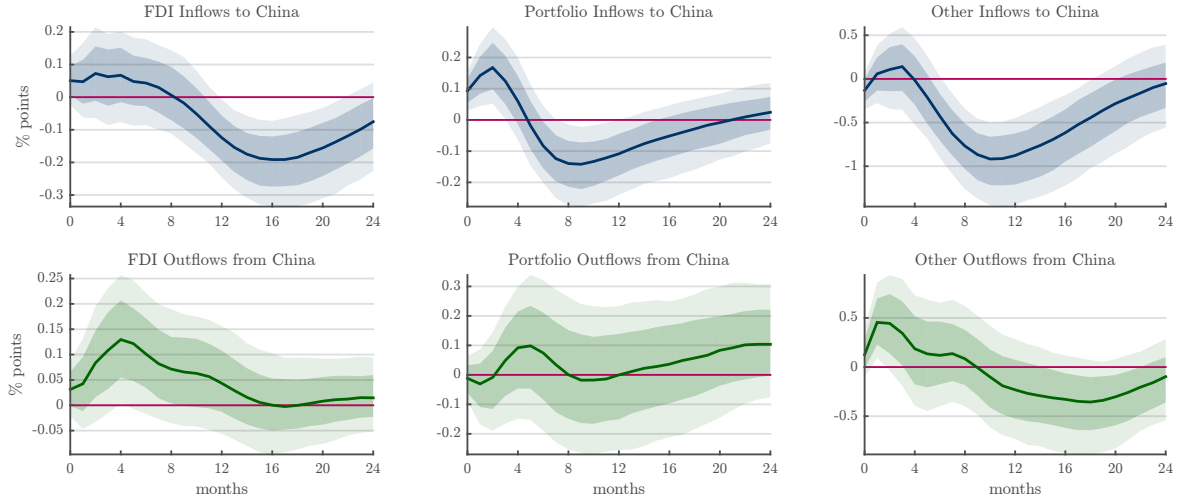
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Each colour corresponds to a different VAR. Common variables as in baseline excluding CFETS EER. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2003:01-2019:12.

Figure C.8: Baseline Domestic Responses: controlling for Fiscal Policy



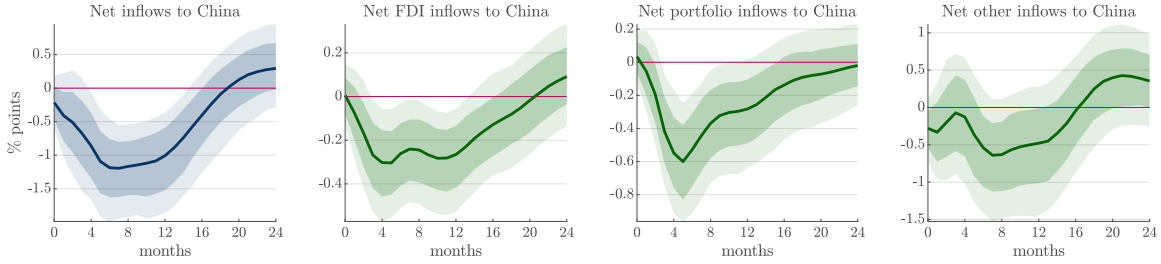
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). Median IRFs from an alternative specification with the budget balance ordered before the MP rule residual are shown as green dashed lines. 2003:01-2019:12.

Figure C.9: Capital flows responses without controlling for global FCI



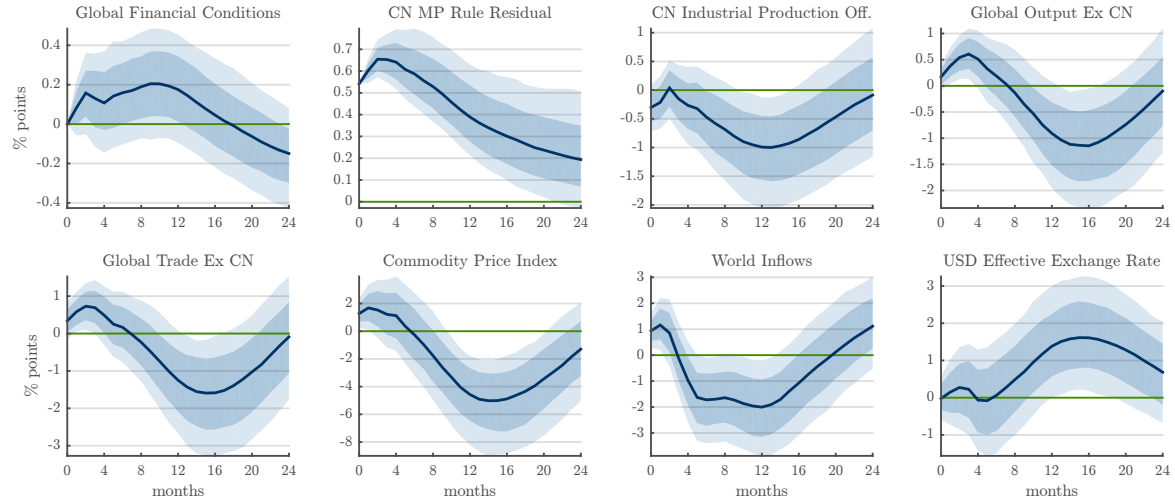
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2006:03-2019:12.

Figure C.10: Net capital inflows responses



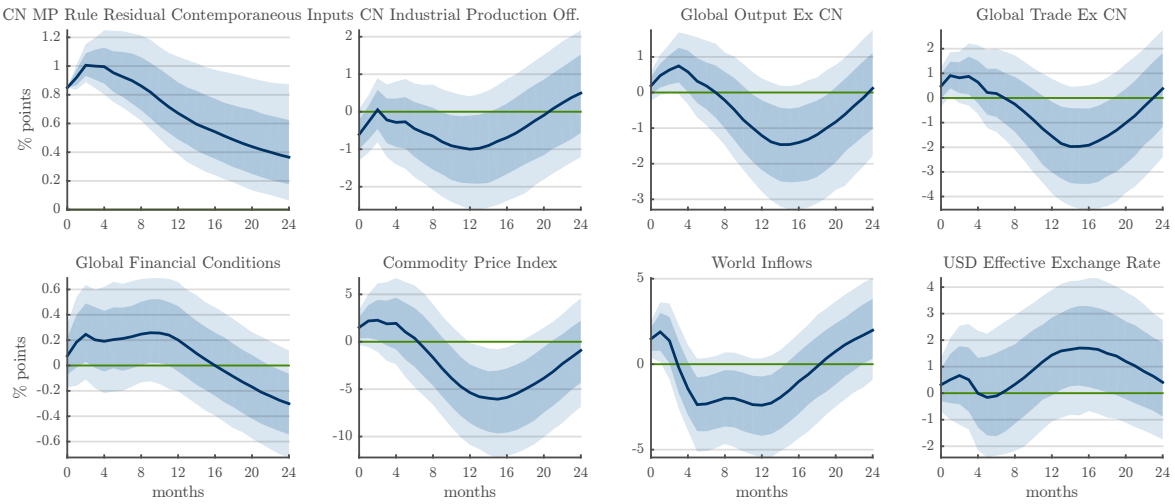
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2006:03-2019:12.

Figure C.11: Baseline Global Responses: global FCI ordered first



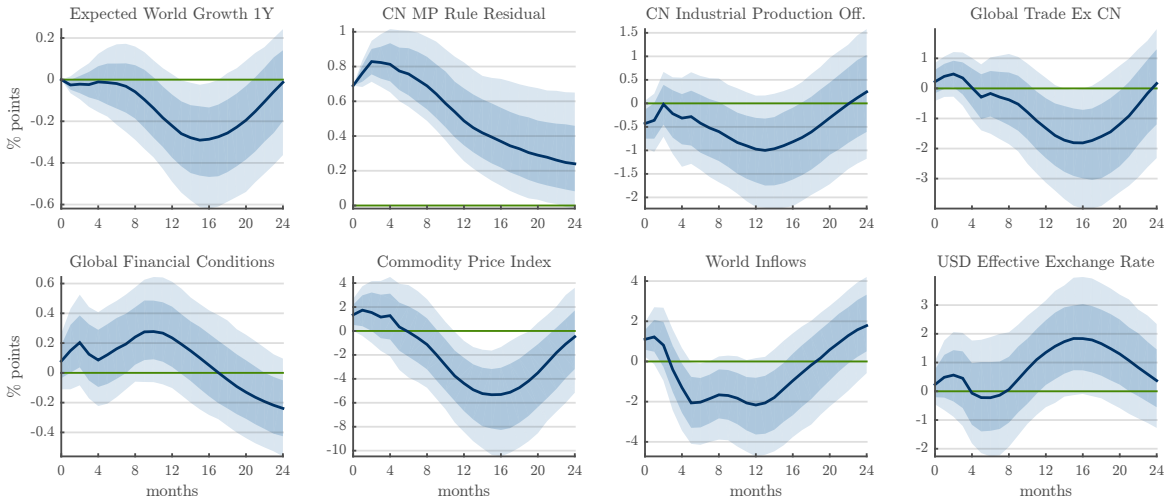
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

Figure C.12: Baseline Global Responses: rule with contemporaneous inputs



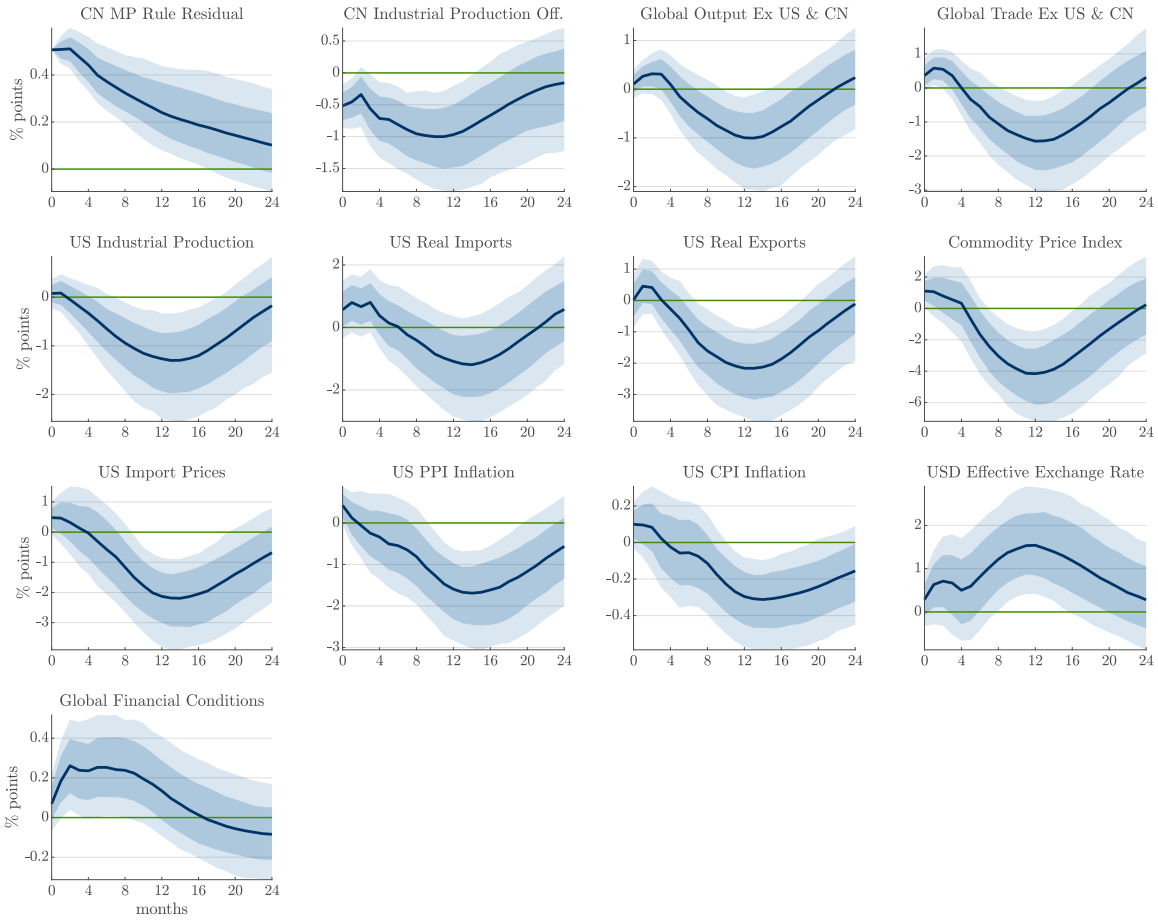
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

Figure C.13: Baseline Global Responses: expected global growth ordered first



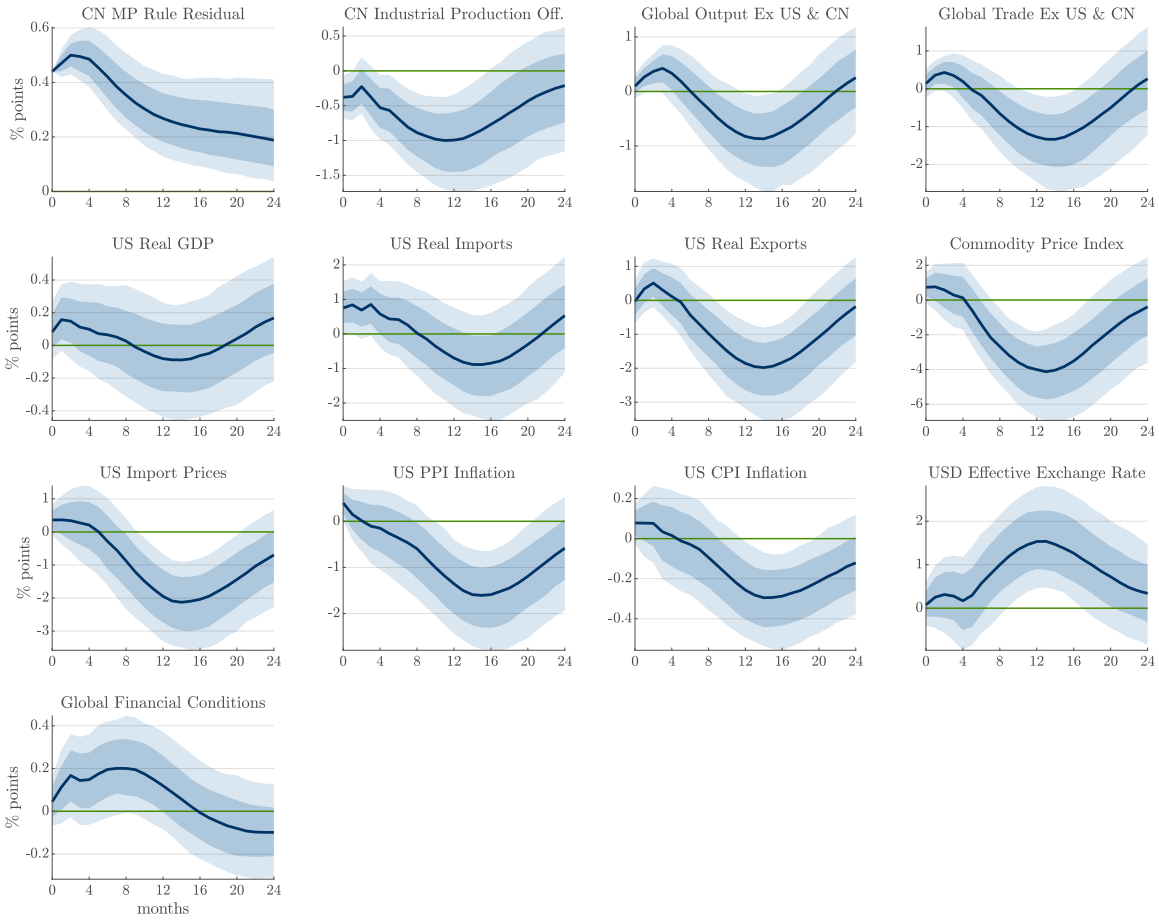
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

Figure C.14: US Spillovers: full IRFs



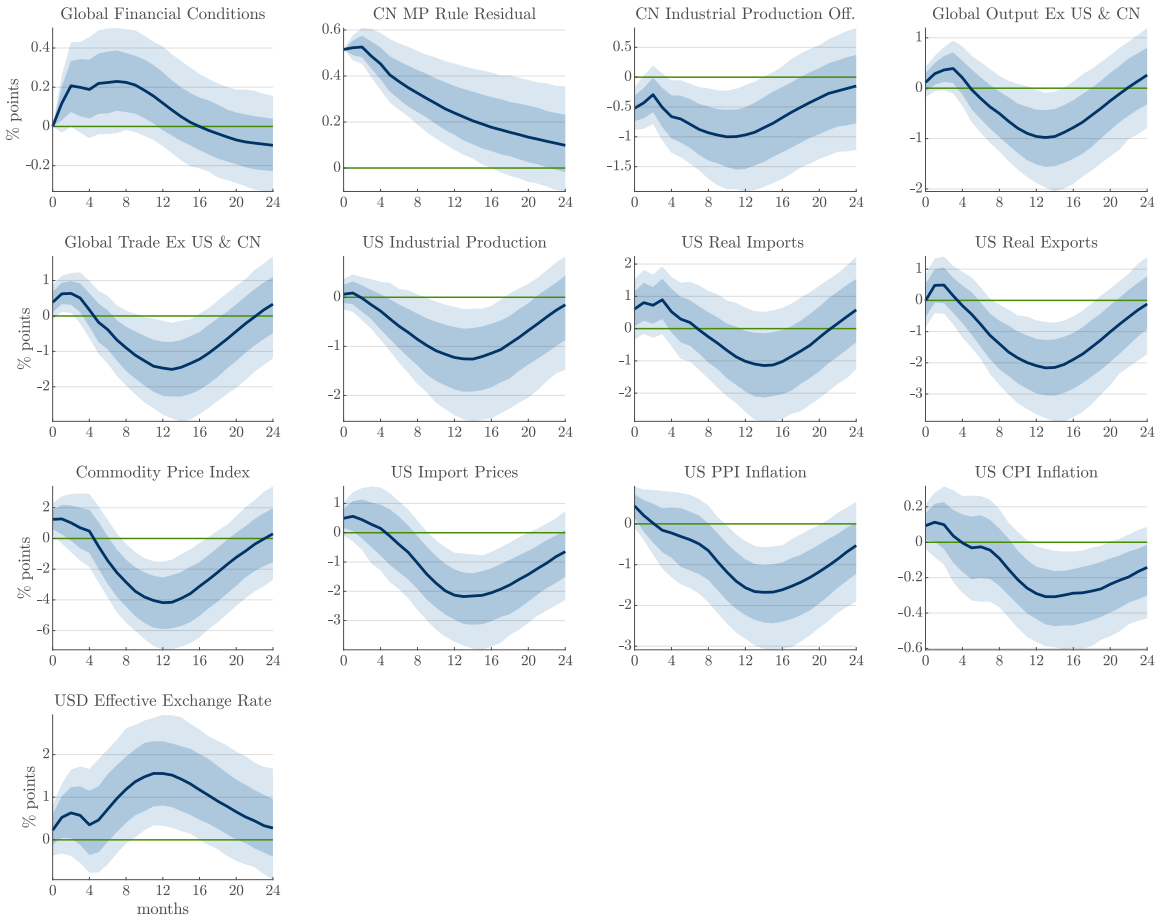
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

Figure C.15: US Spillovers: Response of US GDP



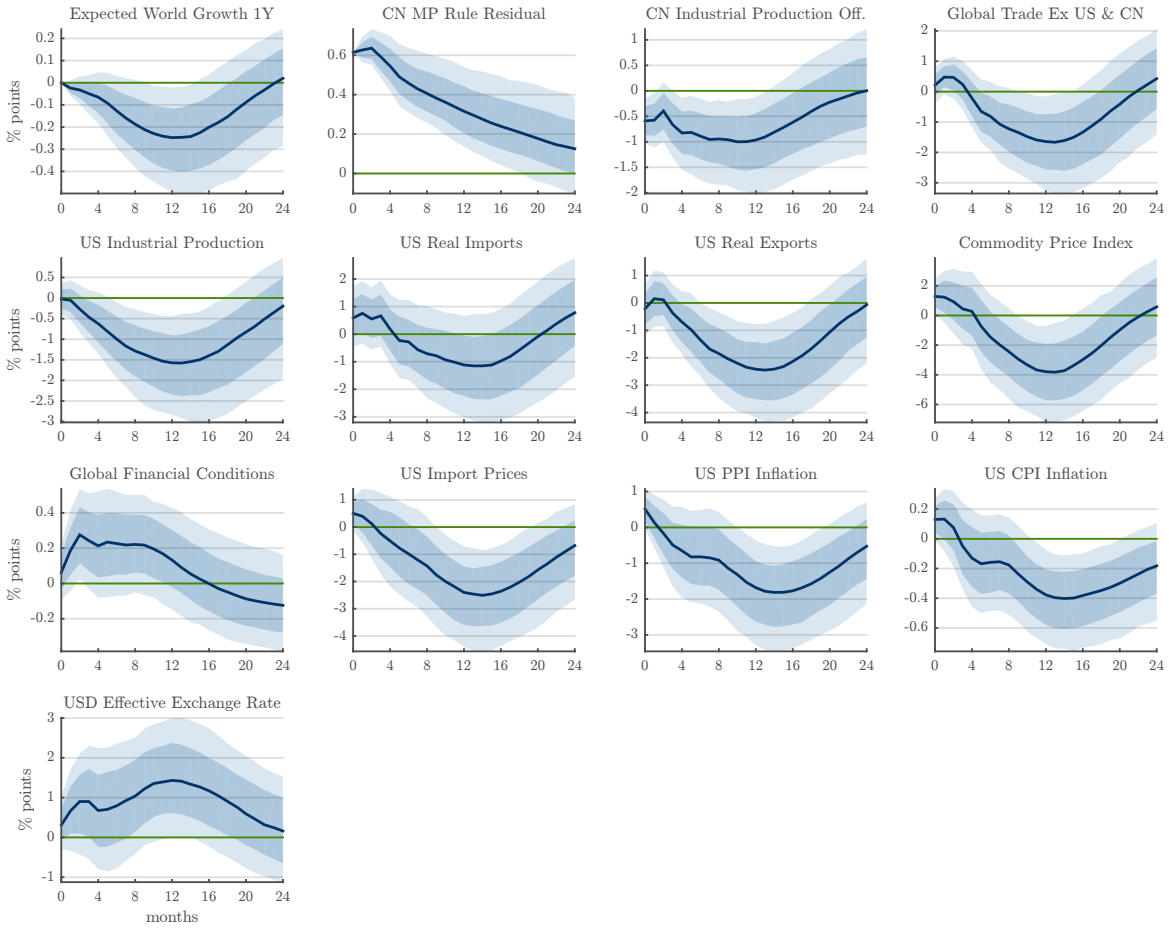
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

FIGURE C.16: US SPILLOVERS: FULL IRFS WITH GLOBAL FCI ORDERED FIRST



Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

Figure C.17: US Spillovers: expected global growth ordered first



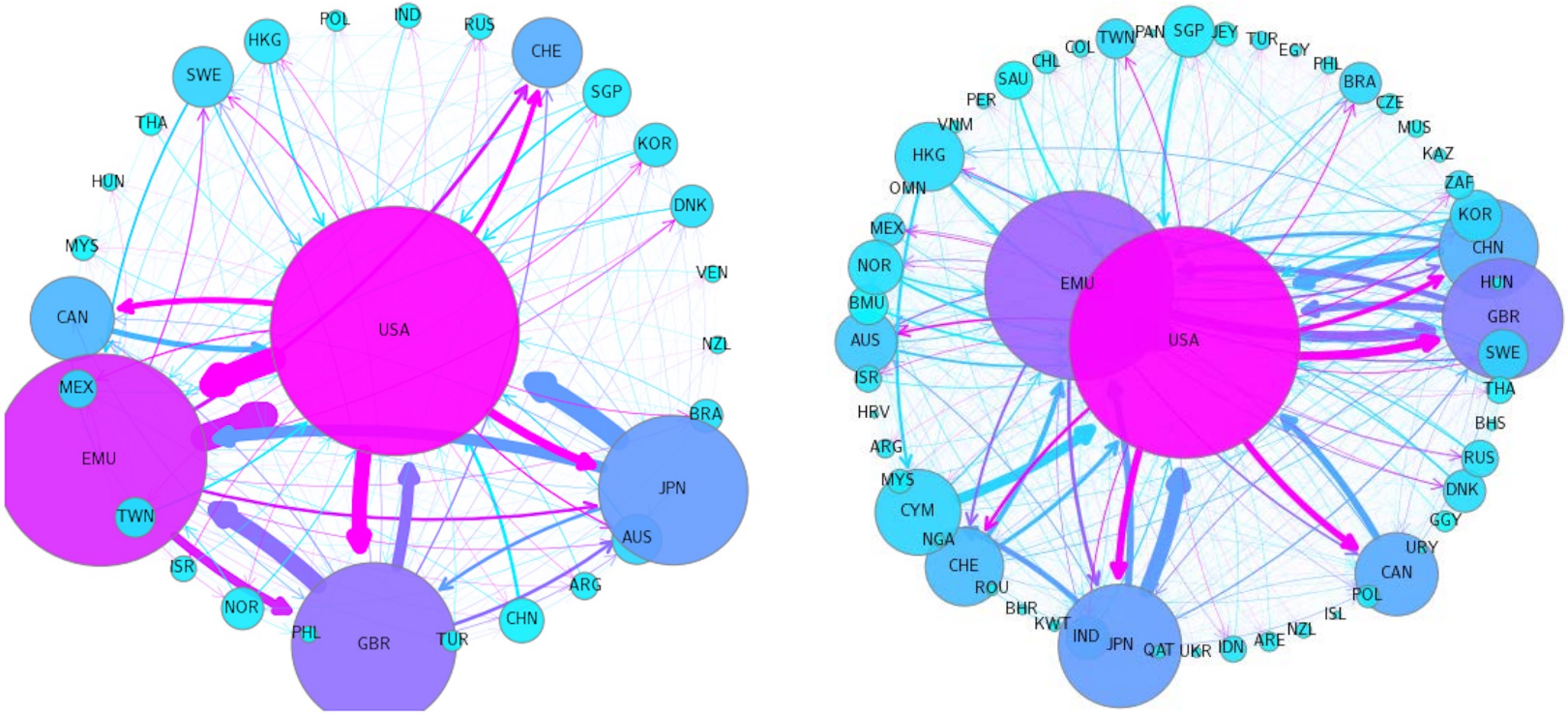
Notes: Median IRFs to a contractionary monetary policy shock normalised to yield a contraction of Chinese industrial production of 1% yoy at peak. Shaded areas correspond to 68% and 90% posterior credible sets. Monthly BVAR(6). 2002:02-2019:12.

D China's Changing Position in Global Financial Network

Figure D.1: Global Portfolio Investment Network: Directed, EMU aggregate

(a) 2000

(b) 2018



Notes: Directed network of bilateral cross-border portfolio holdings of equity and debt securities. European Monetary Union (EMU) exposures versus non-EMU countries only consolidated into a single node. The exposures plotted here are based on the private sector portfolio assets as reported in the IMF Coordinated Portfolio Investment Survey (CPIS) and derived portfolio liabilities. These are then corrected for the role of offshore financial centres by looking through their issuance and ownership as in Coppola et al. (2020). Since for the euro area Coppola et al. (2020) redraw only the aggregate EMU assets, we apply their rescaling matrix to individual euro area countries proportional to their CPIS assets. We add estimated official sector security holdings by allocating country foreign exchange reserves in line with the currency shares reported in IMF COFER data, complemented with reports of the currency shares for the People's Bank of China and the Swiss National Bank. The node size is scaled to reflect the sum of each country's external assets and liabilities as a share of the world total of gross assets and liabilities. We focus only on nodes that have either total assets or total liabilities of at least USD 10 billion. The edge width captures the value of gross assets from investor to destination country, and is normalized between 0 and 20. For comparability, the USA node is positioned in the centre of the graph. Position of the remaining nodes is determined using the Fruchterman-Reingold force-directed algorithm, implemented through the Python NetworkX package. The color scale reflects the eigenvector centrality of each country in the network, ranging from magenta for the most central node (USA), through purple for other nodes with high centrality (e.g. EMU, GBR) and dark blue for less central nodes (e.g. JPN, CHE), to cyan for the many peripheral nodes.