# ECONOMIC REVIEW
## September 2020

NationalBank OF BELGIUM
Eurosystem

# ECONOMIC REVIEW
## September 2020

National Bank OF BELGIUM

Eurosystem

# Contents

# The world economy under COVID-19: Can emerging market economies keep the engine running?

Kristel Buysse
Dennis Essers *

## Introduction

COVID-19 has led to profound turmoil and severe disruptions in our lives and economies. Even more than the 2008-2009 global financial crisis (GFC) – which was most directly felt in the United States and in Europe – the ongoing pandemic-induced crisis is affecting nearly all countries around the world. This article provides an overview of the economic developments in emerging market economies (EMEs), with a focus on those that have been systemically important for the world and/or euro area economy: China, India, Brazil, Russia and Turkey. Some of these EMEs, notably India and Brazil, are currently the epicentre of the pandemic.

In section 1, we start by emphasising that the COVID-19 crisis is different from previous modern-day crises, notably because of its origins in a truly global pandemic. Throughout the article, we highlight some important differences with the GFC, another crisis that at the time was believed to be truly different, due to its unprecedented proportions. A decade ago, EMEs succeeded in weathering the crisis rather well and were the engine of the subsequent global recovery. We examine whether they are likely to play that role again throughout the COVID-19 crisis.

Section 2 then discusses and distils some lessons from the experiences of two countries that were among the first to be affected by COVID-19, China and Korea. As leading indicator economies, their virus containment policies and economic developments have been closely monitored. While China and Korea have not been shielded from the global economic fallout of the pandemic, their relatively quick recovery offers a glimmer of hope.

Even before the virus reached their shores, other EMEs already felt the repercussions of the developments in China, East Asia and the advanced economies. The "third wave" of the pandemic (East Asia being in the "first wave" and Europe and the United States being in the "second wave") dealt a severe blow to their already ailing economies. In section 3, the most elaborated of this article, we detail the direct and indirect impacts of the COVID-19 crisis on major EMEs and examine their pre-existing vulnerabilities and crisis policy responses. The road to recovery will be challenging and for many difficult to achieve without international support.

* While responsibility for any errors is our own, we would like to thank Paul Butzen for helpful comments and suggestions, and staff members from the IMF, the BIS and Capital Economics for providing additional data and explanations. The article uses data up to 6 September 2020, unless indicated otherwise.

The final section concludes by explaining why we believe that EMEs will most likely not play the same role of locomotive for the world economy throughout the COVID-19 crisis as at the time of the GFC.

# 1. This time *is* different

## 1.1 A pandemic-induced global economic crisis

COVID-19 is the first infectious and deadly disease to turn into a pandemic on a truly global scale, in a short time window. The new coronavirus causing the disease originated in China and spread mostly to other East Asian countries (as well as Iran) in February. Building on their past experiences with epidemiological outbreaks (e.g. SARS and MERS[1]), those countries were better prepared to deal with a health crisis compared to others lacking such recent experience, as they already had high levels of public awareness and voluntary cooperation. They were able to quickly scale up the production of necessary medical and personal protection equipment, and testing and treatment capacity. Finally, East Asian countries successfully rolled out an extensive contact tracing system based on their strengths in the digital economy. However, in a highly interconnected world, this was still not enough to prevent the wide international spread of COVID-19.

The WHO declared the outbreak of COVID-19 to be a pandemic on 11 March. By then the disease had already reached the advanced economies of Europe and the United States. In general, these countries were ill prepared, reacted more slowly, and ended up implementing longer lockdowns as a result. European countries eventually succeeded in flattening the epidemiological curve, although they are still struggling with new outbreaks. The United States by contrast tried to restart its economy before the virus was sufficiently under control and failed on both accounts.

Since May, EMEs have become the pandemic's new epicentre. Parts of Latin America (e.g. Brazil and Mexico) and Asia (e.g. India, Pakistan and the Philippines) have been particularly hard hit (Chart 1, left panel). For these countries, it is more challenging to find an effective way to contain the outbreak.

Economies hit by a COVID-19 outbreak typically follow a similar course. In a state of emergency caused by spiralling rates of new infections, governments respond by imposing lockdowns, bringing most economic activity and community life to a standstill. What follows is a precipitous economic free fall. The economy then stays in a trough while the pandemic growth rate of new infections decelerates to a low value. Once containment policies can be relaxed safely, a slow but steady acceleration in growth materialises, but the pace of economic revival loses momentum well before pre-shock output levels are attained. The economy gets stuck at, say, 90 % of pre-shock output levels, as some sectors struggle to resume operations (including air travel, entertainment, events, hospitality), given the continued need for social distancing. Moreover, uncertainty depresses consumers' and firms' spending. According to some observers, it may take several years to exit this so-called "90 % economy" (Economist, 2020), depending on the timeframe in which a vaccine can be made widely available.

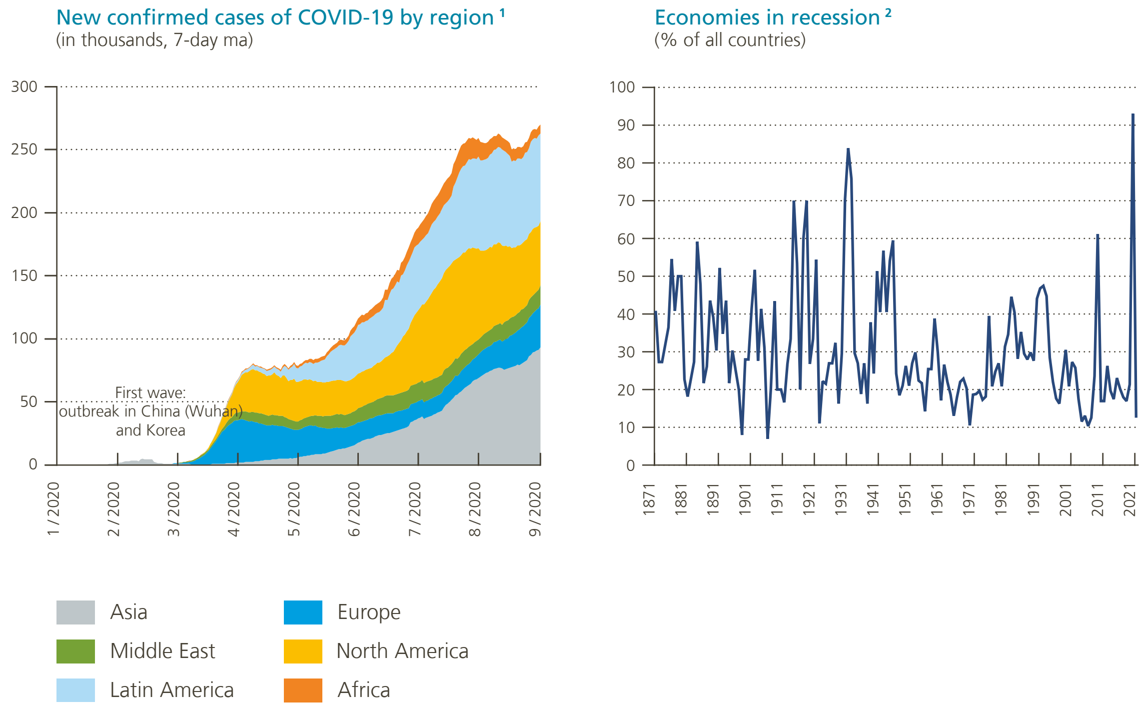
Having spread on a truly global scale, COVID-19 will go down in history as the first pandemic to trigger a global recession on its own. Its scale bears some similarity to the Spanish flu (1918-1920), which is indeed seen as a contributing factor to the prolonged recession of 1917-1921, but which coincided with the conclusion and aftermath of World War I, being itself a major cause of economic destruction (Barro *et al.*, 2020).

Moreover, the resulting economic recession is expected to be the deepest since World War II, and the most synchronised ever recorded (World Bank, 2020). Not only will a large number of countries experience an adverse economic shock associated with an outbreak of COVID-19 on their soil, these shocks will be further reinforced

1 Severe Acute Respiratory Syndrome (SARS) broke out in November 2002. The most affected countries were China, Hong Kong, Taiwan, Singapore and Canada. Middle East Respiratory Syndrome (MERS) started in Saudi Arabia, but also hit Korea in 2014.

Chart 1

**The pandemic pushes a record number of countries into recession**




Sources: OWID, World Bank.

1 The Middle East consists of Afghanistan, Bahrein, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Oman, Palestine, Qatar, Saudi Arabia, Syria, Turkey and Yemen. The other regions correspond with the geographical continent excluding those countries that are part of the Middle East.

2 Proportion of economies in recession, defined as an annual contraction in per capita GDP.

worldwide via the trade channel, disruptions in global value chains, confidence effects and financial market turmoil (see section 3.2). These direct and indirect effects combined explain why nearly all economies (an estimated 93 % of the total according to the World Bank) will be pushed into a recession in 2020 (Chart 1, right panel).

## 1.2 Emerging market economies as a driver of the world economy

Emerging market and developing economies (EMDEs)[1] have contributed significantly to global economic growth over the last two decades. Taken together, the group of EMDEs has consistently experienced faster GDP growth than advanced economies, so that EMDEs' combined weight in the world economy has steadily increased over time. As per the IMF's World Economic Outlook (WEO) database, 2008 marked the year when the EMDE share in world GDP, expressed in purchasing power parity or PPP terms, surpassed the share of advanced economies. In 2019 the EMDE share in world GDP stood at close to 60 %.

However, these overall trends mask important underlying country differences. As in the remainder of this article, we zoom in on a selection of large EMEs to examine those in greater detail. Starting from the non-advanced economies included in the G20 and then further narrowing down the sample to countries with systemic

1 The EMDE classification follows the IMF and, at the moment of writing, consisted of 155 (non-advanced) economies, including many low-income countries. The IMF does not formally break down the EMDE category into subgroups of EMEs and non-EMEs.

relevance for the world and/or euro area economy, we are left with a set of five countries: China, India, Russia, Brazil and Turkey.[1] The Annex to this article provides more details on the importance of these countries for global GDP, global trade, euro area trade, euro area value added, and euro area financial claims.

Chart 2 shows how the large and increasing contribution of EMDEs to world GDP growth has to a great extent been driven by China and, in the second instance, India, whose shares of world GDP had increased to 19 % and 8 % respectively by 2019. Both countries acted as a key counterbalancing force during the 2008-2009 GFC and led the post-GFC recovery. These divergent growth patterns between large EMEs and advanced economies revived the debate about "decoupling".[2] Apart from China and India, most other EMDEs were also growing faster than advanced economies before, during and in the wake of the GFC, but the difference compared to advanced economy growth shrank to a small margin (less than one percentage point) by 2014, when commodity prices collapsed and stayed relatively low thereafter.[3] The share of other EMDEs (excluding China and India) in the world economy stagnated at around 26 %. While some large EMEs, including Turkey, maintained or marginally increased their shares, others – including commodity exporters Russia and Brazil – saw their economic weight diminish.

Enter the COVID-19 crisis. This time around it seems highly unlikely that EMEs will take up the role of backstop to the world economy and lead the economic recovery to the same extent as they did during the GFC. Large EMEs, including China and India, are more severely hit by the current crisis, both directly and indirectly (cf. sections 2 and 3). China entered the crisis with lower economic growth, a larger fiscal deficit (heavily biased towards investment), and extraordinarily high corporate leverage (Buysse *et al.*, 2018; IMF, 2019a). Other systemically important EMEs also featured more severe vulnerabilities and disequilibria than on the eve of the GFC. Moreover, the effects of the COVID-19 pandemic came on top of ongoing, more idiosyncratic stress factors in key EMEs. While India was still among the world's fastest growing economies, it had been grappling with severe problems in its non-bank financial sector and an associated credit crunch (IMF, 2020a). Brazil was slowly recovering from a deep recession in 2015-2016, hampered by great uncertainty surrounding fiscal and structural reforms, including those concerning the pension system and energy sector (IMF, 2019b). Russia saw only moderate growth in a context of subdued oil prices and EU-US economic sanctions (Dabrowski and Collin, 2019), and in March 2020 it was fighting an oil price war with Saudi Arabia, triggered by the failure to agree on oil production cuts.[4] Finally, Turkey had just bounced back from a recession in 2018 following an episode of capital flight and sharp currency depreciation. Its recovery was supported by an expansionary fiscal policy and (unsustainably) fast credit provision by state-owned banks (IMF, 2019c). When COVID-19 hit, most major EMEs therefore found themselves in a worse position and had less policy space relative to 2008.

Just how large the contributions of EMEs to global economic growth will end up being in 2020 and the years to come is subject to a much larger-than-usual degree of uncertainty, due to the unique and still unfolding nature of the COVID-19 crisis (cf. section 1.1). Much will depend on the further course of the coronavirus, which is hard to predict, as well as the responses of consumers, businesses and governments. Whereas the IMF's April 2020 World Economic Outlook report projected EMDE GDP growth of –1 % in 2020 and +6.6 % in 2021, by the time of its June update these figures had been further slashed to –3 % and +5.9 %. China is the only large EME expected to contribute positively to world GDP growth in 2020, and only marginally so, in contrast to 2008-2009 (Chart 2, right panel). For 2021, the June IMF forecasts imply that China's contribution will be almost as large as that of all advanced economies combined, outstripping its own contribution in post-GFC

1 The other G20 EMEs, which we do not discuss separately in the paper, are Argentina, Indonesia, Mexico, Saudi Arabia and South Africa. Although some international organisations (e.g., the BIS) and certain financial market indices (e.g., Morgan Stanley's MSCI) still categorise Korea as an EME, the IMF and OECD classify it as an advanced economy.

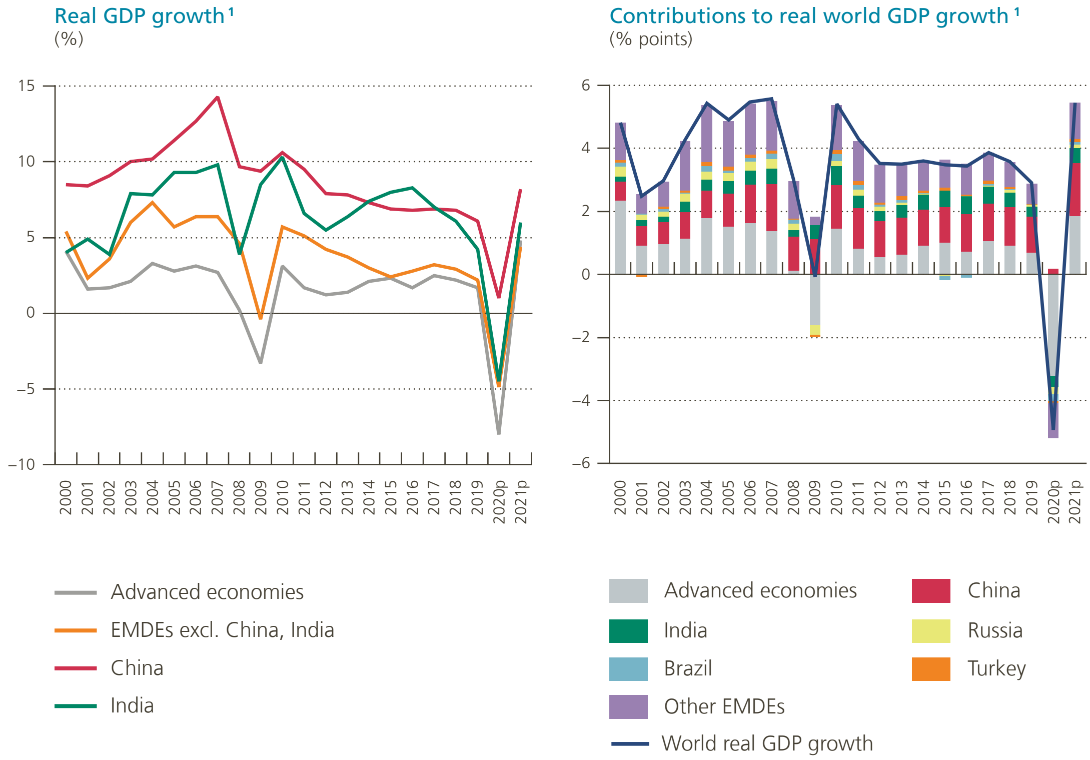
2 Decoupling is generally defined in terms of the (lack of) synchronisation of business cycles. The empirical literature on EME-advanced economy decoupling shows mixed results, depending on the time frame and country samples adopted, as well as on how business cycle synchronisation is measured. Nevertheless, EMEs' relative resilience in the run-up to, during and in the immediate aftermath of the GFC is well documented and believed to have derived from improved institutional and policy frameworks and the availability of fiscal policy space at the time (see Buelens, 2013 and references therein).

3 The steep decline in the price of oil and other commodities between 2014 and early 2016 was the result of a combination of oversupply (including a boom in US shale oil production) and weaker demand (including from China, which gradually shifted away from resource-intensive investment and construction as part of its economic rebalancing efforts) (see Buysse and Vincent, 2015; World Bank, 2018).

4 The oil price war reached a truce with OPEC+ agreements on oil production cuts in April and again in June.

Chart 2

**EMEs have contributed significantly to global growth, but will they continue to do so under COVID‑19?**




Source: IMF (WEO).
1 Growth figures for 2020 and 2021 are forecasts from the IMF WEO June 2020 update.

year 2010. The country's increased weight in the global economy is projected to more than compensate for its lower growth rate in 2021 compared to 2010. Conversely, India, Brazil, Russia and Turkey are all projected to experience deeply negative GDP growth in 2020, between –4.5 % and –9 % (compared to –8 % in advanced economies). The contribution of these four (and most other) EMEs to 2021 global growth is assumed to be positive but smaller than in 2010.[1] It remains to be seen how accurate these projections will turn out to be but, as we will demonstrate in the following sections, there does not seem to be much cause for optimism.

## 2. Where it all began – Observations from China and Korea

### 2.1 Strict containment measures

China and Korea were among the first countries to experience serious outbreaks of COVID‑19. The first infections by the new coronavirus surfaced in the Chinese city of Wuhan in late December 2019. Confronted with an exponential rise in the number of new infections and deaths, the Chinese government took the drastic decision on 23 January, the eve of the Lunar New Year celebrations, to place Wuhan and the other major cities

1 Together India, Brazil, Russia and Turkey accounted for about 1.1 pp out of 5.4 % global growth in 2010, versus less than 0.8 pp out of 5.4 % in 2021.

in the surrounding province of Hubei under a complete lockdown. Other containment measures to prevent a nationwide spread of the disease included the extension of the Lunar New Year holiday, large-scale domestic travel restrictions, social distancing, and a two-week quarantine period for returning migrant workers. Starting in mid-February, the government gradually lifted restrictions on movement and activity, prioritising essential sectors, regions with low infection rates, and population groups based on ongoing risk assessments. The economic reopening process was completed on 8 April with lifting of the lockdown of Wuhan. As a first mover, China provided the world with a blueprint of a containment strategy, to be replicated by many others.

Drawing on lessons learned from previous recent health crises, Korea responded to its own COVID-19 outbreak with a rather unique and less disruptive containment strategy. The country confirmed its first case on 19 January and experienced a surge in infections in the Daegu region in mid-February. Korea's approach relied on a combination of fast approval of a diagnostic testing set, comprehensive testing, extensive contact tracing, early detection, isolation and treatment of positive cases in treatment support centres or hospitals, and foreign entry controls. Digital tools were an essential part of contact tracing (CCTV recordings, tracing apps and GPS data on mobile phones, credit card transactions) and health service provision (remote services such as telemedicine). At the peak of the COVID-19 epidemic, school closures and social distancing measures were temporarily implemented, but a complete lockdown "Wuhan style" was averted. While the Korean approach has been successful in keeping total infections down, other countries have found it difficult to copy owing to poor preparation, plus a less sophisticated digital economy and perceptions of excessive intrusiveness.

After the first outbreak, both China and Korea have responded promptly to new local outbreaks, successfully limiting their spread. Early detection and immediate, decisive action seem to have been key to that success.

## 2.2 China and Korea as leading indicator economies?

As China and Korea were the first to impose containment measures and then the first to again loosen them, their economic developments, captured by high frequency indicators, have been closely monitored elsewhere. Chart 3 shows three standard monthly indicators – industrial production, retail sales and export growth – as well as a more novel daily mobility tracker (see below). Indicator values for the euro area (or Germany and France) are added to the graphs, as we expect the euro area economy to follow developments in China and Korea with a lag. The government response to COVID-19 in the euro area countries was heavily inspired by the Chinese approach, but with lockdowns varying in stringency and length between member states.

The mobility trackers are assumed to reflect the stringency of the containment measures, with more severe measures leading to a larger drop in mobility relative to its reference value. We track the evolution of people's mobility in Korea, Germany and France using four anonymised smart phone-based data series made publicly available by Google and Apple, covering different aspects of economic activity (scores for retail shopping and recreation, attending the workplace, driving, and public transport use, all relative to early 2020 reference values). For China, where the service provision by both tech companies is restricted, we employ an alternative indicator given by the average of daily traffic congestion and subway passengers (both expressed as a percentage of their respective 2019 averages), provided by Capital Economics. The mobility trackers confirm that containment measures in Korea were much lighter than in China, and those in Germany lighter than in France (where the lockdown was apparently as stringent as in China and of a longer duration).[1]

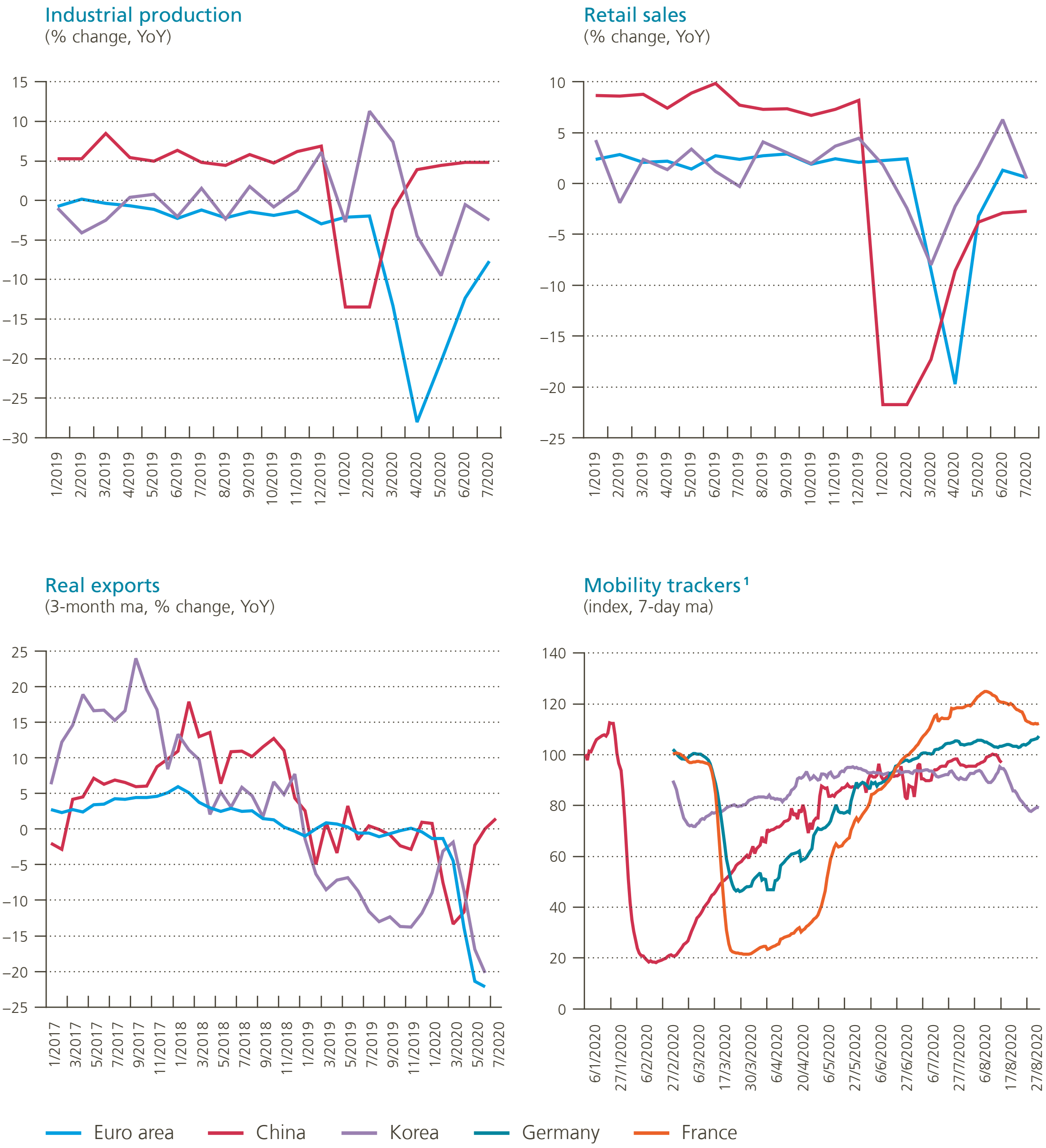
The less disruptive nature of the Korean containment strategy is reflected in the monthly data for industrial production and retail sales in the form of more moderate drops compared to China and the euro area. Korean retail sales contracted around the peak of infections in February-March, as fear of catching the virus caused people

1 Air quality is another indicator that has been used to track the evolution of China's lockdown. We confirm that in February and March, air pollution (as measured by the concentration of nitrogen dioxide) was significantly lower than during the corresponding period in 2019, especially in Wuhan. For a more sophisticated approach, see Cole *et al.* (2020).

to adjust their behaviour and in particular to avoid contact-intensive services, and these behavioural changes tend to increase when the number of infections rises (Aum *et al.*, 2020). Another interesting observation for Korea is that the growth rate of industrial production did not turn (deeply) negative until May, when the virus was already under control domestically. This development is related to a decline in external demand and exports. In contrast to Korea, the contractions in retail sales and industrial production at the peak of infections were spectacular in China and the euro area.

Chart 3

**Economic developments in China, Korea and the euro area**




Sources: CEIC, Eurostat, Statistical Office South Korea, Bank of Korea, CPB, Capital Economics, Google, Apple, Refinitiv.

1 For China the mobility tracker is defined as the average of traffic congestion across 100 cities and number of subway passengers in 9 major cities (% of 2019 average); For Korea, Germany and France the mobility tracker is defined as the average of Google mobility report scores for categories "retail and recreation", "workplaces", and "transit stations", and Apple routing requests for driving (% of Jan – 6 Feb 2020 week day-specific median).

There are also some notable differences in the patterns of recovery between China on the one hand and the euro area and Korea on the other. In China, the post-lockdown rebound in industrial production has been considerably faster than that in retail sales, whereas the opposite has been true in the euro area and Korea. This partly reflects the different focus of policy and highlights the role of fiscal support in getting economies back on their feet. China has focused on the supply side: ordering the reopening of factories early on, supporting large producers, and boosting public investment. However, China's household demand remains weak due to significant job losses (estimated between 20 and 100 million), which were only partly cushioned by the country's limited social welfare system, and increases in precautionary savings (Zenglein and Kärnfelt, 2020). In contrast, policies in the euro area and Korea have focused on the demand side: providing generous income support to households via state-funded job retention schemes (euro area), or the entitlement of workers on a temporary contract to unemployment benefits (Korea).

For export-oriented economies, lasting disruptions in world trade and global value chains are likely to act as a drag on their recovery. Indeed, Chinese, Korean and Euro area exports have plummeted in recent months, in part due to lockdowns in their trading partners. This dismal export performance is the main driver behind Korea's GDP contraction (–2.9 % year on year) in the second quarter of 2020. By contrast, the outbreak of COVID-19 during the first quarter did not push the corresponding GDP growth (1.3 % year on year) into the red.

After collapsing in the first quarter of 2020 due to interruptions in production, China's export growth recovered surprisingly well during the second quarter. Chinese exports benefited from rising foreign demand for personal protection equipment, of which it is a major global supplier, and work-from-home equipment.

The first quarter of 2020 saw China's first economic contraction since it started reopening its economy in 1978: GDP dropped by 6.8 % year on year. However, China also managed to engineer what looks like a V-shaped recovery in the second quarter, with the economy growing at a rate of 3.2 % again. Investment growth was the main driver of this recovery, with state-owned enterprises taking the lead (Zenglein and Kärnfelt, 2020). Note that these data should be interpreted cautiously, especially when comparing them internationally, because unlike in other countries, non-productive assets are not written down in China, thereby introducing an upward bias in its GDP growth estimates (Pettis, 2020). With the share of fixed investment in Chinese GDP still at about 40 %, this is definitely a concern. Scholars have questioned the reliability of China's real GDP data on other grounds too.[1]

## 3. The "third wave" – COVID-19 hits other emerging market economies

### 3.1 Direct effects of the pandemic and containment measures

The initial hope that the majority of EM(D)Es could avoid the pandemic was short-lived, as by the end of March, cases of COVID-19 had surfaced in almost every country. In addition, EMDEs' densely populated cities with clusters of poor people living in precarious conditions provide fertile ground for the spread of the new coronavirus.

Despite containment policies, the health crisis is deepening in India and Brazil as shown by the continuing rise in the number of new cases in India, or the stabilization at a very high level of more than 200 new cases per million inhabitants per day in Brazil as of early September (Chart 4). As before, the stringency of containment measures is proxied by the mobility tracker based on data provided by Google and Apple. We complement this mobility tracker by the Oxford University stringency index, conceived as a government policy response tracker based on a codification of nine types of containment measures.[2] Higher values correspond to more stringent

1 For example, Kerola (2019) compute alternative deflators to derive real GDP data and show that a simple average of all alternative measures indicates that the official growth rate may overstate actual growth by a significant margin, especially since 2014.

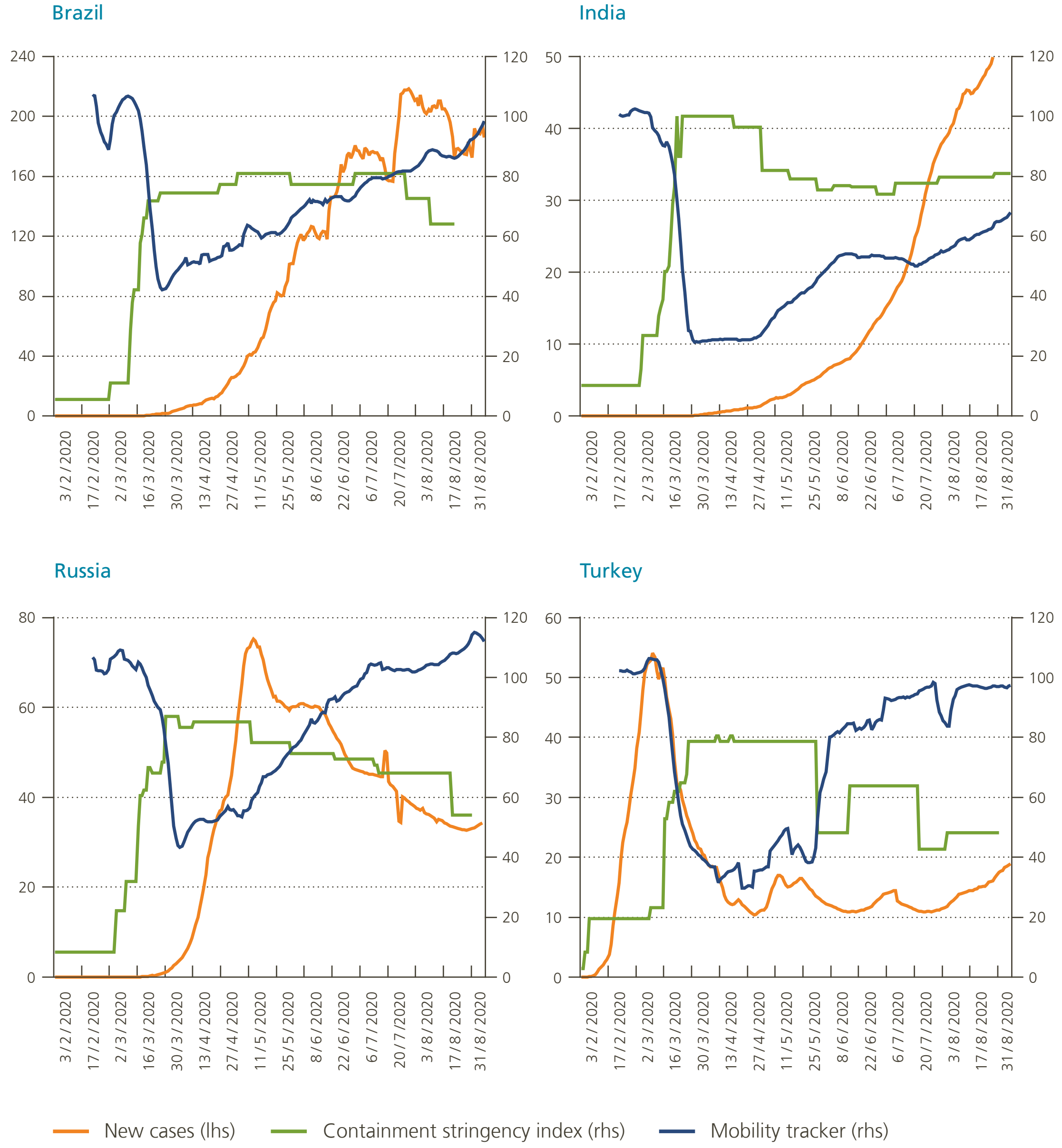
2 The nine containment measures taken into consideration are: closure of schools, workplaces or the public transport system, cancellation of public events, size restrictions on gatherings, domestic and international travel, stay-at-home requirements, and an assessment of public information campaigns.

containment policies. Whenever policies vary at the subnational level, the index is shown as the response level of the subregion with the strictest measures in place.

Brazil is the only country considered here which has adopted a *laissez-faire* approach at the national level, partly because its president believes that the economic costs associated with drastic containment measures would be prohibitively high. However, many Brazilian state governors decided to implement stringent lockdowns when

Chart 4

**The spread of COVID-19, government containment responses, and mobility in major EMEs[1]**




Sources: OWID, OxCGRT, Google, Apple.

1 New COVID-19 cases (per million inhabitants) and the mobility tracker are expressed as 7-day moving averages. The containment stringency index takes values between 0 (no restrictions) and 100 (hard nationwide lockdown). The mobility tracker is defined as the average of Google mobility report scores for the categories “retail and recreation”, “workplaces”, and “transit stations”, and Apple routing requests for driving (% of Jan – 6 Feb 2020 week day-specific median).

confronted with a rapidly rising number of new cases. This is reflected in Brazil's government policy stringency index which has reached values comparable to those in countries with national lockdowns, and is actually slower to decline.

The other three countries all imposed nationwide lockdowns with severe restrictions on movement at the end of March. With hindsight, the travel restrictions proved to be particularly detrimental in India, where rural migrants got stranded in overcrowded and insanitary urban premises that became hotbeds for infections. When, in late April, the Indian government finally permitted inter-state travel, including for migrant workers, these workers brought the virus to all corners of the country. As a consequence, India's lifting of the nationwide lockdown at the end of May had little impact because many states were forced to implement local or state-wide lockdowns, resulting in only a moderate relaxation of containment policies for the country as a whole.

Russia and Turkey fared much better in containing the virus and were able to exit their nationwide lockdowns in the middle of May and June respectively. Turkey's approach differed from the others in deciding to differentiate lockdown measures between age groups. People older than 65 and young children were required to stay at home at all times. Even after the easing of measures in June, many restrictions continued to apply to these groups. In contrast to other countries, production facilities remained open and people were allowed to go to work if they could not work from home, while schools, bars, restaurants and places of mass prayer were closed. In addition, all major cities were put under a strict curfew during weekends and holidays until the middle of June, when these restrictions on movement were lifted. This approach looks justified by the consideration that – on average – younger populations, the prevalence of "hand-to-mouth" households, the size of the informal economy, limited fiscal capacity and low healthcare capacity are all factors likely to alter the trade-off between saving lives and the economic costs (Ray *et al.*, 2020). Alon *et al.* (2020) use a model to show that EMDEs save fewer lives per lost unit of GDP than advanced economies under a nationwide lockdown.[1]

The mobility tracker for the four countries contains some information about the severity and duration of the lockdown, as well as the normalisation process. The tracker runs a qualitatively similar yet quantitatively different course in the four countries, with the stringent national lockdown that was implemented almost overnight in India being mirrored in the steepest drop in mobility. Lockdowns continue to weigh on economic activity in India and to a lesser extent in Brazil, two countries where the spread of the virus is still at alarming levels. On the other hand, the exit from the lockdown appears to be well advanced in Turkey and Russia, where mobility has regained its pre-lockdown levels.[2]

## 3.2 Indirect effects through multiple external shocks

Besides the direct consequences of the coronavirus and the resulting containment measures, EMEs were also hit indirectly (and partly before their own lockdowns) through multiple external shocks, creating a "perfect storm" (Hevia and Neumeyer, 2020). Most of these external shocks were similar in nature to those observed during the GFC but typically steeper.

### 3.2.1 Trade and commodity price decline

One key shock has been the fall in world trade, which suffered from a combination of supply chain dislocations related to virus containment measures (such as the temporary shutdown of many factories in China), weaker

1 Alon *et al.*'s (2020) conclusion is based on an incomplete-markets macroeconomic model with epidemiological dynamics in which the above-mentioned characteristics have been incorporated.

2 The effects of the various containment measures in India, Brazil, Russia and Turkey can also be gleaned from alternative indicators, such as (temperature-corrected) peak-hour electricity consumption. From this indicator it is, for example, also evident that the decline in economic activity was much larger and of longer duration in India than, say, in Russia (McWilliams and Zachmann, 2020).

demand, and new export restrictions (for example, on medical supplies and equipment) (World Bank, 2020).[1] Figures from the Netherlands Bureau for Economic Policy Analysis (CPB) indicate that the world goods trade volume declined by 12.5 % in the second quarter of 2020, on top of a 2.7 % decline in the first quarter. The 12 % fall in world goods trade from March to April 2020 was the sharpest month-on-month drop since the start of data collection in 2007. In June, world trade recouped some of its losses. At this point it is still uncertain whether, over the medium-term, the fall in trade due to the COVID-19 crisis will match or even exceed that observed during the GFC. In 2009, world trade recorded its largest total decline on record so far, plummeting by some 11 % in annual terms. Initially, several international institutions projected at least a similar decline this time around.[2] Notably, in April the WTO projected world merchandise trade in 2020 to contract by 13 % in a relatively optimistic scenario, and by 32 % in a pessimistic scenario of prolonged lockdowns. WTO economists now concede that, in the absence of very adverse developments, the fall in trade volumes is unlikely to reach the worst-case scenario (WTO, 2020).

While the fall in world output in 2020 is set to exceed that in 2009 by a large margin (cf. Chart 2), the trade elasticity of income, i.e., the magnitude of the trade response to the decline in economic activity, is expected to remain lower than in the GFC. This assumption is derived from structural factors, such as the stagnating expansion of global value chains since 2008, as well as the peculiar sectoral composition of output losses in the COVID-19 crisis, with hard-hit services accounting for a much larger share of world output than of world trade. Nevertheless, the fact that a large part of trade still takes place in complex global value chains has important implications for the transmission of trade shocks across countries. Analysis by Cigna and Quaglietti (2020) suggests that as the pandemic unfolded in China, it was China's upstream suppliers, particularly those in the Asian value chain, that were hit first and hardest.

Within services trade, tourism in particular has been severely curtailed by the COVID-19 crisis. As country borders closed, international travel collapsed in March and reached its nadir by the end of April, when the number of commercial flights (tracked by Flightradar24) was only about a quarter of the traffic in early January. The recovery since then has been rather slow. According to the UN World Tourism Organization, there were 300 million fewer international tourist arrivals in January-May 2020 compared to the same period in 2019, translating into a loss of $ 320 billion in tourism revenues. This corresponds to three times the total loss in GFC year 2009 (UNWTO, 2020).

The decline in world trade volumes was accompanied by a steep drop in commodity prices, starting in late January, at the time of the Wuhan lockdown, and then intensifying as the spread of the coronavirus transformed into a pandemic. Oil prices suffered an especially steep drop which was initially magnified by abundant supply (courtesy of an oil price war between Russia and Saudi Arabia, cf. section 1.2).[3] Oil prices gradually recovered from May onwards but are expected to remain close to $ 40 per barrel on average over 2020, according to forecasts by the US Energy Information Administration, the ECB and the IMF. Such prices are much lower than most oil exporters' fiscal break-even prices, i.e., the prices needed to balance the government budget (IMF, 2020c ; BIS, 2020). Other commodity prices have also started to recover, at varying speeds. The price recovery has been much faster for industrial metals such as copper and especially iron ore, because of China's boost in infrastructure investment to support its domestic economy (see section 3.4.2).

Chart 5 (left panel) shows the impact of the trade shock on our selected EMEs. In April, India's merchandise exports plummeted by a record 60 % year on year in dollar value terms, testimony to the extreme weakness of external demand for the country's export products (including engineering goods, jewellery and gems) and supply-side restrictions in exporting companies. Russia and Turkey also saw their goods exports shrink by more

1 World trade had already been weakened before the COVID-19 pandemic by the lingering US-China trade war and a deceleration in global investment and manufacturing production (NBB, 2020).

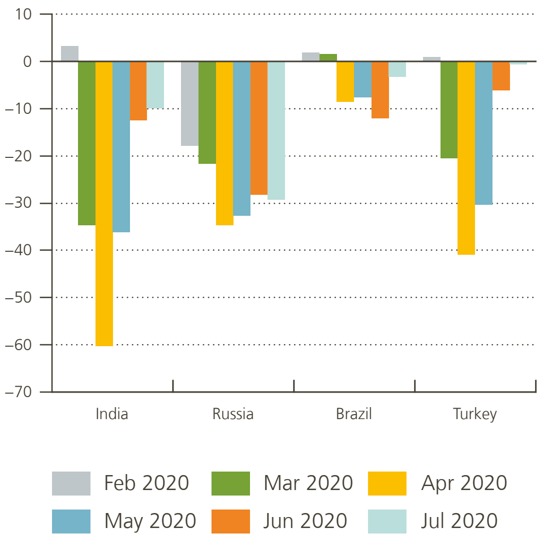
2 See IMF (2020b) and World Bank (2020). Baldwin (2020), who coined the term "Great trade collapse of 2009", has talked about the "*Greater* trade collapse of 2020".

3 On 20 April 2020, the US West Texas Intermediate crude oil benchmark temporarily dropped below zero ahead of May's contract expiry date, due to a lack of available storage capacity.

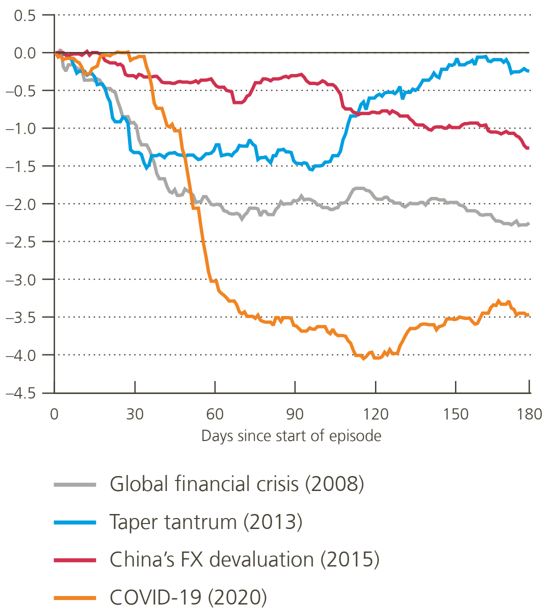
## Chart 5

### EMEs were hit by multiple external shocks

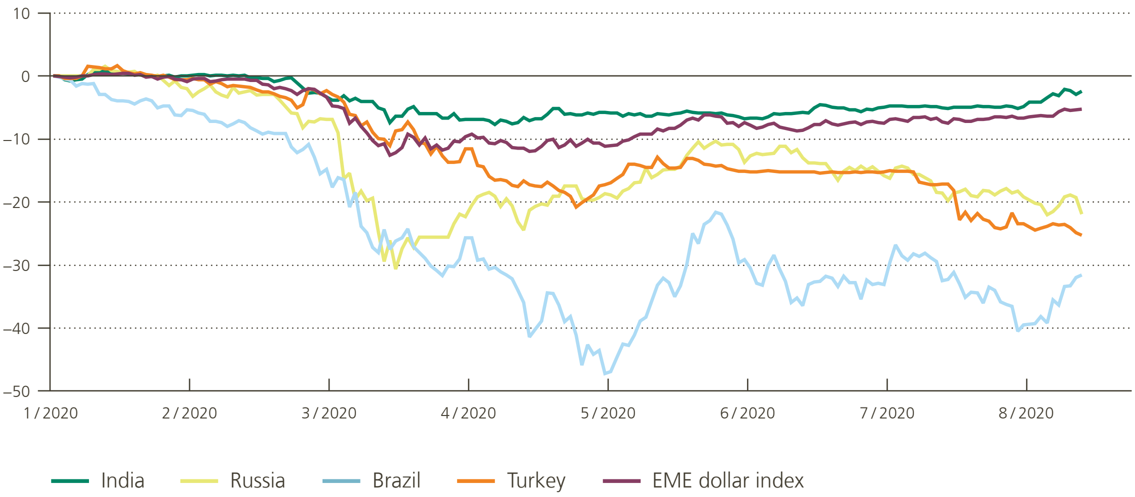
**Export values**
(in $, % change, YoY)




**Portfolio equity and local currency bond flows**[1]
(cumulative flows, % of IIP)




**Nominal exchange rates vs US dollar**[2]




Sources: IMF (MCM update from GFSR, WEO), Federal Reserve Board, Refinitiv, OECD.

1 Based on a sample of 15 EMEs with daily data availability. Start of episodes is defined as follows: 15 Sep 2008 (Global financial crisis), 23 May 2013 (Taper tantrum), 25 Jul 2015 (China's FX devaluation), and 21 Jan 2020 (COVID-19).

2 The Federal Reserve EM dollar index is a weighted average of the FX value of the US dollar against the currencies of major EME trading partners of the United States.

than 30 % in both April and May. Brazil's goods exports declined much less, as they were partly supported by a recovery in Chinese commodity demand. While Turkey stands to gain from lower oil prices, it is also among the countries most impacted by the decline in tourism (IMF, 2020d).

### 3.2.2 Capital outflows and exchange rate depreciations

Given the mounting concerns about the COVID-19 fallout and threats to EMEs' growth models (often dependent on trade, commodity exports and / or global value chains), international investors retrenched. In March alone, more than $ 80 billion in portfolio capital was withdrawn from EMEs, the largest single-month outflow on record and a much more drastic move than during the GFC, the 2013 taper tantrum, or the 2015 Chinese shock devaluation (Chart 5, middle panel).[1] Cumulative portfolio outflows between mid-January and May added up to more than $ 120 billion, or nearly 4 % of asset holdings. By June, the capital from foreign institutional and retail investors started to return, but the recovery remained tepid and uneven. After the initial, broad-based sell-off, investors began to differentiate more among EMEs, taking into account countries' vulnerabilities and prospects. Several countries, including Turkey, were still seeing large capital outflows, whereas others, including China, saw net inflows. In terms of asset classes, EME (hard currency) bond fund flows led the revival as EMEs successfully tapped international bond markets, while equity funds continued to feel pressure. In some EMEs, portfolio outflows were further aggravated by sharp reductions in foreign direct investment. Other (mostly bank-related) investment flows held up in general (IMF, 2020e).

The initially large capital outflows went together with a sharp depreciation of EME currencies, often in spite of significant central bank intervention in foreign exchange markets (BIS, 2020).[2] Over the first quarter of 2020, the Brazilian real and the Russian rouble both lost up to 30 % of their value against the US dollar (Chart 5, lower panel). Whereas the rouble went on to make up part of that loss over the second quarter, the real tanked further and registered a cumulative depreciation of almost 50 % by mid-May, before a correction took place. The Turkish lira also depreciated by 20 % between January and early May. In June and July, EME currencies remained relatively stable vis-à-vis the dollar. The Turkish authorities sold billions of dollar reserves through state banks in an attempt to keep the lira from weakening beyond the symbolic 7 lira per dollar mark, but that attempt was ultimately unsuccessful (Szalay and Samson, 2020). August saw renewed currency depreciation in major EMEs. Similar (often even larger) depreciations of EME currencies were observed during the GFC.

### 3.2.3 Tightening financing conditions

Unlike in the GFC and most previous financial crises, where problems in the financial sector toppled the real economy, the COVID-19 pandemic saw disruptions in the real economy threatening to overwhelm the financial sector (BIS, 2020). Whereas the early lockdown in China seemed to have little effect on global financial markets, the new coronavirus infection cluster in Italy as of late February led to a rude awakening. In a sharp correction from the widespread optimism of early 2020, the prices of equity and other risk assets nose-dived as investors fled to safety and liquidity. At their low point in March, Morgan Stanley's equity benchmarks for advanced economies (MSCI World) and EMEs (MSCI EM) both traded more than 30 % lower than at the beginning of the year. While these were among the sharpest equity price drops ever observed, in percentage terms the declines reached only about half the magnitude of the peak-to-trough sell-off during the GFC (IMF, 2020f). Global market conditions largely stabilised from the end of March onwards, following the announcement of an array of new measures by the Federal Reserve, the ECB and other central banks in advanced economies and EMEs, and large fiscal stimulus packages.[3] Both the IMF (2020g) and the BIS (2020) note that, by June, the financial market revival was so strong

1 Taper tantrum refers to the financial market panic that followed the US Federal Reserve's announcement in June 2013 that it planned to "taper"/slow down the purchases of Treasury bonds under its quantitative easing programme. In August 2015, the People's Bank of China surprised financial markets with a series of devaluations of the yuan, allegedly as part of its efforts to increase the role of market forces, but triggering large capital outflows.

2 According to Goel *et al.* (2020), in March alone EMEs sold $ 160 billion of foreign exchange reserves through spot and derivative operations. While the amounts in US dollars exceeded those in the 2015 and 2018 crisis episodes and approached GFC levels, as a share of total reserve stocks these interventions were significantly smaller (reflecting significant reserve accumulation in most EMEs in the 2010s).

3 See Boeckx *et al.* (2020) for a detailed overview of the ECB's monetary policy response to the COVID-19 pandemic.

as to raise questions about a possible disconnect between investors' bullish mood and the developments and uncertainty on the ground in the real economy.[1]

Notably, and initially somewhat paradoxically given the coronavirus' origins, China's equity markets held up comparatively well throughout these gyrations, probably as a result of the country's relative success with containing domestic virus outbreaks and its strong economic rebound. In early July, Chinese equities experienced a very steep rally, which appeared to be bolstered by the Chinese government talking up the bull market through state-run media. Along with the foreign money pouring in, the momentum was fuelled by Chinese retail investors who still have few options to build their savings besides buying property or stocks (Stevenson, 2020). The Brazilian, Russian and Indian equity markets all underperformed relative to the MSCI EM benchmark, seeing an even steeper drop in valuations and a slower recovery. The Turkish equity market performance was better than average between January and July 2020, but then worsened with the renewed depreciation of the exchange rate. Credit spreads on hard currency EME bonds also widened considerably in March, especially in Turkey and Brazil, where they were already relatively elevated. Spreads have since narrowed again but typically remain above pre-COVID-19 levels.

## 3.3 Pre-existing vulnerabilities

The severe health effects and direct and indirect economic impacts of the COVID-19 crisis on EMEs depend partly on pre-existing country characteristics, which can make countries vulnerable because of the resulting *exposure* to particular shocks and/or the effect on countries' *resilience*, i.e., their ability to bounce back from shocks. Another important part of the ultimate impact of the crisis is determined by countries' policy reactions. The next two subsections zoom in on two broadly defined sources of vulnerability: the state of health systems and degree of informality; and EMEs' fiscal and external positions. Section 3.4 discusses EMEs' economic policy interventions, with a focus on fiscal and monetary policy.

### 3.3.1 Health systems and informality

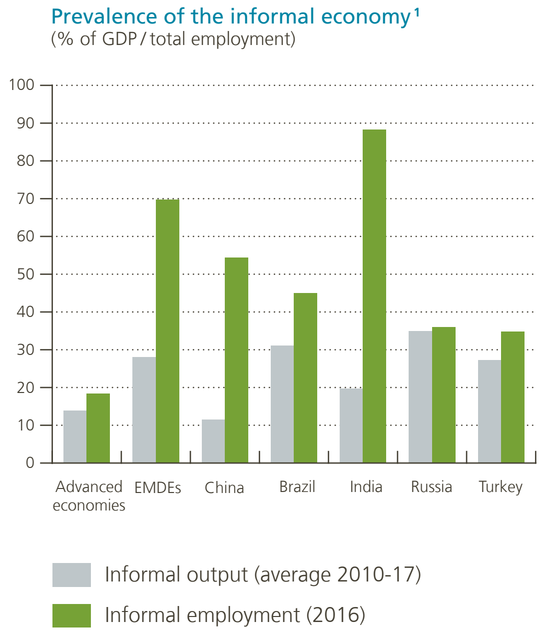
Besides the already mentioned shortcomings in their containment strategies (cf. section 3.1), India and Brazil's difficulties with getting the spread of the coronavirus under control may also be explained by the shortage of health care facilities, especially in their poorest (often densely populated) areas, as well as the relatively high degrees of informality in their economies. Weaker health systems may also be a bottleneck in the rapid distribution of a vaccine, once it becomes available.

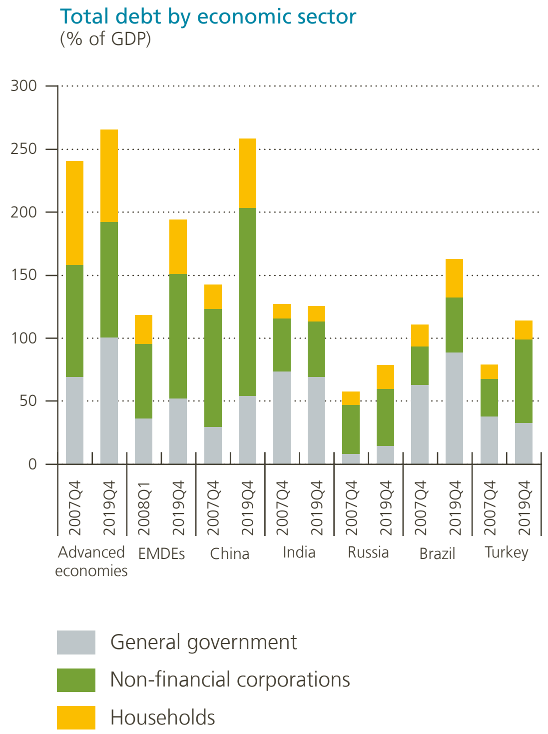
Hospital and clinical capacity are typically less developed in EMDEs than in advanced economies, thereby increasing the risk that health care systems are overwhelmed (World Bank, 2020). One common, yet imperfect, measure of hospital capacity is the number of hospital beds in intensive care units (ICU) per thousand persons. The chances of recovering from COVID-19 in fact depend not only on the availability of an ICU bed, but also on the presence of trained doctors, ventilators, appropriate pharmaceuticals, etc. As is evident from figures reported by the WHO, the number of ICU beds varies widely across countries but tends to be lower in EMDEs than in advanced economies. In our sample, India has the lowest number of ICU beds available, followed at a distance by Brazil and Turkey. Russia is a positive outlier, with more ICU beds than in many advanced economies, possibly a legacy of its communist past.

1 Delle Monache *et al.* (2020) contend that, rather than over-exuberant stock investors pricing in a fast economic recovery from the COVID-19 crisis, such high asset valuations mostly reflect a secular decline in the expected return on government bonds. See also Igan *et al.* (2020), who put more emphasis on the role of central banks' unprecedented monetary policy interventions in lifting asset valuations.

Chart 6

**EMEs are characterised by high informality and rising debt burdens**




Sources: ILO, Medina and Schneider (2019), BIS (Credit statistics).

1 Informal output comprises all economic activities which are hidden from official authorities, for fiscal, regulatory or institutional reasons. Informal employment includes employers and own-account workers in the informal sector, contributing family workers, and employees without formal contracts.

Informality exacerbates the health and economic impacts of COVID-19 through various channels (World Bank, 2020).[1] First of all, informal workers often live and work in crowded places and use cash for their transactions, factors known to enable the spread of the coronavirus. Informal firms also tend to operate in the services sector, which has been harder hit by lockdowns and other containment measures. Workers in poorer countries typically have less scope to engage in teleworking (Dingel and Neiman, 2020), and the inability to work from home is particularly pronounced for the (informally) self-employed, who thus bear a greater cost of social distancing policies (Gottlieb *et al.*, 2020). Moreover, informal workers tend to be excluded from government benefits, such as replacement incomes, which require registration under the national social security system. In addition, informal workers generally have low savings of their own to buffer temporary income losses during containment, making them more prone to fall into poverty. For example, Ray *et al.* (2020) estimate that almost 40 % of Indian households have insufficient savings to get through even a short lockdown of just three weeks.

Estimates by Medina and Schneider (2019) and the ILO confirm that, in our sample of major EMEs, the informal sector accounts for a higher share of total output, and informal workers represent a higher share of total

1 Informality can be expressed in terms of economic activity or employment. The informal or shadow economy comprises all economic activities which are hidden from official authorities, for fiscal, regulatory or institutional reasons (Medina and Schneider, 2019). According to ILO definitions, informal employment includes employers and own-account workers in the informal sector, contributing family workers, and employees without formal contracts.

employment, than in advanced economies (Chart 6, left panel).[1] The prevalence of informal employment is highest in India and second highest in China, due to the relative importance of self-employment (e.g., street vendors in cities and small farmers in rural areas) and casual labour provided by undocumented rural migrants.

### 3.3.2 Fiscal and external positions

In 2019, EME fiscal balances were on average weaker than before the GFC. The deterioration has been most pronounced in China and in Brazil, where the primary balance turned negative after 2014, following more than a decade of surpluses. In Turkey and India, too, the fiscal policy stance had become more accommodative. Conversely, in Russia the non-oil primary balance had improved considerably in recent years, thanks to ambitious fiscal consolidation. However, the Russian government remains heavily dependent on oil to balance its books and faces tighter financial conditions due to shallow domestic markets and constrained access to international markets under the current financial sanctions (Dabrowski and Collin, 2019). EME current account balances, a proxy of an economy's overall external financing needs, also tended to be weaker in 2019 than in 2008. Turkey represents a notable exception to this, but its "much improved" external position reflects the lagged adjustment of external balances to the lira's sharp depreciation in 2018 (IMF, 2020d).

Even before the COVID-19 crisis, overall debt levels were on the rise in most EMEs. Government, corporate and household debt all increased relative to GDP, but at varying speeds and from different starting points in individual countries (Chart 6, right panel). In line with the increasing fiscal deficits, government debt increased most notably in China and Brazil. The fast rise in EME corporate debt is mostly explained by China, where it includes "shadow borrowing" by Chinese local governments through corporate entities (Ma, 2019), and, to a lesser extent, by Turkey. Household debt also grew significantly in China, but from a relatively low base.

With higher public debts and lower fiscal balances in recent years, EMEs' fiscal space was more constrained than on the eve of the GFC. The COVID-19 crisis itself is expected to add substantially to public debt burdens, due to significantly lower economic growth, a further sharp deterioration in fiscal balances (because of relief packages and other additional spending, plus lower revenues; see further), and possibly the realisation of (state-owned enterprise-related) contingent liabilities (Cantu *et al.*, 2020). In June, the IMF (2020b) projected general gross debt of EMEs to increase by 15 percentage points of GDP on average under its baseline scenario, from 52 % of GDP in 2019 to almost 67 % of GDP in 2021. For some countries, especially those exhibiting other vulnerabilities, the increase could raise concerns about future debt sustainability.[2]

The COVID-19 crisis has again brought into focus two important dimensions of EME debt: first, the degree to which it is denominated in foreign currency, which makes EMEs vulnerable to currency depreciations; and second, the dependence on non-resident investors (Cantu *et al.*, 2020). With respect to the first dimension, most EME governments have now overcome "(domestic) original sin", defined as the inability to borrow domestically long-term, at fixed rates, and in local currency (Hausmann and Panizza, 2011). Indeed, following major crises in the 1990s and early 2000s, EMEs deliberately reduced their exposure to potential currency devaluations by developing their (local currency) government bond markets at home. However, several EMEs still have a substantial share of their internationally issued government bonds denominated in foreign currency. This is less of a problem for a country like Russia, which has ample foreign exchange reserves, than for Turkey, whose international reserves are well below the IMF's suggested reserve adequacy benchmark.[3]

1 The share of informal employment generally exceeds the share of informal economic activity because informal employment is concentrated in sectors characterised by low productivity (and low pay).

2 While advanced economies tend to have larger debt-to-GDP ratios than EMEs (cf. Chart 6, right panel), the latter are believed to exhibit higher "debt intolerance": EMEs start to experience market stress and default pressures at levels of debt that are easily manageable by advanced economy standards, partly because of EMEs' history of serial default and high inflation (Reinhart *et al.*, 2003). Moreover, EMEs' debt structure tends to be more risky than that of advanced economies, including in terms of currency denomination, maturities and foreign ownership (see main text).

3 On Turkey's intricate reserves position, see Setser (2020a).

On the second issue, non-resident investors held close to 20 % of EME local currency government securities as of mid-2019, up from about 10 % back in 2007, according to updated figures from Arslanalp and Tsuda (2014). Foreign investor participation in government bonds is a double-edged sword. On the one hand, it increases the pool of funding and may add to the liquidity of domestic bond markets, thereby lowering borrowing costs, especially when the domestic investor base is less developed. On the other hand, foreign portfolio investment holds risks: it increases vulnerability to global financial shocks, as foreign capital tends to be more fickle in times of stress (cf. section 3.2.2).

Hofmann *et al.* (2020) show that EMEs with higher foreign ownership in their local currency bond markets have experienced significantly larger increases in their local currency bond spreads during the COVID-19 pandemic, with exchange rate depreciation acting as a key aggravating factor. This can be explained by what Carstens and Shin (2019) have called the "original sin redux", i.e., borrowing in local currency from foreign lenders mitigates the currency mismatches for the borrower but shifts them to the lender. EME currency depreciation lowers the value of assets in terms of foreign investors' own currencies (in which their risk limits also tend to be denominated). Large depreciations may therefore prompt foreign investors to engage in asset sales, pushing up EME local currency bond spreads in the process. Such dynamics have indeed played out in recent months.

More so than governments, (non-financial) corporate borrowers in many EMEs have increasingly turned to external sources of funding since the GFC, much of it in bonds and loans denominated in foreign currencies. This exposes them to sudden stops and potentially adverse balance sheet effects (depending on the company's asset structure). While the absolute increase in foreign currency-denominated corporate debt is most spectacular in China, it is also apparent in other EMEs, notably Turkey and Russia whose companies have taken on much additional euro-denominated debt in recent years. One should note that traditional international financial statistics, based on the borrowers' residency rather than their nationality, tend to underestimate the foreign currency debts of firms. These statistics ignore the fact that companies may have issued debt via offshore subsidiaries (Coppola *et al.*, 2020). Avdjiev *et al.* (2020) show that the US dollar-denominated corporate debt of several major EMEs, notably Brazil, China, India and Russia, increases considerably when such offshore debt issuance is taken into account.

## 3.4 Policy responses

### 3.4.1 Monetary policy responses

In the first months following the outbreak of the pandemic, the People's Bank of China (PBOC) continued its easing cycle, which had already started in 2018. The policy rate was cut by another 30 bps to 2.2 %, but has remained unchanged since April. Instead, the PBOC has focused more on liquidity injections as a part of its monetary policy response to the crisis. One way to boost liquidity is to reduce the required reserve ratio (RRR). The average RRR has declined by a further 100 bps this year, continuing its longer-term downward trend. In addition, the PBOC has provided ample liquidity to the banking system via the use of open market operations, its standing lending facilities, and direct lending for specific purposes (e.g. SME support).

One striking difference compared to the GFC concerns Chinese credit growth, which peaked near 35 % year on year in late 2009 but shows only timid signs of accelerating in the current crisis (Chart 7, left panel). However, we do notice a pickup in Chinese shadow financing and corporate bond debt issuance. All this suggests that there is still a shift in priorities away from efforts to encourage deleveraging in the financial sector, particularly the shadow financing branch, towards a greater emphasis on maintaining a high growth rate of economic activity. The combination of monetary easing and lower economic growth has led to a jump in the stock of outstanding financing as a percentage of GDP.

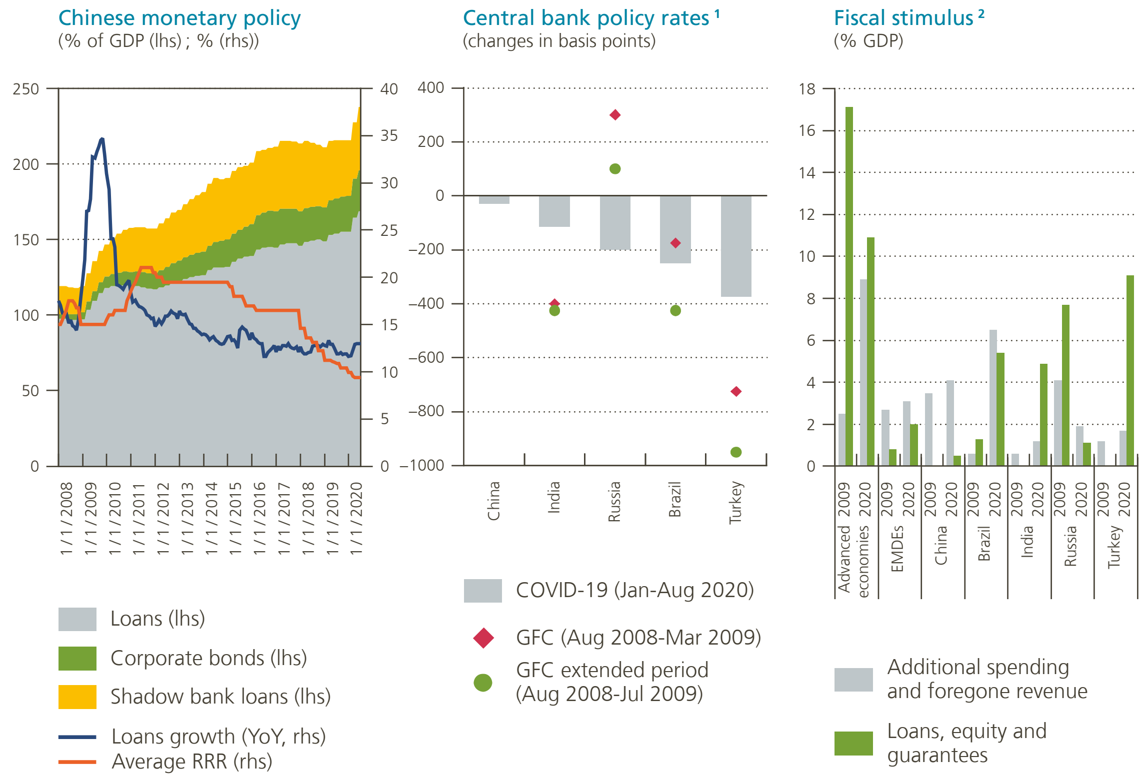
Nevertheless, a comparison of the monetary policy response of the PBOC in the current crisis versus the GFC is not straightforward because the monetary policy framework has been continuously adapted. Empirical research has come to mixed conclusions. Using a dynamic factor model, Funke and Tsang (2020) conclude that China's post-COVID-19 monetary policy is as expansionary as it was at the time of the GFC. In contrast, according to a financial conditions index by Gilhooly *et al.* (2020) which incorporates – in addition to the broad array of policy tools – other factors such as bond yields, money, credit, risk premia, volatility and foreign exchange, current financial conditions are just as accommodative as during the 2015-2016 Chinese financial market scare, but less accommodative than following the GFC, when they became exceptionally loose.

The Bank of Korea cut its policy rate by 50 bps in March 2020 and by another 25 bps in May to 0.5 % and implemented a range of measures to increase liquidity in response to the crisis.

Central banks' room for policy manoeuvre during crises has typically been narrower in EMEs than in advanced economies, due in large part to the challenges posed by big swings in capital flows and exchange rates (BIS, 2020). Cutting interest rates to stimulate the economy may worsen capital outflows and exchange rate depreciation, with possibly adverse balance sheet effects. If inflation expectations are not firmly anchored, depreciation entails the risk of accelerating inflation. However, over time EMEs have adopted more flexible policy frameworks (deviating from textbook models), combining inflation targeting with exchange

Chart 7

**EMEs have eased monetary policy and provided fiscal stimulus**




Sources: CEIC, National central banks, IMF (Fiscal Monitor, Policy tracker), Refinitiv.

1 The PBOC's monetary policy only shifted towards an interest rate corridor in 2016.

2 Cut-off date for individual countries' fiscal measures in 2020: 13 August. Aggregates for 2020 are taken from the IMF WEO – Fiscal Monitor update of June. For 2009, loans, equity and guarantees are based on pledged amounts taken from the IMF Fiscal Monitor, not actual amounts.

rate intervention, active use of macroprudential tools, and sometimes capital flow management measures (BIS, 2019). This flexibility has made it more feasible to cut interest rates in response to the COVID-19 crisis.[1] The central banks of India, Turkey, Russia and Brazil have all implemented multiple policy rate cuts, unlike during the initial stages of the GFC in the case of the latter two (Chart 7, middle panel).[2]

As the situation deteriorated and financial market turmoil ensued, EME central banks introduced a myriad of additional emergency measures to stabilise financial markets and restore confidence. Following interventions by the Fed, the ECB and other advanced economy central banks, several EME central banks themselves engaged in new long-term asset purchase programmes (often for the first time ever); this was the case in India and Turkey, as well as Mexico, Chile, Colombia, the Philippines, Indonesia, South Africa and a few Eastern European countries. The announcement of quantitative easing (QE) interventions by EMEs had noticeable direct short-term impacts on local currency government bond yields, on average even more so than QE announcements in advanced economies (Hartley and Rebucci, 2020). These positive initial market reactions suggest that the programmes successfully restored investor confidence and did not lead to higher inflation expectations, for example due to fears of fiscal dominance.[3] However, market reactions varied between countries, depending on initial conditions as well as on the scope, size and communication of the QE programmes (Arslan *et al.*, 2020). Some EME central banks, like the Bank of Thailand, even went beyond buying government bonds and launched corporate bond purchase programmes (BIS, 2020).

EME central banks also engaged in liquidity provision through an expansion of standing facilities, a lowering of reserve requirements, and new specialised facilities aimed at SMEs and others. Moreover, some central banks organised foreign exchange (typically US dollar) auctions, and adapted macroprudential rules[4] and other regulations, such as restrictions on bank/corporate dividends, short-selling bans, etc.

Crucial as these central bank responses may have been, they have important limitations. As emphasised by the BIS (2020), central bank tools can provide temporary financing, but cannot transfer real resources. As such, these toolkits can only assist borrowers in surviving if their income losses are not too great. This points to the key, complementary role of fiscal policy.

### 3.4.2 Fiscal policy responses

In view of the severe economic shocks caused by the pandemic, many governments, including those in the major EMEs, have been forthcoming with emergency measures to safeguard people's incomes and to prevent corporate bankruptcies. The IMF is keeping a record of all measures announced by G20 countries (and beyond). On this basis, the IMF estimated in its June 2020 WEO update that the average discretionary fiscal response including loans, equity injections and guarantees in EMDEs, at 5 % of GDP, was considerable but still less than a third of the size of the average response in advanced economies (Chart 7, right panel). In EMDEs, 60 % of the value of these measures consists of additional spending and delayed or forgone revenues due to discretionary decisions, and have a direct impact on government budgets. The other 40 % covers instruments such as loans, equity injections and guarantees, including through state-owned banks and enterprises. The latter type of support helps maintain solvency and limit bankruptcies but could also further worsen public finances further down the line. The direct fiscal stimulus in EMDEs in the current crisis already exceeds the support they provided in 2009 (Alberola *et al.*, 2020). Furthermore, with the exception of Russia, EMDEs provided very little indirect support in the form of loans, equity injections and guarantees during the GFC (BIS, 2020).

1 For example, using foreign exchange interventions to counteract exchange rate swings and/or macroprudential policy to stabilise domestic financial conditions can take some pressure off interest rate policy, allowing it to be used more countercyclically.

2 The central bank of Turkey may, however, be forced to hike its policy rates in the near future, in view of the continuing capital outflows and pressure on its currency combined with fast dwindling foreign exchange reserves.

3 Dabrowski and Dominguez-Jimenez (2020) point to some of the longer-term risks if EME central banks were to expand such QE programmes.

4 In Brazil, for example, loan provisioning rules were made more flexible and capital buffer requirements were temporarily lowered. In Turkey, the loan-to-value limit on mortgages was increased.

At first glance, the current fiscal stimulus provided by the Chinese government (4.1 % of GDP) seems to be more generous than in 2008‑2009 (3.5 % of GDP). And this should be encouraging, because the Chinese response to the GFC – both fiscal and monetary – has been credited with supporting a rapid recovery in many EMDEs (primarily through the commodity price channel) and the global economy in general. Alas, such a cursory comparison is misleading, and digging deeper reveals some important differences between the two episodes of fiscal stimulus, which should lower our hopes.

The total size of the Chinese fiscal stimulus in response to the GFC has been estimated by some observers as high as RMB 4 trillion, or 12.5 % of China's 2008 GDP (Fardoust *et al.*, 2012), much higher than the IMF's estimate. This large discrepancy is partly explained by the fact that the stimulus was spread over several years: the IMF estimates another 2.7 % of GDP of additional stimulus for 2010. Most importantly though, a large part of the discretionary spending took place outside the boundaries of the central government, through the state-owned enterprises at the subnational level (local SOEs are not included in the general government accounts). This occurred because the stimulus had an overwhelming focus on traditional infrastructure investments (transport and energy) and was implemented by the local governments who were eager to meet their growth targets and displayed a lot of creativity for that purpose. Local governments engaged in partnerships with local SOEs for the implementation of these infrastructure investments and created financing vehicles through which they gained access to bank loans. As both local government financing vehicles and SOEs benefited from implicit government guarantees, banks perceived them as low-risk clients and extended new loans on favourable conditions, resulting in strong credit growth (cf. section 3.4.1).

As regards the current crisis, as of 30 July 2020, an estimated RMB 4.6 trillion (or 4.1 % of 2019 GDP) of new discretionary measures have been announced. Of course, more stimulus may follow but the increased leverage since the GFC has reduced Chinese policy space. The first measures announced aimed to boost epidemic prevention and control, as well as the production of medical equipment, to reinforce the social safety network, and to support SMEs. Considering the still limited coverage of the Chinese welfare system and the difficulties in reaching all SMEs, their ability to support growth is uncertain. For this reason, Prime Minister Li Keqiang unveiled the government's intentions to step up investments, particularly in the digital economy, at the beginning of the annual meetings of the National People's Congress on 22 May; that constitutes a return to China's old recipe for stimulating its economy. As usual in China, the high-level call for action will be implemented by local governments in the form of projects, focused on improving China's "new" infrastructure such as 5G, electric car charging facilities, data centres, artificial intelligence, etc. (Haasbroeck, 2020), sectors in which China wants to develop its own strength but which are less import intensive. In contrast to the previous massive stimulus, investment projects will be financed in a more transparent way through local government bond issuance.[1] Local governments are also allowed to issue more "special purpose" bonds, which provide an off-budget source of financing for infrastructure projects that can be paid off with the cash flow generated by the project. A final difference in relation to earlier stimulus packages is a greater reliance on private sector investments through the involvement of the private, Big Tech companies in cooperation with the government. This design could improve the selection of projects, although there is a risk that their involvement in such government projects could turn the Big Tech companies into "a new generation of SOEs" (Meinhardt, 2020).

In Korea too, fiscal policy has become expansionary in response to the crisis. The IMF estimates its current discretionary response at 3.1 % of GDP, and its indirect support through loans, equities and guarantees at nearly 10 % of GDP.

As explained before, some large EMEs, such as Brazil and India, are still struggling to stop the spread of COVID‑19, with dire consequences for their people and economies. A strong and well targeted fiscal response may therefore be warranted to alleviate hardship. This is exactly what Brazil has done: its congress declared a state of "public calamity" and its government suspended compliance with all budgetary rules, allowing it

1 The central government's ministry of finance has set bond quotas for the local governments at RMB 4.73 trillion, including RMB 3.75 trillion in special purpose bonds in 2020.

to pass large emergency packages targeting vulnerable households and SMEs. The accumulated total of new spending measures and forgone revenues now amounts to an impressive 7.3 % of GDP. In addition, Brazil's public banks are expanding credit lines for businesses and households, with a focus on supporting working capital (credit lines add up to 4.5 % of GDP), and the government will back about 1 % of GDP in credit lines. Support measures in India and Turkey are also quite generous, but they predominantly take the form of credit provision and guarantees for businesses and farmers, as well as equity injections into financial institutions, the electricity sector (India) and aviation (Turkey). In Russia, high sensitivity of budget balances to fluctuations in energy prices, and limited access to international capital markets (Dabrowski and Collin, 2019) have impelled its government to act more cautiously, as reflected in a relatively modest direct fiscal impulse. In contrast to others, the Russian government has not (yet) suspended its fiscal rule, which aims to reduce the procyclicality of fiscal policy at the cost of reducing the government's flexibility to react to other shocks.[1]

Beyond the selected economies, it is expected that fiscal balances will deteriorate sharply in all EMDEs, and not only as a result of the discretionary fiscal measures taken in response to COVID-19. Other factors that will put pressure on the budgets include the business cycle, lower commodity revenues and higher external borrowing costs, as global financial conditions remain tighter than they were before the outbreak of the pandemic. This will further constrain EMDEs' room to manoeuvre.

### 3.4.3 International support

While EMEs have employed their own monetary and fiscal policies as a first line of defence in the battle against the economic fallout from the COVID-19 pandemic, this may not suffice if the crisis persists over a longer period, especially not for those EMEs that are fiscally constrained and/or may experience problems in accessing external finance at reasonable cost, going forward.

With the notable exception of China, which for now seems to be recovering from the crisis largely on its own, EMEs may be counting on policy actions in advanced economies. Indeed, the decisive and extraordinarily large monetary and fiscal stimulus of advanced economies early on in the pandemic has contributed to the stabilisation of global financial markets and allowed (mostly higher-rated) EME governments and companies to issue hard currency debt at an historically high pace in the second quarter of 2020 (Mühleisen *et al.*, 2020). The strength of EMEs' economic recovery will depend heavily on global interest rates remaining low and on a resumption in external demand for their exports from advanced economies. Furthermore, it will be crucial to avoid a rekindling of US-Chinese trade and technology tensions, which could result in new tariffs and other trade restrictions and hamper an internationally coordinated monetary and fiscal response to the crisis, say through the G20.

The most vulnerable EMEs may also have to rely on the "global financial safety net", which encompasses bilateral support from central bank currency swaps, support from regional financing arrangements, and multilateral support including IMF lending (Essers and Vincent, 2017). The US Federal Reserve has been quick to reactivate its GFC-era currency swap arrangements with EMEs Brazil and Mexico, and has initiated a new, temporary Foreign and International Monetary Authorities (FIMA) Repo Facility, allowing a wider range of EME central banks to exchange their holdings of US Treasury bonds into US dollars.[2] Whereas FIMA helps in reducing the risk of central bank fire sales of US Treasuries, it is no substitute for EMEs' self-insurance through reserve accumulation (Garcia-Herrero and Ribakova, 2020). The ECB, too, has opened currency swap lines with Bulgaria and Croatia, and repo lines with Romania, Hungary, Serbia, Albania and North Macedonia. By analogy with FIMA, the ECB also created its own emergency repo facility with wider country eligibility, called the Eurosystem

1 The Russian fiscal rule requires that, while natural resource prices are high (an oil price above $ 42 per barrel), the Federal Treasury uses the surplus to buy foreign exchange, and then sells it once prices fall below the threshold. The National Welfare Fund currently stands at 9.8 % of GDP, and it will be allowed to finance up to about 2 % of the government deficit. The rest of the budget shortfall will be financed through borrowing.

2 Korea and Singapore, which by some accounts still qualify as EMEs, also saw their previous currency swap arrangements with the Federal Reserve renewed. Some EME central banks, including those of Indonesia, Colombia and Argentina, have chosen to communicate on their access to FIMA so as to comfort markets about future dollar liquidity (Garcia-Herrero and Ribakova, 2020) and perhaps to signal the Federal Reserve's approval of their FIMA eligibility.

Repo Facility for Central Banks (EUREP). Whereas these and other central bank swap and repo arrangements may have instilled confidence in some EMEs and brought down cross-currency basis swap spreads, they were largely precautionary. Actual drawing on these facilities by EMEs has been minimal so far.

Meanwhile, the support provided by regional financing arrangements aimed at EMEs, which include the Chiang Mai Initiative Multilateralization, the Latin American Reserve Fund, the Eurasian Fund for Stabilization and Development, and the Arab Monetary Fund, has been almost negligible (Segal and Negus, 2020). Multilateral development banks – most notably the World Bank, the Asian Development Bank and the Inter-American Development Bank – and the IMF have attempted to fill the void.

The IMF in particular has ramped up its central role in the global financial safety net. Between the intensification of the COVID-19 pandemic in late March 2020 and the end of August, the IMF approved a record total of nearly $ 88 billion in financial assistance to 80 EMDEs, and more support is in the pipeline. Most of the IMF arrangements have been structured as rapid-disbursing emergency financing facilities to low-income countries and smaller EMEs. Larger EMEs, most of which do not face an immediate default risk but show balance sheet weaknesses and could use cheap longer-term official financing as a substitute for some of the private capital that has vanished, are keeping the IMF at arm's length (Setser, 2020b). This is partly because of their governments' aversion to the reform programmes that accompany traditional IMF arrangements and/or the perceived financial market stigma attached to seeking IMF support. One notable exception is South Africa, which secured a $ 4.3 billion emergency loan in July, its first IMF arrangement in almost 20 years. Chile and Peru entered into their first ever Flexible Credit Lines (FCLs) of $ 23.9 billion and $ 11 billion respectively, precautionary IMF arrangements aimed at EMEs with very strong fundamentals and policy track records, and Colombia rolled over its existing FCL. Moreover, the IMF has established a new Short-term Liquidity Line (SLL), a revolving backstop facility with strict, FCL-like eligibility, but the instrument has had no takers so far. Several commentators have argued that the IMF could do more to help EMEs weather the COVID-19 crisis, with proposed measures including further tweaking of the terms of existing lending facilities; the creation of new lending instruments with greater access limits, longer repayment periods, and wider country eligibility; and substantial (re-)allocations of Special Drawing Rights (SDRs) to add to countries' international reserves (see e.g., Setser, 2020b; Garcia-Herrero and Ribakova, 2020; Collins and Truman, 2020).[1]

## 3.5 Near-term economic prospects for emerging market economies

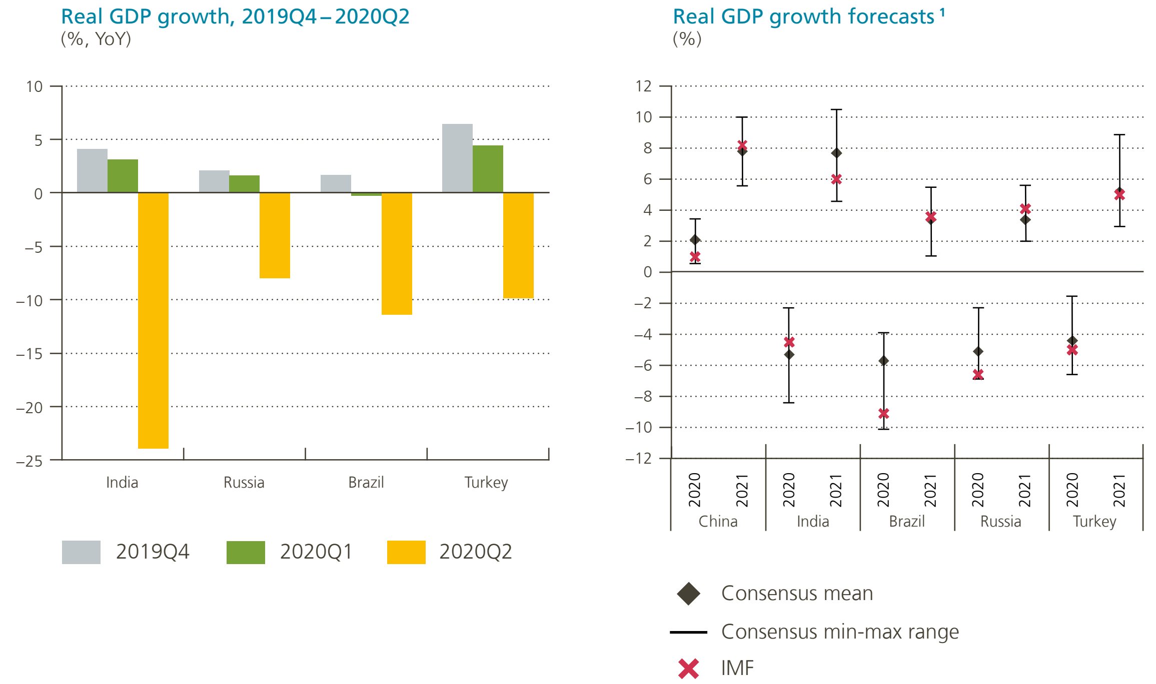
Altogether, the direct and indirect consequences of the COVID-19 pandemic led to unprecedentedly steep drops in EME real economic activity. In contrast to leading economies China and Korea (cf. section 2.2), all other major EMEs' economic growth went deep into negative territory. In the second quarter of 2020, India's GDP plunged by almost 24 % compared to the same period in 2019; Brazil, Russia and Turkey lost between 8 % and 11 % of GDP year on year (Chart 8, left panel). Higher frequency indicators suggest that the economies of these countries bottomed out, and that the recovery was underway in the third quarter of 2020. However, according to the forward-looking purchasing manager indices (PMIs) as of August, expectations for the services sector and for new manufacturing export orders remained downbeat for India and Brazil.

As was the case for advanced economies, EME growth forecasts for 2020 have been increasingly revised downward (cf. section 1.2). These downgrades have been typically much faster and steeper than during the GFC. The latest (June) IMF forecasts for EME growth in 2021 tend to exceed pre-COVID forecasts, reflecting an expected steady recovery from the likely record drops in output in 2020. Whether such a scenario will materialise remains to be seen. Indeed, growth projections remain subject to great uncertainty, much more so than usual. This can be seen from the very wide range of private sector growth forecasts for 2020 and 2021 as

1 The SDR is an international reserve asset created by the IMF. It is not a currency but rather constitutes a potential claim on the freely usable currencies of IMF members, including the US dollar, the euro, the Japanese yen, the British pound and the Chinese renminbi. SDRs are normally allocated to members in proportion to their shares of IMF quotas.

Chart 8

**EMEs' recent growth figures and near-term prospects look grim**




Sources: IMF (WEO), Consensus Economics, Banco Central do Brasil, Refinitiv.

1 Mean forecasts and forecast ranges as of 10 August 2020 from Consensus Economics (China, India, Russia and Turkey) and BCB survey of market expectations (Brazil). IMF forecasts are from the IMF WEO June 2020 update.

of August (Chart 8, right panel). For example, whereas some forecasters expect growth to fall back to about –2 % for India in 2020, others pencil in a decline of more than 8 %.

Therefore, while EMEs will probably not play the same role of locomotive for the world economy as most of them did during and in the aftermath of the GFC, what their contribution to world growth will be in 2020 and thereafter is still an open question. China is likely to remain a positive growth force in the foreseeable future, if it avoids a second wave and continues its swift, stimulus-fuelled recovery. Conversely, the growth forecasts for India, Brazil, Turkey and Russia suggest that these EMEs will add to the negative drag on the world economy in 2020 and may end up contributing a lot less to global economic growth in 2021 than was expected before COVID-19 struck.

## Conclusion

The main conclusion we draw from the overview presented in this article is that, despite larger-than-usual uncertainty about future growth paths, EMEs will most likely not play the same supportive role for the world economy throughout the COVID-19 crisis as at the time of the GFC. Several reasons stand out.

First of all, as we have shown, the COVID-19 crisis is very different from the GFC, or other large crises for that matter. The pandemic-induced global recession is projected to be the deepest since World War II and the most synchronized ever. With the notable exception of China, nearly all major EMEs are expected to experience strongly negative growth in 2020, unlike in 2009. This is the combined result of the severe direct impact the spread of the coronavirus and associated containment measures have had on economic activity in EMEs, as well as of the multiple external shocks that have hit them more indirectly, through the pandemic's bearing on world trade and international financial markets.

Second, certain structural characteristics of EMEs, including weaker health systems and relatively large informal sectors, are making it more difficult for them to get the pandemic under control and are contributing to its economic damage in places such as Brazil and India, where the coronavirus still thrives. Some countries may also struggle to get access to and/or quickly distribute vaccines against COVID-19 once they become available.

Third, major EMEs were already suffering from idiosyncratic stress factors, macroeconomic vulnerabilities, and slowing economic growth before the COVID-19 crisis struck. In fact, if one excludes China and India, EMEs' percentage point contribution to world economic growth had shrunk considerably in recent years, compared to its post-GFC highs.

Fourth, while EMEs have deployed countercyclical monetary and fiscal stimulus, often exceeding their policy responses during the GFC, overall it remains several times smaller than the rescue packages that advanced economies have staged. The ongoing deterioration in fiscal and external positions, exacerbated by the COVID-19 crisis, implies that for many EMEs the initially modest policy space is further shrinking. Hence, EMEs will to a large extent depend on the policy actions of advanced economies for their recovery, including a resumption of demand for their exports and a continued accommodative monetary policy stance by advanced economy central banks, in addition to multilateral support initiatives. Even China, which for now seems to be recovering from the crisis largely on its own, still needs the extra growth impulse from external demand for a solid anchoring of its recovery. There is a real risk that the COVID-19 crisis will be used as an excuse for reshoring and to further ramp up trade protectionism, which would stifle China's and other EMEs' economic growth.

Finally, whereas summer projections still assume a relatively swift recovery and positive contribution of EMEs to world growth in 2021, bringing and keeping the virus under control is a necessary condition. In addition, high and rapidly rising sovereign and corporate debt levels will require deleveraging at some point, weighing on growth over the medium-term.

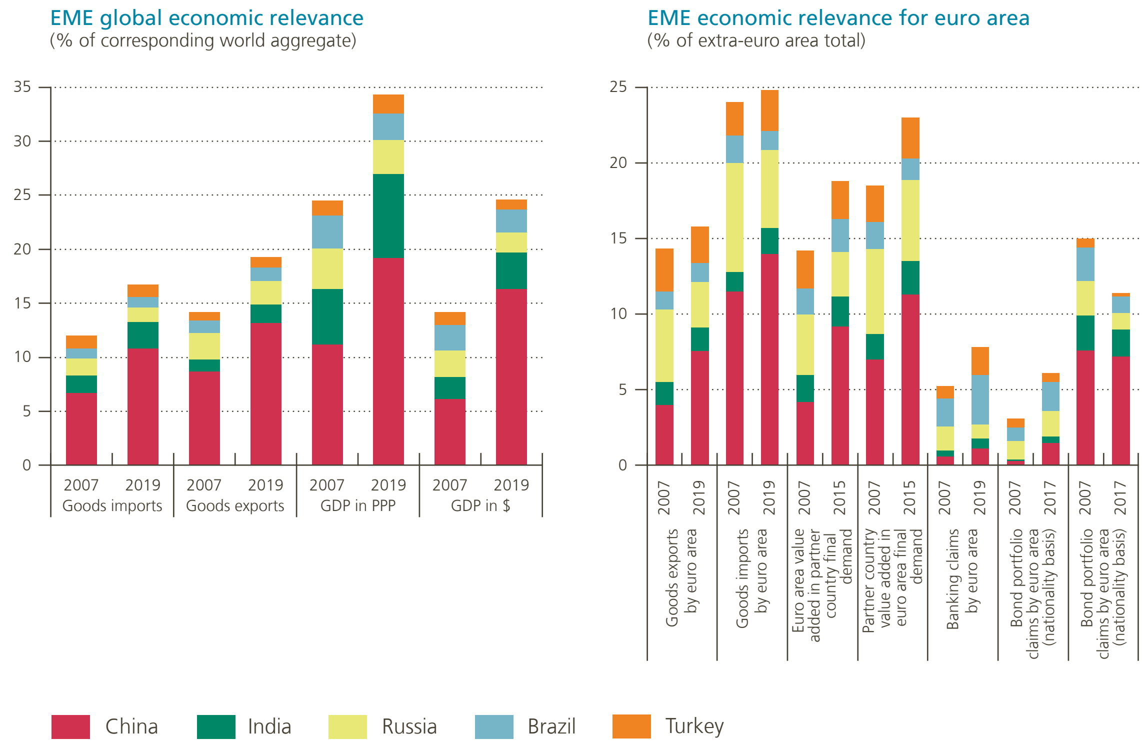
## Annex: Selection of emerging market economies

Taken together, China, India, Russia, Brazil and Turkey accounted for over a third (quarter) of world GDP in PPP terms (at market exchange rates), a sixth of world goods imports, and nearly a fifth of world goods exports in 2019.

These five countries are also systemically important for the euro area economy. In 2019 they received over 15 % of extra-euro area exports and represented a quarter of extra-euro area imports by the euro area (non-euro area EU members, the United Kingdom and United States account for large shares, too). In value added terms, the relevance of these countries for the euro area is of a similar order of magnitude. With respect to banking claims by the euro area, these countries (and other EMEs for that matter) are relatively less important, due to tighter euro area linkages with other advanced economies and financial centres, but still far from negligible (especially Brazil and Turkey). When equity portfolio claims are considered on a nationality basis (i.e., correcting for the fact that Chinese and other EME firms often finance themselves through foreign subsidiaries located in tax havens/financial centres), this group of countries represented about 11 % of total extra-euro area holdings in 2017, down from 15 % in 2007.

Chart

**China, India, Russia, Brazil and Turkey matter for the world and / or euro area economy**




Sources: IMF (WEO), WTO, Eurostat, OECD (TiVA), BIS (CBS), Coppola *et al.* (2020)

## Bibliography


Alberola E., Y. Arslan, G. Cheng and R. Moessner (2020), *The fiscal response to the Covid-19 crisis in advanced and emerging market economies*, BIS, Bulletin, 23, June.

Alon T., M. Kim, D. Lagakos and M. VanVuren (2020), *How should policy responses to the COVID-19 pandemic differ in the developing world?*, NBER, Working Paper, 27273, August.

Arslan Y., M. Drehmann and B. Hofmann (2020), *Central bank bond purchases in emerging market economies*, BIS, Bulletin, 20, June.

Arslanalp S. and T. Tsuda (2014), *Tracking global demand for emerging market sovereign debt*, IMF, Working Paper, 14/39, March.

Aum S., S. Y. Lee and T. Shin (2020), *COVID-19 doesn't need lockdowns to destroy jobs: The effect of local outbreaks in Korea*, NBER, Working Paper, 27264, May.

Avdjiev S., P. McGuire and G. von Peter (2020), "International dimensions of EME corporate debt", *BIS Quarterly Review*, June, 1-13.

Baldwin R. (2020), *The Greater Trade Collapse of 2020: Learnings from the 2008-09 Great Trade Collapse,* VoxEU.org, 7 April.

Barro R. J., J. F. Ursua and J. Weng (2020), *The coronavirus and the Great Influenza pandemic: Lessons from the 'Spanish Flu' for the coronavirus's potential effects on mortality and economic activity*, NBER, Working Paper, 26866, April.

BIS (2019), "Monetary policy frameworks in EMEs: Inflation targeting, the exchange rate and financial stability", *Annual Economic Report 2019*, June, Chapter 2, 31-53.

BIS (2020), *Annual Economic Report 2020*, June.

Boeckx J., M. Deroose and E. Vincent (2020), "The ECB's monetary policy response to COVID-19", NBB, *Economic Review*, September.

Buelens C. (2013), "Decoupled and resilient? The changing role of emerging market economies in an interconnected world", NBB, *Economic Review*, September, 23-39.

Buysse K., D. Essers and E. Vincent (2018), "Can China avoid the middle-income trap?", NBB, *Economic Review*, June, 63-77.

Buysse K. and E. Vincent (2015), "Factors explaining emerging economies' growth slowdown", NBB, *Economic Review*, September, 55-71.

Cantu C., T. Goel and J. Schanz (2020), "EME government debt: Cause for concern?", *BIS Quarterly Review*, June, Box, 15-16.

Carstens A. and H. S. Shin (2019), *Emerging markets aren't out of the woods yet*, Foreign Affairs, 15 March.

Cigna S. and L. Quaglietti (2020), "The great trade collapse of 2020 and the amplification role of global value chain", *ECB Economic Bulletin*, 5/2020, July, Box 2.

Cole M. A., R. J. R. Elliott and B. Liu (2020), "The impact of the Wuhan Covid-19 lockdown on air pollution and health: A machine learning and augmented synthetic control approach", *Environmental and Resource Economics*, 76, August, 553-580.

Collins C. G. and E. M. Truman (2020), *IMF's special drawing rights to the rescue*, Peterson Institute for International Economics, Real-Time Economic Issues Watch, 10 April.

Coppola A., M. Maggiori, B. Neiman and J. Schreger (2020), *Redrawing the map of global capital flows: The role of cross-border financing and tax havens*, NBER, Working Paper, 26855, April.

Dabrowski M. and A. M. Collin (2019), *Russia's growth problem*, Bruegel, Policy Contribution, 4 February.

Dabrowski M. and M. Dominguez-Jimenez (2020), *Emerging market central banks and quantitative easing: High-risk advice*, Bruegel, Blog Post, 26 August.

Delle Monarche D., I. Petrella and F. Venditti (2020), *COVID-19 and the stock market: Long-term valuations*, VoxEU.org, 24 August.

Dingel J. I. and B. Neiman (2020), "How many jobs can be done at home", *Journal of Public Economics*, 189, September, 104235.

Economist (2020), "Not quite all there: The 90% economy that lockdowns will leave behind", *The Economist*, 30 April.

Essers D. and E. Vincent (2017), "The global financial safety net: In need of repair?", NBB, *Economic Review*, September, 87-112.

Fardoust S., J. Y. Lin and X. Luo (2012), *Demystifying China's fiscal stimulus*, World Bank, Policy Research Working Paper, 6221, October.

Funke M. and A. Tsang (2020), *The People's Bank of China's response to the coronavirus pandemic: A quantitative assessment*, BOFIT, Discussion Paper, 12, May.

Garcia-Herrero A. and E. Ribakova (2020), *COVID-19's reality shock for external-funding dependent emerging economies*, Bruegel, Policy Contribution, 10 May.

Gilhooly R., C. Martinez and A. Watt (2020), *COVID-19: Putting the Chinese policy reaction into context*, VoxEU.org, 22 June.

Goel R., P. Schneider and C. Sever (2020), *Update on EM reserve operations*, IMF, Global Markets Monitor, Box, 9 July.

Gottlieb C., J. Grobovsek and M. Poschke (2020), "Working from home across countries", *Covid Economics: Vetted and Real-Time Papers*, 8, 71-91, April.

Haasbroeck M. (2020), *Stimulus package reveals China's financial constraints*, MERICS, Short Analysis, 13 July.

Hartley J. S. and A. Rebucci (2020), *An event study of COVID-19 central bank quantitative easing in advanced and emerging economies*, NBER, Working Paper, 27339, June.

Hausmann R. and U. Panizza (2011), "Redemption or abstinence? Original sin, currency mismatches and countercyclical policies in the new millennium", *Journal of Globalization and Development*, 2(1), August.

Hevia C. and A. Neumeyer (2020), "A perfect storm: COVID-19 in emerging economies", In: S. Djankov and U. Panizza (eds.), *COVID-19 in Developing Economies*, VoxEU.org eBook, CEPR, 25-37.

Hofmann B., I Shim and H. S. Shin (2020), *Emerging market economy exchange rates and local currency bond markets amid the Covid-19 pandemic*, BIS, Bulletin, 5, April.

Igan D., D. Kirti and S. Martinez Peria (2020), *The disconnect between financial markets and the real economy*, IMF, Special Notes Series on COVID-19, 26 August.

IMF (2019a), *People's Republic of China: 2019 Article IV Consultation*, IMF, Country Report, 19/266, August.

IMF (2019b), *Brazil: 2019 Article IV Consultation*, IMF, Country Report, 19/242, July.

IMF (2019c), *Turkey: 2019 Article IV Consultation*, IMF, Country Report, 19/395, December.

IMF (2020a), *Challenges in India's nonbank financial sector*, IMF, Global Markets Monitor, Special feature, 6 May.

IMF (2020b), *World Economic Outlook Update: A Crisis Like No Other, An Uncertain Recovery*, June.

IMF (2020c), *Regional Economic Outlook: Middle East and Central Asia*, April.

IMF (2020d), *External Sector Report: Global Imbalances and the COVID-19 Crisis*, August.

IMF (2020e), *EM Capital Flows Monitor*, 29 July.

IMF (2020f), *Global Financial Stability Report: Markets in the Time of COVID-19*, April.

IMF (2020g), *Global Financial Stability Report Update: Financial Conditions have Eased, but Insolvencies Loom Large*, June.

Kerola E. (2019), "In search of fluctuations: Another look at China's incredibly stable GDP growth", *Journal of Comparative Economics*, 61, 359-380.

Ma G. (2019), *China's high and rising corporate debt: Examining drivers and risks*, MERICS, China Monitor, August.

McWilliams B. and G. Zachmann (2020), *Bruegel electricity tracker of COVID-19 lockdown effects*, Bruegel Datasets, first published on 25 March, available at https://www.bruegel.org/publications/datasets/bruegel-electricity-tracker-of-covid-19-lockdown-effects.

Medina L. and F. Schneider (2019), *Shedding light on the shadow economy: A global database and the interaction with the official one*, CESifo, Working Paper, 7981, December.

Meinhardt C. (2020), *China bets on 'new infrastructure' to pull the economy out of post-COVID doldrums*, MERICS, Short Analysis, 4 June.

Mühleisen M., T. Gudmundsson and H. Poirson Ward (2020), *COVID-19 response in emerging market economies: Conventional policies and beyond*, IMF, Blog, 6 August.

NBB (2020), "Global Economy and euro area", *Report 2019 – Economic and financial developments*, March, Chapter 1.

Pettis M. (2020), *China's economy needs institutional reform rather than additional capital deepening*, Carnegie Endowment for International Peace, China Financial Markets, 24 July.

Ray D., S. Subramanian and L. Vandewelle (2020), *India's lockdown*, CEPR, Policy Insight, 102, April.

Reinhart C. M., K. S. Rogoff and M. A. Savastano (2003), "Debt intolerance", *Brookings Papers on Economic Activity*, 34(1), 1-74, 2003.

Segal S. and O. Negus (2020), *International financial institutions' ongoing response to the Covid-19 crisis*, Center for Strategic and International Studies, Commentary, 24 August.

Setser B. (2020a), *Turkey shows the value of balance sheet analysis*, Council on Foreign Relations, Follow the Money, 5 May.

Setser B. (2020b), *What role should the IMF play in responding to COVID-19?*, Council on Foreign Relations, Follow the Money, 10 June.

Stevenson A. (2020), "Froth returns to China's stock market, echoing the 2015 crisis", *New York Times*, 22 July.

Szalay E. and A. Samson (2020), "Turkish lira hits new low in sharp decline", *Financial Times*, 6 August.

World Bank (2018), "With the benefit of hindsight : The impact of the 2014-16 oil price collapse", *Global Economic Prospects : Broad-based upturn, but for how long ?*, January, Special Focus 1, 51-71.

World Bank (2020), *Global Economic Prospects*, June.

WTO (2020), *Trade falls steeply in first half of 2020*, Press release, 23 June.

UNWTO (2020), *World Tourism Barometer*, 18(4), July.

Zenglein M. J. and M. Kärnfelt (2020), *Stimulus measures drive China's economic rebound*, MERICS, Economic Indicators, Q2/2020, 23 July.

# The ECB's monetary policy response to COVID‑19

J. Boeckx
M. Deroose
E. Vincent *

## Introduction

In early 2020, the world was turned upside down by a new viral infection named COVID‑19, the spread of which the World Health Organization (WHO) declared as a pandemic on 11 March. The virus combines (at least) three shocks: health, financial and economic, causing one of the deepest crises ever seen in peacetime. Governments around the world quickly took unprecedented measures to fight the pandemic, with the top priority being the containment of the virus, closely followed by limitation of the financial panic and economic fallout, in which they were aided by central banks and supervisors.

This article focuses on the initial actions taken by the European Central Bank (ECB)[1] to mitigate the impact of the pandemic. The first section outlines the context: the global spread of the virus sent financial markets into turmoil, while the lockdown measures implemented by countries to mitigate the spread of the virus resulted in large short-term economic losses. Looking ahead, the macroeconomic outlook is extremely uncertain. The second section highlights the complementarity of the measures taken by fiscal, monetary and supervisory authorities around the world, which helped to curb the financial panic and cushion the economic fallout caused by COVID‑19. Sections three and four focus on the ECB's monetary policy decisions taken during the first half of 2020. In order to achieve its primary objective – maintaining price stability – the ECB pursued three main goals: ensuring an overall sufficiently accommodative stance, supporting market stabilisation to safeguard the transmission mechanism and providing ample central bank liquidity, especially to maintain credit provision (Lane, 2020). Asset purchases were stepped up, both under the existing Asset Purchase Programme and by launching a new, temporary Pandemic Emergency Purchase Programme. The ECB also gave banks more scope for borrowing liquidity under its longer-term refinancing operations, while simultaneously easing its collateral requirements. Finally, enhanced US dollar and euro swap and repo lines mitigated pressures in global funding markets. The focus is on the motivation, purpose and impact of these measures rather than on their technical details. The final section concludes, and discusses the challenges posed for monetary policy by a low-economic growth and high-debt environment. While policymakers have steered the economy relatively well through the depth of the crisis, their task is far from over and may well become even more complex.

1 For simplicity, this article uses the terms ECB and Eurosystem interchangeably, while noting that the Eurosystem comprises the ECB and the national central banks of the nineteen euro area countries. Monetary policy decisions are taken by the ECB's Governing Council (consisting of the six members of the ECB's Executive Board and the governors of the euro area's national central banks) and implemented at the level of the Eurosystem.

* The authors thank Hans Dewachter, Geert Langenus, Stefan Van Parys, Luc Aucremanne and Xavier Debrun for useful comments and suggestions. The article uses data up to 30 June 2020.

# 1. An abrupt macroeconomic shock which triggered a financial panic and an economic crisis

COVID-19 will engrave 2020 in collective memory as the year of an exceptional health shock that caused untimely human death, had a dramatic impact on daily life, and disrupted financial markets and economic activity.

## 1.1 The health crisis quickly turned into an economic crisis

The COVID-19 outbreak quickly spread across the world causing a major global health crisis. The number of confirmed cases grew from 10 000 in China by late January 2020 to over 10 million cases worldwide by late June (of which 11 % were reported in the euro area).[1] Countries' first priority in battling the virus soon became "flattening the curve" : slowing the spread of the virus in order to avoid overburdening the healthcare system, and limiting the tragic loss of lives. In order to do so, many countries imposed containment measures drastically restricting economic activity and limiting social interaction and mobility. China introduced these measures in late January, while Italy (being heavily impacted by the health crisis) was the first euro area country to follow suit, going into lockdown in early March. By the end of March, all euro area countries had implemented containment measures, but their strictness varied significantly.

The interventions proved successful in slowing the spread of COVID-19, but they also led to a sharp decline in economic activity in the euro area and elsewhere. This resulted in an unprecedented global economic crisis.

### *Financial and economic data took a deep dive in February and March, but stabilised somewhat during April and/or May*

Financial markets were the first to undergo large corrections, with the turmoil being comparable to that of the 2008 financial crisis. Sentiment deteriorated abruptly by the end of February as the global spread[2] of the COVID-19 outbreak and its economic and financial cost became clearer.

In the euro area, financial conditions deteriorated suddenly, significantly and across all asset classes from the end of February (see chart 1). The equity market crashed, losing almost 40 % of its value on account of the bleaker economic outlook. In addition, spreads on corporate bonds widened, and the increase was especially dramatic for lower grade bonds (reflecting expectations of corporate defaults). The sovereign bond market also showed signs of fragmentation, with Belgian and French sovereign spreads against the German Bund remaining relatively contained, but Italian (and to a lesser extent Spanish) spreads rising noticeably (owing to concerns about the sustainability of public debt in the wake of the pandemic).

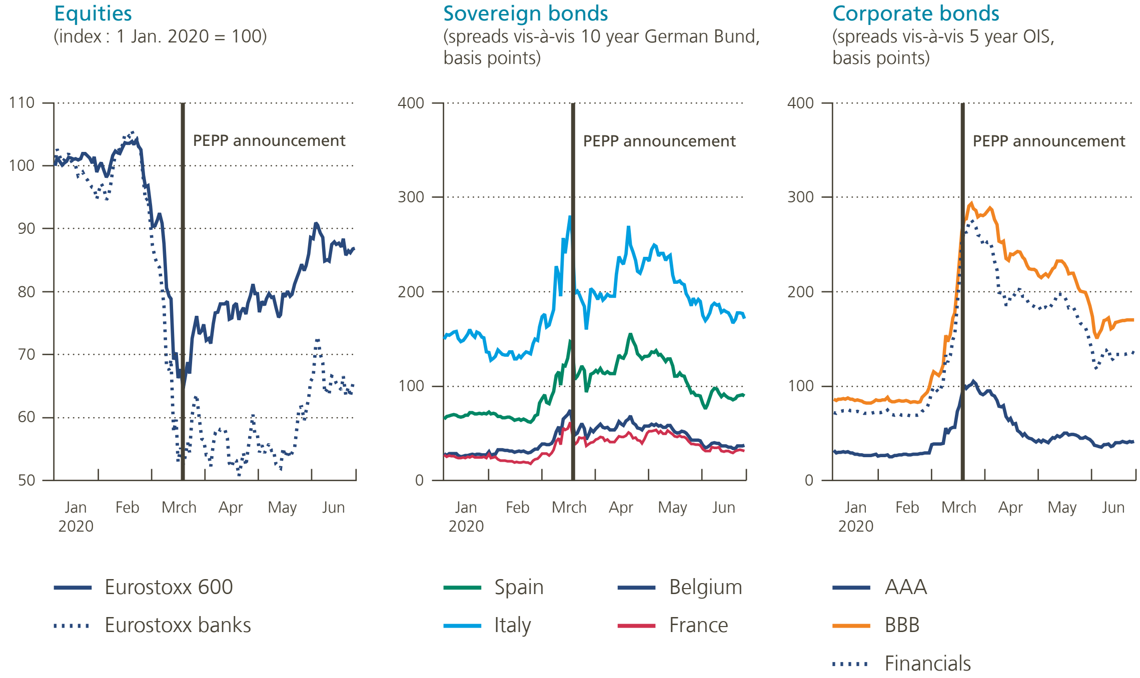
Following prompt and decisive monetary and fiscal policy measures (see the following sections), financial conditions in the euro area stabilised from the end of March, with the stock market rebounding and bond spreads narrowing again. It therefore appears that an amplification of the virus shock through the financial system has been avoided.

Nevertheless, economic data for the euro area also deteriorated sharply. Timely survey indicators on confidence and economic activity fell sharply in March and plunged to all-time lows in April, highlighting the unprecedented economic fallout of the pandemic and the related containment measures. With euro area countries gradually lifting restrictions during May, survey indicators have edged up slightly, but they still point to a strong contraction in GDP in the second quarter. More specifically, following a record 3.6 % quarter-on-quarter contraction in the first quarter of 2020, euro area economic activity is expected to fall even more sharply in the next quarter. Further ahead, the economic recovery path remains highly uncertain.

1 COVID-19 statistics are from the John Hopkins University.
2 In Italy, for instance, confirmed cases started rising quickly in the last week of February.

Chart 1

**Euro area financial markets reacted abruptly to COVID-19**




Source : Refinitiv.

## 1.2 Looking ahead : macroeconomic projections are subject to great uncertainty

Given the many uncertainties in the current situation, macroeconomic forecasting has recently become extremely complex. These uncertainties relate first and foremost to the pandemic itself, including the possibility of a second wave of infections in the euro area and the development of a vaccine. In addition, there is also uncertainty about how economic agents will respond to the pandemic, including future actions by governments (such as renewed restrictions), shifts in spending patterns and behavioural change (such as people avoiding public transport). Moreover, with the euro area being a relatively open economy, the pattern of external demand – which is equally dependent upon how the pandemic plays out – adds an extra layer of uncertainty. To take this extraordinary uncertainty into account, Eurosystem staff have opted to work out three macroeconomic scenarios for the euro area which differ in the assumptions about how the pandemic develops[1].

### *A deep recession followed by a very slow recovery of economic activity*

The baseline projection scenario assumes only partial success in containing the virus : new waves of infections over the coming quarters require persistent containment measures (weakening supply and demand) until a medical solution becomes available (which is assumed to happen by mid-2021). While high uncertainty and deteriorating labour market conditions are expected to induce further cuts in private spending, public sector stimulus should help cushion the impact of the crisis. Under these assumptions, real GDP growth in the euro area is projected to follow a V-shaped pattern : growth falls by 8.7 % in 2020 and rebounds by 5.2 % in 2021 and by 3.3 % in 2022. However, in terms of levels, economic activity remains depressed : at the end of the projection

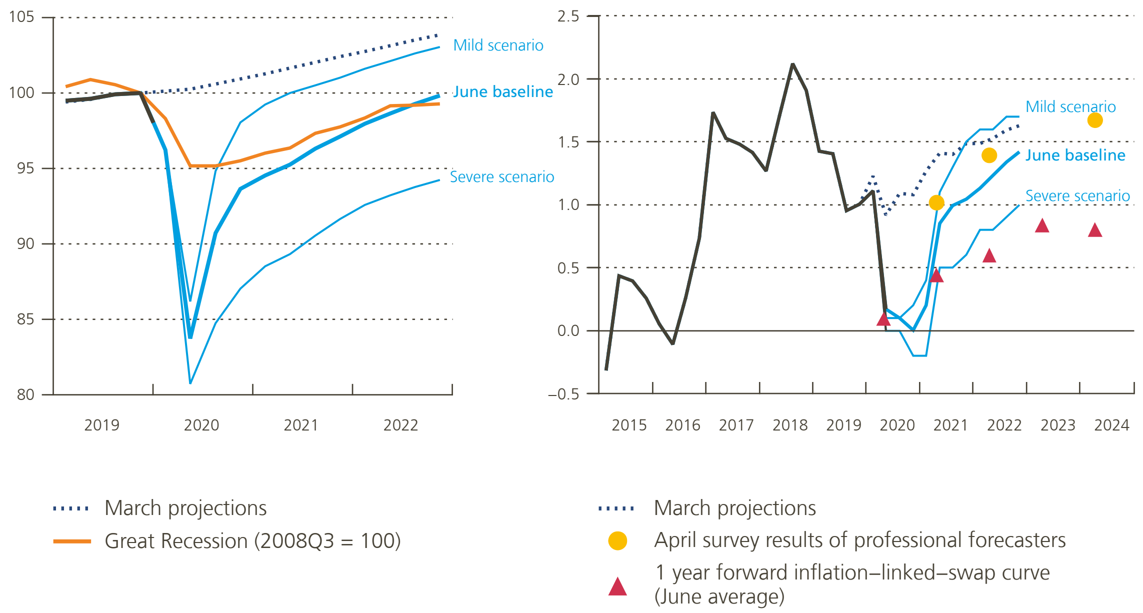
1 For more information about the projections for the euro area and Belgium, see ECB (2020) and NBB (2020), respectively.

Chart 2

**June Eurosystem staff projections foresee a deep recession and a slow path to recovery that is subject to high uncertainty**

Real GDP projections
(2019Q4 = 100*)

Headline inflation projections
(in %)




Sources: ECB, Refinitiv.
* Unless mentioned otherwise.
Note that the March projections are made by ECB staff, while the June projections are the result of joint work between national central bank staff and ECB staff.

horizon (i.e. the fourth quarter of 2022) real GDP would still be slightly below its pre-crisis level and around 4 % below the level expected in the March projections (see chart 2).

The baseline scenario is complemented by a mild scenario (which assumes successful containment of the virus) and a severe scenario (which assumes a strong resurgence of infections implying stricter containment measures that significantly depress economic activity). These alternative scenarios provide a range of possible recovery paths around the baseline projection. Note that all scenarios imply a severe decline in output in the initial phase of the crisis, dwarfing the decline caused by the Great Recession (see orange line in chart 2). A faster recovery could limit the medium-term output loss to comparable levels, however.

### *The pandemic appears disinflationary in the short-term, but its longer-term impact on inflation remains uncertain*

Following the outbreak of COVID-19, HICP inflation in the euro area initially fell, dropping from 1.2 % in February 2020 to 0.1 % in May. This mainly reflected the collapse in oil prices which was in turn partly driven by lower oil demand owing to the pandemic. Longer-term inflation expectations derived from financial markets also plunged during March, reaching new historic lows in the euro area, mainly because markets were pricing in rising uncertainty and the size of the economic fallout.

As the pandemic and related containment measures disrupt both the demand- and supply-side of the economy, the future path of inflation will depend upon which forces prevail. In the coming months, inflation

## Chart 3

**Inflationary and disinflationary forces related to the pandemic: a non-exhaustive overview**

| | | SHORT TERM | LONGER TERM (i.e. post lockdown) |
|---|---|---|---|
| SUPPLY – DRIVEN | Upward price pressures | • Lengthening of supplier delivery times | • Firms face extra costs related to safety and health measures (e.g. hand sanitizers, plexiglass, more space between seats in restaurants, …)<br>• Liquidity-constrained firms increase their selling prices<br>• Widespread corporate bankruptcies (limiting supply and increasing industry concentration) could lead surviving firms to increase their prices<br>• Wage increases demanded by "frontline" workers<br>• Self-sufficiency / deglobalising supply chains<br>• Lower investment lowers potential output, narrowing the ouput gap (i.e. reducing slack in the economy) |
| | Downward price pressures | • Firms give price discounts to reduce their stocks | • Firms give price discounts to attract new and existing clients<br>• Fast rebound in productive capacity |
| DEMAND – DRIVEN | Upward price pressures | | • Large-scale fiscal and monetary stimulus may create upward price pressures (but possibility of Ricardian equivalence)<br>• Pent-up demand (i.e. spending forced savings as nominal income has been sustained e.g. via fiscal transfers) |
| | Downward price pressures | • Oil price decline (less oil demand due to pandemic)<br>• Containment measures restrict consumer demand | • Higher unemployment depresses demand<br>• Austerity / public and private debt deleveraging<br>• Soft post-lockdown demand (e.g. for travel, leisure)<br>• Increased precautionary/emergency savings by firms and households |

Source : NBB.

is expected to remain depressed, as downward price pressures stemming from weak demand should offset upside price pressures related to supply-side disruptions and shortages. Further ahead, the outlook for inflation is clouded in considerably more uncertainty. At the time of writing, the consensus among markets and economic forecasters seems to be that negative demand shocks will continue to predominate over negative supply shocks, thus keeping a lid on inflation. This is also evident in the Eurosystem staff macroeconomic projections : the June baseline inflation path lies consistently below the March projections. At the end of 2022, inflation would have only risen to 1.4 %, far below the ECB's objective of below, but close to 2 %. Depending upon the strength of the economic recovery, inflation might turn out to be a bit higher (cfr. the mild scenario) or a bit lower (cfr. the severe scenario), but it is not projected to accelerate drastically. Likewise, recent longer-term survey-based inflation expectations (see yellow dots in chart 2) remained at historic low levels and longer-term market-based inflation expectations (see red triangles in chart 2) are even more subdued.[1] That said, chart 3 indicates that there are plausible factors that might push up post-pandemic inflation. Hence, it is prudent to keep an open mind with respect to the importance of upside versus downside risks to inflation in the longer run.

1 The gap between the two can largely be explained by the sizeable negative risk premia contained in the latter.

## 2. Governments, central banks and supervisors reacted fast

All over the world, governments, central banks and prudential authorities deployed measures which were unprecedented in both size and speed, to help curb the financial panic and cushion the economic impact caused by COVID-19.

In view of the targeted nature of the policy response, governments have been, and still are, at the forefront of the fight against COVID-19 and its economic fallout. Thanks to a combination of automatic stabilisers and discretionary measures, the drop in households' disposable income was limited compared to the decline in economic activity, and firms' weakening solvency was shored up. On top of such measures that support private sector solvency, governments also provided liquidity support in the form of tax deferrals and various credit guarantee schemes (sometimes accompanied by private and/or public moratoria on outstanding loans) that helped firms and households to preserve access to bank credit. In contrast to net transfers, guarantees do not directly weigh on public finances but create contingent liabilities for governments that only later might turn into actual expenses. In Europe, it is not only national governments that have reacted fast and decisively: at the EU level, too, important initiatives were taken to deal with liquidity problems and support the recovery. Most notably, the European Commission proposed to issue € 750 billion of debt on financial markets. Combined with a revised long-term EU budget of € 1,100 billion for 2021-2027, this forms its Recovery Plan for Europe. That plan comes in addition to the three safety nets of € 540 billion already put in place by the EU to support workers, businesses and countries[1].

Using the terminology of J. Powell, chairman of the US Federal Reserve, central banks have complemented governments' spending powers with their powers to lend (Powell, 2020). They brought down interest rates through policy rate cuts and asset purchases. They also paid particular attention to ensuring that the monetary stimulus reached households and firms by setting up dedicated and targeted lending programmes (Cavallino and De Fiore, 2020). Governments' credit guarantees levering the impact of such measures and central bank bond purchases keeping interest rates in check when debt issuance spikes are just two examples of the complementarities between fiscal and monetary policy at the current juncture.

As the financial sector is key in channeling funds from savers to borrowers, the responses of prudential authorities have also been instrumental in supporting financial intermediation, and notably lending to the real economy. Supervisory authorities in the euro area allowed banks to use capital and liquidity buffers, granted them more flexibility on deadlines and procedures, and requested banks to refrain from paying dividends so as to preserve balance sheet capacity. This gives central banks' lending stimuli and governments' loan guarantee schemes even more traction.

The following sections explain in more detail the monetary policy reaction in the euro area.

## 3. The ECB's crisis response measures

On the eve of the crisis, the monetary policy stance in the euro area was already very accommodative. Since the end of 2011, the ECB had been continuously lowering its interest rates, with its main policy rate – the deposit facility rate (DFR) – standing at a record low of –0.5 % since September 2019. In addition, asset purchases under the ECB's Asset Purchase Programme (APP) had been resumed since November 2019, at a monthly pace of € 20 billion. Furthermore, the ECB's forward guidance ensures that a very easy policy stance will remain in place

1 For more details, see https://www.consilium.europa.eu/en/policies/coronavirus/covid-19-economy/

until euro area inflation robustly converges towards its target of below, but close to, 2 % over the medium term. To support the bank‑based transmission channel in a world of negative interest rates, the ECB had also launched a third series of targeted longer‑term refinancing operations in September 2019 – the so‑called TLTRO III – on more favourable conditions than initially planned. While the maturity of the operations had been lengthened by one year, borrowing rates had also been lowered, down to the deposit facility rate (DFR), or –0.5 %. Lastly, a two‑tier system for reserve remuneration was introduced from the end of October 2019. The scheme exempts part of banks' excess liquidity holdings with the Eurosystem from negative remuneration at the DFR – to be compensated at 0 % instead.

When designing the monetary policy response to COVID‑19, the Governing Council of the ECB has three goals in mind, all critical in achieving the primary objective of maintaining price stability:

- Ensuring an overall sufficiently accommodative stance, despite the surge in public debt issuance that – all other things being equal – would push up bond yields with knock‑on effects on other interest rates.

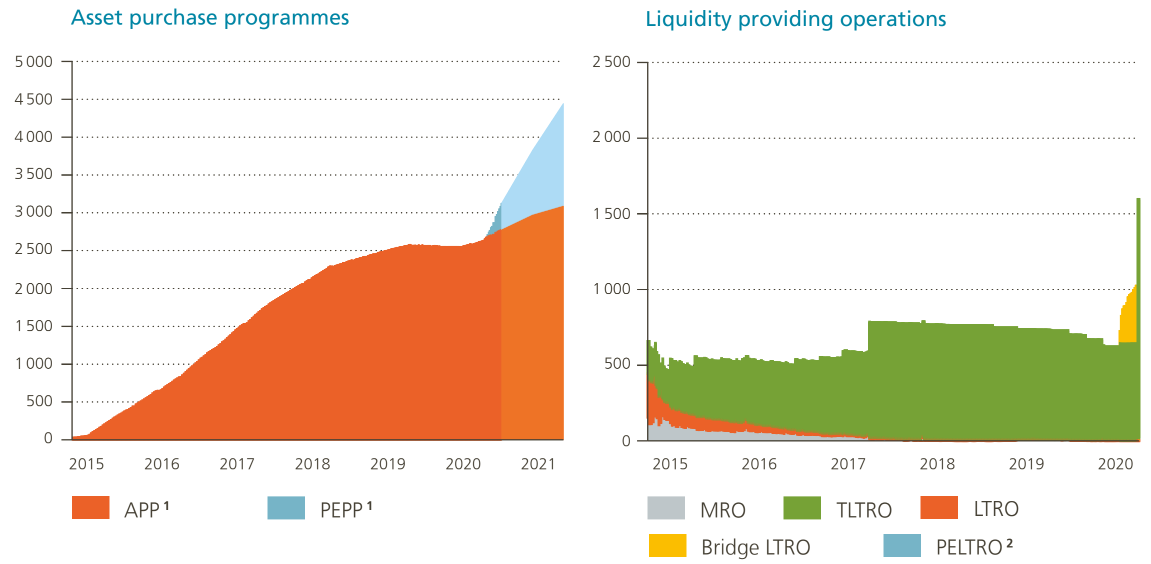
- Supporting market stabilisation to safeguard the transmission mechanism, including by avoiding fragmentation across euro area countries, which are not all hit equally hard by COVID‑19 and not all had similar starting points when the crisis hit.

- Providing ample central bank liquidity, especially to keep access to bank credit intact for firms and households. This is very important in the euro area where bank loans account for a very large chunk of the private sector's external financing.

Chart 4

**The ECB expanded its balance sheet**

(billion €)




Sources: ECB, own calculations.

1 Realised asset purchases until 30 June, 2020. The light areas show projected asset purchases for the period July 2020 – June 2021, based on an assumption that the remainder of the temporary € 120 billion APP and € 1,350 billion PEPP envelopes would be exhausted, as a result of constant daily purchases, by the end of 2020 and the end of June 2021 respectively, and monthly APP purchases of € 20 billion would be continued until at least end‑June 2021.

2 The first two PELTRO operations, settled on 21 May and 24 June, for a total of € 16 billion, are included but, due to their limited amounts, not visible in the chart.

### *The ECB stepped up its asset purchases*

On 12 March, in a first reaction to the crisis, the ECB stepped up its purchases under the APP, adding an envelope of € 120 billion to top up planned asset purchases until the end of 2020. By ensuring a substantial contribution from the private sector purchase programmes and extending the eligibility of assets to non-financial commercial paper, the ECB further supported favourable financing conditions for the private sector. As the virus rapidly spread and lockdown measures were being introduced across Europe, it quickly became clear that the crisis would cause more severe damage to the economy than previously anticipated. Against that background, on 18 March the ECB launched a new, temporary asset purchase programme, the so-called Pandemic Emergency Purchase Programme (PEPP), with an envelope of € 750 billion. At the beginning of June, this envelope was scaled up to € 1,350 billion in a context of downwardly revised projections for euro area activity and inflation. The horizon for purchases under the PEPP was also extended until at least the end of June 2021, from the end of 2020 initially planned. In addition, the ECB announced that the principal from maturing securities purchased under the PEPP would be reinvested until at least the end of 2022.

While the rules are broadly the same for the APP and PEPP, purchases under the latter can be conducted with a larger degree of flexibility, reflecting the importance for the ECB to act as needed in a context of extreme uncertainty about how the crisis will evolve and its impact on the economy and financial conditions. That flexibility applies to the allocation of purchase flows over time, asset classes and jurisdictions. Regarding the allocation across countries of public sector bond purchases, each country's share in the ECB's capital (which reflects a country's share in the EU's total population and GDP) serves as the benchmark in both programmes. At the same time, purchases under the PEPP will be conducted in a flexible manner. In addition, Greek government bonds can be bought under the PEPP, whereas they are not eligible for purchases under the APP as they do not satisfy the credit quality requirements. Finally, the self-imposed limits regarding bond holdings, restricting the Eurosystem's securities holdings to a maximum share of each issuer's debt and of each issue of a particular security, do not apply for holdings under the PEPP.

The left-hand panel of chart 4 shows the volumes of Eurosystem purchases under the APP and PEPP and projected additional purchase amounts until the end of June 2021. Between the onset of the crisis and the end of June 2020, the Eurosystem had bought about € 150 and € 350 billion under the APP and PEPP respectively, with total net purchases under both programmes accounting for over half of the Eurosystem's total assets at the end of June.

### *More liquidity on more favourable terms under the longer-term refinancing operations*

From the beginning of the crisis, monetary policy measures have also aimed at providing banks with ample liquidity on favourable conditions to support a smooth flow of bank credit to firms and households. In that context, the terms of the third series of targeted longer-term refinancing operations (TLTRO III), launched in September 2019, were eased [1]. The ECB's TLTROs incentivise lending to the private sector, as banks can borrow more liquidity and at more favourable rates the more credit they provide to the private sector. In response to the crisis, borrowing conditions under TLTRO III were loosened in three ways. First, the ECB allowed banks to borrow larger amounts of liquidity. Banks' total borrowing allowances under TLTRO III were hence scaled up by two thirds [2], while per operation borrowing limits were abolished. Second, banks could more easily qualify for a lower interest rate. If banks maintain their levels of credit provision during the pandemic crisis phase, they qualify for the lowest borrowing rate. For banks not beating that newly introduced benchmark, the old lending performance benchmark applies, but is reduced, given the challenging circumstances due to COVID-19. Third, the pricing structure of TLTRO III was adapted, in two steps, to be ultimately lowered by 50 basis points during the pandemic period. The entry rate thus dropped

1 For more details, see the ECB's press releases: https://www.ecb.europa.eu/press/pr/html/index.en.html.

2 Banks were allowed to borrow up to 50 %, instead of 30 %, of their outstanding stock of private sector loans as at the end of February 2019, excluding loans to households for house purchase.

to 50 basis points below the main refinancing operations (MRO) rate, or currently –0.5 %. For banks that maintain their levels of credit provision during the crisis phase, the rate was lowered to the DFR minus 50 basis points, or currently –1 %.

TLTRO operations only take place on a quarterly basis. In order to bridge the period leading up to the June TLTRO III operation, the ECB therefore also announced a new series of weekly longer-term refinancing operations, the so-called bridge LTROs. Priced at DFR, these operations provided euro area banks with liquidity on somewhat less favourable terms than the TLTRO III, but they have no conditions attached in terms of lending performance. All operations matured at the end of June 2020, on the settlement day of the fourth TLTRO III operation.

In order to provide an effective backstop for shorter-term liquidity needs after the expiration of the bridge LTROs in June, so-called Pandemic Emergency LTROs – PELTROs – were introduced at the end of April. Seven PELTRO operations are scheduled about once a month between May and the end of 2020, at the MRO rate minus 25 basis points. All operations mature in the third quarter of 2021.

Given these highly favourable borrowing conditions, banks took up considerable amounts of liquidity with the Eurosystem during the first months of the crisis. The total take-up under the third and fourth TLTRO III operations amounted to € 1.4 trillion, i.e. 14 times the amount taken up under the first two TLTRO III operations (see chart 4, right-hand panel). The bulk of this amount was taken up in June, when the more favourable conditions applied. The net liquidity injection in June was smaller however, as the bridge LTROs were repaid on the same day. Euro area banks had borrowed a total of just below € 390 billion under these bridge LTROs, mainly concentrated on the initial operations. PELTRO take-ups under the May and June operations remained rather limited, amounting to € 16 billion.

### *A comprehensive package to ease collateral requirements*

To ensure that banks gained the full benefit from the more favourable conditions under the ECB's longer-term refinancing operations, additional measures related to their collateral requirements were essential. Since collateral availability tends to come under pressure during crises, in a context of worsened financial market conditions, the ECB introduced a comprehensive package of collateral easing measures, to ensure banks continued to have access to sufficient liquidity to support their lending activities. Overall, these measures extended the range of assets eligible as collateral and allowed the ECB to tolerate more risk on its balance sheet. For example, the extended collateral framework permits banks to pledge as collateral smaller business loans, such as loans to small and medium-sized enterprises or self-employed workers, that benefit from state guarantee schemes in many euro area countries. In Belgium, too, banks could pledge as collateral the loans covered by the guarantee scheme for firms and self-employed workers as agreed between the financial sector and the government at the end of March.

### *Dollar swap lines enhanced, euro swap and repo lines (re)activated*

In response to a tightening global dollar funding market, the Federal Reserve, the ECB, the Bank of Japan, the Bank of England, the Bank of Canada and the Swiss National Bank agreed to ease the terms of their standing dollar swap lines [1]. In particular, the Federal Reserve reduced the pricing of the swap arrangements and increased the frequency of the 7-day operations to daily from weekly [2], while it was agreed that longer-term, 84-day operations would be offered every week. In addition, non-euro area central banks could also access euro liquidity, as the ECB established new euro swap lines with the central banks of Bulgaria and Croatia, while reactivating its

1 Swap lines are agreements among central banks to exchange their currencies. The ECB's swap line with the Federal Reserve, for example, enables the ECB and all national euro area central banks to receive US dollars from the Fed in exchange for an equivalent amount of euros.

2 As from July 1, this frequency was again reduced to three times per week, in view of the improved US dollar funding conditions and lower demand for the 7-day operations.

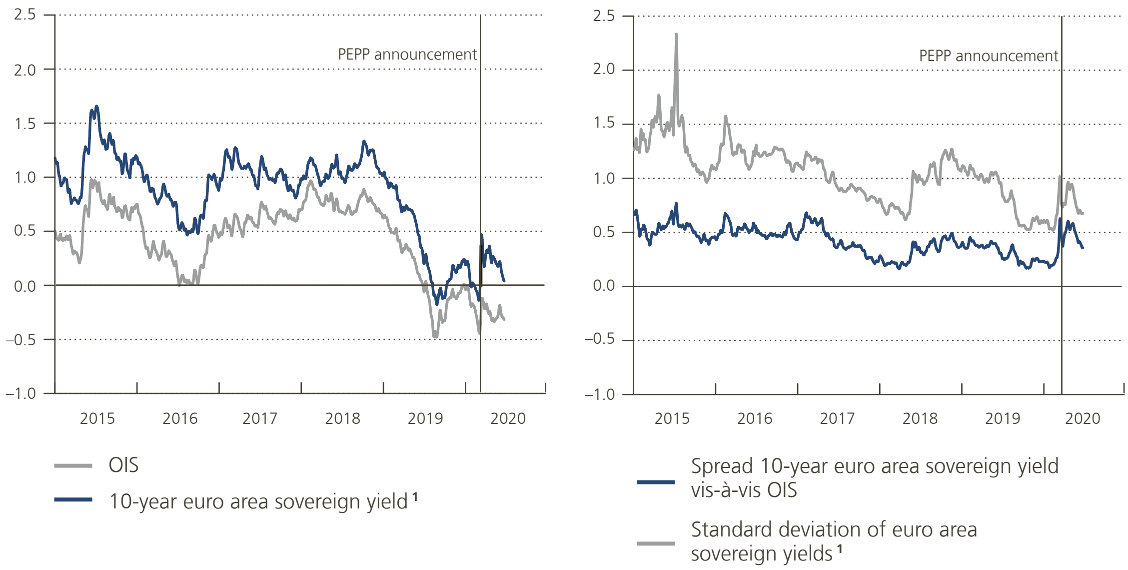
swap line with the central bank of Denmark. A repo line, which exchanges euros for collateral, was introduced with the central bank of Romania. Complementing these bilateral euro swap and repo lines, finally, a Eurosystem repo facility for central banks (EUREP) was set up at the end of June, providing precautionary euro repo lines to central banks outside the euro area. The facility addresses pandemic-related euro liquidity needs until the end of June 2021.

## 4. Financial conditions stabilised and bank lending met record-high liquidity needs

Chart 5

**The ECB's asset purchases curbed stress and fragmentation pressures in euro area sovereign bond markets**

(%, 5-day moving averages)




Sources: ECB, Refinitiv.

1 GDP-weighted, based on eleven euro area countries: Germany, France, Italy, Spain, Netherlands, Belgium, Austria, Portugal, Finland, Ireland and Greece.

The ECB's asset purchases are a key tool for keeping borrowing costs low and ensuring that easy financing conditions get shared evenly across the euro area. As the virus spread across Europe, and the public sector was expected to issue sizeable amounts of additional debt on financial markets, sovereign bond yields moved up in all euro area countries. In the process, they also decoupled from the corresponding OIS rates[1] as illustrated in chart 5. Apart from this common shock, illustrated by a higher GDP-weighted euro area sovereign yield, the crisis also induced fragmentation across the euro area, as some countries, like Italy and Spain, were hit harder by the crisis but also had higher debt levels to begin with. The increased dispersion in euro area government bond yields since the start of the crisis illustrates this (chart 5, right-hand panel). The introduction of the PEPP – with its large crisis envelope and built-in flexibility – significantly mitigated both common stress and fragmentation pressures: the euro area sovereign yield moved closer to OIS rates while the dispersion in national sovereign yields came down after 18 March.

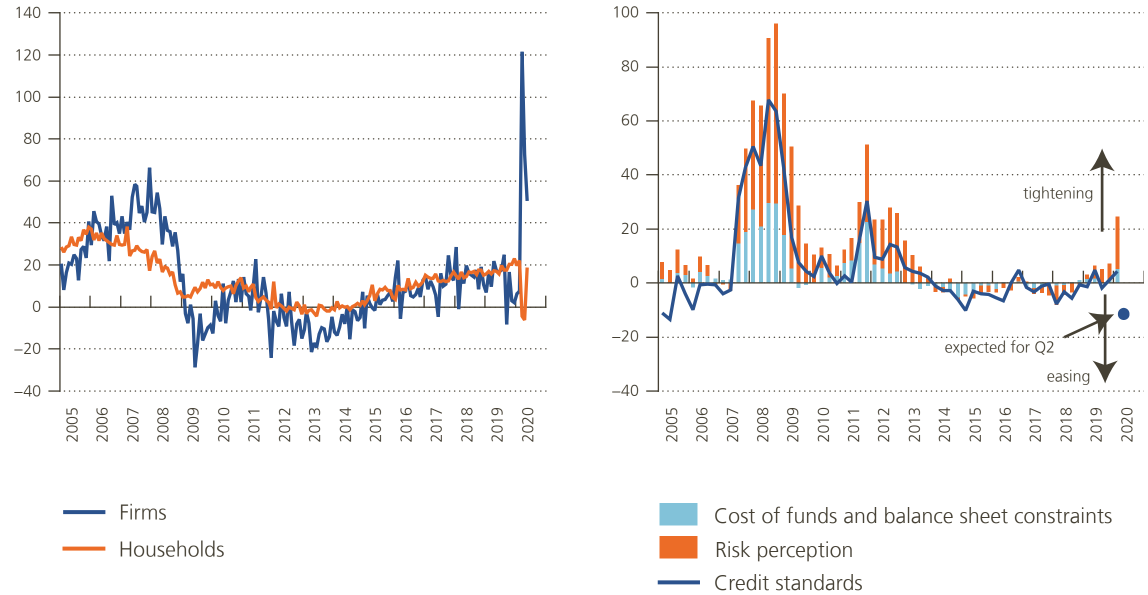
1 Euro area OIS rates are priced on the basis of the expected future path of the ECB's policy rates and, hence, are an important basis for financing conditions in the euro area.

Chart 6

**Spike in bank lending to firms**

Loans to firms and households
(monthly flows in billion €)

Credit standards for loans to firms and contributing factors
(in %)[1]




Source: ECB.

1 Net percentages refer to changes over the previous quarter and are defined as the difference between the sum of the percentages of banks responding that credit standards tightened / the given factor contributed to a tightening and the sum of the percentages of banks responding that credit standards eased / the given factor contributed to an easing.

As well as avoiding upward pressures on market-based interest rates in all euro area countries, monetary policy measures in the context of the COVID-19 crisis also focused on keeping the bank lending channel intact. This has been very valuable for helping euro area firms navigate the crisis. First, as a result of the lockdown measures, a large number of firms faced a sudden and significant drop in their cash flows, forcing them to borrow on a massive scale. Second, euro area firms rely heavily on bank lending, which accounts for about half of their external financing. Available data until the end of June suggest that, at least during the first months of the crisis, euro area banks have been able to meet firms' increased liquidity needs (chart 6, left-hand panel). In March, when confinement measures were being introduced in euro area countries, non-financial firms borrowed about € 120 billion from euro area banks. To put things into perspective, it is worth noting that this number is almost double the previous monthly record, which was, moreover, recorded during the credit boom preceding the global financial crisis. As firms were mainly seeking to finance working capital, the biggest increase was initially recorded for short-term credit.

While firms were borrowing massively during the first months of the crisis, they were also hoarding cash. Indeed, deposits placed by non-financial corporations with euro area banks also increased by more than € 100 billion per month in March-May. This suggests that credit demand was driven not only by real funding needs, but also by precautionary motives, in a context of extreme uncertainty about how the crisis would play out and its impact on the economy. In this context, firms drew on previously committed credit lines to channel these funds into bank deposits.

Net lending to households, on the other hand, was negative during the first two months of the crisis, with lending flows reverting to levels observed before the crisis only in May. Rising fears of unemployment, combined with the sheer physical constraints that the lockdown measures imposed on buying a property or consumption goods, induced households to significantly cut down on borrowing in the first stages of the crisis. Consistent with such forced saving, households' bank deposits jumped.

Belgian banks' lending followed a similar pattern. Loans to firms climbed to record amounts in March and April, with flows in March reaching the highest figure in almost twenty years. In May however, net lending to firms turned negative. Loans to households saw negative origination in April but went up again in May.

As banks lent a record amount to euro area firms, credit conditions for corporates also remained relatively easy, according to the ECB's Bank Lending Survey (BLS)[1] (chart 6, right‑hand panel). Importantly, a deterioration in banks' balance sheets or cost of funds made only a minor contribution to the tightening of credit standards in the first quarter of 2020. While many banks' risk perceptions increased, the resulting tightening of credit standards remained small compared to the situation during the global financial and sovereign debt crises. On the one hand, in March – when the BLS survey was conducted –, banks were not yet able to fully evaluate the effects of the COVID‑19 crisis. On the other hand, euro area banks' sounder capital and liquidity positions, as well as the introduction of government guarantee schemes in euro area countries, undoubtedly also played a role here. Moreover, the early introduction of monetary policy measures, especially related to the ECB's longer-term refinancing operations, also prevented a further tightening of borrowing conditions by providing substantial funding cost and liquidity relief for banks. Against that background, banks even expect credit standards for firms to ease considerably in the second quarter.

Conversely, credit standards for loans to households for house purchase and for consumer credit tightened somewhat more than for firms during the first quarter of 2020 and are also expected to continue tightening in the second quarter. Contributory factors here are concerns about households' creditworthiness, as a result of a deteriorating income and employment outlook.

## 5. Looking ahead, many uncertainties and challenges remain

So far, so good. That is the shortest possible way to summarise how authorities have managed the financial stress and economic fallout of COVID‑19. Focusing on the contribution of monetary policy in the euro area, the ECB Governing Council deployed a wide range of measures. Bond purchases under the APP have been stepped up and an extra envelope of € 1,350 billion of purchases is available until at least June 2021 under the new PEPP. Significantly more attractive conditions for the TLTROs have led euro area banks to demand a total of € 1.4 trillion in these operations. A major relaxation of collateral requirements has been instrumental in allowing banks to tap central bank funding to such a large extent. This package of measures has prevented an abrupt and excessive tightening of financial conditions and fragmentation across euro area countries that would impair transmission. Thanks to synergies with government measures, more resilient banks and supervisory relief, they have also allowed banks to accommodate firms' record demand for loans to address sudden liquidity needs.

### *Monetary policy in a post‑pandemic low‑growth and high‑debt world*

However, the challenges ahead for monetary policy are manifold. The risks around an already subdued macroeconomic outlook are on the downside. First and foremost is the risk of the virus flaring up again and forcing economies back into lockdown. Its economic costs could be amplified, for instance as rising corporate insolvencies could lead to adverse real-financial feedback loops. Regarding inflation, the outlook might be even more uncertain, as it depends on the extent to which COVID‑19 has damaged the supply or the demand side

1 The April 2020 Bank Lending Survey was conducted between 19 March and 3 April, 2020.

of the economy. While the virus outbreak is perceived to be disinflationary in the months ahead, the assessment is more complicated over the medium and longer term, as explained in section 1.

Both adverse demand and supply factors complicate life for monetary policy, be it in a different way. Were growth to remain weak because of subdued demand, the resulting low inflation calls for more monetary easing. With policy rates close to the effective lower bound, and non-standard measures already being used in a very active way, delivering the required support to demand is far from easy. If supply factors are behind low growth, inflation will rise and this makes the lower bound problem less pertinent as there is room to raise policy rates. However, in such a configuration, monetary policy has less scope to support economic growth, and the debt-overhang challenge caused by COVID-19 might become more pressing.

Indeed, COVID-19 will increase debt in all sectors of the economy, but the public sector will see the biggest rise as it supported private incomes when GDP plummeted. According to the European Commission spring forecast, the euro area gross government debt-to-GDP ratio is predicted to increase by some 13 percentage points between 2019 and 2021, towards 99 %, with several countries expected to post increases of almost 20 percentage points. This raises questions on the sustainability of such high levels of public debt and the interaction with monetary policy.

In this context, a crucial variable is the difference between the interest rate that governments pay on their debt and the growth rate of the economy, as explained in more detail by Blanchard (2019) and Baert *et al.* (2020). That difference, which can be expressed in either nominal or real terms and which we label here as *r-g*, determines the dynamics of the debt ratio for a given primary balance. A negative value for *r-g* facilitates debt management, as a negative snowball effect endogenously reduces the debt ratio as time passes. If such an environment proved to be permanent, the debt ratio would even stabilise with a primary deficit, but possibly at extremely – and undesirably – high levels (see further). In contrast, a positive differential requires governments to engineer a primary surplus to prevent snowball effects from rendering debt unsustainable.

Chart 7 illustrates that markets currently expect *r-g* to be supportive for the sustainability of many euro area governments' debts. Except for the current year during which economies will experience a sharp contraction in nominal growth, forward bond yields are clearly below forecasts of economic growth in Belgium and Germany. Italian growth, however, barely surpasses the yield on Italian government bonds. It is worth noting that the present outlook for *r-g* is clearly more friendly for debt dynamics than during the Great Financial Crisis of 2008 or the sovereign debt crisis of 2011-2012.

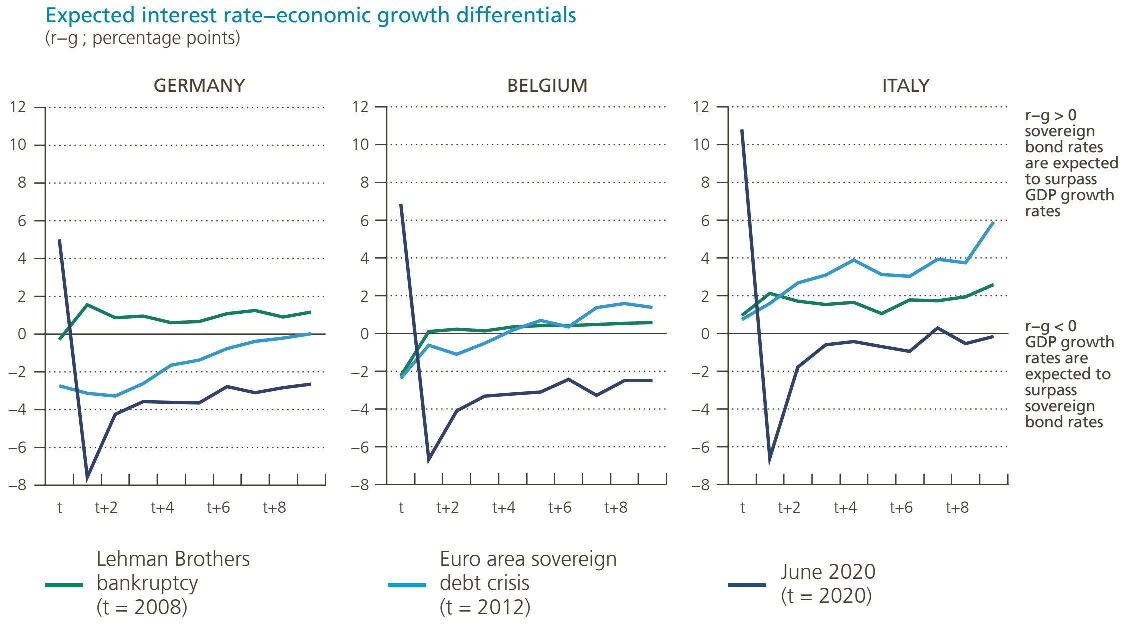
It is important to underscore that these debt-friendly *r-g* numbers are not driven by a monetary policy that sacrifices price stability to preserve governments' debt sustainability – a choice that would not be allowed by the Treaty. Rather than being driven by a form of "fiscal dominance", today's low interest rates reflect a depressed natural rate of interest and too low inflation. If the latter factors return to normal, central banks with a clear price stability mandate, like the ECB, will restore normal interest rates and the alleged coordination between fiscal and monetary policy will be history.

Against that background, there should be no reason for complacency on the part of governments, and prudence in setting fiscal policy is of the essence. First, while it is mathematically true that a permanently negative *r-g* number stabilises debt ratios even with a permanent primary deficit, that can imply unacceptably high debt ratios. To illustrate this in a mechanical way, if the currently projected 2022 Belgian primary deficit[1] of 4.2 % in the baseline scenario and the forward *r-g* of –2.5 % were to become a new steady state, the Belgian debt level would in theory only stabilise at 172 %. This is a number that cannot be called desirable. Moreover, in practice, it is very likely that continued fiscal deficits resulting in such a high debt level would put upward pressure on

1 See NBB (2020).

Chart 7

**Government bond yields are generally below growth expectations**




Sources: Consensus Economics, Refinitiv.
June 2020: difference between nominal government bond rates (June 2020 average) and Consensus Economics June 2020 nominal GDP forecasts for 2020, 2021 and 2022 and April 2020 nominal GDP forecasts for 2023-2029; Lehman Brothers bankruptcy: difference between nominal government bond rates (2008Q3 average) and Consensus Economics October 2008 nominal GDP forecasts; euro crisis: difference between nominal government bond rates (2012Q1 average) and Consensus Economics April 2012 nominal GDP forecasts. The Belgian data use short-term nominal GDP forecasts from Consensus Economics while long-term nominal GDP forecasts are from the Federal Planning Bureau.

Belgian government bond yields which may in turn depress economic growth, making r-g significantly less supportive. More generally, uncertainty about the future *r-g* is large and calls for caution.

Going forward, *r-g* could indeed become less supportive for debt sustainability: the graphs show only a central scenario for economic growth and interest rates, whereas reality may – and likely will – turn out differently. Small changes to *r-g* have large implications for the debt ratio: if *r* increases by a mere 50 basis points in the above mechanical example for Belgium, the debt stabilises only at 216 %. As already stated, downside risks to growth stemming from demand shocks could render the *r-g* profile less conducive for debt sustainability as there is limited scope for interest rates to go much lower.[1] Interest rates on government bonds could also rise. Faced with adverse supply shocks, a less accommodative monetary policy stance could be justified and lower economic growth might not go hand in hand with lower interest rates, resulting in a shrinking gap between economic growth and government bond yields. Another possible driver of higher borrowing costs is the risk premium that countries pay on top of the risk-free rate. While the ECB stands ready to act as a lender of last resort for sovereigns with liquidity problems but sustainable debts – and can be relied upon to eliminate any bad equilibria and unjustified rises in yields –, that is not equivalent to unconditional backing for all sovereign debt issued by euro area Member States.

To sum up, current conditions allow for a temporary shift towards expansionary fiscal policy without threatening debt sustainability. However, the fact that sizeable fiscal space exists today does not mean that it should be exploited. That is because, looking ahead, governments should be prepared for scenarios where borrowing

1 This is closely linked to the concept of "debt deflation", as pioneered by I. Fischer (1933).

costs rise. In fact, monetary policy can only deliver on its primary mandate of maintaining price stability if governments can be relied upon to make the necessary fiscal choices to ensure that debts are sustainable, even when interest rates go up. Otherwise, debt sustainability considerations will interfere with the conduct of monetary policy. That can happen via – possibly extreme – stress on sovereign bond markets with adverse spillovers to the real economy and inflation, or via a form of "fiscal dominance" where the central bank, sacrificing price stability for debt stabilisation, is too slow in raising interest rates.

## Bibliography


Baert S., B. Cockx, F. Heylen and G. Peersman (2020), "Economisch beleid in tijden van corona: een kwestie van de juiste uitgaven te doen", Gentse Economische Inzichten, nr. 1.

Blanchard O. (2019), "Public Debt and Low Interest Rates", American Economic Review, vol. 109(4), p. 1197-1229, April.

Cavallino P. and F. De Fiore (2020), "Central banks' response to COVID-19 in advanced economies", BIS Bulletins 21, Bank for International Settlements.

ECB (2020), "Eurosystem staff macroeconomic projections for the euro area", June.

Fisher I. (1933) "The Debt-Deflation Theory of Great Depressions", Econometrica, vol. 1(4), October, p. 337-57.

Lane Ph. R. (2020), "The ECB's monetary policy response to the pandemic: liquidity, stabilisation and supporting the recovery", speech at the Financial Center Breakfast Webinar organised by Frankfurt Main Finance, 24 June.

National Bank of Belgium (2020), "Economic projections for Belgium – Spring 2020", Economic Review, June.

Powell J. H. (2020), "Current Economic Issues", speech at the Peterson Institute for International Economics, Washington, D.C. (via webcast), 13 May.

# Price-setting behaviour in Belgium: New evidence from micro-level CPI data

S. Blanas
H. Zimmer

## Introduction

In recent decades, national statistical agencies have increasingly been providing researchers with the micro-level data on consumer and producer prices that they rely on for compiling official statistics. This trend has spawned numerous empirical studies seeking to come up with evidence on price adjustment and explain inflation dynamics. Despite the significant progress that has now been made and the broad coverage of countries examined[1], the bulk of the existing literature covers the 1990s and early 2000s, with pertinent evidence as of the more recent period being scarce[2]. Importantly, while the 1990s and early 2000s span the period characterised by robust GDP growth and inflation rates close to target levels (i.e. the "Great Moderation") in most advanced economies, subsequent years have been marked by the financial crisis of 2007 and the ensuing global GDP and trade collapse, the 2010-2012 euro area sovereign debt crisis with its regional and global side effects and the low inflation environment in the euro area as of 2013. As a result, these events have rendered even more compelling the need of policy-makers and academics alike to understand how micro-level prices have been set in recent years and inform monetary policy accordingly.

Our main objective in this article is to contribute on this front. Exploiting a new release of micro-level CPI (Consumer Price Index) data of monthly frequency for Belgium over the period from January 2007 to December 2015, we provide evidence on how frequently prices adjust, how large these adjustments are, and the time- and state-dependent aspects of these adjustments. The patterns and trends that we identify are summarised in six stylised facts and are broadly consistent with those documented in the existing literature.

First, firms change their prices quite frequently, that is, every five to seven months. These numbers are smaller compared to what has been reported in the literature for Belgium and the euro area. Second, downward price adjustments are not uncommon (even excluding seasonal sales): they account for roughly one-third of total price changes and are comparable to what has been reported previously for Belgium, other euro area countries and the US. Third, price increases and decreases are relatively sizeable, of an average magnitude of roughly 12 % each, and small price changes (i.e. of less than 1 % or 2 %) are relatively few. Both the magnitudes of price changes and the scarcity of small price changes are greater than what has been reported in earlier studies. These facts, along with the more frequent price changes, possibly reflect the more volatile macroeconomic

1 See, among others, Bils and Klenow (2004), Klenow and Kryvtsov (2008), Nakamura and Steinsson, (2008), Midrigan (2010) and Midrigan and Kehoe (2015) for the US; ECB Inflation Persistence Network (IPN) studies for individual euro area countries and the euro area (Dhyne *et al.*, 2006; Alvarez *et al.*, 2006; Fabiani *et al.*, 2006; Vermeulen *et al.*, 2012); Gagnon (2009) for Mexico; Berardi *et al.* (2015) for France; and Wulfsberg (2016) for Norway. For a comprehensive review of the early literature, see Klenow and Malin (2010).

2 See, for instance, Berardi *et al.* (2015) who use monthly micro-level CPI data for France over the period April 2003 - April 2011.

environment from 2007 to 2015 compared to previous years. Fourth, the frequency of price changes has a time-dependent feature (Taylor, 1980; Calvo, 1983). Price rises occur more often in January, February, April and October, while price cuts occur more often in April, July and October.

Fifth, heterogeneity in all these dimensions across product categories is salient. For instance, the prices of unprocessed and processed food products change roughly every one or two quarters, prices of non-energy industrial goods change every year, while services prices change every two years on average. In terms of size, price changes for unprocessed food products and non-energy industrial goods are relatively large (16 % to 18 % and 10 % to 11 %), while price changes for services and processed food products are relatively small (roughly 7 %).

Sixth, during the great financial crisis and its aftermath (2007-2009) and the low inflation environment in the euro area (as of 2013), there was a declining trend in the frequency of price rises in Belgium, a growing trend in the frequency of price cuts, while price falls were more sizeable than price rises. These patterns and trends may be suggestive of price changes being determined by macroeconomic and financial shocks highlighting their state-dependent feature (Cecchetti, 1985; Klenow and Kryvtsov, 2008; Dixon *et al.*, 2020).

## 1. Data

In this section, we describe the micro-level CPI dataset that we use in the empirical analysis.

The dataset has been made available to the National Bank of Belgium (NBB) by the Belgian Statistical Office (Statbel), which collects data on consumer prices for calculating the official National and Harmonised Index of Consumer Prices for Belgium. The dataset covers the period from January 2007 to December 2017 at a monthly frequency. Data collection over the period 2007-2015 was mostly made by regular visits of pollsters to retail shops, except in the case of cars where prices were collected from catalogues. By contrast, as of 2016, the Statistical Office has relied primarily on scanner data for a wide range of products sold at supermarkets in Belgium[1]. As these data could not be released to the NBB for confidentiality reasons, the dataset has a limited product coverage from 2016 onwards. For this reason, we drop the last two years and consider only the period between January 2007 and December 2015 in our analysis.

For each price quote available in the dataset except for those for cars, we observe the date (month and year), the unique product identifier and its corresponding description as well as the corresponding 6-digit COICOP[2], the measurement unit, the unique identifier and address of the retail shop, the unique identifier and name of the Belgian city or town where the retail shop is located, and flags indicating a promotion, unavailability of the product for at least a month, and imputed price[3]. Except for services, the product description is a detailed text enabling us to identify different brands of products after dealing with small discrepancies across text descriptions[4]. We mostly identify brands by the name of the brand included in the text (e.g. Côte d'Or, Jacques, etc. for chocolate products). When additional product characteristics are included, we take these into consideration in order to define individual products. In other words, we treat as different items two chocolates that have the same brand name (e.g. Côte d'Or) but different characteristics (e.g. milk chocolate, dark chocolate). In order to calculate unit values, upon which we rely throughout the analysis, we first homogenise measurement units whenever necessary (e.g. from ml and cl to litre, from grams to kilogram). As regards cars, in addition to

1 Covering as much as 22 % of the consumption basket in 2016.

2 The Classification of Individual Consumption According to Purpose (COICOP) is the international reference classification of household expenditure on homogeneous categories of goods and services. The COICOP codes available in the dataset, along with the corresponding product description and average weight over 2007–2015 are shown in table A1.

3 For instance, the price collector may impute a missing price and this is flagged in the dataset.

4 For a few observations, applying mostly to unprocessed food products, the text description is missing. We can, however, uniquely identify these products from the combination of their identifier and the identifier of the retail shop.

the date (month and year) of each price quote, we observe the name of the manufacturer, the model and the version, the number of doors, the engine type, the motor type and the number of gears, the combination of which allows us to identify an individual car. In this way, we ensure consistency in the definition of an individual product between cars and the rest of the products (e.g. chocolates).

We group each product available in the categories of unprocessed food, processed food, non-energy industrial goods, or services, based on its unique identifier and the relevant classification established by Eurostat[1]. Information on energy sector products is not available in the dataset. We also account for the weight of each product in the consumption basket by using additional information on its share in household expenditure. This information originates from the Household Budget Survey (HBS) and is made available to us by the Statistical Office at the 6-digit COICOP level. The weights of most products vary by month or by year, while the weights of seasonal products (e.g. winter jackets) are non-zero only in certain calendar months, when expenditure on such products is mostly recorded.

We calculate price trajectories of individual products based on the combination of brands, unique retail shop identifiers and year-month pairs[2]. That is, we consider that the brand of a product sold at a certain shop and location in a given month and year has a different price trajectory from the same brand sold in the same month and year at another shop of the same or another location[3]. After eliminating a small fraction of duplicates and the observations corresponding to 2016 and 2017, we are left with 8 794 966 observations. In order to account for outliers while calculating monthly price changes, we apply the methodology of Klenow and Kryvtsov (2008). We consider a price change as "unusual" if the new price is at least five times larger or smaller than the old price. Factor 5 indicates that there are 267 price trajectories in which outliers are detected. Dropping the factor 5 outliers results in a loss of 4 051 observations.

Relying on the flag for imputed prices, we identify that such cases correspond to 25 950 observations (0.3 % of the total) and eliminate them. The flag for promotions indicates that these correspond to 164 323 price quotes (1.87 % of the total). For the majority of these observations (84.7 %), we do observe a drop in price. For small fractions of these, however, we observe no price changes (6.12 %) or price rises (4.96 %). After dropping the observations corresponding to the last two cases[4], we lose 10 057 and 8 156 observations, respectively. In contrast to promotions, data limitations do not allow us to account for seasonal sales that take place in Belgium in January and July of each year. Relatedly, we identify 171 408 price quotes in January and July that have been assigned the values of the respective preceding month (i.e. December and June)[5]. To avoid any bias in our analysis, we drop these other imputed prices from the sample. Regarding product replacements, these are identified by the flag indicating whether the product has become unavailable for at least a month. There are 75 084 such cases (0.87 % of the total). For the majority of these (66 481), no price change is observed, while price increases are observed in only 185 cases. Although a fall in prices is observed in the remaining 7 084 cases, we consider as valid only 182 of these as the new price for the rest drops to zero.

After the data cleaning, the dataset that we rely on in the empirical analysis comprises 8 575 344 observations. Price quotes for unprocessed and processed food account for relatively high fractions of the total number of observations (35.6 % and 42.3 %, respectively), price quotes for non-energy industrial goods and services account for relatively low fractions of the total number of observations (14.2 % and 7.9 %, respectively), while there are no price quotes for energy products (columns 2 and 3 of table A2). In addition, comparisons of the average weights of product categories in our dataset over the period 2007-2015 (column 4 of table A2) with the corresponding weights in the aggregate CPI (column 5 of the same table) reveal that although we make use

1 This classification groups COICOP codes into "special aggregates" such as those considered in this article.
2 For cars, we use only brand-year-month triplets.
3 As each retail shop corresponds to a single city or town, it is sufficient to consider only the retail shop identifiers in conjunction with the brands of products.
4 As these might have been mistakenly flagged as promotions by the price collectors.
5 These imputed price quotes correspond to non-energy industrial goods (primarily clothes).

of all the information used by the Statistical Office for the calculation of official CPI statistics on unprocessed food (12.5 %) and processed food (8.3 %) products, we use rather limited information on non-energy industrial goods (16.2 % versus 30.7 %) and especially, on services (9.9 % versus 36.2 %)[1].

Conceptually, the frequency of price adjustments shows the fraction of retailers that change the price of a certain item that they sell. We thus calculate it as the ratio of the total number of monthly price changes of a given brand-shop pair (i.e. of an individual product) in the respective total number of price quotes. Conditional on a price change made by a retailer for a certain item, the size of the price adjustment shows the magnitude of the change. Hence, we calculate it as the log difference of prices between two consecutive months. At the aggregate, the product of the frequency of price adjustments (extensive margin) and the size of price adjustments (intensive margin) yield the inflation rate.

## 2. Evidence on price adjustment

In this section, we present cross-sectional and time-series evidence on the frequency and size of price adjustments.

### 2.1 How frequently do prices adjust ?

In order to examine how often retailers change their prices, we start off with the analysis on the frequency of price adjustments in the cross section. Table 1 displays the mean and median frequencies of price changes, the same statistics considering the direction of price changes (i.e. up or down), the fraction of price reductions, and the mean and median implied durations. In Panel A, we produce the statistics on the sample that includes promotions and product replacements, while in Panel B, we produce the statistics on the sample that excludes both promotions and product replacements.

Panel A reveals that the mean and median frequencies of price changes are 18.3 % and 14.7 %, respectively (column 1). These frequencies work out at 5 and 6.3 months during which prices remain unchanged (column 5). Although price decreases are less frequent than increases, these are not uncommon. The corresponding mean and median frequencies are 7.7 % and 5.5 % (column 3), implying that price decreases account for 42 % and 37.2 %, respectively, of price changes (column 4). Panel B exhibits the same patterns. However, primarily due to promotions being excluded, the mean and median frequencies of price changes and the fraction of price decreases are smaller, and in turn, the mean and median implied durations are larger. In particular, the mean and median frequencies of price changes are 16.8 % and 13.1 % (column 1), which work out at 5.4 and 7.1 months of unchanged prices (column 5). The mean and median frequencies of price decreases are 6.2 % and 3.6 % (column 3), implying that 37.2 % and 27.2 %, respectively, of price changes correspond to decreases (column 4).[2]

The frequencies given in table 1 are almost identical to or higher than those reported by studies covering Belgium and the euro area in the 1990s and early 2000s. Using micro-level CPI data on a common sample of 50 goods and services for individual euro area countries[3] over the period from January 1996 to January 2001, Dhyne *et al.* (2006) report a mean frequency of price changes in the euro area of 15.1 %, a mean implied

1 Data cleaning does not alter the composition of the raw dataset, as we observe very similar patterns to those in table A2 when we produce the statistics before removing observations for data cleaning purposes. These statistics are available upon request.

2 Including promotions and excluding product replacements produces very similar statistics to those in Panel A, while excluding promotions and including product replacements produces very similar statistics to those in Panel B. These tables are available upon request.

3 The euro area countries included in the analysis are Austria, Belgium, Finland, France, Germany, Italy, Luxembourg, the Netherlands, Portugal, and Spain.

Table 1

**Frequency of price changes**

| | Frequency (%) | | | Fraction (%) | Implied Duration (months) |
|---|---|---|---|---|---|
| | Changes | Increases | Decreases | Decreases | –1 / ln (1 – Freq) |
| Panel A: Incl. promotions and product replacements | | | | | |
| Mean | 18.3 | 10.5 | 7.7 | 42 | 5 |
| Median | 14.7 | 9.7 | 5.5 | 37.2 | 6.3 |
| Panel B: Excl. promotions and product replacements | | | | | |
| Mean | 16.8 | 10.5 | 6.2 | 37.2 | 5.4 |
| Median | 13.1 | 9.7 | 3.6 | 27.2 | 7.1 |

Notes: Mean and median frequencies are calculated in two steps. First, we calculate the *unweighted* mean of the frequency of price changes across year-month pairs by retailer-brand pair. Then, we calculate the *weighted* mean or median across retailer-brand pairs using the 6-digit COICOP weights. The fraction of price decreases is the ratio of the mean or median frequency of price decreases to the corresponding frequency of price changes. Frequencies of price changes and the fraction of price decreases are in percentages. The mean and median implied durations are calculated as –1/ln (1 – Freq), where Freq is the mean and the median frequency of price changes, respectively (Nakamura and Steinsson, 2008). Implied durations represent the number of months during which prices remain unchanged. Calculating the mean (median) implied duration of Panels A and B as the inverse of the mean (median) frequency of price changes, 1/Freq, yields 5.5 and 6 (6.8 and 7.6) months.

Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

duration of 13 months, and a median implied duration of 10.6 months[1]. The mean frequency of price changes that they report for Belgium is equal to 17.6 %. Berardi *et al.* (2015) use micro-level CPI data for France covering a period that overlaps with ours (April 2003 - April 2011) and report mean frequencies of price changes that range from 15 % (excluding promotions-seasonal sales and product replacements) to 20.1 % (including promotions-seasonal sales and product replacements)[2].

For the US, Bils and Klenow (2004) use micro-level CPI data from the US Bureau of Labor Statistics (BLS) for the period 1995-1997 and find a mean frequency of price changes of 26.1 %. Relying on the same data source but covering a longer time span (1988-2004), Klenow and Kryvtsov (2008) report a mean (median) frequency of regular (i.e. non-sales) price changes of 29.9 % (13.9 %) and a mean (median) implied duration of 8.6 (7.2) months. Nakamura and Steinsson (2008) also rely on the BLS CPI data and conduct their analysis on two different sample periods: 1988-1997 and 1998-2005. They find that the median frequency of regular price changes is roughly half of what it is when sales are considered as price changes (9 % - 12 % compared with 19 - 20 % when product replacements are excluded; 11 % - 13 % compared with 21 - 22 % when product replacements are included). For regular prices, the corresponding median implied durations range between 8 and 11 months (when product replacements are excluded) and between 7 and 9 months (when product replacements are included).

The fractions of price reductions are comparable to those reported in early and more recent studies: 42 % for the euro area (Dhyne *et al.*, 2006), roughly 35 % for the US (Nakamura and Steinsson, 2008), 36.5 % (excluding

1 In addition to the different period and product composition examined with respect to our study, the authors calculate the weighted mean and median implied durations slightly differently from us. In particular, rather than plugging the weighted mean or median frequency of price changes in the formula of implied duration (Nakamura and Steinsson, 2008), they first calculate the implied duration at the product level, and then they calculate the weighted mean and median implied durations across products using relevant product weights.

2 In this paper, sales prices are defined as prices corresponding to either seasonal sales or temporary promotional discounts. Product replacements correspond to cases where the product is no longer available in a certain retail store, the retail store ceases to exist, or the retail store or product is disregarded by the Statistical Office so that the sample includes items that are representative of the consumption pattern.

promotions-seasonal sales and product replacements) and 39.8 % (including promotions-seasonal sales and product replacements) for France (Berardi *et al.*, 2015).

The statistics in table 1 are produced on samples that include all available products. In order to examine possible differences across product categories, we produce in table 2 the same statistics for unprocessed food, processed food, non-energy industrial goods, and services[1]. For the scope of this exercise, we use the sample without promotions and product replacements which we consider as the benchmark. Heterogeneity in the frequency of price adjustments and the implied duration across the four product categories is salient.

Prices of unprocessed and processed food products change more frequently than prices of non-energy industrial goods and services. Also, the mean frequencies of the first two product categories are above the sample mean, while the mean frequencies of the other two product categories are below the sample mean (27.4 %, 19 %, 7.2 % and 3.7 % compared with 16.8 %). Comparisons of the median frequencies reveal the same patterns. In terms of duration, prices of unprocessed and processed food products change every 3.1 to 5.7 and 4.4 to 4.7 months, respectively, while prices of non-energy industrial goods change every 13.2 to 13.4 months and prices of services change every 26.5 to 28.9 months. Also, (downward) price rigidity for the first three product categories is comparable to that on the whole sample, as indicated by comparisons of the fractions of price decreases (40.4 %, 36.8 %, 30.7 % against 37.2 % based on the mean frequencies). By contrast, the prices of services are relatively rigid, as decreases account for only 12 % or 9.3 % of the identified price changes, based on mean or median frequencies[2].

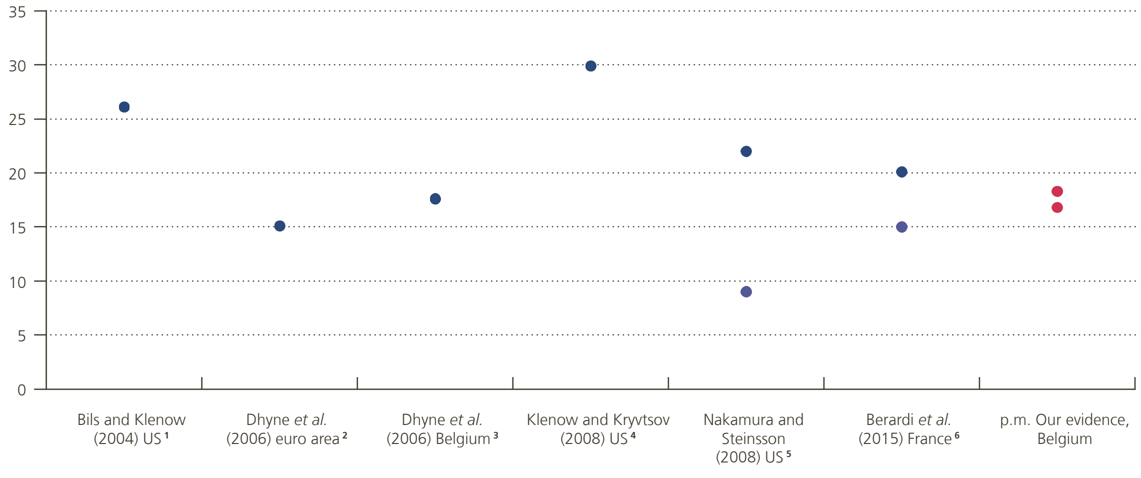
1 As mentioned in the data section, the dataset does not include prices on energy products and thus, the energy sector is not included in the analysis.

2 Using the same statistics from table 2 on the sample that includes promotions and product replacements naturally results in higher mean and median frequencies and lower mean and median implied durations within each product category, but the comparisons across product categories lead to the same conclusions (table B1).

Chart 1

**Key findings of related empirical studies**

(frequency of price changes in %)




1 Mean frequency, 1995-1997, 70 % of the CPI covered.

2 Mean frequency, January 1996 - January 2001, common sample of 50 products.

3 Mean frequency, January 1996 - January 2001, common sample of 50 products.

4 Mean frequency, 1988-2004, 70 % of the CPI covered.

5 Median frequency, 1988-1997 and 1998-2005, 70 % of the CPI covered: lowest point is excluding sales and product replacements, highest point is including sales and product replacements.

6 Mean frequency, April 2003 - April 2011, 65 % of the CPI covered: lowest point is excluding sales and product replacements, highest point is including sales and product replacements.

Table 2

**Frequency of price changes by product category, excluding promotions and product replacements**

| | Frequency (%) | | | Fraction (%) | Implied Duration (months) |
|---|---|---|---|---|---|
| | Changes | Increases | Decreases | Decreases | −1/ln (1 – Freq) |
| Panel A: Unprocessed food | | | | | |
| Mean | 27.4 | 16.3 | 11.1 | 40.4 | 3.1 |
| Median | 16 | 11.8 | 4.7 | 29.5 | 5.7 |
| Panel B: Processed food | | | | | |
| Mean | 19 | 12 | 7 | 36.8 | 4.7 |
| Median | 20.2 | 12.8 | 7.6 | 37.7 | 4.4 |
| Panel C: Non-energy industrial goods | | | | | |
| Mean | 7.2 | 5 | 2.2 | 30.7 | 13.4 |
| Median | 7.3 | 4.8 | 1.8 | 24.7 | 13.2 |
| Panel D: Services | | | | | |
| Mean | 3.7 | 3.3 | 0.4 | 12 | 26.5 |
| Median | 3.4 | 3.1 | 0.3 | 9.3 | 28.9 |

Notes: Mean and median frequencies are calculated in two steps. First, we calculate the unweighted mean of the frequency of price changes across year-month pairs by retailer-brand pair and product category. Then, we calculate the weighted mean or median across retailer-brand pairs by product category using the 6-digit COICOP weights. The fraction of price decreases and implied duration are calculated as in table 1. Frequencies of price changes and the fraction of price decreases are in percentages. Implied durations represent the number of months during which prices remain unchanged. Calculating the mean (median) implied duration of Panels A, B, C and D as the inverse of the mean (median) frequency of price changes, 1/Freq, yields 3.6, 5.3, 14 and 27 (6.2, 4.9, 13.4 and 29.4) months.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007-December 2015.

The literature has rationalised price rigidity by putting forward reasons that vary from explicit and implicit contracts with customers for the development of strong ties, to cost-based pricing, to coordination failure (Fabiani *et al.*, 2006). In relation to cost-based pricing, as labour costs account for a relatively high share of total production costs in the services sector, downward price rigidity is also expected to be relatively high. Another possible reason is the composition of services included in the dataset. In fact, the bulk of services are accounted for by restaurants and cafés where price changes are subject to menu costs, as well as by hairdressers and housing-related services (e.g. painting, electricity work, plumbing) where prices change infrequently. By contrast, services whose prices change more frequently (e.g. telecommunications, holidays, cultural events) are not included in the dataset.

The patterns that appear in table 2 are consistent with those documented in the literature. Among the four product categories, Dhyne *et al.* (2006) show that the frequency of price changes is the highest for unprocessed food products, smaller for processed food products, even smaller for non-energy industrial goods, while it is the smallest for services (31.5 %, 19.1 %, 5.9 % and 3 % for Belgium). This is also the case for the other individual euro area countries examined (Austria, Germany, Finland, France, Italy, Luxembourg, the Netherlands, Portugal, Spain). The corresponding figures for the US are 47.7 %, 27.1 %, 22.4 % and 15 % (Bils and Klenow, 2004). For the same country, Nakamura and Steinsson (2008) report ranges of frequencies from 25 % to 39 % (unprocessed food), 10.5 % to 25.9 % (processed food), and 6.1 % to 9.1 % (services), depending on whether sales and product replacements are excluded or not and whether the mean or median is calculated.

## 2.2 How large are price adjustments?

In this section, we present the cross-sectional evidence on the size of price adjustments. Table 3 displays the mean and median size of price changes, the values of the 25th and 75th percentiles (P25 and P75), and the fraction of prices that change by less than 1 % and 2 % in the total number of price changes. The same statistics are also produced when considering the direction of price changes (i.e. increase or decrease).

When promotions and product replacements are included (Panel A), we find that prices change, on average, by 13.2 % (column 1) in absolute value. The respective P25, median (P50) and P75 values are equal to 7.3 %, 10.9 % and 16.9 % (columns 2-4). Considering the direction of price changes, we find that decreases are more sizeable than increases: the mean size of price increases is equal to 12 %, while the mean size of price decreases is equal to 14.7 %. This also holds in the other segments of the distribution: 7.1 % compared with 8.3 % (P25), 9.8 % compared with 13.3 % (median), and 14.8 % compared with are 19.3 % (P75). Regarding small price changes, we find that these are relatively few. In particular, the prices that change by less than 1 % and 2 % account for 6.3 % and 13.8 % of the total number of price changes. Similarly, the prices that increase (decrease) by less than 1 % and 2 % account for only 5.8 % (6.9 %) and 13.6 (14 %), respectively, of the total number of price changes.

Due to the smaller price reductions when promotions and product replacements are excluded, price increases are, on average, almost as big as price decreases (12 % against 12.3 %), larger at the lower end (P25) and middle (median) of the distribution (7.1 % compared with 5.9 % and 9.8 % against 8.7 %), and smaller only at the higher end (P75) of the distribution (14.8 % compared with 17.1 %)[1]. Although the fractions of prices that fall by less than 1 % and 2 % rise to 7.9 % and 16 %, they still suggest that small price cuts are relatively few.

The magnitudes of price changes that we observe are mostly larger compared to those reported in the literature. Using monthly CPI data for 1996-2001, Dhyne *et al.* (2006) report a mean size of price increases equal to 8.2 % and a mean size of price decreases equal to 10 %. According to Berardi *et al* (2015) who

1 Including promotions and excluding product replacements produces very similar statistics to those in Panel A, while excluding promotions and including product replacements produces very similar statistics to those in Panel B. These tables are available upon request.

### Table 3

**Size of price changes**

| | Size (log price difference) | | | | Fraction (%) | |
|---|---|---|---|---|---|---|
| | Mean | Median | P25 | P75 | Size ≤ 1 % | Size ≤ 2 % |
| Panel A: Incl. promotions and product replacements | | | | | | |
| Changes | 0.132 | 0.109 | 0.073 | 0.169 | 6.3 | 13.8 |
| Increases | 0.12 | 0.098 | 0.071 | 0.148 | 5.8 | 13.6 |
| Decreases | 0.147 | 0.133 | 0.083 | 0.193 | 6.9 | 14 |
| Panel B: Excl. promotions and product replacements | | | | | | |
| Changes | 0.121 | 0.096 | 0.068 | 0.15 | 6.6 | 14.6 |
| Increases | 0.12 | 0.098 | 0.071 | 0.148 | 5.8 | 13.6 |
| Decreases | 0.123 | 0.087 | 0.059 | 0.171 | 7.9 | 16 |

Notes: The size of price changes is the log price difference in two consecutive months. The statistics for the size of price changes are calculated in two steps. First, we calculate the unweighted mean of the size of price changes across year-month pairs by retailer-brand pair. Then, we calculate the weighted mean, median, P25 or P75 value across retailer-brand pairs using the 6-digit COICOP weights. The fractions of small price changes (less than 1 % and 2 %) are in percentages.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007-December 2015.

use CPI data for France, the mean and median sizes of price increases are equal to 7.9 % and 3.7 % when promotions and seasonal sales are excluded, and 12.8 % and 4.3 %, when these are included. The respective figures for price decreases are 7.8 % and 4.4 % (promotions and seasonal sales excluded) and 11.5 % and 6.1 % (promotions and seasonal sales included). According to Nakamura and Steinsson (2008) who use CPI data for the US, the mean and median sizes of price increases are 9.2 % and 8 % (sales excluded) and 14.9 % and 12.3 % (sales included); and the mean and median sizes of price decreases are 12 % and 10.7 % (sales excluded) and 18.5 % and 15.3 % (sales included). In terms of the fraction of small changes reported in this article, these are smaller compared to what has been reported in earlier studies. According to Berardi *et al.* 2015), price changes in France that are smaller than 1 % (2 %) account for 13 % (27.4 %) and 11.2 % (23.7 %) of total price changes when promotions and seasonal sales are excluded and included, respectively.

Next, our goal is to document possible differences in the size of price adjustments across the four product categories examined. To this end, we re-produce in table 4 the statistics from table 3 by product category for the benchmark case. The salient heterogeneity in the size of price adjustments across the four panels is easily discernible. According to the mean values and the values of the other parts of the size distribution (P25, median, P75), changes in the price of unprocessed food products, including when considering the direction of these, are bigger compared to the whole sample. This is most likely explained by the relatively short shelf life of such products and their supply being subject to higher uncertainty (e.g. weather conditions, logistics). By contrast, price changes for processed food products, non-energy industrial goods and services are smaller, except for the price reductions for non-energy industrial goods. The latter may be explained by electronic products (e.g. game consoles), furniture, motorcycles and bicycles. Prices of unprocessed food change, on average,

Table 4

**Size of price changes by product category, excluding promotions and product replacements**

| | Size (log price difference) | | | | Fraction (%) | |
|---|---|---|---|---|---|---|
| | Mean | Median | P25 | P75 | Size ≤ 1 % | Size ≤ 2 % |
| Panel A : Unprocessed food | | | | | | |
| Changes | 0.177 | 0.164 | 0.112 | 0.235 | 3.9 | 8.4 |
| Increases | 0.179 | 0.149 | 0.116 | 0.24 | 3.7 | 8.4 |
| Decreases | 0.175 | 0.171 | 0.099 | 0.238 | 4 | 8.3 |
| Panel B : Processed food | | | | | | |
| Changes | 0.071 | 0.069 | 0.058 | 0.082 | 10.5 | 23.6 |
| Increases | 0.076 | 0.076 | 0.063 | 0.09 | 8.3 | 20.6 |
| Decreases | 0.062 | 0.058 | 0.049 | 0.073 | 14.1 | 28.7 |
| Panel C : Non-energy industrial goods | | | | | | |
| Changes | 0.096 | 0.108 | 0.019 | 0.135 | 6.8 | 10.6 |
| Increases | 0.079 | 0.087 | 0.018 | 0.123 | 7 | 11.5 |
| Decreases | 0.134 | 0.133 | 0.109 | 0.166 | 6.6 | 9.2 |
| Panel D : Services | | | | | | |
| Changes | 0.073 | 0.073 | 0.062 | 0.078 | 4.1 | 11.6 |
| Increases | 0.072 | 0.072 | 0.062 | 0.081 | 3.7 | 11.3 |
| Decreases | 0.082 | 0.078 | 0.068 | 0.094 | 7.3 | 14 |

Notes : The size of price changes is the log price difference in two consecutive months. The statistics for the size of price changes are calculated in two steps. First, we calculate the unweighted mean of the size of price changes across year-month pairs by retailer-brand pair and product category. Then, we calculate the weighted mean, median, P25 or P75 value across retailer-brand pairs by product category using the 6-digit COICOP weights. The fractions of small price changes (less than 1 % and 2 %) are in percentages.

Source : Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

by 17.7 % (column 1 of Panel A), while prices in the other categories change, on average, by 7.1 %, 9.6 % and 7.3 % (column 1 of Panels B to D).

Differences in the degree of scarcity of relatively small price changes are also evident. In particular, the scarcity of small price changes is greater for unprocessed food products and non-energy industrial goods compared to the whole sample. This is also the case for services, despite the smaller price adjustments observed for this category. By contrast, identifying relatively small price changes for processed food products is less uncommon compared to the whole sample and the other product categories. Depending on the threshold considered and the direction of price changes, such occurrences account for 8.3 % to 28.7 % of the total number of changes. Comparisons between the sizes of price increases and decreases within each product category reveal that while price increases are more sizeable than price decreases for unprocessed and processed food products, the reverse holds true for non-energy industrial goods and services [1].

Similar heterogeneity across product categories to that observed in table 4 has also been documented in the existing literature. Considering consumer prices in the euro area from 1996 to 2001, Dhyne *et al.* (2006) find that the mean sizes of increases and decreases are the highest for unprocessed food products (14.7 % and 16.3 %), followed by non-energy industrial goods (9.4 % and 11.4 %), services (7.3 % and 9.7 %) and processed food products (6.9 % and 8.1 %). A slightly different pattern is observed for US consumer prices (Nakamura and Steinsson, 2008). The median size of regular price increases is the highest for unprocessed food products (13.9 %), followed by processed food products (11.5 %) and services (6.5 %). The median size of regular price decreases is the highest for processed food products (17.6 %), followed by unprocessed food products (15 %) and services (9.5 %).

## 2.3 Are price adjustments time- and state-dependent ?

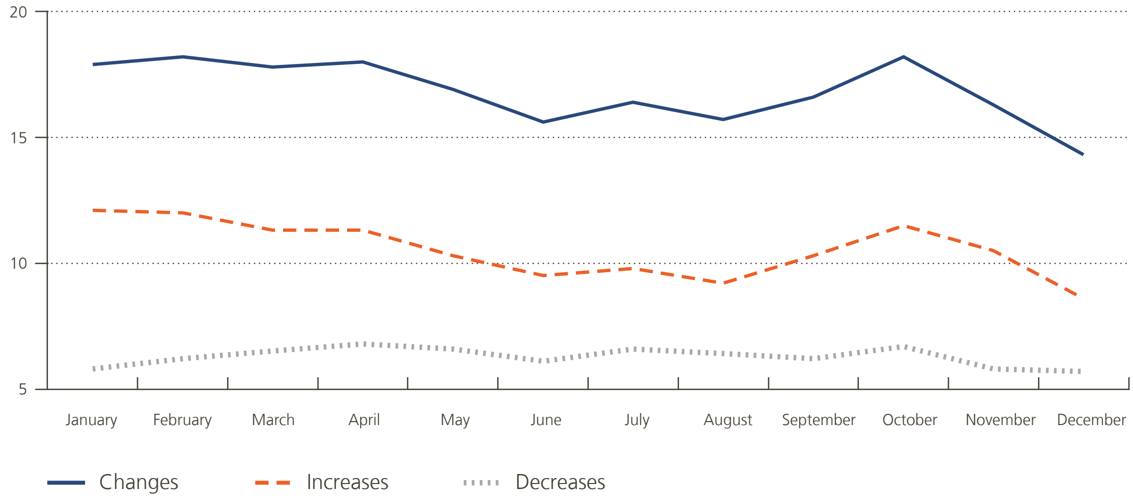
Having examined the cross-sectional evidence on the frequency and size of price adjustments, we now proceed to the analysis of the relevant time-series evidence. Our starting point is to show suggestive evidence on the time-dependent aspect of price adjustments (Taylor, 1980 ; Calvo, 1983). Relying on the benchmark sample (i.e. promotions and product replacements excluded), chart 2 portrays the evolution of the mean frequencies of price changes (solid line), increases (dashed line) and decreases (dotted line) across months. The lines exhibit seasonal trends : price increases occur more often in January, February, April and October, while price decreases occur more often in April, July and October. The three lines are largely unchanged when we include promotions and product replacements in the sample (chart B1). Berardi *et al.* (2015) also obtain very similar trends for consumer prices in France when promotions and seasonal sales are excluded, but, unlike our analysis, they obtain the "January effect" for price cuts when promotions and seasonal sales are included.

In order to better understand the trends in chart 2, we consider the four product categories for which a great deal of heterogeneity is observed in this respect. While the seasonal trends for unprocessed and processed food products are very similar to those for the whole sample (charts B2 and B3), the trends for non-energy industrial goods and services are quite different. Price increases and decreases for non-energy industrial goods occur more often in April and in October, while those for services occur more often in February and in October (charts B4 and B5). As clothes account for one third of non-energy industrial goods in the dataset, the seasonality identified for this product category is most likely explained by winter and summer clothing collections introduced around April and October, respectively. The seasonal trend in services is likely explained by the fact that the largest fraction of these in the dataset is accounted for by restaurants and cafés, where menu prices tend to change at the beginning of the year or after the summer holidays.

1 Producing the statistics by product category while including promotions and product replacements results in slightly bigger price adjustments for all product categories and slightly lower fractions of small price adjustments. Not surprisingly, price decreases are in this case bigger than price increases for all product categories and all parts of the size distributions (table B2).

Chart 2

**Mean frequency of price adjustments by month (%), excluding promotions and product replacements**




Notes: The mean frequencies by month are calculated in two steps. First, we calculate the unweighted mean of the frequency or size of price changes across years by retailer-brand-month triplet. Then, we calculate the weighted mean across retailer-brand pairs by month using the 6-digit COICOP weights.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007-December 2015.

Similar heterogeneity in the frequency of consumer price changes has been documented by Nakamura and Steinsson (2008) for the US and Berardi *et al.* (2015) for France.

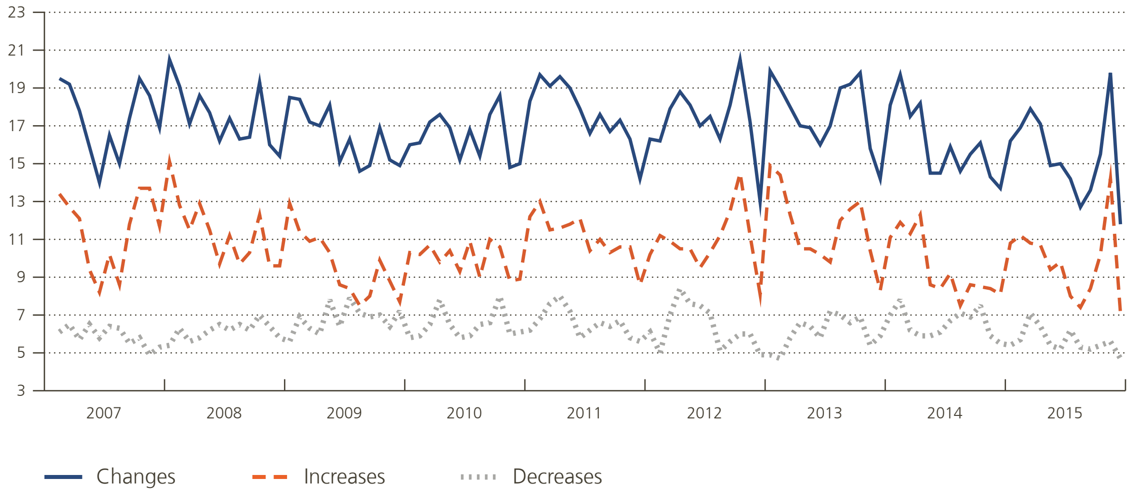
In charts 3 and 4, we plot the mean frequency and absolute size of price changes (solid line), increases (dashed line) and decreases (dotted line) against year-month pairs using the benchmark sample. Conducting this analysis is particularly relevant as the 2007–2015 period was marked by the great financial crisis and its aftermath (2007-2009), the sovereign debt crisis in the euro area, and the low inflation environment in the euro area from early 2013 onwards. In other words, the price-setting behaviour of firms in Belgium over the period examined might have also been determined by macroeconomic and financial shocks, which would point to its state-dependent aspect (Cecchetti, 1985; Caplin *et al.*, 1987; Caplin *et al.*, 1991; Dotsey *et al.*, 1999; Klenow and Kryvtsov, 2008; Nakamura and Steinsson, 2008; Midrigan, 2010; Kehoe and Midrigan, 2015; Dixon *et al.*, 2020). A careful examination of the trends of the mean frequencies and sizes of price increases and decreases over this period suggests that these may be related to such kinds of shocks.

According to chart 3, the mean frequency of price increases exhibits declining trends in the first half of 2007, from January 2008 until the end of 2009, and as of 2013, while it exhibits an increasing trend between January 2010 and December 2012. The mean frequency of price decreases moves mostly in the opposite direction. It is on a rising trend from the end of 2007 until mid-2009 and from 2013 towards the end of 2014, and on a declining trend from the second half of 2011 until the end of 2012. Chart 4 reveals that price decreases are, on average, bigger than price increases from January 2007 until the end of 2009, and in some months of 2013 and 2014. By contrast, price decreases are mostly smaller in 2010-2012. Producing these figures on the sample that includes promotions and product replacements does not alter these trends (figures B6 and B7). As expected, price decreases become more sizeable than price increases in the biggest part of the period examined, and this is particularly evident in 2007-2008, in 2011, the second half of 2012 and 2013 and in 2014 except for its last few months[1].

1 It is noteworthy that we obtain very similar trends to those portrayed in figures 1-3 and B1-B7 by relying on the *median* frequencies and sizes of price increases and decreases. These figures are available upon request.

Chart 3

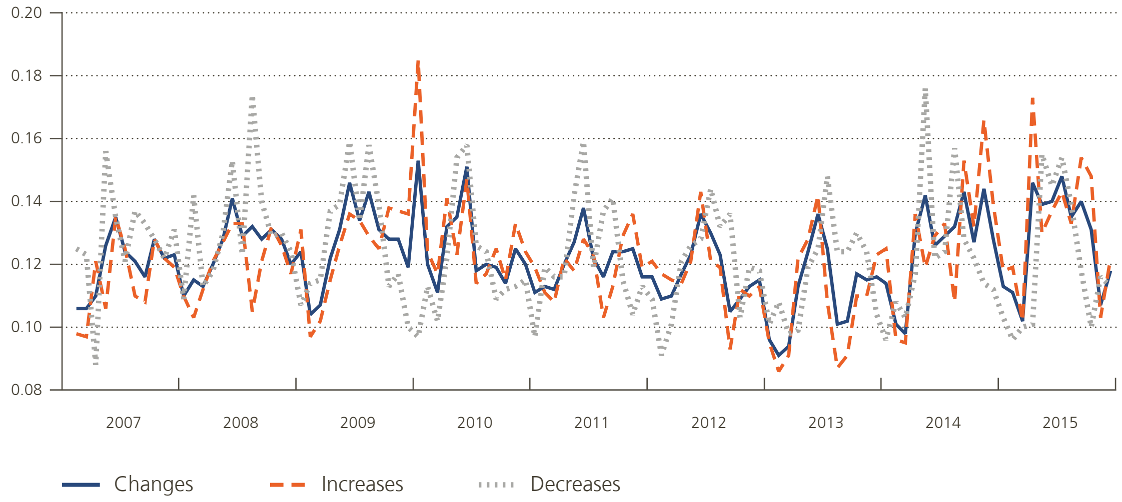
**Mean frequency of price adjustments by year-month (%), excluding promotions and product replacements**




Notes : The mean frequency by year-month is calculated as the weighted mean of the frequency of price changes across retailer-brand pairs by year-month pair using the 6-digit COICOP weights.
Source : Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

Chart 4

**Mean size of price adjustments by year-month (log price difference), excluding promotions and product replacements**




Notes : The mean frequency by year-month is calculated as the weighted mean of the frequency of price changes across retailer-brand pairs by year-month pair using the 6-digit COICOP weights.
Source : Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

## Conclusion

Using newly-available micro-level CPI data of monthly frequency for Belgium covering the period from January 2007 to December 2015, we derive a set of stylised facts on the price-setting behaviour of firms regarding products that span four categories: unprocessed food, processed food, non-energy industrial goods and services.

We document that prices change quite frequently (stylised fact 1), downward price adjustments are common (stylised fact 2), and price increases and decreases are relatively sizeable (stylised fact 3). The frequencies and sizes of price adjustments reported in this article are larger than those found by earlier studies, possibly due to the more volatile macroeconomic environment over the period examined compared to the "Great Moderation" period. In addition, the frequencies of price increases and decreases exhibit seasonal trends (stylised fact 4). Heterogeneity in all these dimensions across the four product categories examined is salient (stylised fact 5). Finally, during the great financial crisis and its aftermath (2007-2009) and the low-inflation environment in the euro area (as of 2013), price rises became less frequent, price cuts became more frequent, and price decreases were more sizeable than price increases (stylised fact 6). Despite these trends being intuitive, further research relying on micro-level price data could help us gain a better understanding of state-dependent features of price changes and in particular, of their determinants during periods that are marked by macroeconomic and financial instability, incomplete transmission of monetary policy or simultaneous demand and supply shocks such as those generated by the coronavirus pandemic.

## Bibliography

Alvarez L. J., E. Dhyne, M. M. Hoeberichts, C. Kwapil, H. Le Bihan, P. Lunnemann, F. Martins, R. Sabbatini, H. Stahl, Ph. Vermeulen and J. Vilmunen (2006). "Sticky Prices in the Euro Area : A Summary of New Micro Evidence", *Journal of the European Economic Association*, 4, 575-584.

Bils M. and P. J. Klenow (2004). "Some Evidence on the Importance of Sticky Prices", *Journal of Political Economy*, 112, 947-985.

Calvo G. (1983). "Staggered Prices in a Utility-Maximizing Framework", *Journal of Monetary Economics*, 12 (3), 383-98.

Caplin A. and J. Leahy (1991). "State-Dependent Pricing and the Dynamics of Money and Output", *Quarterly Journal of Economics*, 106, 683-708.

Caplin A. and J. Leahy (1997). "Aggregation and Optimization with State-Dependent Pricing" *Econometrica*, 65, 601-625.

Caplin A. and D. Spulber (1987). "Menu Costs and the Neutrality of Money", *Quarterly Journal of Economics*, 102, 703-725.

Cecchetti S. G. (1985). "Staggered Contracts and the Frequency of Price Adjustment", *Quarterly Journal of Economics*, 100, 935-959.

Dixon H., K. luintel and K. Tian (2020). The Impact of the 2008 Crisis on UK prices : What We Can Learn from the CPI Microdata, *Oxford Bulletin of Economics and Statistics*.

Dhyne E., L. J. Alvarez, H. Le Bihan, G. Veronese, D. Dias, J. Hoffmann, N. Jonker, P. Lunnemann, F. Rumler and J. Vilmunen (2006). "Price Changes in the Euro Area and the United States : Some Facts from Individual Consumer Price Data", *Journal of Economic Perspectives*, 20, 171-92.

Dias D., C. Robalo Marques and J. M. Santo Silva (2007). "Time or State Dependent Price Setting Rules ? Evidence from Micro Data", *European Economic Review*, 51, 1589-1613.

Dotsey M., R. King and A. Wolman (1999). "State-Dependent Pricing and the General Equilibrium Dynamics of Money and Output", *Quarterly Journal of Economics*, 114, 655-690.

Fabiani S., M. Druant, I. Hernando, C. Kwapil, B. Landau, C. Loupias, F. Martins, Th. Matha, R. Sabbatini, H. Stahl and A. Stokman (2006). "What Firms' Surveys Tell Us about Price-Setting Behavior in the Euro Area", *Journal of International Central Banking*, 2(3), 1-47.

Gagnon E. (2009). "Price Setting during Low and High Inflation : Evidence from Mexico", *Quarterly Journal of Economics*, 124, 1221-63.

Kehoe P. and M. Virgiliu (2015). "Prices are sticky after all", *Journal of Monetary Economics*, 75(C), 35-53.

Klenow J. P. and O. Kryvtsov (2008). "State-Dependent or Time-Dependent Pricing : Does It Matter for Recent US Inflation ?", *Quarterly Journal of Economics*, 123, 863-904.

Klenow J. P. and B. Malin (2010). "Microeconomic Evidence on Price-Setting", *Handbook of Monetary Economics*, 3, 231-84.

Midrigan V. (2010). "Is Firm Pricing State or Time Dependent? Evidence from U.S. Manufacturing", *The Review of Economics and Statistics*, 92(3), 643-656.

Nakamura E. and J. Steinsson (2008). "Five Facts about Prices: A Reevalutaion of Menu Cost Models", *Quarterly Journal of Economics*, 123, 1415-64.

Nakamura E. and J. Steinsson (2013). "Price Rigidity: Microeconomic Evidence and Macroeconomic Implications", *Annual Review of Economics*, 5, 133-63.

Taylor J. B. (1980). "Aggregate Dynamics and Staggered Contracts", *Journal of Political Economy* 88 (1), 1-23.

Wulfsberg F. (2016). "Inflation and Price Adjustments: Micro Evidence from Norwegian Consumer Prices 1975-2004", *American Economic Journal: Macroeconomics*.

# Annexes

## *A. Data Appendix*

### Table A1

**Products covered in the dataset**

| 5-digit COICOP | Description | Average Weight 2007-2015 (‰) |
|---|---|---|
| 01.1.1.1 | Rice | 0.40 |
| 01.1.1.2 | Flours and other cereals | 0.63 |
| 01.1.1.3 | Bread | 11.27 |
| 01.1.1.4 | Other bakery products | 11.92 |
| 01.1.1.5 | Pizza and quiche | 1.74 |
| 01.1.1.6 | Pasta products and couscous | 2.28 |
| 01.1.1.7 | Breakfast cereals | 1.23 |
| 01.1.1.8 | Other cereal products | 1.02 |
| 01.1.2.1 | Beef and veal | 7.37 |
| 01.1.2.2 | Pork | 2.65 |
| 01.1.2.3 | Lamb and goat meat | 1.16 |
| 01.1.2.4 | Poultry | 4.54 |
| 01.1.2.5 | Other meats | 1.43 |
| 01.1.2.7 | Dried, salted or smoked meat | 12.58 |
| 01.1.2.8 | Other meat preparations | 15.02 |
| 01.1.3.1 | Fresh or chilled fish | 4.45 |
| 01.1.3.2 | Frozen fish | 1.20 |
| 01.1.3.3 | Fresh or chilled seafood | 0.64 |
| 01.1.3.4 | Frozen seafood | 0.19 |
| 01.1.3.5 | Dried, smoked or salted fish | 0.83 |
| 01.1.3.6 | Other preserved or processed fish and seafood and fish and seafood preparations | 2.46 |
| 01.1.4.1 | Fresh whole milk | 0.86 |
| 01.1.4.2 | Fresh low fat milk | 1.67 |
| 01.1.4.3 | Preserved milk | 0.27 |
| 01.1.4.4 | Yoghurt | 3.45 |
| 01.1.4.5 | Cheese and curd | 10.81 |
| 01.1.4.6 | Other milk products | 2.34 |
| 01.1.4.7 | Eggs | 1.08 |
| 01.1.5.1 | Butter | 1.28 |
| 01.1.5.2 | Margarine and other vegetable fats | 1.50 |
| 01.1.5.3 | Olive oil | 0.67 |
| 01.1.5.4 | Other edible oils | 0.68 |
| 01.1.6.1 | Fresh or chilled fruit | 9.89 |
| 01.1.6.3 | Dried fruit and nuts | 0.81 |
| 01.1.6.4 | Preserved fruit and fruit-based products | 0.41 |
| 01.1.7.1 | Fresh or chilled vegetables other than potatoes and other tubers | 7.97 |
| 01.1.7.2 | Frozen vegetables other than potatoes and other tubers | 1.01 |
| 01.1.7.3 | Dried vegetables, other preserved or processed vegetables | 2.86 |
| 01.1.7.4 | Potatoes | 2.25 |
| 01.1.7.5 | Crisps | 1.36 |
| 01.1.8.1 | Sugar | 0.59 |
| 01.1.8.2 | Jams, marmalades and honey | 1.20 |
| 01.1.8.3 | Chocolate | 6.49 |
| 01.1.8.4 | Confectionery products | 0.78 |
| 01.1.8.5 | Edible ices and ice cream | 1.87 |

| 5-digit COICOP | Description | Average Weight 2007-2015 (‰) |
|---|---|---|
| 01.1.9.1 | Sauces, condiments | 2.92 |
| 01.1.9.2 | Salt, spices and culinary herbs | 0.31 |
| 01.1.9.3 | Baby food | 1.24 |
| 01.1.9.4 | Ready-made meals | 1.12 |
| 01.1.9.9 | Other food products n.e.c. | 1.78 |
| 01.2.1.1 | Coffee | 3.13 |
| 01.2.1.2 | Tea | 0.46 |
| 01.2.1.3 | Cocoa and powdered chocolate | 0.17 |
| 01.2.2.1 | Mineral or spring waters | 3.70 |
| 01.2.2.2 | Soft drinks | 7.23 |
| 01.2.2.3 | Fruit and vegetable juices | 2.47 |
| 02.1.1.1 | Spirits and liqueurs | 2.02 |
| 02.1.1.2 | Alcoholic soft drinks | 0.02 |
| 02.1.2.1 | Wine from grapes | 9.62 |
| 02.1.2.2 | Wine from other fruits | 0.03 |
| 02.1.2.3 | Fortified wines | 1.35 |
| 02.1.3.1 | Lager beer | 2.38 |
| 02.1.3.2 | Other alcoholic beer | 2.08 |
| 02.2.0.1 | Cigarettes | 7.62 |
| 02.2.0.3 | Other tobacco products | 2.27 |
| 03.1.2.1 | Garments for men | 13.47 |
| 03.1.2.2 | Garments for women | 24.99 |
| 03.1.2.3 | Garments for infants (0 to 2 years) and children (3 to 13 years) | 9.29 |
| 03.2.1.1 | Footwear for men | 3.25 |
| 03.2.1.2 | Footwear for women | 5.39 |
| 03.2.1.3 | Footwear for infants and children | 3.25 |
| 04.3.2.1 | Services of plumbers | 1.87 |
| 04.3.2.2 | Services of electricians | 1.78 |
| 04.3.2.3 | Maintenance services for heating systems | 1.78 |
| 04.3.2.4 | Services of painters | 1.62 |
| 04.4.4.9 | Other services related to dwelling | 0.98 |
| 05.1.1.1 | Household furniture | 16.03 |
| 05.1.1.2 | Garden furniture | 1.22 |
| 05.1.1.3 | Lighting equipment | 2.46 |
| 05.1.1.9 | Other furniture and furnishings | 2.35 |
| 07.1.1.1 | New motor cars | 68.65 |
| 07.1.2.0 | Motor cycles | 3.12 |
| 07.1.3.0 | Bicycles | 2.36 |
| 07.2.3.0 | Maintenance and repair of personal transport equipment | 17.21 |
| 09.3.1.1 | Games, toys and hobbies | 3.15 |
| 09.3.1.2 | Toys and celebration articles | 3.41 |
| 11.1.1.1 | Restaurants, cafés and dancing establishments | 46.49 |
| 11.1.1.2 | Fast food and take away food services | 11.58 |
| 11.2.0.3 | Accommodation services of other establishments | 0.33 |
| 12.1.1.1 | Hairdressing for men and children | 1.48 |
| 12.1.1.2 | Hairdressing for women | 8.81 |
| 12.1.1.3 | Personal grooming treatments | 1.24 |
| 12.7.0.1 | Administrative fees | 1.57 |
| 12.7.0.3 | Funeral services | 0.69 |
| 12.7.0.4 | Other fees and services | 1.75 |
| Total | | 460.59 |

Table A2

**Product coverage**

| Product category | Price quotes | | Weight in our sample, average 2007-2015 | Weight in total CPI, average 2007-2015 |
|---|---|---|---|---|
| | No. | % | % | % |
| Processed food | 3,626,419 | 42.3 | 12.5 | 12.5 |
| Unprocessed food | 3,052,145 | 35.6 | 8.3 | 8.3 |
| Non-energy industrial goods | 1,218,185 | 14.2 | 16.2 | 30.7 |
| Services | 678,595 | 7.9 | 9.9 | 36.2 |
| Energy | 0 | 0 | 0 | 12.3 |
| Total | 8,575,344 | 100 | 46.1 | 100 |

Source: Authors' calculations based on the micro-level and aggregate CPI data for Belgium over the period January 2007 - December 2015.

## *B. Appendix with additional descriptive statistics*

### Table B1

**Frequency of price changes by product category, including promotions and product replacements**

| | Frequency (%) | | | Fraction (%) | Implied Duration (months) |
|---|---|---|---|---|---|
| | Changes | Increases | Decreases | Decreases | –1 / ln (1-Freq) |
| Panel A: Unprocessed food | | | | | |
| Mean | 30.4 | 16.3 | 13.9 | 45.8 | 2.8 |
| Median | 19.5 | 11.8 | 7.7 | 39.5 | 4.6 |
| Panel B: Processed food | | | | | |
| Mean | 20.6 | 12 | 8.6 | 41.8 | 4.3 |
| Median | 21.6 | 12.8 | 9.3 | 42.9 | 4.1 |
| Panel C: Non-energy industrial goods | | | | | |
| Mean | 7.2 | 5 | 2.3 | 31.1 | 13.3 |
| Median | 7.3 | 4.8 | 1.9 | 25.4 | 13.2 |
| Panel D: Services | | | | | |
| Mean | 3.7 | 3.3 | 0.4 | 12.1 | 26.5 |
| Median | 3.4 | 3.1 | 0.3 | 9.3 | 28.8 |

Notes: Mean and median frequencies are calculated in two steps. First, we calculate the unweighted mean of the frequency of price changes across year-month pairs by retailer-brand pair and product category. Then, we calculate the weighted mean or median across retailer-brand pairs by product category using the 6-digit COICOP weights. The fraction of price decreases and implied duration are calculated as in table 1. Frequencies of price changes and the fraction of price decreases are in percentages. Implied durations represent the number of months during which prices remain unchanged. Calculating the mean (median) implied duration of Panels A, B, C and D as the inverse of the mean (median) frequency of price changes, 1/Freq, yields 3.3, 4.8, 13.8 and 27 (5.1, 4.6, 13.4 and 29.3) months.

Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

Table B2

**Size of price changes by product category, including promotions and product replacements**

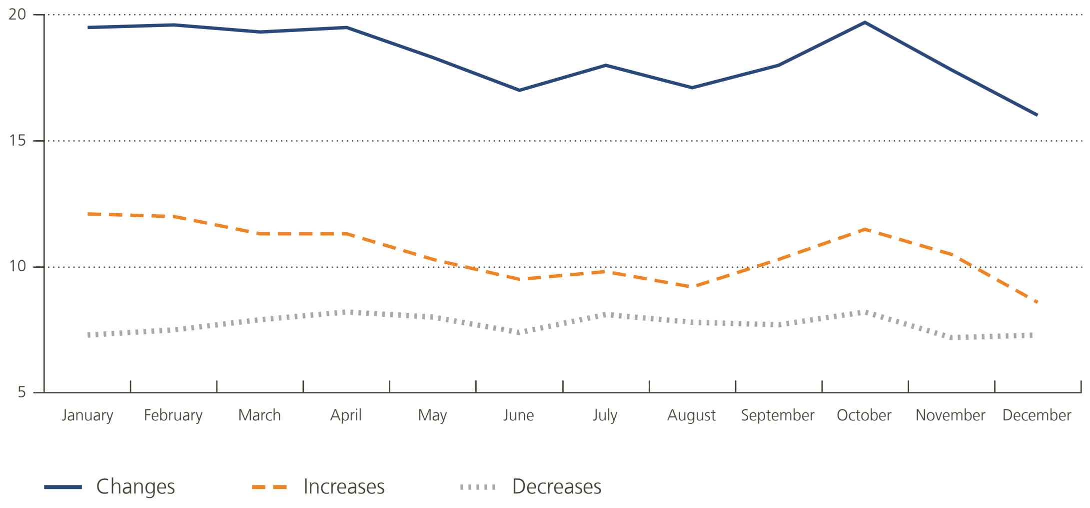
| | Size (log price difference) | | | | Fraction (%) | |
|---|---|---|---|---|---|---|
| | Mean | Median | P25 | P75 | Size ≤ 1 % | Size ≤ 2 % |
| Panel A: Unprocessed food | | | | | | |
| Changes | 0.191 | 0.172 | 0.138 | 0.246 | 3.6 | 7.8 |
| Increases | 0.179 | 0.149 | 0.116 | 0.24 | 3.7 | 8.4 |
| Decreases | 0.205 | 0.19 | 0.157 | 0.249 | 3.5 | 7.2 |
| Panel B: Processed food | | | | | | |
| Changes | 0.078 | 0.075 | 0.064 | 0.09 | 9.9 | 22.3 |
| Increases | 0.076 | 0.076 | 0.063 | 0.09 | 8.3 | 20.5 |
| Decreases | 0.081 | 0.076 | 0.061 | 0.095 | 12 | 24.5 |
| Panel C: Non-energy industrial goods | | | | | | |
| Changes | 0.097 | 0.108 | 0.019 | 0.138 | 6.8 | 10.5 |
| Increases | 0.08 | 0.087 | 0.018 | 0.123 | 7 | 11.5 |
| Decreases | 0.136 | 0.134 | 0.113 | 0.166 | 6.4 | 9 |
| Panel D: Services | | | | | | |
| Changes | 0.073 | 0.073 | 0.062 | 0.078 | 4.1 | 11.6 |
| Increases | 0.072 | 0.072 | 0.062 | 0.082 | 3.7 | 11.3 |
| Decreases | 0.082 | 0.078 | 0.068 | 0.094 | 7.3 | 13.9 |

Notes: The size of price changes is the log price difference in two consecutive months. The statistics for the size of price changes are calculated in two steps. First, we calculate the unweighted mean of the size of price changes across year-month pairs by retailer-brand pair and product category. Then, we calculate the weighted mean, median, P25 or P75 value across retailer-brand pairs by product category using the 6-digit COICOP weights. The fractions of small price changes (less than 1 % and 2 %) are in percentages.

Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

## Chart B1

**Mean frequency of price adjustments by month (%), including promotions and product replacements**

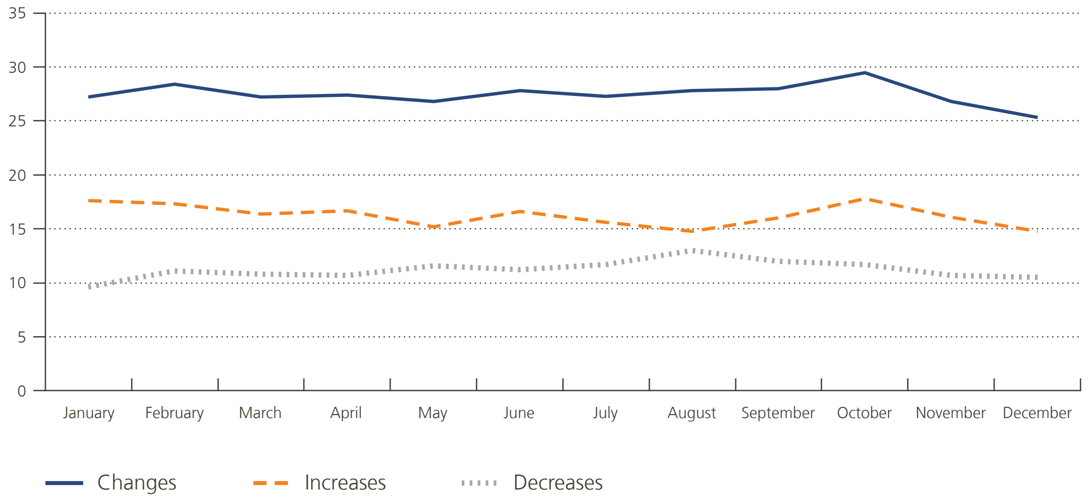



Notes: The mean frequencies by month are calculated in two steps. First, we calculate the unweighted mean of the frequency or size of price changes across years by retailer-brand-month triplet. Then, we calculate the weighted mean across retailer-brand pairs by month using the 6-digit COICOP weights.

Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007-December 2015.

## Chart B2

**Mean frequency of price adjustments by month (%), unprocessed food**

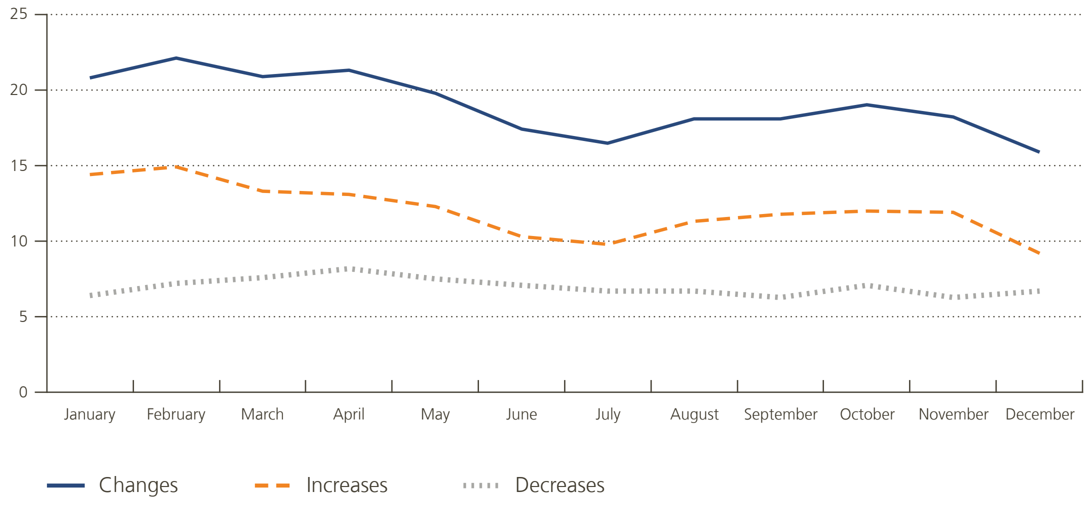



Notes: The mean frequencies by month and product category are calculated in two steps. First, we calculate the unweighted mean of the frequency or size of price changes across years by retailer-brand-month triplet and product category. Then, we calculate the weighted mean across retailer-brand pairs by month and product category using the 6-digit COICOP weights.

Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007-December 2015.

## Chart B3

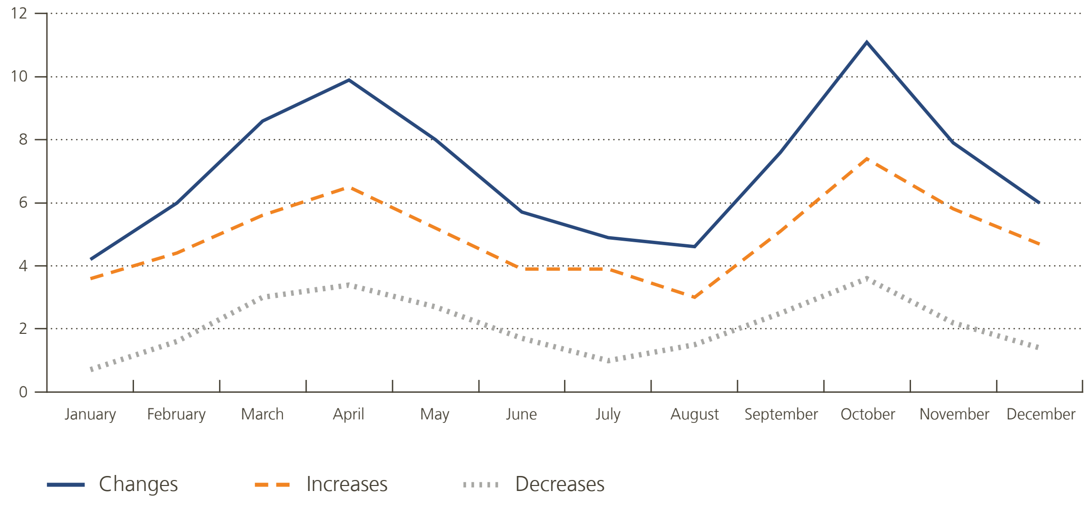
### Mean frequency of price adjustments by month (%), processed food




Notes: The mean frequencies by month and product category are calculated in two steps. First, we calculate the unweighted mean of the frequency or size of price changes across years by retailer-brand-month triplet and product category. Then, we calculate the weighted mean across retailer-brand pairs by month and product category using the 6-digit COICOP weights.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

## Chart B4

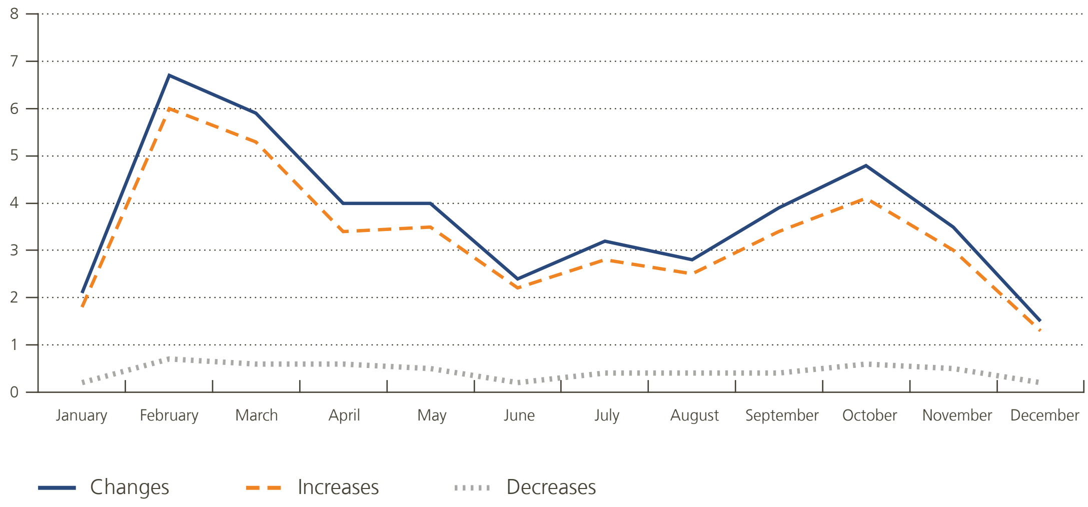
### Mean frequency of price adjustments by month (%), non-energy industrial goods




Notes: The mean frequencies by month and product category are calculated in two steps. First, we calculate the unweighted mean of the frequency or size of price changes across years by retailer-brand-month triplet and product category. Then, we calculate the weighted mean across retailer-brand pairs by month and product category using the 6-digit COICOP weights.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

Chart B5

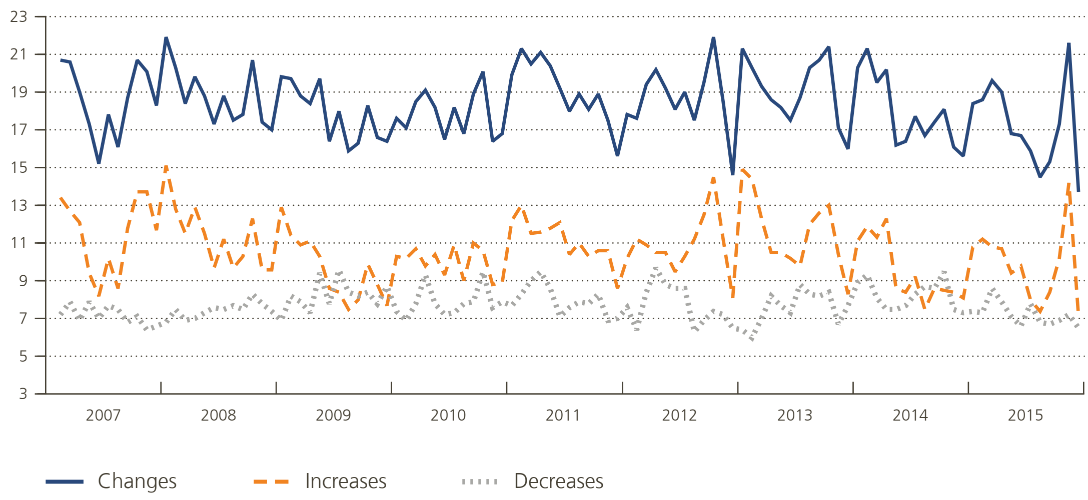
**Mean frequency of price adjustments by month (%), services**




Notes: The mean frequencies by month and product category are calculated in two steps. First, we calculate the unweighted mean of the frequency or size of price changes across years by retailer-brand-month triplet and product category. Then, we calculate the weighted mean across retailer-brand pairs by month and product category using the 6-digit COICOP weights.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007-December 2015.

Chart B6

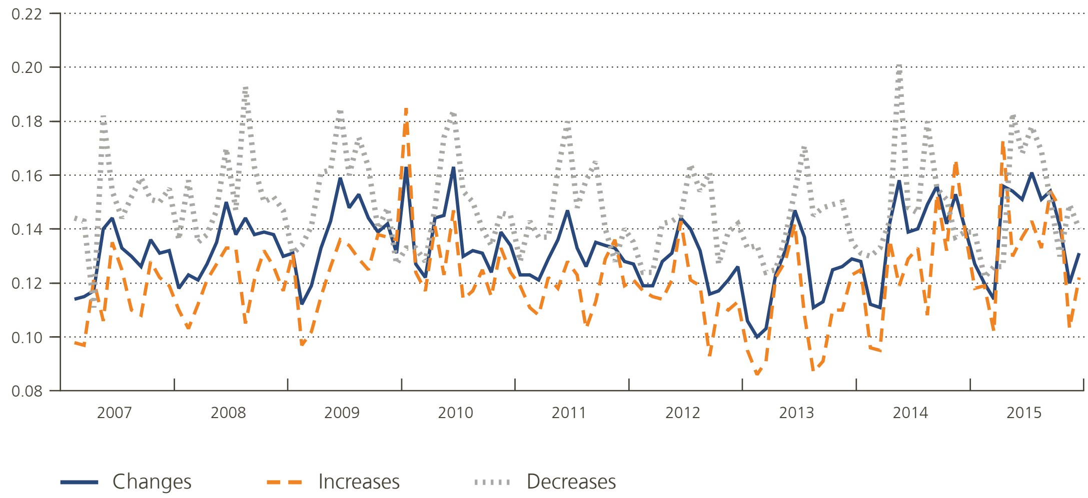
**Mean frequency of price adjustments by year-month (%), including promotions and product replacements**




Notes: The mean frequency by year-month is calculated as the weighted mean of the frequency of price changes across retailer-brand pairs by year-month pair using the 6-digit COICOP weights.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007-December 2015.

Chart B7

**Mean size of price adjustments by year-month (log price difference), including promotions and product replacements**




Notes: The mean size by year-month is calculated as the weighted mean of the size of price changes across retailer-brand pairs by year-month pair using the 6-digit COICOP weights.
Source: Authors' calculations based on the micro-level CPI data for Belgium over the period January 2007 - December 2015.

# Tax incentives for R&D : Are they effective ?*

R. Schoonackers

## Introduction

Boosting research and development (R&D) investment remains one of the top priorities of advanced economies, the reason being that R&D is an important driver of innovation and long-run economic growth. Moreover, the transition to a sustainable economy requires new technologies. Hence, incentivising and providing the necessary conditions for R&D investment by the business sector ranks high on the innovation policy agenda of OECD countries and partner economies (Appelt *et al.*, 2019). In line with this, one of the key targets of the Europe 2020 strategy includes that 3 % of EU GDP has to be invested in R&D by the end of 2020.

Due to its long-term and risky nature and the presence of knowledge spillovers, private business investment in R&D is mostly lower than socially optimal, justifying government support. To address the private underinvestment in R&D, governments have different policy responses at their disposal. Against the backdrop of sustainable public finances, the evaluation of the effectiveness – in terms of input and output additionality – of these policy instruments is important.

This article focuses on the effectiveness of R&D tax incentives, in other words indirect government support. The remainder is structured as follows. Section 1 discusses why government support for investment in R&D is important and describes different support mechanisms. Section 2 then gives a broad international comparison of R&D public stimuli, followed by a more detailed discussion of Belgian R&D tax incentives in section 3. Finally, section 4 analyses the effectiveness of R&D tax incentive schemes and section 5 concludes.

## 1. The importance of public support for R&D investment

### 1.1 Rationale for government intervention

When it comes to structural long-run economic growth, both the theoretical and empirical economic literature recognises investment in R&D as a major contributor (see, amongst others, Romer, 1990 ; Aghion and Howitt, 1992 ; Coe *et al.* 2009). The growth-enhancing impact of R&D is both direct, through its effect on total factor productivity (TFP) and innovation within a country, and indirect through the positive impact on a country’s capacity to absorb worldwide available technology.

* The author would like to thank Saskia Vennix and Karl Boosten for their help with the BELSPO data and Luc Van Meensel for his constructive remarks and suggestions.

Yet, private business investment in R&D tends to be sub-optimal due to several reasons. For one thing, relative to investment in physical capital, R&D spending typically has a higher uncertainty of success in outcomes, it takes longer to yield profitable output and the R&D activity is more open to imitation by a large number of firms (Guceri, 2016). As investment in R&D is riskier, this makes it more difficult for investors and banks to monitor innovative firms causing a large information asymmetry between innovators and investors. As a result, firms will find it difficult to obtain funding; this is especially the case for young innovative enterprises (EC, 2014).

Another – and probably more important – reason is that R&D generates spillover effects. Following, amongst others, Bloom *et al.* (2013), one can broadly define two types of spillover. The first are technology or knowledge spillovers. Knowledge creation can have positive externalities on other firms' activity and even on the whole economy as technology spillovers raise the productivity of other firms that operate in similar technological areas. The second type of spillover is the product market rivalry effect of R&D, where innovations through R&D lead to more market share vis-a-vis competing firms. Whereas knowledge spillovers are beneficial to other firms, R&D work by product market rivals has a negative effect on a firm's value as it loses market share. So, if the product market rivalry effect dominates the knowledge spillover effect, there may be too much investment in R&D from a social perspective, meaning that the conventional wisdom regarding under-investment in R&D should be overturned. Bloom *et al.* (2013) and, more recently, Lucking *et al.* (2019) analysed both spillover effects and found that positive spillovers significantly exceed negative ones[1].

Consequently, the overall return to society from investment in R&D is much higher than the individual return to the investing firm, which leads to significant socially suboptimal private under-investment in R&D in the market equilibrium. A strong case for public support for R&D can therefore be made.

## 1.2 Direct and indirect support for private R&D investment

Governments can choose between different policy responses to tackle the problem of under-investment in R&D by the private sector. Traditionally, these measures can be sub-divided into direct support, such as public sector R&D and direct R&D subsidies, and indirect support via R&D tax incentives. Finally, governments may also provide support for the university research system and the formation of high-skilled human capital.

Direct R&D support refers to direct R&D spending by public research institutions and universities (public sector R&D) and government funding of business-performed R&D (grants or subsidies). In the latter case, the results of the R&D investment belong to the private (business) performer.

From a theoretical viewpoint, the effects of direct R&D support are ambiguous. The macroeconomic impact may be positive when public sector involvement reduces the risks and costs for the business sector. This is the case when basic or fundamental research – where the wedge between private and social return is probably the highest – is conducted by the public sector and/or universities and when results are made publicly available. Another way is to provide subsidies, which may lift potential cash constraints in private firms or provide a buffer when high financial risk is involved. Public money will then crowd in private money. Effects may also be negative. R&D in the public sector may increase demand for researchers, which may in turn raise their wages and consequently make private R&D investment more costly. Moreover, public sector money – subsidies or grants – can act as a substitute to private money, i.e. governments may subsidise projects that would have been implemented anyway.

Recently, the policy mix aimed at stimulating business R&D investment has seen a growing use of tax incentives. The main difference between direct measures and tax incentives is that the latter leaves the direction of innovation in the hands of individual firms, while direct funding usually allows a larger role for the government

1 Back-of-the-envelope welfare calculations in Lucking *et al.* (2019) show that the ratio of the social to the private return to R&D is about four to one.

in choosing the projects to be funded (Hall, 2020). Tax incentives are thus considered to be more market-oriented than direct subsidies. In practice, the optimal choice between grants and tax-related measures largely depends on the type of firm targeted and type of R&D project.

Tax policy can target the inputs of innovation – R&D tax incentives – or the output of innovation through a patent/intellectual property (IP) box, where IP-derived income is taxed below the statutory corporation tax rate. Existing evidence suggests that IP boxes do not necessarily stimulate R&D investment, one argument being that they do not reduce the *ex-ante* risk of innovation, because they only reward successful projects. Moreover, they can be used as a profit- shifting instrument, although recent international rules – the so-called Nexus rules – should limit this (EC, 2020).

In this article, we focus on the effectiveness of input-related R&D tax incentives. They may take on various forms such as R&D tax credits, accelerated depreciation schemes or enhanced allowances. In general, public support via R&D tax incentives affects business R&D spending through three channels: (i) Tax support for R&D reduces the effective average tax rate, which induces firms to relocate their R&D activity towards the jurisdiction where the support is given. (ii) Conditional on already having R&D activity in a certain jurisdiction, tax incentives reduce the user cost of R&D which encourages firms to undertake more R&D in that location. (iii) Finally, R&D tax incentives have a positive effect on a firm's cash flow, which relaxes financing constraints and boosts R&D by firms for which such constraints are binding (Guceri, 2016).

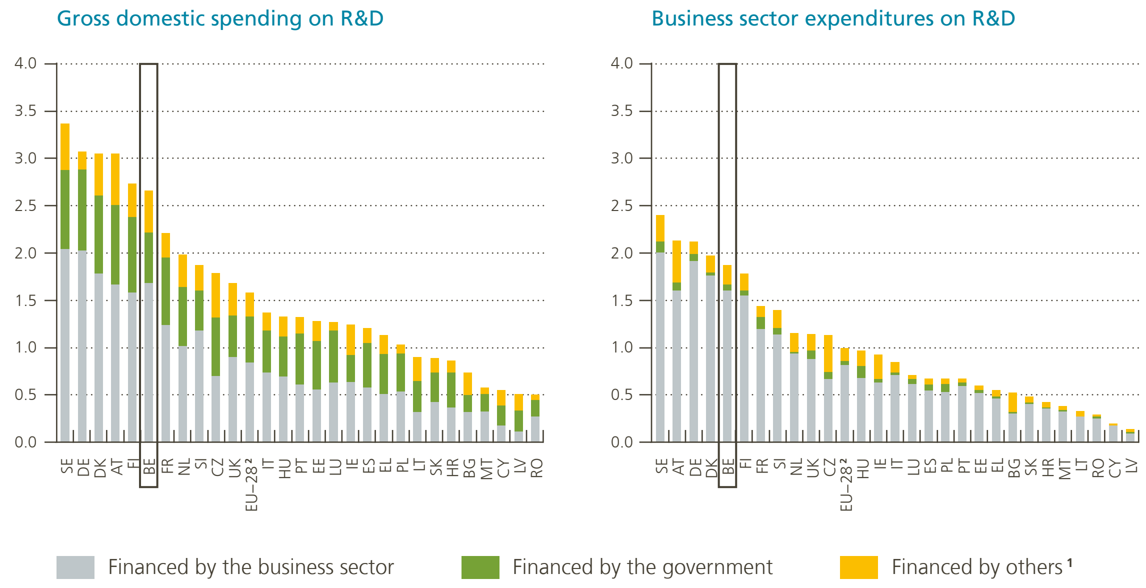
## 2. R&D and public support: a cross-national comparison

Gross domestic R&D spending in Belgium reached a level of 2.7 % of GDP in 2017. This is slightly below the 3 % target set out in the Europe 2020 strategy, but significantly above the EU28 country average of 1.6 % of GDP. Within the EU, only Sweden, Germany, Denmark, Austria and Finland spend more on R&D. In all EU countries, most of gross domestic R&D spending is funded by the private sector, while direct government support varies between 0.2 % and 0.8 % of GDP. In Belgium, government funded domestic R&D spending equals 0.5 % of GDP.

Chart 1

**R&D spending within the European Union**

(2017, in % of GDP)




Source: Eurostat.

1 "Others" include the higher education sector, the private non-profit sector and financing from abroad.

2 Unweighted country average.

When only considering R&D spending within the business sector, Belgium obtains a business R&D intensity of 1.9% of GDP in 2017. This was also among the highest of the EU28. Chart 1 thus confirms the European Innovation Scoreboard 2020 which considers Belgium to be a strong innovator, mentioning attractive research systems and innovative SMEs collaborating with others as two of the country's strengths.

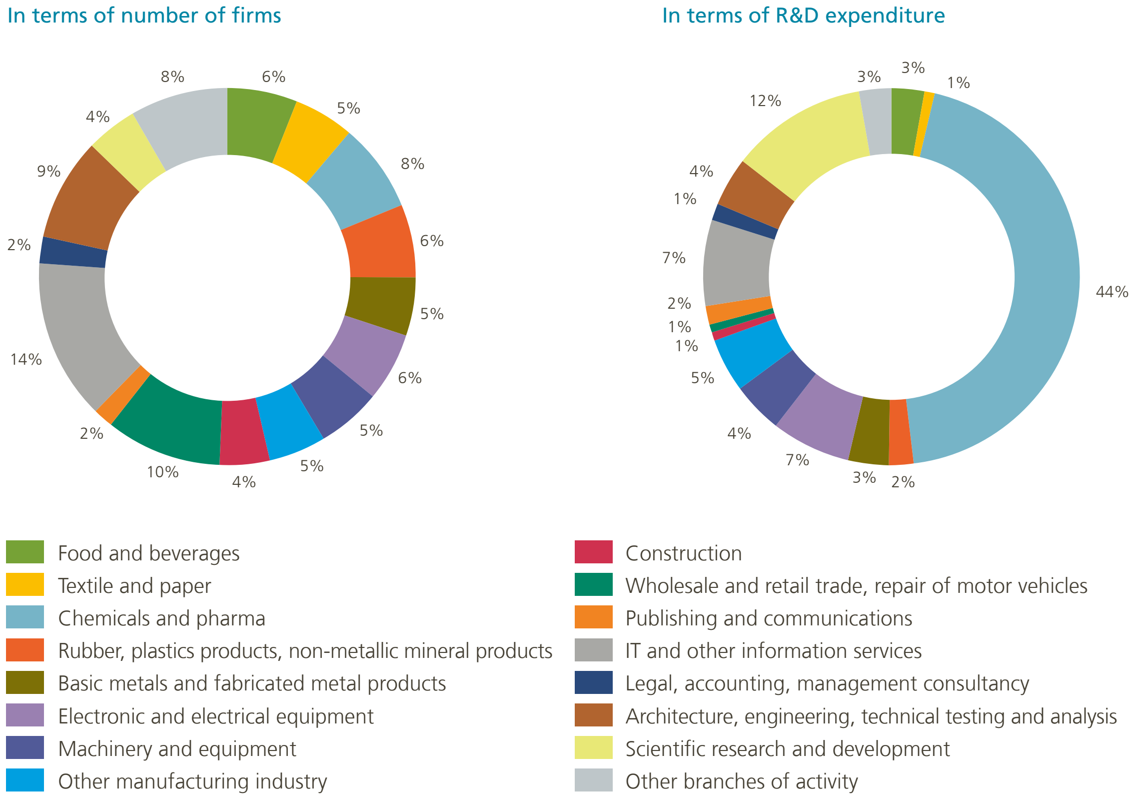
A more detailed portrait of Belgian companies investing in R&D is given by Vennix (2019), based on the biannual survey performed by the Belgian Science Policy Office (BELSPO)[1]. An update, based on the most recent survey data for 2017, of the importance of the different economic branches of activity with respect to R&D is given in chart 2.

1 Vennix (2019) clearly shows that information from the financial statements cannot be used to determine the amount of a firm's R&D expenditure. Therefore, a sample needs to be defined to give a clear view of Belgian companies investing in R&D. The biannual survey from BELSPO is therefore used as a source for R&D expenditure at the micro level.

Chart 2

**Share of branches of activity in R&D expenditure**

(2017)




Source: Vennix (2019), updated with the most recent biannual BELSPO survey of 2017.

The figure shows that in terms of R&D expenditure, the chemicals and pharmaceuticals industries are by far the most important branches of activity[1]. They account for 44.4 % of all business R&D spending. As noted by Vennix (2019), this is mainly due to pharmaceutical companies. Considering the total number of companies that incurred R&D expenditure, the IT sector accounts for the lion's share. But it still only accounts for 7.4 % of total business R&D expenditure.

### *Evidence on the use of R&D tax incentives*

When considering public support to private investment in R&D, governments can choose between direct support via subsidies or indirect support via the tax system. However, the heterogeneity in the design of R&D tax provisions across countries makes an international comparison very challenging. To facilitate cross-country analysis, the OECD has recently created a database – the R&D Tax Incentives Database – to examine the use and impact of R&D tax incentives in promoting business R&D investment (OECD, 2017; Appelt *et al.*, 2019). Drawing on this dataset, chart 3 gives an overview of the magnitude of direct and indirect support to business R&D for

1 Annex 2 from Vennix (2019) gives a clear definition of the different branches of activity in terms of NACE codes.

the latest year available, being 2017. To capture the amount of indirect support, an OECD measure is chosen that reflects the amount of R&D tax expenditure at the macro level, i.e. the amount the central government has spent on R&D tax support, which comprises both foregone tax revenues and refunded amounts. It thus measures the actual amount of tax support provided by governments, which is the outcome of both the presence of R&D tax incentive design features and firms making use of these provisions.

Chart 3

**Government support to business R&D**

(2017, % of GDP)


Source: OECD.

1 As a measure for indirect support, the "GTARD"-series of the OECD (OECD(2017), Appelt *et al.* (2019)) was chosen. This data series reflects the actual cost of R&D tax support to the central or federal government. More specifically, GTARD focuses on capturing the cost of provisions that imply a more favourable treatment of R&D relative to other non-R&D-specific expenditure.

2 For Belgium, data on indirect funding (GTARD series from the OECD) refer to the R&D tax credit and partial exemption from payment of the withholding tax for private companies, young innovative companies and partnership agreements with universities. The investment deduction for environmental projects is excluded as the R&D component cannot be identified.

3 For Greece and Romania, the data refer to 2016.

4 Unweighted country averages, no data available for Bulgaria and Croatia.

5 The "GTARD"-data from the OECD was not available for 2006.

Chart 3 shows that, as a percentage of GDP, France provides the largest combined support for business R&D investment in 2017 (0.4 % of GDP), closely followed by Belgium. In Belgium, the federal government is responsible for indirect support via R&D tax incentives, while direct R&D subsidies are a regional competence.

When considering only direct support, the highest values are obtained in Hungary, France and Sweden. Direct R&D subsidies in Belgium are relatively low and were only worth 0.06 % of GDP in 2017. Expressed as a percentage of total government support, they accounted for 17 % of total support in Belgium in 2017, which is amongst the lowest in the European Union.

For indirect support through R&D tax incentives, the most is spent in Belgium and France. Belgium, together with countries such as the Netherlands, Italy, Lithuania and Portugal, provide more than 80 % of total public support through tax relief provisions. On the contrary, some countries like Germany and Finland do not provide any R&D assistance through their tax system.

It should be noted that according to EU Competition Law, R&D tax incentives may constitute state aid which is prohibited by the EC Treaty. However, in some cases of market failure, state aid is considered compatible with the Common Market under specified conditions, as is the case with state aid for R&D (EC, 2014).

Over time, tax support for business R&D expenditure has increased significantly. In 2006, the EU28 country average was less than 0.03 % of GDP, whereas it more than doubled to 0.07 % of GDP in 2017. In Belgium, indirect support increased significantly from 0.02 % of GDP in 2006 to 0.30 % of GDP in 2017. As such, one can state that there has been a proliferation in the use of R&D tax incentives by governments as a key instrument in their policy toolbox for inducing higher levels of business R&D expenditure (Appelt *et al.*, 2019).

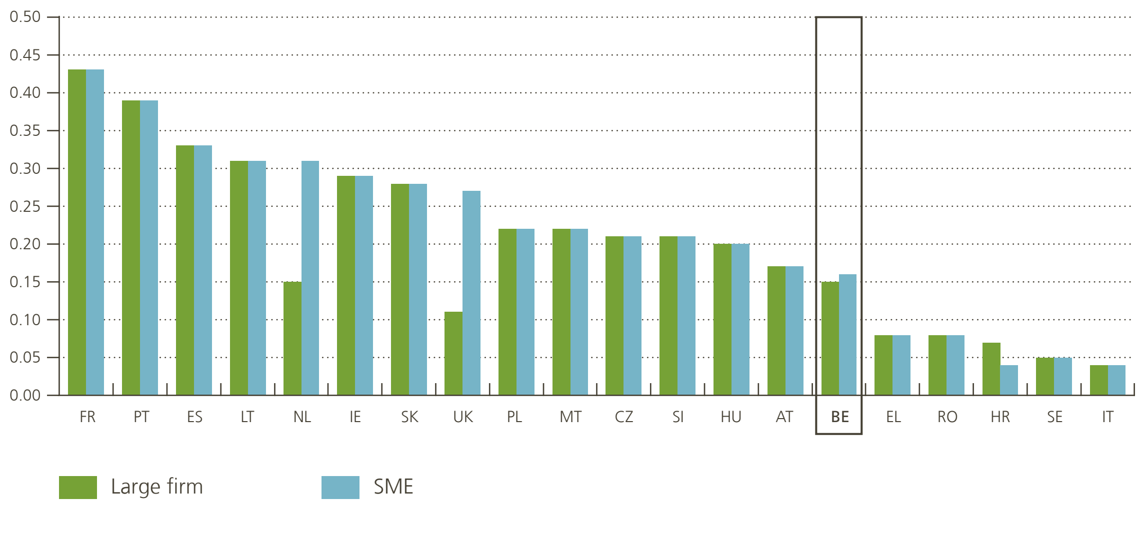
So far, we have only considered R&D tax expenditure as a measure to capture the generosity of the tax system. But it is also important to understand the potential implications of tax relief provisions for the cost of R&D work. One can also explicitly focus on the qualitative features of R&D tax support schemes by constructing forward-looking measures that quantify a number of qualitative features of the national tax code in a synthetic indicator that reflects the overall generosity of specific R&D tax relief provisions. In addition, these indicators also consider specific business characteristics – such as profitability – as they also relate to the overall R&D tax generosity.

An often-used synthetic indicator is the so-called B-index (Warda, 2001). This a composite index that is computed as the present value of income before taxes necessary to cover the initial cost of R&D investment and to pay the corporate income tax so that it becomes profitable to perform research activities i.e. the before-tax break-even economic return required by firms. The more generous the tax provisions for R&D, the lower the pre-tax break-even return by firms (i.e. the lower the B-index) and therefore the higher, the implied marginal R&D tax subsidy. For this reason, it is standard practice to present this indicator in the inverse form of an implied subsidy rate, expressed as 1 minus the B-index. (Warda, 2001, OECD, 2017, Appelt *et al.* ,2019). More details on the B-index and its construction can be found in box 1.

Chart 4

**Implied tax subsidy rate for R&D**[1]

(2019)




Source: OECD.

1 Only EU-28 countries with a positive B-index lower than 1 are reported. This means that countries without any R&D tax incentive provisions are excluded from the figure.

The implied marginal R&D tax subsidy rates for profitable firms are presented in chart 4, which shows a large variation across countries. A value of 0.10 suggests that the price for a firm to invest in R&D is 10 % lower than it would have been in the absence of any R&D tax incentives. In 2019, implied tax subsidy rates were the highest for France and Portugal. The figures also show that, in the Netherlands and the UK, there is a considerable preferential tax treatment for SME compared to large firms. In Belgium, the user cost for an R&D investment for large profitable firms is 15 % lower due to preferential tax treatment, this is very close to the EU28 country average. The combination of an average implied subsidy rate, together with a relatively high amount of eligible business R&D spending in Belgium (see chart 1), leads to a relatively high budgetary cost, in terms of foregone tax revenues, of Belgian R&D tax incentives[1].

1 One can also calculate a macroeconomic *ex-post* average subsidy rate by dividing R&D tax expenditure by total business R&D expenditures. For 2017, this gives an average implied subsidy rate of 16 % for Belgium, which is almost equal to the forward-looking implied subsidy rate based on the B-index.

BOX 1

## The B-index: a forward-looking synthetic indicator measuring R&D tax treatment

When focusing on the qualitative features of R&D tax provisions, synthetic indicators can be computed to compare the relative importance of R&D tax support across countries. A widely used indicator is the B-index, which calculates the tax component of the user cost of R&D.

More concretely, the B-index specifies the present value of pre-tax income needed for a representative firm to break even on a marginal, € 1 of R&D spending and to pay the applicable taxes (Warda, 2001, OECD, 2017).

The formula for the measure is given by:

$$B = ATC/(1 - CIT),$$

where ATC is the current value of the after-tax cost (ATC) of a one dollar of expenditure on R&D, taking into account all R&D tax relief provisions and where CIT is the applicable corporate income tax rate. ATC is thus converted into pre-tax terms, allowing a comparison across countries with different tax rates (Appelt *et al.*, 2019)

In general terms, ATC can be expressed as (Thompson, 2012):

$$ATC = 1 - NVTDeductible \times CIT - Credit,$$

where NVTDeductible is the net present value of tax allowances and Credit stands for any applicable tax credits.

The value of tax allowances is determined by both the net present value of the stream of allowable claims and by any augmented deduction policy, where claimable amounts are multiplied by a factor greater than 1.

Different tax provisions can be modelled and rendered comparable through the B-index. In other words, consider all R&D expenditure to be fully deductible in a current year (not an augmented deduction policy), and assume there is an R&D tax credit, which is equal to 15 % of R&D spending, then ATC becomes:

$$ATC = 1 - (1 * CIT) - 0.15.$$

Finally, when calculating the B-index, one takes into account that a representative R&D investment is not only comprised of current expenditure but also of machinery and equipment and buildings. For each expenditure type, the tax price is calculated separately. Afterwards, a weighted average is taken that represents the most likely division between the types of R&D expenditure. In most cases, the assumption is made that a representative R&D investment is comprised of 90 % current expenditure (of which two-thirds account for the labour component), 5 % machinery and equipment and 5 % investment in buildings.

## 3. R&D tax incentives

### 3.1 Conceptual issues [1]

When analysing the conceptual issues in the construction of R&D tax relief provisions, one notices that the specific design, type and number of R&D tax incentives deviate substantially across countries. As pointed out by the EC (2014), R&D tax policies differ according to three broad categories: (i) the scope of the underlying policy measure, (ii) the targeted groups of firms and (iii) the exact organisation of the measure which mainly encompasses administrative practices. In what follows, we will elaborate more on the scope and targeted groups of R&D tax relief provisions.

#### 3.1.1 Scope

The scope of an R&D tax incentive relates to the intrinsic construction of the R&D tax relief provision, where three important choices need to be made regarding to (i) the type of instrument, (ii) the eligible expenses and the type of costs targeted and (iii) the tax liability to which the R&D tax benefit can be applied.

***Type of R&D tax relief measure***

Different approaches co-exist in the way countries shape their R&D tax incentives. Broadly speaking, four categories of instruments can be distinguished: tax credits, enhanced allowances, accelerated depreciation schemes and reduced rates. Chart 5, taken from EC (2014), gives a clear overview of the particularities of each of these instruments. The first three types clearly target R&D inputs, while "reduced rates" in the form of an IP box clearly target the output of an R&D investment. As mentioned before, in this analysis, we focus on the input-type R&D tax incentives.

1 Section 3.1. is mainly based on EC (2014).

Chart 5

**Different types of R&D tax incentives**

| | |
|---|---|
| Tax credits (R&D expenditure) | • Tax credit decreases the corporate income tax rate a firm has to pay.<br>• Rate can be applied to either corporate tax, payroll tax paid for R&D workers or personel income in case the incentive is targeted to self-employed. |
| Enhanced allowances (R&D expenditure) | • An enhanced allowance effectively decreases the base amount that is taxed by allowing to 'inflate' the R&D expenditure base.<br>• Example: if R&D expenditure is € 100 and the rate of enhanced allowance 1.5 then the total R&D expenditure will be increased to € 150. This will decrease the base of taxable income. |
| Accelerated depreciation (R&D expenditure) | • Accelerated depreciation sheme permits to depreciate the purchased fixed assets at higher rates in the first years of the asset's life. This allows, therefore, to decrease the overall taxable income in the specific perions. |
| Reduced corporte tax rate (R&D expenditure) | • Reduced corporate tax rate on intellectual property income ("IP Box") are an outcome related incentive.<br>• It reduces the corporate income that firms pay on commercialization of innovative products that are protected by intellectual property (IP) rights. |

Source: EC (2014).

In practice, many countries that provide R&D tax measures do use a combination of different types of instruments. For example, most EU countries that allow for a tax credit, also offer the possibility of an enhanced allowance.

### *Defining the base: eligible expenses and targeted costs*

Another aspect in the design of R&D tax incentives is the way their base is calculated. In general, there are two approaches: a volume-based approach that applies to all qualified R&D expenditure and an incremental approach that only applies to the extra R&D expenditure. To define this incremental part, the base amount is an average amount that the firm had spent in the past over a specified period of time.

The definition of R&D is also important when defining the base eligible for tax relief. Many European countries explicitly note the existence of the OECD Frascati Manual definition[1] (OECD, 2015) as a general reference or starting point but then go further in explaining distinctive features of R&D for tax relief provisions. In Belgium, there is no formal definition but the definition of R&D in the context of tax support measures largely corresponds to that found in the Frascati Manual. (OECD, 2017).

1 The OECD's Frascati Manual (2015) is the international standard for the definition of R&D and its components and thus the methodology for collecting R&D statistics. The manual provides a basis for a common language about R&D and its outcomes.

Furthermore, R&D tax provisions can also differ by the nature of the incentive base. Instead of focusing on total R&D spending they can be targeted to different expenditure sub-categories. For example, one can choose to limit qualified R&D expenditure to R&D costs that are made domestically or one can focus particularly on R&D wages.

#### *Tax liability*

Finally, a choice needs to be made about the tax liability to which the R&D tax benefit can be applied. Most R&D tax relief provisions are deducted from corporation tax. However, some countries have R&D tax incentives that are based on social security contributions (e.g. France) or tax schemes that are set against the wage tax (e.g. Belgium, the Netherlands).

### 3.1.2 Targeted firms

Beyond the conceptual design of the R&D tax incentive scheme, governments also need to decide on the type of firms it wants to target. Targeting can be done explicitly by defining the beneficiary subjects, that can either include all firms or specify a particular group. Often SMEs and start-up companies are targeted as these firms may find it harder to attract the funds needed to invest in R&D work. In addition, some tax instruments are designed to promote R&D spending in specific industries or are focused on certain types of technologies, such as environmentally friendly investment.

Instead of explicitly targeting specific types of firms, countries can also focus on a sub-set of firms by implementing tax brackets with different rates, which would make it possible to apply more generous deduction rates for R&D expenditure below a certain amount. This makes the tax incentive relative more generous for smaller firms, which have mostly lower R&D expenditure. Another way to achieve this is by putting a ceiling on the amount that firms can claim.

To fully benefit from R&D tax incentives, small firms and start-ups often lack the amount of taxable income on which the tax reduction would apply. The option to carry the tax benefit back or forward, whether or not in combination with a cash refund, can also be used as another type of indirect targeting.

## 3.2 Main R&D tax incentives in Belgium

In the first decade of the 21st century, the Belgian federal government introduced several tax incentives for supporting business investment in R&D. The most important of these are the partial exemption from payment of withholding tax on the wages of R&D personnel that was introduced in 2005 in the private sector and gradually extended in the subsequent years; and the tax credit for investment in R&D that has been available since tax year 2007.

### 3.2.1 Partial exemption from payment of the withholding tax

The partial exemption from payment of the withholding tax on wages of R&D employees reduces the R&D wage costs for firms because part of the withholding tax does not need to be transferred to the government. The scheme has been in place since 2003 for research organisations. In 2005, it was applied to the private sector and gradually extended from employees with a PhD to employees with a Master's degree. Four schemes were introduced over time: (i) for companies involved in research cooperation with a university, a higher education institution or a scientific institution, (ii) for R&D employees with a doctoral degree and civil engineers, (iii) for R&D personnel with a Masters degree and (iv) for Young Innovative Companies (YIC)[1]. For YIC, it should be noted that the exemption for remittance of the withholding tax not only applies to knowledge workers but can also

1 Small enterprises can be defined as a Young Innovative Company, based on several conditions. These prerequisites can be found on the BELSPO website (http://www.belspo.be/belspo/fisc/profit_YIC_nl.stm).

be applicable to supporting staff. The 2017 reform of the Belgian corporation tax has led to the introduction of a fifth scheme as the partial exemption of payment of the withholding tax has been further extended to researchers with Bachelor's degrees.

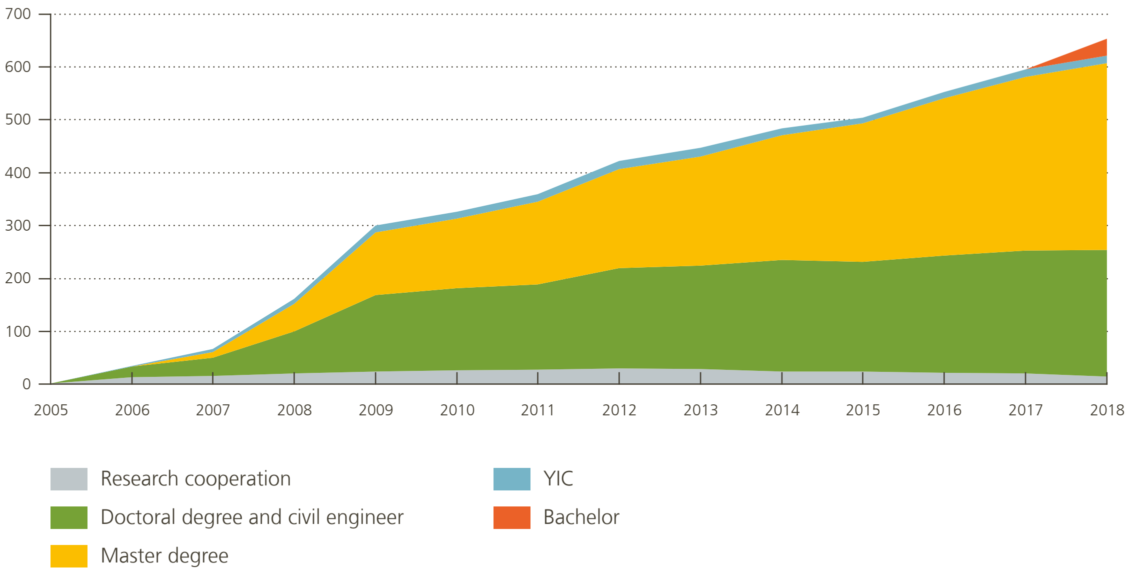
Over the years, the discount rate on the payroll withholding tax has also gradually risen from 25 percent in 2005 to 80 percent in 2013. Moreover, as shown by Dumont (2019), there has been a steady increase in the number of firms that have made use of the partial exemption schemes. As a result, the budgetary cost of the measure has grown significantly over time. As can be seen from chart 6, the schemes for research employees with a doctoral and Master's degree account for the bulk of the budgetary cost and the steady increase over the last few years is mainly due to the change in the cost of the scheme for R&D employees with a Master's degree.

Based on the sample of R&D active firms of Vennix (2019), updated with the BELSPO (2017) survey data, one can derive that almost 63 percent of R&D active firms are making use of the partial exemption schemes. The branches of activity that benefit the most, in terms of number of companies using the partial exemption schemes, are the IT sector, the chemicals and pharmaceuticals branches of activity and the scientific research branch of activity (see chart 7). This is not surprising as the IT sector is the branch of activity with the most R&D active firms and the research branch of activity has a specific partial exemption scheme.

Chart 6

**Budgetary cost[1] of the partial exemption from payment of the withholding tax for R&D employees.**

(€ million)




Source: Belgian House of Representatives – Inventory of federal tax expenditure.
1 Measured as foregone tax revenues.

### 3.2.2 R&D tax credit or investment deduction

Firms that invest in innovative products can choose between an R&D tax credit and an investment deduction for investment in patents and environmentally friendly or "green" R&D investment[1]. The tax credit is deducted from the corporate income tax liability while the investment deduction leads to a decrease in the taxable base. An important difference between the two R&D tax incentives is that the tax credit, if not fully used after four years, becomes refundable while the investment deduction is simply carried forward.

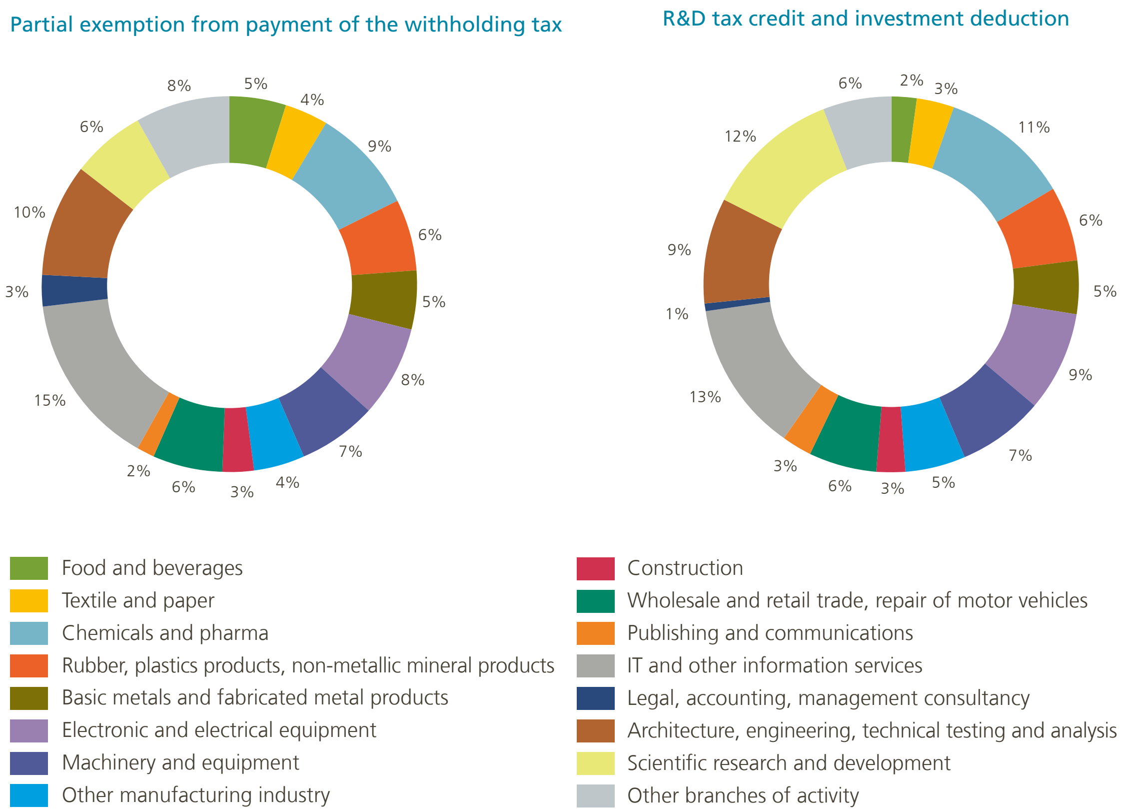
For both R&D tax relief provisions, a company can choose to apply the tax relief all at once or to spread it out based on the depreciation of the R&D investment. If the one-time option is preferred, the tax relief will be calculated based on the annual investment in R&D at a rate of 13.5 % for revenue year 2020 (tax year 2021). To obtain the R&D tax credit, this is multiplied by the normal statutory corporation tax rate, i.e. 25 % for revenue year 2020. If a firm wants to spread it out over time, the annual depreciation is multiplied by a rate of 20.5 %. Dumont (2019) illustrates that in the past most firms, especially SMEs, opted for a tax deduction rather than for a tax credit.

1 The specific types of investment that are eligible for a tax credit are broadly equivalent to those eligible for an investment deduction: The investment should promote the research and development of new products and technologies that have no effect or aim to limit the negative effect on the environment as much as possible and it should be new investments in tangible or intangible fixed assets , obtained or accomplished in the year itself. Furthermore, the use of the assets cannot be transferred to a third party.

Chart 7

**Share of branches of activity in making use of R&D tax incentives[1]**

(2017)




Source: BELSPO (2017) based on the sample of R&D active firms as defined in Vennix (2019).

1 In terms of number of firms.

Making use of the BELSPO (2017) survey data, one can calculate that almost 18 % of the Vennix (2019) sample of R&D active firms benefit from an R&D tax credit or deduction, which is significantly less than firms using the partial withholding tax exemption schemes. Again, the branches of activity that are the best represented are the IT sector and the chemicals and pharmaceuticals branches of activity.

#### 3.2.3 Targeting the output of innovation: the Belgian IP box

Although this article focuses on input-related R&D tax incentives, it is worthwhile briefly describing the patent/intellectual property (IP) box in Belgium, where IP-derived income is taxed below the statutory corporation tax rate to create a tax advantage for income derived from intellectual property.

From 2008 until 2016, the Belgian federal government granted a deduction of 80 % of qualifying gross patent income from the taxable basis for corporate income taxation – the Belgian deduction for patent income. However, in line with OECD guidelines on Base Erosion and Profit Shifting (BEPS), patent box regimes needed to be modified, conform to the Nexus approach and the deduction for patent income has been abolished.

Since July 2016, a new system has been in place – the deduction for innovation income – that applies a Nexus ratio. This implies that the favourable tax regime for income from intellectual property can only apply if the work designed to acquire intellectual property is actually done by the entity concerned. To judge whether the entity actually carries out sufficient activities, R&D expenditure is used as approximation. In other words, the tax advantage thus depends on the Nexus fraction, which corresponds to the ratio between the amount spent on R&D by the company itself (or expenditure outsourced to an unrelated company) and the total amount that has been spent on developing or buying the intellectual property. Furthermore, the deduction for innovation income applies to net income[1] and a rate of 85 % is granted.

Finally, it should be noted that a transitional system has been introduced until the end of June 2021 for patents applied for before July 2016.

## 4. Evaluation of R&D tax incentives

### 4.1 Main findings in the literature

When considering the effectiveness of government support for private R&D investment, one needs to ask whether the government is subsidising (directly or indirectly) R&D work that would be done even in the absence of such support mechanisms. As for the exact choice of instrument, the question then arises whether a tax incentive is the best instrument to stimulate private R&D investment, or would a direct subsidy be preferable in certain cases.

When it comes to the effects of direct funding by the government of private sector R&D, the most recent empirical evidence tends to be positive, i.e. private and public funds tend to complement each other, meaning that the full crowding-out hypothesis is rejected (e.g. Guellec and Van Pottelsberghe, 2003; Westmore, 2014; Becker 2015; Buyse *et al.* 2020). Direct subsidies mainly have an impact on small and young firms' R&D decisions as these companies are more likely to face financing constraints because they have less collateral to secure external funding. Moreover, they also encounter stronger information asymmetries in the capital market (Guceri *et al.*, 2020). It further appears that the level of public subsidisation is important. Both Guellec and Van Pottelsberghe (2003), Goerg and Strobl (2007) and Buyse *et al.* (2020) find an inverted U-shaped relationship, with the strongest positive effects on private R&D for public subsidy rates that are neither too low, nor too

1 Instead of gross income as was the case in the deduction for patent income. The difference being that gross income includes R&D spending.

high. In the former case, support may be too weak to help firms overcome the risks and uncertainties involved in innovation projects, while in the latter case, support may be wider than the number of (new) projects that firms can develop, so that in the end they simply use public resources to finance projects that would have been carried out anyway[1].

The findings of Becker and Hall (2013)[2] are worth mentioning as they imply that direct government support stimulates private R&D investment by businesses in low-tech industries in particular, while R&D by high-tech firms does not increase significantly when receiving public subsidies. Based on these findings, one could conclude that direct subsidies targeted at low-tech industries may be able to support aggregate R&D more effectively than in high-tech businesses. As such, the results suggest that high-tech firms may substitute incremental public funding for internal funding, leaving aggregate R&D unchanged. As noted by Becker and Hall (2013), an R&D tax incentive could therefore be the more effective policy instrument in high-tech industries, as it will support incremental R&D investment by the firm.

Over the last few years, governments have chosen to rely more on R&D tax incentives (see chart 3). They are more market-oriented than direct subsidies as the decision on which projects to invest in is left up to the firms. Firms themselves know the market better and therefore can invest in more profitable opportunities. Moreover, administrative costs are also potentially lower as the government no longer has to set up committees of experts to assess projects and select among them. However, this also comes at a price. The overall budgetary cost of R&D tax incentives, in terms of foregone tax revenue, is much larger and not directly predictable in the future. That is because the government has to subsidise all private sector R&D and not only incremental projects. As a result, the government ends up paying for some project that would also have taken place when no R&D tax relief provisions where present (Guceri *et al.* 2020).

A large volume of empirical research, both macro and micro, exists to see whether R&D tax incentives lead to incremental private R&D investment. Empirical estimates of the size of the impact are widely divergent and not always comparable across studies. The wide range of estimates is the result of differences in methodology, countries and time periods studied and differences in specific R&D tax policies. However, it should be noted that most studies in the available literature show positive effects of tax incentives on private R&D spending (see, for example, Hall and Van Reenen, 2000; Guellec and Van Pottelsberghe, 2003, Thomson, 2017, Alvarez-Ajuso *et al.*, 2018; Buyse *et al.*, 2020). This is confirmed by Becker (2015) in her survey which concludes that recent evidence suggests much more unanimously – compared to surveys of earlier work – that R&D tax credits have a positive effect on private R&D investment. Generally, she states that the negative demand elasticity of R&D with respect to the tax component of its user cost is estimated to be broadly around unity, at least in countries with a tax credit[3].

Interestingly, empirical results suggest that tax incentives and R&D subsidies might to some extent be substitutes. In a macro panel of OECD countries, Guellec and Van Pottelsberghe (2003) found that increased intensity of either tax incentives or subsidies reduces the effect of the other on business R&D. Using a sample of Belgian R&D-active firms, Dumont (2017) confirms that the effectiveness of R&D policy tools declines when firms benefit from different support schemes at the same time. This is especially the case when firms combine subsidies with several R&D tax benefits.

Despite the enormous volume of research on the impact of R&D tax incentives, challenges remain for researchers. One important methodological issue is how to separate the causal impact of tax incentives from relationships that run in the opposite direction. Ideally, for policy evaluation, one should be able to compare the actual behaviour

1 Considering the use of macro data in Guellec and Van Pottelsberghe (2003) and Buyse *et al.* (2020), the non-linear relationship for direct government support is also a macro feature. Low or high macro rates of subsidies may hide large firm-level heterogeneity in the subsidies.

2 Becker and Hall (2013) test the pooling assumption – whether coefficients should be homogeneous across industries or not – for different R&D determinants for a panel of manufacturing industries for the UK over the period 1993-2000.

3 A decrease of the R&D user cost, due to R&D tax stimuli, with 1 %, will, ceteris paribus, lead to an average increase of private R&D spending with 1 %.

of a firm enjoying a tax incentive with the counterfactual situation in which a firm with similar characteristics does not have this incentive. This could be done by simulating a social experiment where R&D tax credits are randomly allocated to firms. However, due to the nature of R&D tax incentives, this is not possible. In that sense, an interesting analysis has been conducted by Guceri and Liu (2019) for the UK, where they exploit the changing definition for SMEs which increased the R&D tax generosity for certain medium-sized companies. This policy reform provided an excellent quasi-experimental setting to identify the causal impact of R&D tax incentives. Their main results underline the positive impact of R&D tax incentives as they found that companies in the treatment group raised their R&D spending significantly in response to the increased generosity of tax incentives[1].

A critique on R&D support mechanisms relates to its positive impact on the demand for researchers, which may push up researchers' wages. Consequently, higher R&D private spending, due to R&D support, could mainly reflect higher spending on existing R&D personnel. Lokshin and Mohnen (2013) provide micro-level evidence for a panel of Dutch firms that there is indeed a wage effect related to R&D tax incentives. They find that a part of the R&D tax credit gets transferred to higher wages, i.e. they estimate the wage effect to reduce the quantity effect – more real R&D spending – by some 25 percent. All in all, these findings suggest that most of the impact really does go to the quantity of R&D, rather than the price. Moreover, as also noted by Lokshin and Mohnen (2013), higher wages might be the price to pay to retain high-skilled researchers with promising returns in the future.

In order to evaluate the impact of R&D tax incentives, it is also important to look at the presence of R&D spillovers[2], due to higher R&D spending caused by public support. New technology and knowledge may spill over to other firms and countries, so that all may benefit from an improvement in the world level of technology, although not necessarily to the same extent. Buyse *et al.* (2020) use an unobserved common factor approach to capture this global level of technology and show that it is an important driver of private R&D spending. The findings in Everaert *et al.* (2015) also suggest that the worldwide level of technology and knowledge and a country's absorptive capacity are very important for long-run TFP growth. As such, sustained public investment in education and high-skilled human capital is important to reap the fruit of worldwide available technology.

Finally, by introducing generous R&D tax incentives, countries also try to attract R&D operations of foreign multinational firms. A tax competition element is thus present when assessing the effectiveness of R&D tax incentives. Montmartin and Herrera (2015), for example, use spatial dynamic panel data methods to illustrate for a sample of 25 OECD countries the possibility of a substitution effect between in-country and out-of-country R&D policies. This suggests that the effects of national R&D policies on in-country private R&D investment can be cancelled out by the effects of external R&D policies[3].

## 4.2 Effectiveness of Belgian R&D tax incentives

To explicitly focus on the effectiveness of Belgian R&D tax incentives (discussed in section 3.2.), we rely mainly on the work done by Dumont (2019). For a panel of Belgian R&D active companies, he analyses the impact of Belgian R&D tax incentives over the period 2003-2015 and provides robust evidence that the four different schemes of partial exemption from payment of the withholding tax on the wages of R&D personnel are effective in stimulating additional R&D activities. Especially for the partial exemption granted to R&D employees with a Master's degree, very consistent and significant evidence for input additionality is provided[4].

1 More specifically, they found that a 10 percent reduction in the user cost of R&D induces firms to increase R&D spending by around 16 percent.

2 Hall, Mairese and Mohnen (2010) illustrate that social returns to R&D are almost always estimated to be substantially greater than private returns, implying the existence of significant technological spillovers.

3 In their empirical analysis, Montmartin and Herrera (2015) find that a 1 % drop in the B-index in all neighbouring countries reduces private R&D intensity in the home country by 1.4 % in the long run.

4 As pointed out by Dumont (2019), it should be noted that the rate of partial exemption from payment of the withholding tax for masters is the same as for researchers with a PhD or civil engineers, who have by definition a Master's degree. The usefulness of the distinction with the scheme for Master's degrees is therefore not clear.

However, Dumont (2019) finds no clear evidence that R&D tax credits induce extra R&D spending. Over different specifications and for his sample, R&D tax credits are in general found to have a positive, but limited and statistically insignificant effect on R&D spending. For a specific sub-sample of firms with no more than 50 employees, the impact of R&D tax credits becomes significantly positive when it comes to stimulating extra private R&D spending. One suggestion that could raise the effectiveness of the R&D tax credit would be to pay out the unused tax credit immediately and not after four years.

Dumont (2019) further confirms earlier results regarding the combined use of different R&D support mechanisms. When firms combine direct support with indirect tax incentives, input additionality decreases. As mentioned by Dumont (2017), this could give an indication of a lack of coordination in Belgium between regional – responsible for granting subsidies – and federal – responsible for tax incentives – authorities. When combining different support mechanisms, firms could achieve a support rate above the optimum rate – the point from which additional support just substitutes private R&D funding for public funding. Coordination and consultation between the regional and federal authorities is thus important for efficient use of public resources in stimulating private R&D spending.

In its country report for Belgium, the EC (2020) also mentions that the efficiency of government support for business investment in R&D could be improved. To make their point, the authors refer to the work done by Dumont (2019) and an analysis by the Belgian Court of Auditors (2019) concerning partial withholding tax payment exemption schemes for R&D personnel. The Court of Auditors concluded that there was a lack of controlling function, meaning that there are insufficient checks to see if the beneficiary really is eligible for the exemption granted. By developing an adequate controlling mechanism and rigorously applying it to potential beneficiaries of the partial exemption schemes, benefit abuse could be much more easily detected and efficiency could be improved.

Finally, in Vennix (2019), it is shown that less than 3 percent of Belgian R&D spending in the private sector comes from firms younger than five years. However, as pointed out by the OECD (2019), some of these young firms have the best growth potential, especially when it comes to further digitalisation of the Belgian economy – which is primordial for boosting productivity and innovation. With respect to public R&D support for these young firms, the OECD (2019) notes that the tax benefits that are provided through corporate tax allowances, i.e. R&D tax credit or deduction, are biased against R&D-active young firms as these often have no profits and it thus takes time before they can benefit from the public support granted[1]. This is in line with existing empirical evidence, i.e. direct public funding is more effective for small and young firms (see above). The OECD (2019) therefore suggests that a rethink of Belgium's R&D support policy could be beneficial and could increase its efficiency. More concretely, the OECD (2019) states that the return on public R&D spending and the targeting of young firms, with high growth potential and possibly the largest return from public support, has to improve. One suggestion they make for tax support via corporation tax is to cut off eligible sums at an upper limit. As a result, small and young firms could receive a larger part, vis-à-vis big and multinational firms, for a given amount of support. This could prevent that the bulk of public resources for R&D ending up in the hands of a small number of large firms. Another proposed and potentially promising reform to target young firms would be to shift R&D support via corporation tax towards direct government funding. However, such a reform is challenging as these government competences are divided between public authorities in Belgium.

1 The Belgian R&D tax credit, if not fully used after four years, becomes refundable, while the investment deduction is simply carried forward.

## 5. Conclusion

Investment in research and development is an important driver of innovation and long-run economic growth. However, private business investment in R&D tends to be sub-optimal due to the wedge between its private and social returns. Government involvement in promoting business R&D investment is thus highly justified. Nevertheless, in the post COVID-19 environment in which governments will need to restore the sustainability of public finances, and hence increase public policy efficiency, the question arises whether public support mechanisms for private sector R&D investment are actually effective.

In addressing the under-investment in R&D by the private sector, governments have different instruments at their disposal. Traditionally, they can be sub-divided into direct support, such as direct R&D subsidies, and indirect support via R&D tax incentives. Over the last decade, R&D tax support has increased significantly in Belgium and in the European Union. The main R&D tax relief provisions in Belgium are, in terms of input-related R&D support, the partial exemption schemes from payment of the withholding tax on the wages of R&D employees and the R&D tax credit or investment deduction in the corporate tax system. When it comes to targeting the output of innovation, Belgium has a system where IP-derived income is taxed well below the statutory tax rate.

A sizeable amount of empirical research has been done to evaluate the effectiveness of public R&D support mechanisms. Compared to some earlier studies, recent evidence suggests more unanimously that both direct public support and R&D tax incentives have a significant positive effect on private R&D investment. Governments' optimal choice of exact policy instrument, however, depends on the type of firms targeted. Direct subsidies mainly have an impact on small and young firms' R&D decisions, while R&D tax incentives are more market-oriented as the decision on which projects to invest in is left up to the firms themselves. Larger firms seem to benefit more from the latter. To some extent, R&D subsidies and tax relief measures might be substitutes, as their effectiveness declines when firms benefit from both at the same time.

For Belgium, the evidence on the effectiveness of R&D tax incentives is somewhat mixed. Dumont (2019) shows that the partial withholding tax exemption schemes significantly contribute to stimulating private R&D investment, whereas the stimulating impact of the R&D tax credit cannot consistently be illustrated. In Belgium, only a small amount of R&D spending comes from young firms, and these firms often have the best growth potential. It could therefore be beneficial to rethink Belgian R&D support mechanisms.

## Bibliography

Aghion P. and P. Howitt (1992), "A model of growth through creative destruction", *Econometrica*, 60(2), 323-351.

Alvarez-Ajuso L., C., Kao and D. Romero-Jordan (2018), "Long-run effect of public grants and tax credits on R&D investment: A non-stationary panel data approach", *Economic Modelling*, 75, 93-104.

Appelt S., F. Galindo-Rueda and A.C. Gonzales Cabral (2019), *Measuring R&D tax support: Findings from the new OECD R&D tax incentives database*, OECD Science, Technology and Industry Working Papers, 06.

Becker B. and S.G. Hall (2013), "Do R&D strategies in high tech sectors differ from those in low-tech sectors? An alternative approach to testing the pooling assumption", *Economic Change and Restructuring*, 46(2), 183-202.

Becker B. (2015), "Public R&D policies and private R&D investment: a survey of the empirical evidence", Journal of *Economic Surveys*, 29(5), 917-942.

Belgian Court of Auditors, (2019), "Vrijstellingen van storting van bedrijfsvoorheffing – een complexe regeling ter ondersteuning van werkgevers".

Bloom N., M. Schankerman and J. Van Reenen (2013), "Identifying technology spillovers and product market rivalry", *Econometrica*, 81(4), 1347-1393.

Buyse T., F. Heylen and R. Schoonackers (2020), "On the impact of public policies and wage formation on business investment in research and development", *Economic Modelling*, 88, 188-199.

Coe D., E. Helpman and A. Hoffmaister (2009), "International R&D spillovers and institutions", *European Economic Review*, 53(7), 723-741.

Dumont M. (2017), "Assessing the policy mix of public support to business R&D", Research Policy, 46(10), 1851-1862.

Dumont M. (2019), *Tax incentives for business R&D in Belgium: Third evaluation*, Federal Planning Bureau, Working Paper 4.

EC (2014), *A study on R&D tax incentives*, Taxation Papers, Working Paper 52.

EC (2020), *Tax policies in the European Union – 2020 survey*, DG Taxation and Customs Union.

Everaert G., F. Heylen and R. Schoonackers (2015), "Fiscal policy and TFP in the OECD: measuring direct and indirect effects", *Empirical Economics*, 49(2), 605-640.

Goerg H. and E. Strobl (2007), "The effect of R&D subsidies on private R&D", *Economica*, 74(294), 215-234.

Guceri I. (2016), *Tax incentives for R&D*, Working Paper, University of Oxford.

Guceri I. and L. Liu (2019), "Effectiveness of fiscal incentives for R&D: Quasi-experimental evidence", *American Economic Journal: Economic Policy*, 11(1), 266-291.

Guceri I., M. Köthenbürger and M. Simmler (2020), *Supporting firm innovation and R&D: what is the optimal policy mix?*, EconPol Policy Report, March, 3.

Guellec D. and B. Van Pottelsberghe (2003), "The impact of public R&D expenditure on business R&D", *Economics of Innovation and New Technology*, 12(3), 225-243.

Hall B. and J. Van Reenen (2000), "How effective are fiscal incentives for R&D? A review of the evidence", *Research Policy*, 29(4-5), 449-469.

Hall B., J. Mairesse and P. Mohnen (2010), "Measuring the returns to R&D", *Handbook of the Economics of Innovation*, 2, 1304-1076.

Hall B.H. (2020), *Tax policy for innovation*, NBER, Working Paper, 25773.

Lokshin B. and P. Mohnen (2013), "Do R&D tax incentives lead to higher wages for R&D workers? Evidence from the Netherlands", *Research Policy*, 42(3), 823-830.

Lucking B., N. Bloom and J. Van Reenen (2019), "Have R&D spillovers declined in the 21st century", *Fiscal Studies*, 4(40), 561-590.

Montmartin B, and M. Herrera (2015), "Internal and external effects of R&D subsidies and fiscal incentives: Empirical evidence using spatial dynamic panel data models", *Research Policy*, 44(5), 1065-1079.

OECD (2015), *Frascati Manual 2015: Guidelines for collecting and reporting data on research and experimental development, the measurement of scientific, technological and innovation activities"*, 7th edition, OECD Publishing Paris.

OECD (2017), *OECD review of national R&D tax incentives and estimates of R&D tax subsidy rates,* Version 18, April 2018.

OECD (2019), *In-depth productivity review of Belgium*, OECD Publishing, Paris.

Romer P. (1990), "Endogenous technological change", *Journal of Political Economy*, 98(5), 71-102.

Thomson R. (2012), *Measures of R&D tax incentives for OECD Countries*, Melbourne Institute Working Paper series, 17.

Thomson R. (2017), "The effectiveness of R&D tax credits", *Review of Economics and Statistics*, 99(3), 544-549.

Vennix S. (2019), *Research and development activities in Belgium: A snapshot of past investment for the country's future*, NBB, Working Paper, July, 373.

Warda J. (2001), *Measuring the value of R&D tax treatment in OECD Countries*, STI Review No 27: Special issue on new science and technology Indicators, OECD Publishing.

Westmore B., (2014), "Policy incentives for private innovation and maximising the returns", *OECD Journal: Economic Studies*, 2013(1), 121-163.

# Public debt: Safe at any speed?

Xavier Debrun
Mariusz Jarmuzek
Anna Shabunina*

## Introduction

The potential causes of a deadly car crash are often many and interrelated (the make of the car, weather conditions, the driver's experience, the type of road, etc.), but speed is always a factor. Yet, roaring at 200 km/h in a brand-new V8 sports car on an empty motorway under clear skies is arguably less risky than pushing a vintage model at 50 km/h on an icy mountain road wrapped in dense fog. Although no car is safe at any speed, it is extremely difficult to determine a limit beyond which the risk of a crash would be too high for comfort.

The same logic applies to sovereign default, be it explicit or implicit. There are many interrelated reasons why countries choose to renege on their financial obligations, but the public debt level is always a factor. Taking the argument to the limit, if debt was zero, there would be nothing to default on. Yet public debt is a useful instrument for policy-makers, and such an extreme form of fiscal rectitude would be highly undesirable. So, what debt level puts a government at excessive risk of default? Simple facts show the magnitude of the challenge. We look for an analytical framework flexible enough to accommodate the fact that a number of advanced economies can thrive with gross debt levels well above their GDP, while Ukraine actually defaulted on a stock of obligations three times smaller than its own GDP[1].

As challenging as this may be, knowing whether a given debt level should ring alarm bells is more important today than at any point in time since the end of World War II. For the last four decades, public debt has been rising in most countries, with two global tail events, the global financial crisis of 2008-9 and the COVID-19 pandemic, adding massive amounts to the already high levels reached at the turn of the 21st century. Should we worry about historically high public debt? Or on the contrary, should we welcome the fact that, at the same time, the debt footprint on the budget (i.e. interest payments) has steadily declined in line with interest rates?[2] After all, if creditors seem happy to reward greater public indebtedness with lower borrowing costs, that leaves policy-makers with ample room to put the State budget to good use.

While there is no reason to panic in the short to medium term, there are reasons to be vigilant. First, no sensible economic theory of *optimal* public debt can possibly rationalise the upward trend in debt ratios seen

1 See Debrun *et al.* (2019) for a survey of public debt sustainability assessments.

2 See Cornille *et al.* (2019).

* The background work for this article was initiated when all three authors were with the International Monetary Fund. Jarmuzek is now with the European Central Bank. The views expressed here are those of the authors and do not necessarily reflect those of the European Central Bank or the International Monetary Fund. Without implication, the authors are grateful to Carlo Cottarelli, who gave the initial impetus to this work, to Hugues Famerée, Dennis Essers and colleagues at the National Bank of Belgium for useful comments and suggestions, and to Manzoor Gil for outstanding research assistance.

since the late 1970s. Of course, the right theory may not have been found yet, but lots of studies show how political agency problems can push well-intended governments towards highly *sub-optimal* debt policies[1]. In other words, excessive public debt might be wired into the political system in a way that could ultimately spark trouble. Second, the global financial crisis was a dramatic reminder that highly indebted advanced economies could be vulnerable to a brand of economic and financial instability usually thought to be confined to the proverbial "basket-case" emerging market. Third, the implication is that the universe of safe assets[2] might shrink, pushing risk-free interest rates ever lower and encouraging excessive risk-taking in a desperate search for yield. Fourth and finally, unless we live in a brave but still uncharted new world, history teaches us that the current public debt levels are strong signals of impending trouble (Sandleris, 2016).

The aim of this article is to develop an operational compass to navigate the high-debt question. We first propose a definition of "safe" public debt. Echoing an approach to sovereign risk assessment developed by Mendoza and Oviedo (2004) for developing countries, a public debt level (in proportion to GDP) is considered safe if it is plausible to expect the government to stabilise or reduce it under most circumstances – including persistently adverse ones – using fiscal policy (i.e. excluding default, inflation or restructuring). The notion rests on three basic elements: (i) the requirement for the government to remain solvent with a high degree of confidence; (ii) the requirement that returning to safety implies a feasible policy path; and (iii) the fact that growth, interest rates, and the budget itself are subject to random shocks that are often correlated and persistent. Taken together, (i) and (ii) form the conventional definition of public debt sustainability, whereas (iii) stresses the importance of not losing control of debt dynamics even under adverse conditions.

To estimate the upper bound of the safe debt zone, we propose three pragmatic and computationally light methods closely related to conventional debt sustainability assessments (stochastic simulations and stress tests). It is important to note upfront that the analysis, although related to the determination of "debt limits", differs from it in important dimensions[3]. A debt limit should be feared because unsustainability lies just beyond with near certainty. In an uncertain world, being close to or at the debt limit is an inherently *unstable* position. By contrast, we conceive a safe debt level as a *stable* position in most circumstances. Since the likelihood of losing control of debt dynamics rises with debt itself, the upper bound of the safe debt zone must be sufficiently low to accommodate adverse shocks without jeopardising the government's capacity to generate the primary balances required to keep debt dynamics in check. Thus, the fundamental practical difference with the notion of debt limit is that, with no binding borrowing constraints and liquidity issues, public indebtedness could rise significantly above the safe zone without triggering notable fears of default.

The pragmatic approaches discussed here can be used to produce useful guideposts to anchor fiscal policy to a specific long-term objective or to pin down the often-elusive notion of fiscal space in the short term. Our main contribution is to link the definition of safe debt boundaries to explicit assumptions about risks to debt dynamics, the intensity of risk aversion and the capacity to generate and sustain primary surpluses. These tools can usefully discipline judgment and help calibrate sensible fiscal policy rules or estimate fiscal space[4].

An important caveat to bear in mind when interpreting our results is that the analysis is premised on the absence of strategic motives to default. Thus, the key consideration underlying our approach is the government's *capacity* to service its debt, not its *willingness* to do so after a cold cost-benefit analysis. That said, we believe that focusing on the capacity to pay is a good approximation in the case of financially sophisticated economies where a sovereign default would be too costly to contemplate (i.e. financial sector meltdown and a massive destruction of wealth).

1 Yared (2019) provides an authoritative survey.

2 Safe or risk-free assets carry no credit risk; they pay off the agreed income stream in all states of the economy. Government bonds are usually considered as the best proxy to a safe asset in a given economy.

3 Wyplosz (2011) and Debrun *et al.* (2019) provide comprehensive surveys of the relevant literature.

4 For instance, Eyraud *et al.* (2018) use two of the methodologies we developed to calibrate the debt "anchor" underpinning well-designed fiscal policy rules according to IMF criteria. Countries may have good reasons to target lower levels, but they would be hard-pressed to justify neglect for debt levels outside the safe zone. Fiscal space is the largest amount of additional funds a government could borrow without jeopardising market access (see IMF, 2016a).

Finally, we cannot emphasize enough that the numbers presented here are mostly illustrative. All the models can be calibrated differently to reflect more recent data or country-specific developments. Moreover, one should always keep in mind the significant uncertainty around the underlying models. Today, the implicit assumption that the past is a good guide for the future is even stronger than usual. The long-term properties of the models, especially regarding the interest-growth differential, warrant close scrutiny before putting them to use. Durably lower differentials are bound to raise the safe debt boundaries obtained with such tools, suggesting that in unchartered territory sound judgment remains an even more essential component of any balanced diagnostic.

The rest of the paper is structured as follows. Section 1 introduces the concept of safe debt and formally compares it to the notion of debt limit. Sections 2 and 3 discuss measures of key inputs, and present the results in the case of known and unknown debt limits respectively.

## 1. Safe public debt: concept and implementation

### 1.1 Solvency, sustainability and safety

Any public debt sustainability assessment is rooted in a *sufficient* condition for public sector *solvency*. Applying the no-Ponzi condition to the forward solution of the stock-flow identity linking debt and the primary balance (i.e. the budget balance excluding interest payments on debt), solvency requires public debt not to exceed the net present value of all *future* primary balances. This is a *necessary and sufficient* condition. Operationally, however, the challenge is obvious: assessing solvency is a mere prediction about an unknowable and indefinite future. With an infinite time horizon, even minor changes in parameters have huge effects on the assessment, and uncertainty is considerable. Besides, the very low interest rates – even well below nominal GDP growth rates – that have persisted for more than a decade call into question the relevance of net present values calculated over very long time horizons (Bartolini and Cottarelli, 1994; Blanchard, 2019). Since solvency is not an operational concept offering much concrete guidance over a relevant time window, economists tend to focus on more restrictive criteria that are largely sufficient to meet the solvency requirements[1].

In a celebrated article, Bohn (1998) shows that a systematically positive response of the primary balance to changes in the debt level ensures solvency[2]. Although the Bohn principle is simple and intuitive, its operational relevance remains limited. First, any prospective debt sustainability assessment based on it must assume that future fiscal policy behaviour will replicate historical trends. Second, as the test is defined in marginal terms, the *level* of the primary balance is not bounded, which imposes very little constraint on possible debt trajectories. In other words, while the Bohn criterion rules out explosive debt paths, it cannot exclude trajectories culminating at implausibly high levels.

This explains why debt sustainability frameworks – such as those used at the IMF or the European Commission – rely on a more demanding condition: the *stability of the debt-to-GDP ratio* over a given horizon (see, for example, Blanchard, 1990, or Escolano, 2010). The intuitive rationale behind that condition is that nominal public debt – which is a claim on future tax revenues – should not be allowed to grow faster than the broadest proxy of a country's tax base (GDP) on a permanent basis. As discussed in Bartolini and Cottarelli (1994), that condition is robust to cases where the solvency condition itself becomes fuzzy, such as when the interest-growth differential is persistently negative, which has often been the case since the 2008-2009 great recession (Mauro and Zhou, 2020).

1 Admittedly, deviations from the solvency condition have been used in some cases, including to assess debt overhang in emerging markets (IMF, 2003) or long-term sustainability challenges in the European Union (the solvency gap is at the core of the European Commission's S2 indicator).

2 That condition holds in a fully-fledged general equilibrium model under weak technical assumptions. In practice, the empirical validity of the Bohn test rests on the assumption that both debt and the primary balance are stationary in a statistical sense.

Ensuring a stable debt-to-GDP ratio restricts not only the sign of the primary balance response to debt (positive as shown by Bohn) but also its strength (it must be strong enough). If the primary balance path is deemed politically and economically feasible, there is in principle no reason to question debt sustainability, and the probability of a fiscal crisis – i.e. an incapacity to bring debt dynamics under control through fiscal consolidation only – is negligible. The key question is whether such a benign assessment is robust to most circumstances, including turbulent times. Thus, we define a safe debt level as follows:

**Definition.** *A public debt level is safe if it does not exceed the largest stock of gross financial liabilities the government could plausibly stabilise or reduce (in proportion to GDP) within a given time frame characterised by persistently adverse conditions for debt dynamics, using fiscal policy only.*

Safe debt calculation thus requires a good understanding of (i) the uncertainty surrounding the main determinants of debt dynamics (interest rate, growth, direct shocks to debt or the budget), (ii) the persistence and correlation of these shocks, and (iii) the government's capacity to generate and sustain primary balances at or above their debt-stabilising level. Clearly, the combination of uncertain debt dynamics and limits to feasible policy response implies that, all else equal, a lower debt ratio is *a priori* "safer" in the sense of the above definition[1].

However, stating that a very low debt level is best to preserve sustainability is not particularly informative for policy-makers, especially if large and protracted fiscal consolidations are expected to cause significant damage to economic activity. As policymakers balance the risks of unsustainability with the potential benefits of wisely using fiscal space – e.g. to plug infrastructure gaps known to undermine long-term growth – there is more value for them in having a sense of the upper bound of the safe debt zone. Symmetrically, if the initial debt level is deemed excessive or unsafe, it is useful to have a sense of the debt reduction required to feel reasonably safe again.

## 1.2 Safe debt boundary and debt limit

Arithmetically, two opposing factors shape public debt dynamics[2]. The first is the "snowball effect" that arises when interest payments are financed with new debt: the higher the debt, the stronger the effect. The second is the government's offsetting response to the snowball effect: primary surpluses[3]. According to our definition, a debt level is safe if the latter can at some point credibly offset the former even when interest rates are abnormally high compared to GDP growth. By contrast, a debt limit is a level beyond which the government cannot be expected to offset the snowball effect even under *normal* circumstances. At the debt limit, any adverse shock to debt puts it on an explosive path unless there are sufficiently favourable conditions (low interest rates or high growth).

One sufficient condition for the existence of a debt limit is the so-called "fiscal fatigue" (Ostry *et al.* 2010, Bi 2012, Ghosh *et al.* 2013). Because governments cannot be expected to raise the primary surplus indefinitely (or at an ever-increasing speed), there is a point at which keeping debt under control requires impossibly large surpluses. Beyond that point, debt is not sustainable. Even if only the strength of the primary surplus response – but not the level – is bounded, market discipline, in the form of borrowing costs rising with the debt level, eventually ensures that the snowball effect dominates the capacity or willingness to generate primary surpluses, making self-fulfilling prophecies possible.

The difference between conventional debt limits and the safe debt boundary can be illustrated in a diagram (chart 1)[4] describing possible combinations of positive debt levels $(d)$ and primary surpluses $(p)$. To assess whether

1 That statement obviously neglects the fact that some countries make a better use of borrowed resources than others (e.g. to fund growth-enhancing policies), which means that a higher debt level in country X compared to country Y does not necessarily mean that X's sovereign is less safe.

2 Operational aspects of debt sustainability are usually handled outside formal economic models, relying on the simple arithmetic of debt accumulation. See however, Bi (2012) or Battistini *et al.* (2019).

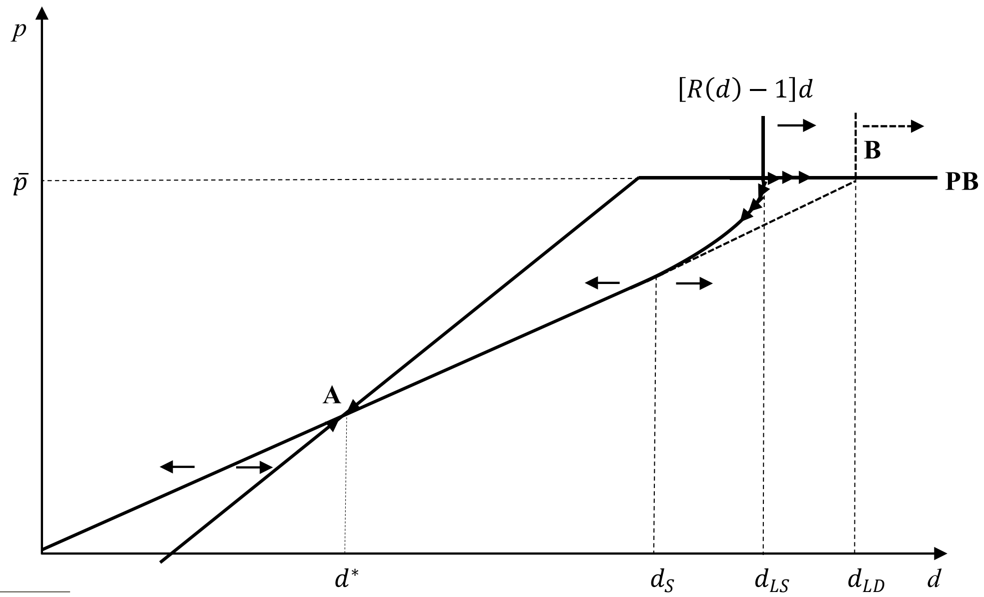
3 A primary surplus ensures that at least part of the interest bill is paid with own revenues.

4 See Ghosh *et al.* (2013) or Fournier and Fall (2015a) for similar diagrams.

these combinations are consistent with falling, stable or rising debt levels, we recall that $\Delta d = (\mathrm{R}(d) - 1)d - p$, where $d$ is the debt-to-GDP ratio[1], $\Delta$ designates the discrete time difference operator, $p$ is the primary balance as a percentage of GDP, and $R(d) = \frac{1+r(d)}{1+g(d)} > 1$ denotes the growth-adjusted gross interest rate (which depends on the debt level). These assumptions yield an upward-sloping "demarcation line" along which the primary balance exactly offsets the snowball effect: $p^* = (R(d) - 1)d$, so that $\Delta d = 0$. Above the demarcation line, the primary balance is consistent with a falling debt-to-GDP ratio, whereas below the line, the debt ratio rises.

## Chart 1

**Public debt dynamics: a simple diagram**




Source: Authors' calculations.

Primary balance behaviour can also be depicted in chart 1 assuming a systematic positive response to the debt level up to a point $\bar{p}$ where fiscal fatigue discretely sets in:

$$p = \mathrm{Min}(\kappa + \rho d, \bar{p}), \text{ with } \rho > 0. \quad (1)$$

Equation (1) is represented by the PB schedule in chart 1. The steeper the line (higher $\rho$), the stronger the fiscal policy response to a change in debt. The PB line captures fiscal (primary balance) behaviour, with adjustment fatigue setting in once a hypothetical upper bound $\bar{p}$ is reached. Beyond $\bar{p}$, the government stops responding to rising indebtedness, violating Bohn's solvency condition and setting the stage for unstable debt dynamics.

Intersections between these two loci define equilibria where the primary balance exactly offsets the snowball effect (debt is constant unless it is hit by a shock). To establish the stability condition for each equilibrium, we use (1) to substitute for the primary balance in the debt accumulation equation and obtain:

$$\Delta d = \left(\frac{r(d) - g(d)}{1+g(d)} - \rho\right) d - \kappa. \quad (2)$$

1 For simplicity, we abstract from stock-flow discrepancies, liquid assets and uncertainty.

The stability condition directly follows from observing that the debt-to-GDP ratio converges to some finite level (mean-reversion) if and only if the term in brackets is strictly negative. Therefore, a given equilibrium debt level $d_0$ will be stable if the marginal response of the primary balance to public debt exceeds the growth-adjusted interest rate prevailing at that equilibrium debt level $\left(\rho > \frac{r(d_0)-g(d_0)}{1+g(d_0)}\right)$. In chart 1, an equilibrium debt level is stable if the PB locus is steeper than the demarcation line at the intersection of the two.

Thus, point A determines a dynamically stable equilibrium debt $d^*$. By contrast, point B identifies another equilibrium debt level $d_{LD}$ that is fundamentally unstable: below $d_{LD}$, debt converges back towards $d^*$, but above $d_{LD}$, the debt ratio is on an explosive path, default is certain, and no finite interest rate can lure market participants into buying government bonds. Point B determines a debt limit like Ostry *et al.* (2010) in *a deterministic setting*.

Matters are technically much more involved in a stochastic setting because the interest rate on government bonds and the probability of explosive debt dynamics (and default) are jointly determined. Ghosh *et al.* (2013) deal formally with this "fixed point" problem. Here, we simply sketch a heuristic argument based on the diagram.

In chart 1, it is easy to imagine that as debt rises, the probability of default turns positive beyond a certain level $d_S$. At that point, the stable-debt locus departs from the linear/deterministic schedule prevailing when the interest rate on public debt is equal to the risk-free rate. This "stochastic" demarcation line ultimately crosses PB vertically at a debt level $d_{LS}$ which is lower than $d_{LD}$. This *illustrates* the solution to the "fixed point" problem by Ghosh *et al.* (2013).

According to our definition above, $d_S$ qualifies as a safe debt boundary because it is the highest debt level consistent with a zero probability of default. It could of course be set higher if the government was ready to tolerate a non-zero probability to experience explosive debt dynamics and to pay the corresponding risk premium.

Overall, three broad levels of alert for public debt sustainability can be derived from this discussion: safe $(d \leq d_S)$, risks to debt sustainability $(d_S < d < d_{LS})$, and unsustainable $(d \geq d_{LS})$. The precise boundaries of these zones are country-specific and depend on the joint distribution of shocks affecting the debt trajectory (interest rates, exchange rate, growth, contingent liabilities), the plausible response of fiscal policy to public debt developments, and the probability of default one is ready to tolerate *ex ante*.

The challenge is now to provide an operational meaning to the debt thresholds delineating these three areas. Among them, the determination of debt limits has already received considerable attention. In particular, IMF (2003), Ostry *et al.* (2011), Ghosh *et al.* (2013), and Fournier and Fall (2015a) explore non-linearities in the empirical relationship between public debt and the primary surplus to calculate debt limits. Bi (2012) proposes a dynamic and stochastic general equilibrium (DSGE) model where tax revenues are subject to a Laffer effect and public spending is incompressible below a certain level. Battistini *et al.* (2019) elaborate on the DSGE approach, focusing on interactions between monetary and fiscal policies.

Estimating distributions of debt limits is numerically demanding because it requires a plausible model of the non-linear reaction of the risk premium. In this article, we propose three pragmatic and easily implementable options to capture the notion of "safety" embedded in $d_S$.[1] None of them pins down $d_S$ as formally illustrated in chart 1, but we believe they provide useful proxies at low computational cost. Close variants of these pragmatic options have now been regularly used since we first developed them (see, e.g., IMF, 2016b; Eyraud *et al.*, 2018).

1 Although Fournier and Fall (2015b) also derive "prudent" debt levels, they use far more restrictive criteria, which, unlike ours, are not exclusively rooted in the idea of preventing a debt crisis depicted in chart 1.

## 1.3 Operational options

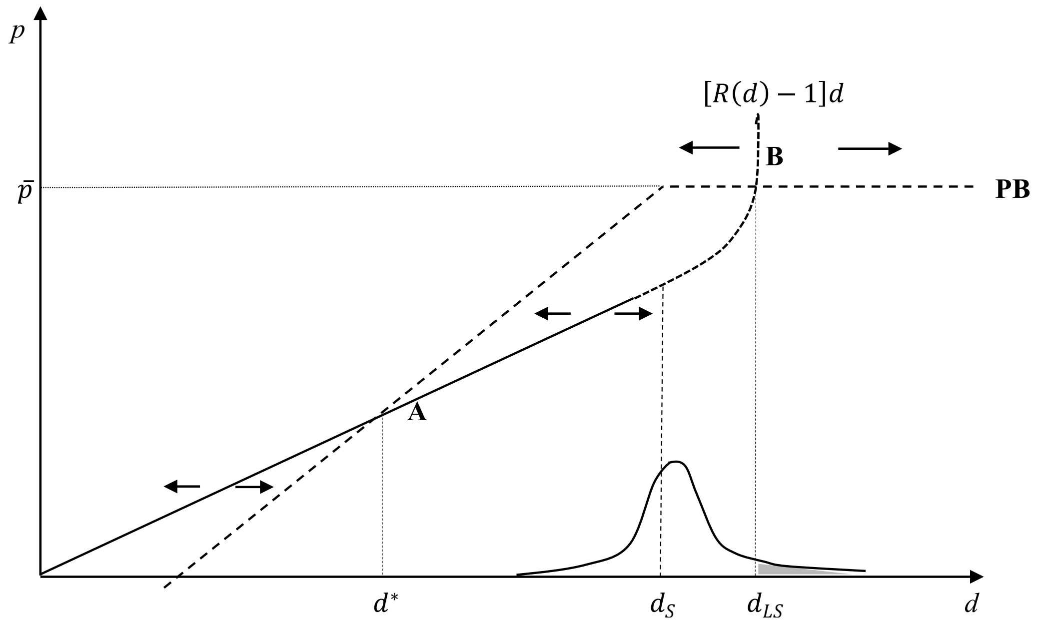
The diagram in chart 1 suggests two alternative avenues to calculate a safe debt boundary similar to $d_S$, both using simple and readily available simulation tools. The first is to estimate a safety buffer below a *known* debt limit $d_{LS}$.[1] The second is to assess the highest public debt level a government could plausibly commit to stabilise or reduce under highly adverse conditions.

### 1.3.1 Safe debt boundary with known debt limit

Reasonable priors about $d_{LS}$ allow defining the safe debt boundary as the difference between the limit and a safety buffer. As illustrated in chart 2, information about the distribution of risks affecting debt trajectories can help to pin down a safe debt boundary. The bell-shaped curve illustrates the uncertainty surrounding the evolution of public debt at a given time horizon, say T years. (The distribution is slightly skewed to the right because the snowball effect amplifies the effect of shocks at higher debt levels.) The safe debt upper bound $d_S$ can then be defined as the initial debt level corresponding to a given probability *not* to exceed $d_{LS}$ over the time horizon T. Note that $d_S$ can be at, below, or above the median of that distribution depending upon whether the median projected debt path is flat, upward or downward sloping, respectively.

Chart 2

**Determination of $d_S$ when $d_{LS}$ is known**




Note: The bell-shaped curve along the horizontal axis sketches the distribution of debt projections at the end of a given time horizon (period T). The shaded area under the curve symbolizes the probability of exceeding the debt limit at that time. In that representation, the starting value for the debt projection exercise ($d_S$) is assumed to be smaller than the median debt projection in T, which is consistent with a growing median debt path over the projection window.

Source: Own calculations.

1 If we had a tool to easily estimate plausible distributions of debt limits, the safe debt boundary could be defined as an arbitrarily low percentile of the debt limit distribution (say 1 or 5 percent). See Bi (2012) and Battistini *et al.* (2019).

One practical issue in estimating the safety buffer below the limit is that public debt is typically subject to two very different types of shocks. The first type consists of high-frequency disturbances affecting GDP growth, borrowing costs, the fiscal balance, and, if some government liabilities are denominated in foreign currency, nominal exchange rates. The joint distribution of such shocks is straightforward to estimate and can be used to randomly generate many simulations of future debt outcomes. This approach implies that, all else equal, more volatile economies face lower safe debt boundaries. Similarly, countries with rising median debt trajectories over time would have lower safe debt boundaries.

Low-frequency but large shocks hitting the economy and the public sector balance sheet constitute the second source of uncertainty around public debt projections. For the most part, they are related to the realisation of contingent liabilities (banking crises, natural disasters, bail-out of subnational governments or state-owned enterprises). Because these events are scarce and highly country-specific, a stress-test approach is advisable (Clements *et al.*, 2016). The stress scenario typically assumes the realisation of a fraction of a country's contingent liabilities.

A relevant but tricky issue is whether high and low frequency shocks are correlated. Event studies in Bova *et al.* (2015) show that large shocks often coincide with adverse economic and financial conditions affecting debt dynamics. That coincidence suggests adding up two buffers: one obtained with the stochastic method described above and another capturing the potential fiscal costs of contingent-liability stress. Thus, the safe debt boundary $d_S^*$ could be calculated as:

$$d_S^* = d_{t_0}^*(\pi), \text{ where } d_{t_0}^*(\pi) \text{ is such that } Pr\left(d_{t_0+T}^F \leq (d_{LS} - \bar{C}) | d_{t_0}^F = d_{t_0}^*(\pi)\right) = \pi. \quad (3)$$

$\bar{C}$ is an *ad-hoc* buffer allowing for large but low-frequency shocks to public debt, $d_{t_0}^*(\pi)$ is the starting value of a debt forecasting exercise such that the projected debt level at horizon $T$ (denoted by $d_{t_0+T}^F$) has a probability $\pi$ of being below $d_{LS} - \bar{C}$, the debt limit $d_{LS}$ adjusted down by an amount $\bar{C}$. This uniquely defines $d_{t_0}^*(\pi)$ because there is a one-to-one mapping between the distribution of debt forecasts at any given point in time and the initial value of debt at time $t_0$ of the corresponding forecasting exercise.

In the calculations reported later in this article, we set $\pi$ =0.95 and $T$=6. However, $\pi$ can be adjusted upwards (downwards) to reflect a lower (higher) tolerance for risk. Although the time horizon is also a matter of preference, it should ideally balance two considerations: (i) the time needed for sustainable fiscal policy measures to durably influence debt trajectories and (ii) the rapid increase in uncertainty around debt forecasts at longer projection horizons. For instance, long horizons (say 10 years or more) could yield implausibly large buffers without conveying enough sense of urgency to policy-makers.

### 1.3.2 Safe debt boundary when the debt limit is unknown

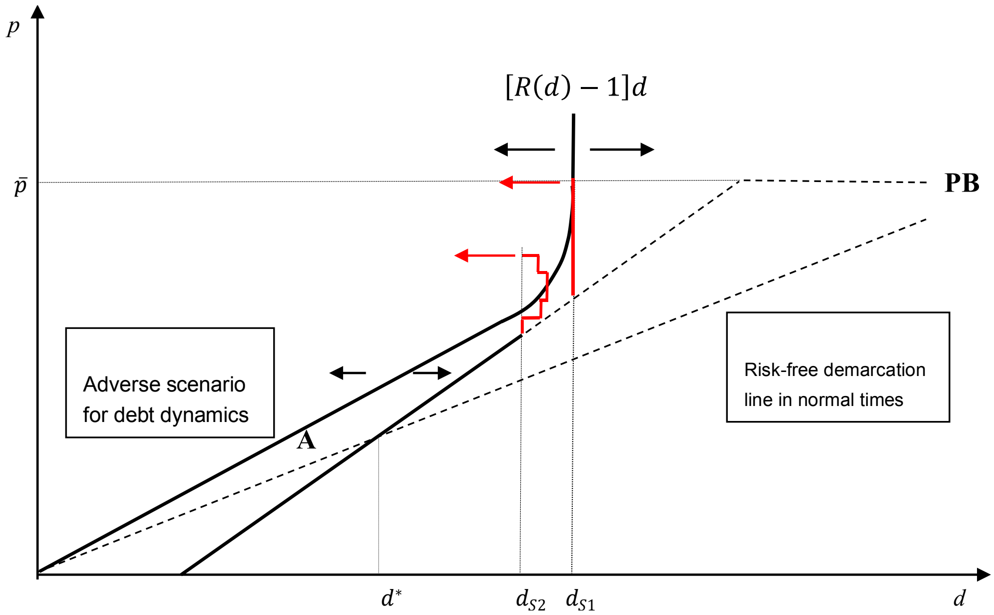
When the debt limit is unknown, we can still identify the highest debt level a government could commit to stabilising or reducing over a given time frame under persistently bad circumstances. Hence, a public debt level could be considered safe if the highest sustainable primary surplus ($\bar{p}$) suffices to prevent explosive debt trajectories even after adverse conditions emerge and persist.

In terms of our diagram, the safe debt upper bound can be identified using either stress-testing or stochastic simulations to characterise adverse circumstances. Under the first approach, we must define a hostile, yet plausible scenario of abnormally high growth-interest differentials and correspondingly jittery market sentiment. Under the second approach, we focus on the probability of having to bring the primary surplus above $\bar{p}$ to stabilise the debt ratio, a policy which, by definition, lacks credibility.

Chart 3 illustrates the proposed deterministic method. The bad state of the world for debt dynamics is described by a steeper "risk-free" demarcation line and the possibility of markets pricing in a default. One question to settle when implementing this approach is how quickly the government could deviate from its normal reaction function and implement an extraordinary fiscal consolidation in response to the bad state of the world. In the "cold turkey" case, the primary balance could jump to $\bar{p}$ before debt dynamics turns unstable. In a gradual case, only a stepwise fiscal consolidation could be implemented. Under the cold-turkey scenario, the government could stabilise the debt ratio when it asymptotically reaches its limit under the bad scenario (denoted by $d_{s,1}$). With gradual debt consolidation, there is an upper limit to the feasible fiscal adjustment (measured in terms of the annual improvement in the primary balance). The government would then incrementally raise the primary balance until debt goes back to its initial, pre-shock position after a certain time (in the chart, 5 years). Both approaches define a unique safe debt boundary: it is the debt limit (minus an arbitrarily small number) if the maximum primary surplus is attainable in one go, and the highest debt level that the government can commit to returning to over a given time horizon after the bad state of the world materialises. Note that for simplicity, we assume that market beliefs in the adverse scenario for debt dynamics are not affected by the assumed fiscal consolidation path (cold-turkey versus gradual).

Chart 3

**Determination of $d_S$ when $d_{LS}$ is unknown: deterministic case**




Source: Own calculations.

This reasoning directly echoes the "natural debt limit" concept proposed by Mendoza and Oviedo (2004), which combines the uncertainty affecting government revenues with an assessment of the capacity to cut primary spending to the bare minimum when revenues are the lowest. These authors define their "natural debt limit" as the perpetuity value of the highest primary balance a government could credibly commit to sustain in a state of "fiscal crisis" [1]. What makes the natural debt limit a genuine limit in the sense discussed above is that the government would violate the solvency condition with certainty in a "fiscal crisis". Unsurprisingly, this method points to very low public debt limits – of around 30 % of GDP for selected Latin American countries.

1 Mendoza and Ovideo (2004) define a fiscal crisis as "a sufficiently long sequence of adverse shocks to public revenues", forcing the government to adjust "its [primary] outlays to minimum admissible levels".

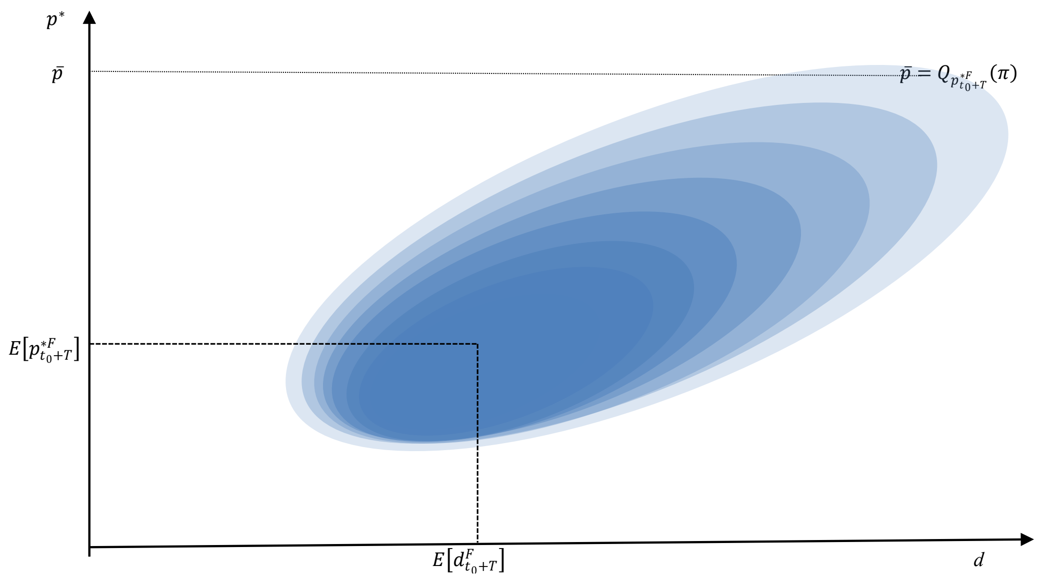
Stochastic methods can also be used when the debt limit is unknown. Once again, the only known critical threshold is $\bar{p}$, the point at which fiscal fatigue sets in. Thus, one pragmatic option to get a sense of the safe debt boundary is to assess the risk of the primary balance required to at least stabilise the public debt ratio exceeding $\bar{p}$. As in the first stochastic approach discussed above, that risk rises with the debt level set as the starting value for the simulation exercise. It should be recalled that, all else equal, the debt-stabilising primary balance $p^*$ is proportional to the debt level (i.e. $p^* = \left(\frac{r-g}{1+g}\right) d_{-1}$, omitting time subscripts). It is therefore possible to identify the starting value for a debt forecasting exercise $d_{t_0}^{**}(\pi)$ such that $Pr\left(p_{t_0+T}^{*F} \leq \bar{p} | d_{t_0}^F = d_{t_0}^{**}(\pi)\right) = \pi$, where $p_{t_0+T}^{*F}$ denotes the projected debt-stabilising primary balance at horizon T.

It is worth noting that reliance on model-based stochastic simulations raises the question of the underlying steady-state equilibrium of the model. Should the latter exhibit a strongly negative interest-growth differential, the circumstances under which a 4 % primary surplus might be required to stabilise debt could be so rare that the safe debt boundary might be implausibly high or not even exist. Clearly, that approach is irrelevant for countries with a negative equilibrium interest-growth differential.

For the sake of comparison with the other two methods, chart 4 proposes a stylised visual of the approach, showing the joint distribution of debt forecasts (at a given horizon *T*) and the corresponding debt-stabilising primary balance. That specific distribution yields a probability $\pi$ of avoiding unfeasible primary balances to realisation the national debt (i.e. to remain at or below $\bar{p}$) and corresponds to a unique initial debt level at the beginning of the simulation exercise.

Chart 4

**Determination of $d_S$ when $d_{LS}$ is unknown: stochastic case**




Note: $p^* = [R-1]d$ and $Q_{p_{t_0+T}^{*F}}(\pi)$ is the value for a given probability $\pi$ of the quantile function associated with the marginal distribution of $p_{t_0+T}^{*F}$. Note that the empirical distributions of debt and primary balance forecasts are positively skewed, as the debt impact of a given shock to growth and interest rates is proportional to the debt level itself (see section 2).
Source: Own calculations.

### 1.3.3 Stochastic versus deterministic: pros and cons

A key advantage of stochastic approaches is to allow assigning probabilities to the adverse situations one wants to insure against. The degree of risk aversion embedded in the safe debt boundary is explicitly measured. Their main disadvantage is to be relatively data intensive as they require estimating a reasonable dynamic forecasting model (typically a VAR) with desirable properties (i.e. stable dynamics and a well-defined steady state). As for any model-based approach, structural breaks in the basic relationships between growth and interest rates, or between the latter and fiscal variables, are bound to have first-order effects on the assessment. Finally, existing estimates of debt limits based on past fiscal behavior and the evidence of fiscal fatigue exist mostly for advanced economies. Debt limits remain difficult to pin down for emerging market and developing economies.

Symmetrically, deterministic approaches are much more parsimonious in terms of country-specific data and can be customised across a broader range of countries. They also offer the flexibility to capture relevant developments – e.g. a permanent shift in growth-adjusted interest rates – that a model-based methodology could only partly reflect. However, they suffer from the drawback associated with any stress-testing exercise: the plausibility of the selected adverse scenario is always debatable because technically speaking, its probability of occurrence is exactly zero.

Adopting a combination of approaches could be a sensible course of action. However, the range of estimates of the safe debt boundary might be too wide to provide useful guidance to policy-makers. In the end, as in any debt sustainability assessment, a serious dose of judgment is needed, depending on the availability of forecasting models and their properties (stability, steady-state, etc.). We now turn to the implementation of each approach.

## 2. Safe debt with known debt limit

This section calculates the safe debt boundary by identifying desirable buffers under a known debt limit. After a brief discussion of the main inputs, we present results for selected advanced economies and assess the sensitivity of the estimates to variations in key assumptions.

### 2.1 Main inputs

### 2.1.1 Distributions of debt forecasts

Any computer routine producing distributions of public debt forecasts can be used to estimate $d^*_{t_0}(\pi)$ in equation (3). In this article, we use a variant of the tool developed by Celasun, Debrun and Ostry (2007, hereafter CDO). That stochastic model incorporates three sources of risk: fiscal policy shocks – reflecting for instance any unexpected expenditure slippages, revenue shortfalls, or calls on guarantees – the budget's sensitivity to macroeconomic (growth) and financial (interest and exchange rates) developments,[1] and the direct impact of macroeconomic shocks on debt dynamics through growth and borrowing costs. The empirical link between the primary balance, the output gap, and public debt being a core component of CDO, we re-estimate it, using a sample of (mostly) advanced economies covered here[2].

The main advantage of the CDO tool is that it operates even under rather limited data availability, allowing applications to many different countries. Indeed, a major practical hurdle in applying stochastic simulations to public debt is the need for consistent higher-than-annual frequency time series for key fiscal aggregates.

1 Since the countries considered here have most of their obligations denominated in domestic currency, the exchange rate is not part of the VAR models.

2 Celasun, Debrun and Ostry (2007) estimate a reaction function on a large panel of emerging economies.

This often limits applicability to the few countries that consistently publish such data, i.e. based on actual budget flows (and not interpolations) and with broad coverage of the public sector (general government) and consistent accounting methodology[1].

CDO requires only annual data for debt and the primary balance. This comes at the cost of separating the analysis of economic dynamics – requiring quarterly data – from the fiscal block. The silver lining of this two-block approach is the ability to use a well-tested specification of the fiscal reaction function instead of the one mechanically imposed by the VAR model at the heart of the economic block.

Two main drawbacks need to be kept in mind when interpreting the results. First, the estimates ignore relevant information on the interaction between the budget and economic conditions. Second, the simulations drawn from the model implicitly assume that although fiscal policy responds to cyclical developments, it does not affect the economy in return. Annex I describes the main technical features of the algorithm.

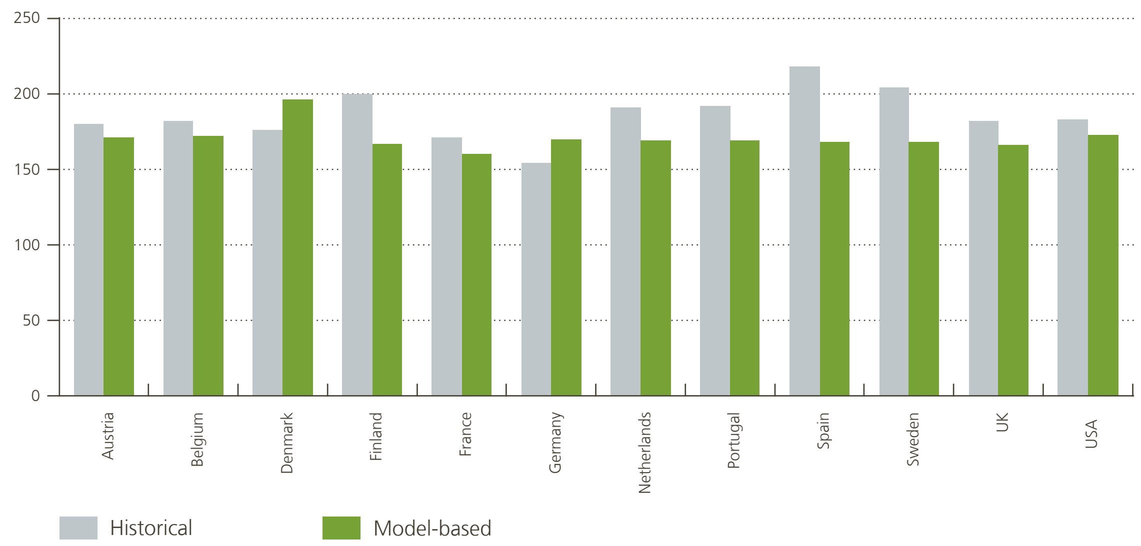
### 2.1.2 Debt limits

The debt limits $\bar{d}$ are based on a framework similar to chart 1 and borrowed from Ostry *et al.* (2010). Using a panel of advanced economies, they first estimate a non-linear reaction function exhibiting fiscal fatigue – as the PB schedule in chart 1. The debt limit is obtained by intersecting the reaction function with an interest-rate schedule. To construct the latter, they take into account either current market interest rates on government debt or a model-based projection that considers the likely response of borrowing costs to debt as it approaches the limit[2].

Chart 5

**Selected Advanced Economies: Debt limits**

(in % of GDP)




Source: Ostry *et al.* (2010).

1 High frequency budget data (quarterly or monthly) serve cash management purposes and are often not reported with the same classification or using the same accounting methods as annual data supporting policy analysis. Brazil is one exception (Garcia and Rigobon, 2005, Penalver and Thwaites, 2003, and Tanner and Samake, 2005). However, fiscal policy remains subject to an annual decision process, suggesting that even high-frequency fiscal data of good quality may suffer from a high noise-to-signal ratio. Wyplosz (2005) shows that reaction functions like that estimated in this paper are a very poor match for monthly data for Brazil.

2 As Ostry *et al.* (2010, p.10) note, "the drawback of [this] approach is that it requires various assumptions about the risk-free interest rate, the distribution and support of the shocks to the primary balance, and the recovery rate in the event of default".

Under both assumptions for interest rates, debt limits are generally well above 150 % of GDP (chart 5). Assuming an endogenous response of the interest rate to debt tends to reduce the estimated $\bar{d}$ by about 15 percentage points on average. Note that the methodology proposed by Ostry *et al.* (2010) cannot guarantee that a solution to the debt-limit problem as presented in chart 1 always exists. As a matter of fact, neither a stable solution ($d^*$) nor a debt limit could be pinned down for both Italy and Japan. In the numerical simulations below, we will therefore ignore the case of Japan. For Italy, we will assume a debt limit equal to the average level in the other countries of the sample.

### 2.1.3 Contingent liabilities: calibrating the debt impact of a tail event

The CDO simulation tool allows for direct shocks to the primary balance reflecting the history of deviations between actual and average fiscal realisation. Regardless of the assumed distribution of the shocks underlying the stochastic simulations (joint-normal or empirical), the likelihood of large and disruptive realisations of contingent liabilities would be too low for comfort[1]. The recent financial crisis highlighted the strong connections between the health of the banking sector and public finances (Amaglobeli *et al.*, 2015), calling for any notion of safe debt to be resilient to a high-impact tail event. Bova, Toscani and Ture (2015) confirm that the realisation of large contingent liabilities was mostly related to financial sector stress.

To incorporate financial sector risk into the safety margin, we use data collected by Laeven and Valencia (2013) to calibrate the country-specific impact of banking stress on public debt. Debt shocks following banking crises ranged from 9 % of GDP in Italy to 44 % of GDP in Finland, with an average of 25 % of GDP in our sample of advanced economies. As a percentage of total banking assets, the public debt effect lies between 4 and 22 %, with an average of 10 % (table 1). Thus, we calibrate the additional safety buffer $\bar{C}$ to represent 10 % of the total bank assets in the country. In our sample, $\bar{C}$ averages 30 % of GDP with differences across countries reflecting

Table 1

**Public debt dynamics after banking crises and size of banking sector**

| | | | |
|---|---|---|---|
| Austria | 15 | 378 | 4 |
| Belgium | 19 | 360 | 5 |
| Denmark | 25 | 270 | 9 |
| Finland | 44 | 202 | 22 |
| France | 17 | 357 | 5 |
| Germany | 18 | 261 | 7 |
| Italy | 9 | 217 | 4 |
| Netherlands | 27 | 326 | 8 |
| Portugal | 34 | 277 | 12 |
| Spain | 31 | 285 | 11 |
| Sweden | 36 | 230 | 16 |
| United Kingdom | 24 | 496 | 5 |
| United States | 24 | 104 | 23 |
| **Mean** | 25 | 289 | 10 |
| **Median** | 24 | 277 | 8 |

Source: Laeven and Valencia (2013).

1 The CDO template assumes normal distributions. Drawing the shocks on their empirical distribution would still attribute a very low probability to very large shocks.

the importance of the financial sector. We will refer to the adjusted debt limits as "debt ceilings" since they are not *limits* in the sense defined in chart 1.

### 2.1.4 Additional assumptions

We assume that fiscal fatigue uniformly sets in at a primary surplus of 4 % of GDP. That corresponds to the maximum five-year moving average of country-specific primary balances in the IMF historical fiscal database (Mauro *et al.*, 2012) and the 75th percentile of the historic distribution of positive primary balances, observed in the panel of advanced economies. An alternative would be to calibrate fiscal fatigue based on each country's history. However, this would lead our framework to effectively confirm the higher historical debt levels reached by each country as the safe boundary. Concluding that governments with historically low debt also have low safe debt boundaries is too close to a tautology to add value. Moreover, a country that has never had to raise its primary balance by very much to keep debt dynamics under control is unlikely to have experienced fiscal fatigue in the first place.

Safe debt boundaries will differ across countries depending on the macroeconomic volatility prevailing in the economy and the stock of contingent liabilities. To contrast these two sources of heterogeneity, we derive the safety margins in two steps. We first assume that the same debt limit applies to all countries, ignoring the risk from contingent liabilities. We then consider country-specific debt limits and incorporate an additional safety buffer for financial sector contingent liabilities.

Finally, we exclude the last five years of data from all our statistical models' estimates. The reason is that the protracted period of extremely low interest rates since the global financial crisis is long enough to seriously contaminate the steady-state (i.e. long-term) properties of the statistical models. While we might well be in a new normal of permanently negative interest-growth differential $(r - g)$, we have opted to preserve estimated models with long-term properties broadly consistent with positive differentials for most countries. First, this is a technical requirement to have a well-defined intertemporal budget constraint, a feature which is worth preserving in this kind of exercise. Second, as noted by Mauro and Zhou (2020), while negative differentials are not infrequent historically, they can rise abruptly; and the likelihood of such reversals appears to rise with the debt level itself (Lian *et al.*, 2020), suggesting that policy-makers should not indulge in low-rate sedation. At the same time, we could not ignore the post-2008 period entirely and be in denial of the possibility of permanently negative $r - g$.

By truncating the estimation sample at end-2014, we obtained a broad range of steady-state interest-growth differentials, enabling us to discuss the implications of such conditions on debt limits. The median steady-state interest-growth differential embedded in our country-specific VAR models is 0.8 of a percentage point, with two countries in negative territory (the US, at –0.1 % and Austria, at –0.2 %), whereas Italy and Portugal are on the high end, at 2.9 and 3.3 % respectively. With an estimated long-term differential of 0.7 %, Belgium is slightly below the median.

## 2.2 Results

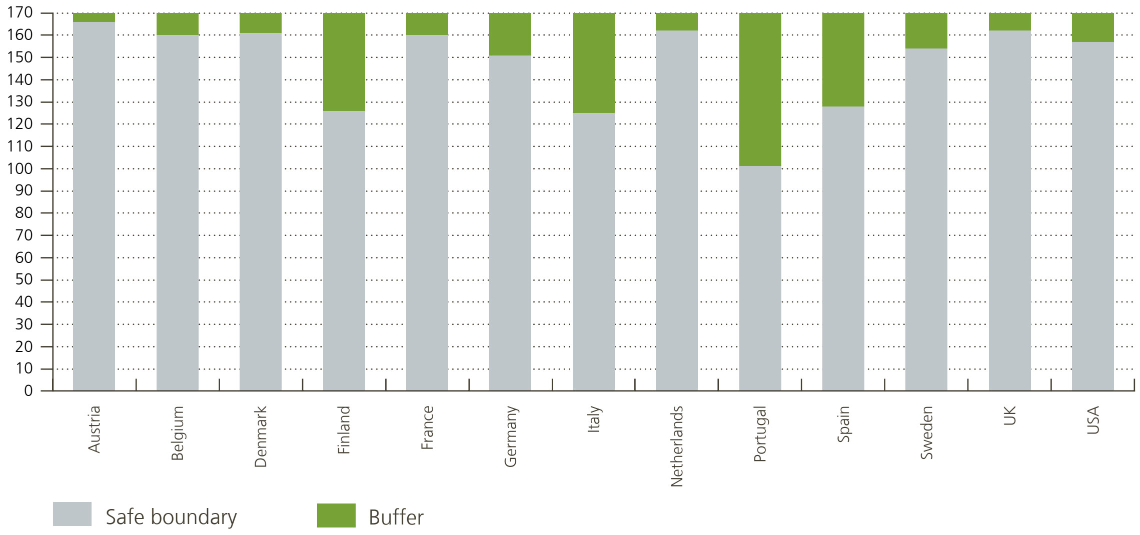
### 2.2.1 Common debt limit across countries

The common debt limit is set at 170 % of GDP, which is the average of the model-based limit estimated by Ostry *et al.* (2010) for our country sample. The tolerated probability for exceeding the debt limit over a 6-year horizon is set at 0.05. Thus, for each country $i$, the safe debt boundary is given by $d^*_{i,t_0}(0.95)$ such that $Pr\left(d^F_{i,t_0+6} \leq 170 | d^F_{i,t_0} = d^*_{i,t_0}(0.95)\right)$ = 0.95. The results are reported in chart 6. The range of safe debt boundaries spans from 101 % of GDP (Portugal) to 166 % (Austria).

The stochastic simulations behind the numbers in chart 6 can be described with fan charts. For each period of the forecasting horizon, those charts depict the distribution of debt outcomes (see chart 7, top panel). Each coloured band represents a probability mass of 10 %, except for the two outer bands, which cover a 5 %

Chart 6

**Safe debt boundaries–uniform debt limits and no adjustment for contingent liabilities**




Note: We apply the uniform debt limit of 170 percent of GDP to Italy, even though Ostry et al. (2010) failed to identify such a limit for that country.
Sources: Authors' estimates.

mass each. The width of the debt fan charts can vary substantially across countries, reflecting the volatility of their public debt outcomes. Some countries exhibit narrow fans so that only minimal buffers below the limit appear necessary to feel safe. Other countries with more volatile debt outcomes (wider fan charts) need sizeable room below the limit to secure a low probability of exceeding it.

These differences reflect the intrinsic volatility of interest rates, growth and the primary balance, as well as the average magnitude of the snowball effect. Volatility alone matters a great deal. For illustrative purposes, we look at the cases of Italy and Portugal. These economies face similar steady-state growth-interest differentials, with Portugal having higher exposure to economic, financial and fiscal shocks. The fan charts reflect these differences (chart 7, top panel). The more volatile profile of Portugal's public debt explains why it has a smaller safe debt boundary (101 % of GDP) than Italy (125 % of GDP). The bottom panel of chart 7 also illustrates the important role of the steady-state or equilibrium interest-growth differential in determining the required safety buffer below the limit. In our sample, a change in the equilibrium differential by 100 basis points is on average associated with a change in the safe debt boundary of about 18 % of GDP.

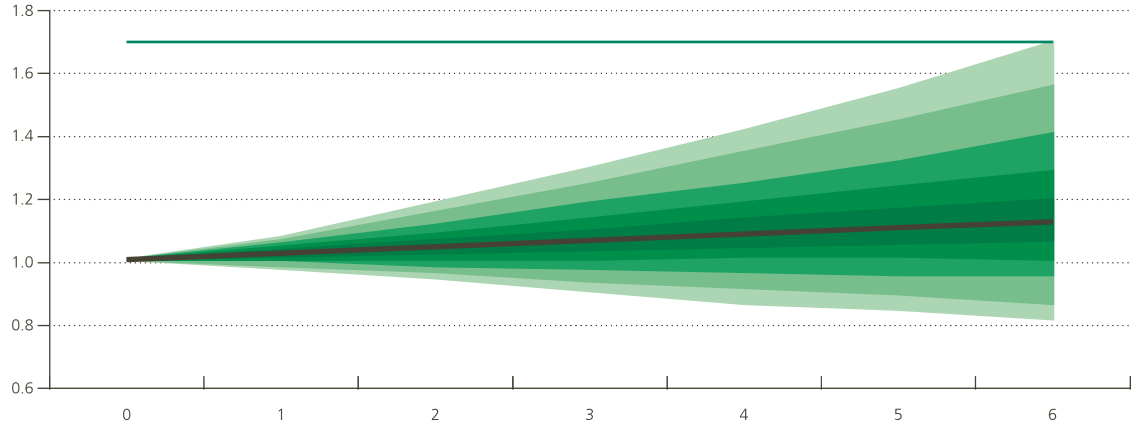
To the extent that the interest-growth differential reflects a government's credibility in keeping debt stable, underlying patterns of policy behaviour matter a great deal in the determination of safe debt boundaries. A key feature of the CDO simulation tool used in this article is that it incorporates the endogenous fiscal policy response to public debt developments (see Annex 1). Thus, the country's history in terms of its "revealed preference" for stabilising the debt ratio (by raising the primary balance in response to higher debt and vice versa) has a first-order effect on the safe debt upper bound. Although the simulations reported here rely on panel estimates of the fiscal reaction function – so that all countries have the same average policy behaviour – the VARs used to simulate interest rates and growth are country-specific. As a result, the debt ratio in countries with a low equilibrium $r - g$ will exhibit stronger mean reversion than countries with a higher $r - g$. At very high debt ratios, mean reversion entails downward trends in most circumstances.

Chart 7

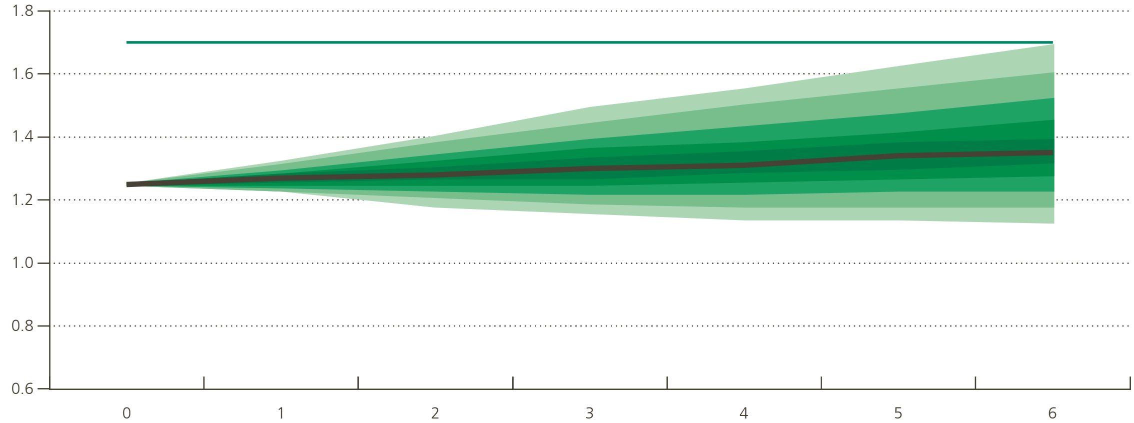
**Drivers of safety buffers**

Shocks to debt dynamics (growth, interest rate and fiscal shocks)

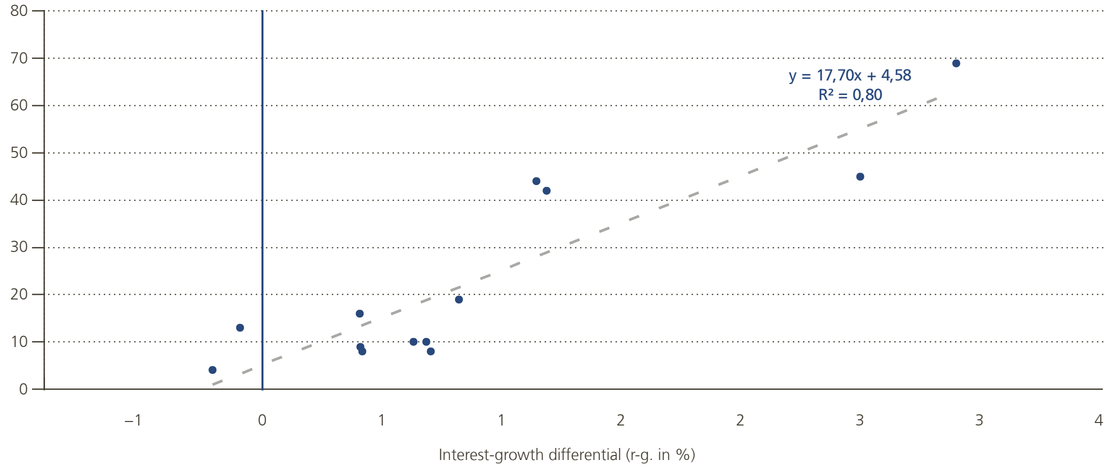
Portugal




Italy



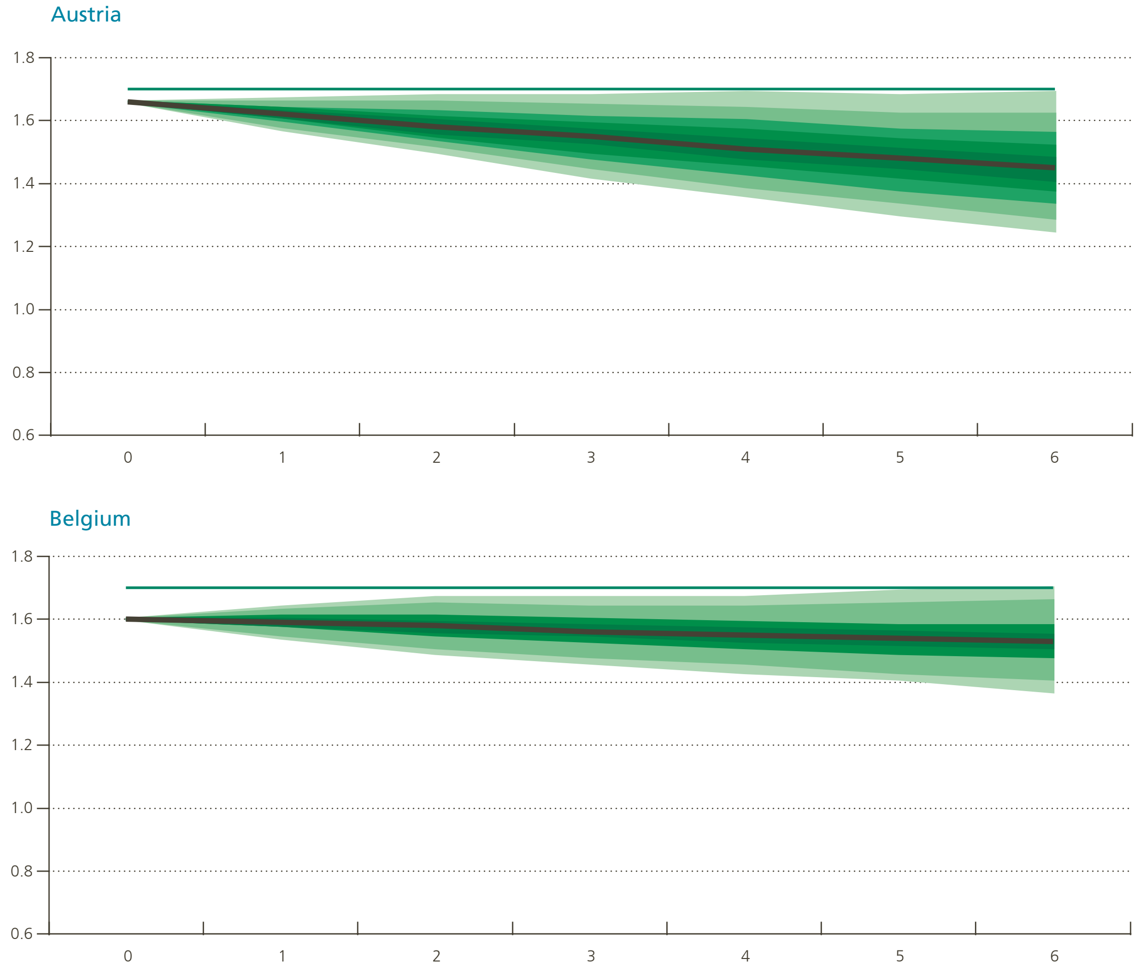

Steady-state (growth-adjusted) interest rate




Sources: Authors' estimates.

Chart 8

**Fiscal behaviour, mean reversion and safe debt boundary**




Sources: Authors' estimates.

Chart 8 illustrates that feature with the fan charts for Austria and Belgium. Unlike the cases of Portugal and Italy displayed above, the median debt trajectory shows a clear downward trend over the simulation horizon, allowing the safe debt upper bound to be much closer to the assumed debt limit. This shows the value of fiscal credibility: a country with a consistently sound pattern of policy behaviour can safely sustain much higher debt levels (in this example, close to an estimated debt limit) than countries with weaker credentials in terms of debt stabilisation.

## 2.2.2 Country-specific debt limits and adjustment for contingent liabilities

We now replicate the exercise using the country-specific debt limits estimated by Ostry *et al.* (2010) and augmenting the safety buffer to accommodate the risk associated with contingent liabilities. First, we subtract from the limit an amount equivalent to 10 % of the country's total banking sector assets (obtained from Laeven and Valencia, 2013)). Second, we identify $d^*_{i,t_0}$ (0.95) such that $Pr\left(d^F_{i,t_0+6} \leq \left(d_{i,LS} - \bar{C}\right) | d^F_{i,t_0} = d^*_{i,t_0}(0.95)\right)$=0.95. Although the size of the banking sector now matters for the definition of safe debt boundaries, macroeconomic conditions (magnitude of the snowball effect, growth and interest rates volatility, prevalence of fiscal policy shocks) remain a key factor behind cross-country differentiation.

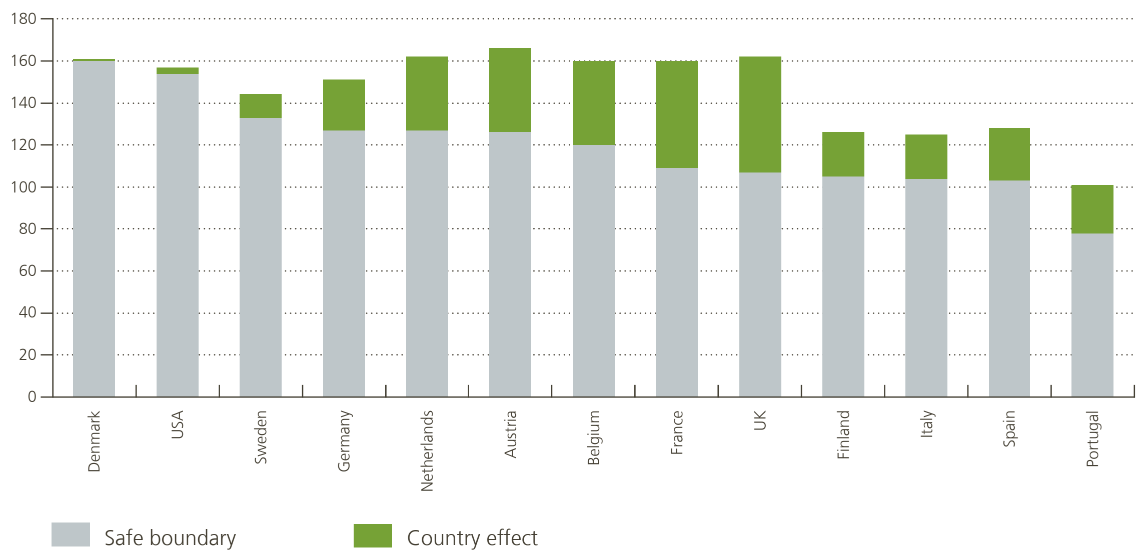
Safe debt boundaries are now more than 25 % of GDP (on average) lower than in the previous scenario. Compared to the numbers reported in chart 6, the safe debt upper bounds (grey bars) displayed in chart 9 are generally lower – sometimes substantially – due to the country-specific safety margin (green blocks) covering contingent liability risk (10 % of the total banking sector assets as reported by Laeven and Valencia (2013)) and some modest differentiation in the estimated debt limits. In the case of Denmark, however, the safe debt boundary is largely unchanged because the extra buffer for banking sector risk is almost fully covered by the higher debt limit estimated by Ostry *et al.* (2010) – i.e. 196 % of GDP instead of the uniform 170 % applied in the previous exercise. As for Belgium, the country-specific safety buffer is 40 percentage points of GDP lower, bringing the safe debt boundary to 120 % of GDP, mostly on account of the country's sizeable banking sector.

Two secondary effects of using a debt ceiling much lower than the debt limit are worth noting. First, because the impact of shocks to growth and interest rates on debt are proportional to the debt level itself, the fan charts below the ceiling will be narrower than those below the limit. This tends to reduce the precautionary buffer needed to handle high-frequency economic and financial disturbances. Second, all else equal, navigating fiscal policy at lower debt levels weakens any downward trend associated with mean reversion in the debt ratio. This contributes to a higher precautionary buffer below the limit.

Chart 9

**Safe debt boundaries considering country-specific limits and contingent liabilities**

(in % of GDP)




Sources: Authors' estimates.

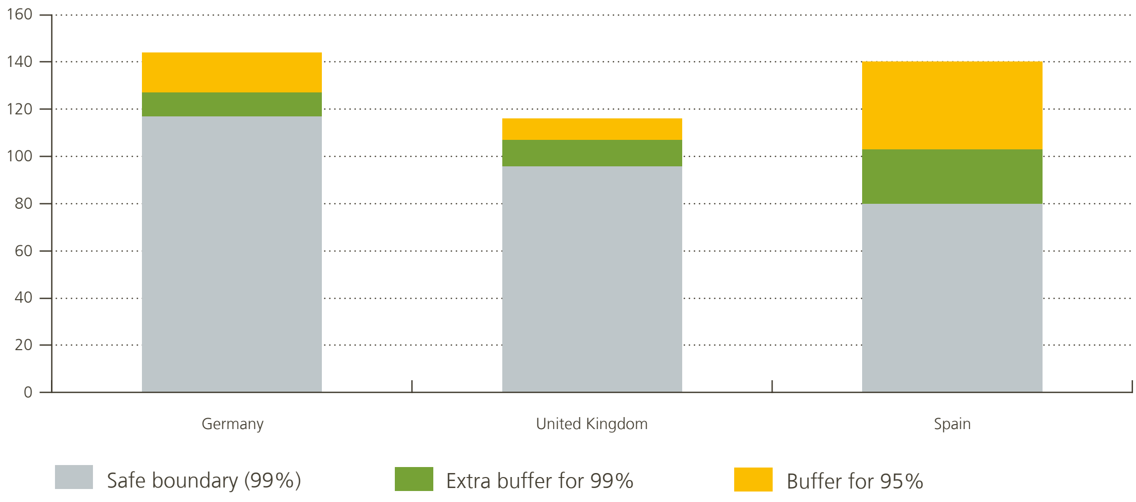
## 2.3 Lower risk aversion

To assess the sensitivity of our safe debt boundaries to risk aversion, we can lower the tolerance for exceeding the debt ceiling in six years from 0.05 to 0.01, which means raising $\pi$ from 0.95 to 0.99. Since the impact depends only on the range of the fan chart, the reduction in the safe debt boundary is in general more pronounced in countries with more volatile public debt profiles (chart 10). While the extra buffer to secure a 99 % probability of not exceeding the ceiling (instead of a 95 % probability) is estimated at around 10 % of GDP for Germany and the United Kingdom, it reaches twice that amount for Spain.

Chart 10

**Extra buffers to secure a higher probability of not exceeding the debt ceiling**

(in % of GDP)




Note: For each country, the sum of the grey and green blocks yields the safe boundary reported in chart 9, while the sum of all blocks corresponds to the debt limit adjusted for the tail-risk buffer (here defined as 10 % of the banking sector assets.)

Sources: Authors' estimates.

## 3. Safe debt with unknown debt limit

This section implements the deterministic and stochastic approaches discussed earlier to estimate safe debt boundaries based solely on the strongest plausible fiscal behaviour a country could adopt in the case of highly adverse conditions for debt dynamics.

### 3.1 Deterministic approach

#### 3.1.1 Methodology

As discussed in section 2, the underlying methodology relies on building a stress scenario. For that purpose, we define "adverse conditions" during which a "crisis-mode" fiscal policy deviating from normal fiscal behaviour can be credibly implemented. Probability distributions of primary balances and $r - g$ can help define such a combination of bad realisations of the interest-growth differential and good realisations of the primary balance. Here, striking a good compromise between the exceptional and the plausible is of the essence because, like in Mendoza and Oviedo (2004), the stress scenario is conceived as a "permanent" state of the economy. For that reason, we select less extreme realisations than the conventional 95$^{th}$ percentiles, preferring instead the 75$^{th}$ percentiles. Of course, plausibility is in the eye of the beholder, and all the calculations below can be implemented for any other quantile.

As regards the primary balance, the 75$^{th}$ percentile is selected from the distribution of the entire panel of countries in our sample and it is used uniformly as the fiscal fatigue threshold for all countries. The reason for doing so is that not all countries in our sample have faced situations forcing them into "crisis-mode" fiscal behaviour. Uniformity presumes that if it were pushed into crisis mode, *any* country in our sample would be able to behave as its sample peers that faced very adverse public debt dynamics in the past.

By contrast, the statistical properties of $r-g$ arguably reflect country-specific structural factors moving slowly over time. In the calculations of the safe debt boundary, the uncertainty surrounding the growth-adjusted interest rate is therefore country-specific. In addition, the likely existence of a positive relationship between the growth-adjusted interest rate and the debt level suggests for conditioning the distribution on debt itself. The conditioning relationship is estimated with a simple panel regression reported in Annex 2.

Denoting by $\bar{p}$ the highest primary surplus a country can plausibly achieve (and presumably sustain for some time) the safe debt boundary can be found as follows:

1. Assume a distribution for $r-g$. In the calculations below, we assume a normal distribution with a mean equal to the predicted value of $r-g$ obtained from the model in Annex 2 (and therefore dependent on debt) and a variance equal to the *country-specific* conditional sample variance.

2. Take the 75th percentile of the distribution defined in step 1, denoted by $\overline{r-g}$. Under our assumptions, it is a positive function of the debt level.

3. Select a sufficient condition ruling out explosive debt trajectories under $\overline{r-g}$. In line with the discussion around chart 3, we consider two alternative conditions for step 3.

**Condition 3A** seeks to identify $d_{S1}$ as the debt level the government can stabilise under $\overline{r-g}$ by keeping the primary balance at $\bar{p}$. This simply requires solving $d_{S1} = \frac{\bar{p}}{f(d_{S1})}$ which has in general multiple roots depending on the specific form of $f(d)$. In the calculations below, it has only one positive root, which gives the upper bound for safe debt. While this formula has the advantage of simplicity, it presumes the feasibility of a discreet jump to $\bar{p}$ as soon as the bad state for $r-g$ materialises. Like in Mendoza and Oviedo (2004), $d_{S1}$ is conceptually a debt limit (hence an unstable equilibrium as depicted in chart 3) contingent on adverse conditions.

**Condition 3B** determines the safe debt boundary as a stable equilibrium. We define it as the highest debt level to which the government can credibly commit to returning after stress conditions occur. The fiscal consolidation is considered credible if it follows historical patterns of large annual improvements in the primary balance taking place over a given time frame (five or ten years in the calculations below). The feasible fiscal adjustment in one year is calibrated on the 75th percentile of the first-differenced primary balance observed in the sample.

The safe debt boundary calculated in these ways will in any instance:

- decrease with the average growth-interest differential,
- decrease with the variance of that differential,
- increase with the quantile defining the plausibly high primary surplus (or its yearly adjustment),
- decrease with the quantile defining adverse circumstances in terms of growth-interest differential.

### 3.1.2 Results

For the sake of brevity, and because all the calculations reflect the same fundamentals as above, we only comment on the range of estimated safe debt boundaries under the two conditions 3A and 3B[1].

1 Country-by-country results are available upon request to the corresponding author.

### *3.1.2.1. Condition 3A: the primary balance jumps to its "fatigue" level*

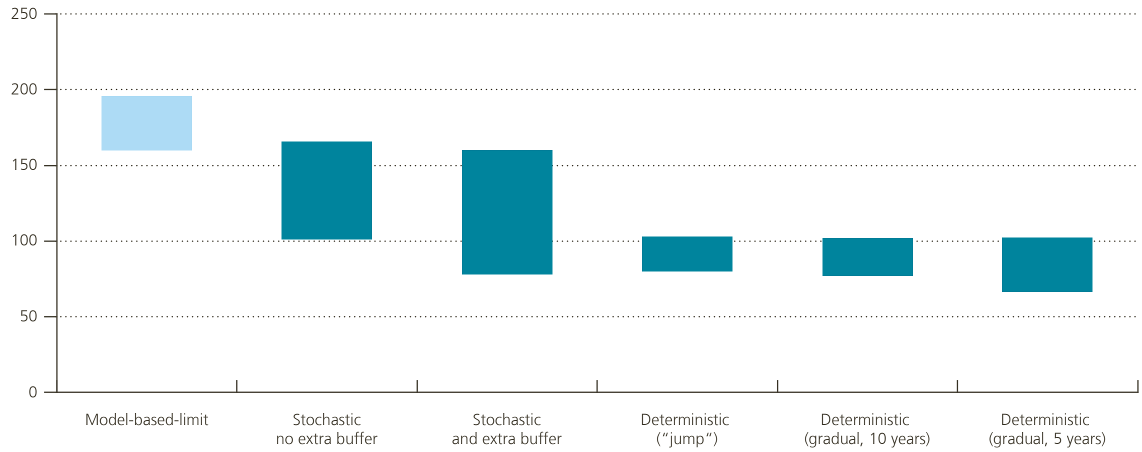
The maximum attainable primary balance of 4 % of GDP apply to all countries, whereas the increase in $r - g$ is permanent and country specific. Countries manage to jump to that threshold during the year of the emergence of adverse conditions for debt dynamics. The median safe debt boundary obtained in that way amounts to about 95 % of GDP, which is significantly lower than the median safe debt upper bound found under the known debt-limit hypothesis (i.e. 157 % without extra buffer for contingent liability and 120 % with such a buffer). Of course, that gap says as much about the methodological difference between the two approaches (stress testing versus stochastic simulations) as about the estimated debt limits themselves (i.e. are those limits "too high" ?).

The range of estimates is also narrower than in section 2, spanning from less than 80 % of GDP to slightly more than 100 %. Heterogeneity across countries is mainly driven by the conditional variance of $r - g$. An intuitive conjecture explaining the narrower cross-country range is that the deterministic stress scenario focuses on the 75$^{th}$ percentile of distributions (instead of the 95$^{th}$ in the stochastic simulations framework). Relatedly, the technical assumption making the adverse scenario a permanent state of the economy is intrinsically more conservative than letting estimated VAR models generate a large number of forecasts reflecting the degree of persistence in the data. Chart 11 compares the ranges of safe debt boundaries under the various methodologies applied in this article.

Chart 11

**Range of country-specific safe debt boundaries under alternative methodologies**

(in % of GDP)




Sources: Authors' estimates.

### *3.1.2.2. Condition 3B: gradual adjustment of the primary balance*

We obtain safe debt boundaries under the following assumptions:

- The maximum attainable primary balance level is the same across countries and equal to 4 % of GDP.
- The maximum annual improvement in the primary balance is the same across countries and equal to 0.82 % of GDP. That fiscal contraction can be implemented for a maximum of five or ten consecutive years and it stops as soon as the 4 percent fatigue threshold is reached (it might never be reached though, depending on the starting balance).
- Starting primary balances are country-specific and equal to the debt stabilising primary balance at the safe-debt threshold under normal $r - g$ conditions.
- The adverse scenario for $r - g$ is permanent and country-specific.
- The safe debt boundary is the highest initial debt ratio such that the gradual fiscal consolidation as defined above ensures a return of the debt ratio to that initial "safe haven" under the adverse scenario for $r - g$. (This is the stepwise path illustrated in chart 3.)

Compared to the previous sub-section, safe debt boundaries are on average around 5 percentage points lower, and heterogeneity across countries is slightly greater. Results also show that extending the adjustment period from five to ten years does not matter much for countries with high debt thresholds and correspondingly high starting primary balances since their fiscal adjustment quickly pushes the primary balance to the 4 percent cap. The mirror argument applies for countries with low initial primary balances: limiting their fiscal adjustment period to five years yields lower safe debt boundaries. (In chart 3, $d_{S2} < d_{S1}$.).

## 3.2 Stochastic approach

### 3.2.1 Methodology

The modeling blocks underlying the computation of the safe debt boundary are the same as in the case of a known limit (see Annex 1). The difference is that the boundary is now determined by the fiscal fatigue threshold for the primary balance. In practice, we select the highest starting debt level of a projection exercise such that, over a given time horizon, the projected *debt-stabilising primary surplus* (i.e. $p^* = \left(\frac{r-g}{1+g}\right) d_{-1}$) exceeds the fiscal fatigue threshold with a low probability (say 5 percent). In the universe of positive interest-growth differentials, setting a higher debt level at the beginning of the projection horizon increases the likelihood that $p^*$ exceeds the threshold. Thus, fixing a tolerance level for unfeasible primary balances determines a unique safe debt boundary.

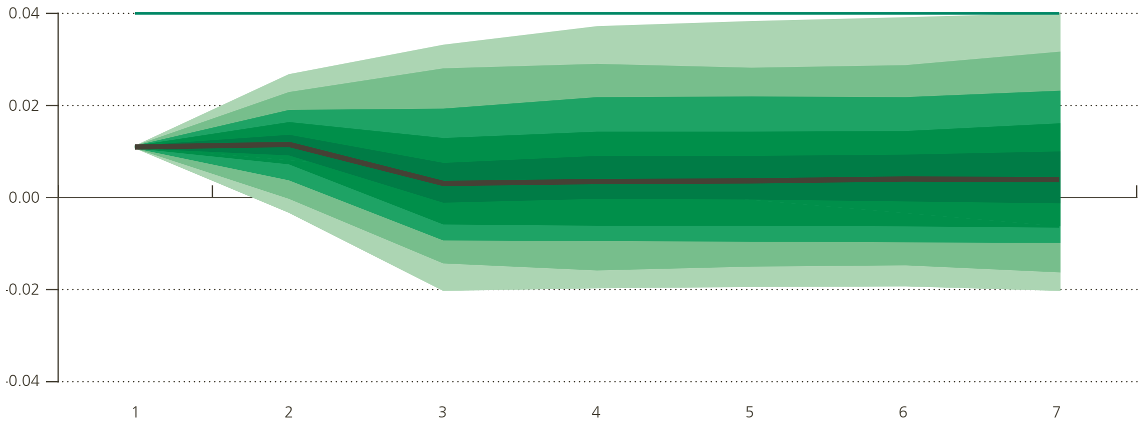
A practical limitation to this approach, however, has to do with the steady-state (or equilibrium) level of the interest-growth differential. If the latter gets close to zero or even plunges into negative territory, we might well never find any $p^*$ above the 4 percent threshold, or at least not for plausible initial debt levels of the projection exercise.

### 3.2.2 An example: Spain

Chart 12 displays the fan chart for Spain's debt-stabilising primary balance. We see that in year 6, the $95^{th}$ percentile of $p^*$ is equal to 4 percent of GDP. Chart 12 mirrors a public debt fan chart with a starting value equal to the safe debt boundary. The approach yields sensible results because for the sample period considered here, Spain features an interest-growth differential that is both positive in equilibrium and relatively volatile. In this example, the estimated boundary is 75 percent of GDP. That number is lower than the outcome of the deterministic approach calibrated with the same data (90 percent of GDP) because stochastic simulations consider the full distribution of projected debt paths (and the corresponding $p^*$). In this case, the distribution is skewed to the right (i.e. higher values of debt and $p^*$). The safe debt boundary estimated in this way would rise if the equilibrium $r - g$ (and/or its variance) were to fall.

Chart 12

**Spain: Fan charts for the debt-stabilising primary balance**




Sources: Authors' estimates.

## Conclusions

Public debts are historically high, with no significant decline in sight. Many people worry, but many others don't. In the first group are those pointing out that, in the past, current debt levels have tended to predict costly accidents, including sovereign defaults, high inflation, and financial meltdown (e.g. Sandleris 2016). In the second group are those arguing that because negative differentials between interest rates and growth are here to stay, public debt is essentially a fiscal free lunch (Blanchard, 2019). Yet, the two groups converge on one basic reality: no one can have their cake and eat it indefinitely[1]. In plain language, the laws of economic and financial gravity still apply, and for public debt, this means that the sky is *not* the limit.

Thus, more than ever, an important question for policy-makers is the following: when does accumulating additional public debt become unsafe? This is the question we tackle in this article.

Using the standard toolkit of debt sustainability analysis, our goal is to provide pragmatic approaches that can usefully inform an answer to that question. In this context, a debt level (in proportion of GDP) is considered safe if it is plausible to expect the government to stabilise or reduce it under most circumstances (including adverse ones) using fiscal policy. This definition combines the uncertainty surrounding growth and interest rates, and the plausibility of primary surpluses required to at least keep the debt ratio constant. The practical problem we aim to solve is to determine the highest possible debt level beyond which the risk of losing control of debt dynamics could be deemed unreasonable.

Because we rely on well-tested tools of debt sustainability analysis, the common denominator to the different methods reviewed here is the medium-term prospects for debt dynamics. We use simple forecasting models to determine safety buffers below a known "limit" to debt (i.e. a threshold beyond which policy-makers cannot

1 Blanchard (2019) himself cautions his readers: "My purpose in the lecture is not to argue for more public debt. It is to have a richer discussion of the costs of debt and of fiscal policy than is currently the case".

credibly commit to continue to service the debt indefinitely)[1]. These safety buffers reflect the intrinsic riskiness of debt trajectories in a country (due to economic and financial volatility) and the typical response of fiscal policy to debt developments (i.e. strongly stabilising or not). When the debt limit is unknown, we determine the safe debt boundary by reference to a practical limit to the primary budget surplus a government can be expected to generate and sustain.

A fundamental caveat applying to all those forecasting-based methods is the always questionable role of the past as a reliable predictor of the future. The Lucas critique thus applies with full force and should be kept in mind when interpreting the specific numbers coming out of these exercises: they reflect a hypothetical "equilibrium" observed in the (recent) past but that may not properly reflect today's or tomorrow's circumstances. Blanchard (2019) suggests nothing else when he reviews the reasons why public debt is currently less costly than one might think. The safe debt boundaries derived here may thus appear exceedingly conservative to many analysts. We have no qualms about such a judgment and would simply point out that all the tools considered here can be calibrated or re-estimated to stick more closely to present conditions.

Another important property of the safe debt boundaries is that they can be exceeded by significant margins without causing any tangible risk of default or accident. This is especially true if central banks cover Treasuries' backs by ruling out self-fulfilling sovereign debt crises that could be inflicted on fundamentally solvent governments. During tail events, like the global financial crisis of 2008-9 or the COVID-19 pandemic, such backing can and should create significant fiscal space to enable the adequate fiscal policy response (see Bartsch *et al.* 2020).

Taken at face value, our results suggest that public debt levels in advanced economies are currently flirting with the safe debt upper bound or already go well beyond it. While this warrants careful monitoring, it should be no cause for undue concern as long as the "equilibrium" interest-growth differential remains durably lower than the historic norm. That said, the costs of public debt "accidents" are so high that there should be no room for complacency. Today's differential is low because equilibrium interest rates are low, reflecting a persistent excess of savings over investment. This, in itself, is far from a healthy or desirable situation, and we would expect (and actually hope for) normalisation in the longer run. This is when we should remember that based on the estimates discussed in this article, a 100-basis-point increase in the interest-growth differential is on average associated with a reduction in the safe debt boundary by close to 20 percentage points of GDP.

1 An alternative approach is to produce distributions of debt limits as in Battistini *et al.* (2019) and Bi (2012).

# Annexes

## Annex 1. The stochastic simulation model

### *The economic block*

For each country, we estimate an unrestricted VAR describing the joint dynamics of the non-fiscal variables needed to project public debt, namely real interest rates (foreign and domestic), real GDP growth, and the real exchange rate. Formally, we write:

$$Y_t = A_0 + \sum_{k=1}^{p} A_k Y_{t-k} + \varepsilon_t \ , \qquad \text{(A.1)}$$

with $Y_t = (r_t^{us}, r_t, g_t, z_t)$. The $A'$s are vectors of coefficients, while $r^{us}$ symbolises the real foreign interest rate, $r$, the real domestic interest rate, $g$, the real GDP growth rate, $z$, the (log of the) real effective exchange rate, and $\varepsilon_t$ is a vector of normally distributed error terms: $\varepsilon_t \sim N(0, \Omega)$. Estimation uses quarterly data over 1990-2014.

The VAR plays two roles. First, the estimated variance-covariance matrix of residuals $\Omega$ is the basis to calibrate the generation of random, non-fiscal shocks. Specifically, we produce a sequence of shock vectors $\hat{\varepsilon}_{t+1}, \dots, \hat{\varepsilon}_T$ such that $\forall \tau \in [t+1, T]$, $\hat{\varepsilon_\tau} = \Lambda \mu_t$, where $\Lambda$ is the Choleski factorisation of $\Omega$ $(\Omega = \Lambda' \Lambda)$ and $\mu_t \sim N(0,1)$. Second, we feed the simulated shock sequence in the estimated VAR to obtain consistent forecasts of $Y$. As shocks occur each period, the VAR produces joint dynamic responses of all elements in $Y$. In practice, it is important to check that the VAR's coefficients rule out explosive paths for any of the variable.

After annualising all relevant projections, the fiscal block of the model projects the primary balance and the debt-to-GDP ratio reflecting the simulated shocks and the corresponding dynamic response of the economy.

### *The fiscal block*

The fiscal block consists of a reaction function and a stock-flow identity to project debt-to-GDP ratios. The reaction function follows a well-established specification aimed at capturing the main features of average fiscal policy patterns. In line with Bohn (1998), it describes the link between the primary fiscal balance that is related to current economic conditions (the business cycle) and to solvency concerns, as reflected in the positive impact of inherited public debt. We use an unbalanced panel of 29 advanced economies over the period of 1990-2014. Table A.1 shows estimation results using robust country-fixed effects estimator (LSDV) for specifications that differentiate between good and bad times by separately estimating the impact of negative and positive output gaps. Full sample results are reported in column 1. In order to gauge the influence of the financial crisis and the ensuing great recession, we drop one observation at a time until we eliminate the post-crisis observations and report the results in the latter columns.

The reported magnitudes are in line with the empirical literature[1]. The primary balance tends to be persistent, and sensitive to economic conditions, but in an asymmetric fashion. When the output gap is negative, a widening of the output gap by 1 percentage point deteriorates the primary balance by 0.48 % of GDP on average, pointing to a fairly large countercyclical response in bad times. By contrast, any widening of an already positive output gap is not reflected in a statistically significant improvement of the primary balance, in line with a well-documented tendency to spend revenue windfalls in good times. Persistence of primary balance and response of primary balance to debt is robust to the inclusion of post-crisis observations. Finally, countries have tended to react strongly and in a stabilising fashion to public debt developments.

1 Among others, see for example, Celasun, Debrun and Ostry (2007) and Mauro *et al.* (2013, table 7).

Table A.1

**Fiscal "reaction function" in advanced economies**

| | (1)<br>pbal<br>1990-2014 | (2)<br>pbal<br>1990-2013 | (3)<br>pbal<br>1990-2012 | (4)<br>pbal<br>1990-2011 | (5)<br>pbal<br>1990-2010 | (6)<br>pbal<br>1990-2009 | (7)<br>pbal<br>1990-2008 | (8)<br>pbal<br>1990-2007 |
|---|---|---|---|---|---|---|---|---|
| pbal t-1 | 0.687***<br>(0.0449) | 0.694***<br>(0.0463) | 0.694***<br>(0.0472) | 0.692***<br>(0.0496) | 0.685***<br>(0.0530) | 0.663***<br>(0.0658) | 0.655***<br>(0.0725) | 0.672***<br>(0.0604) |
| ygap pos | 0.00301<br>(0.0426) | 0.00714<br>(0.0429) | 0.000985<br>(0.0462) | −0.00554<br>(0.0467) | −0.00411<br>(0.0472) | −0.0158<br>(0.0481) | 0.00215<br>(0.0369) | −0.00854<br>(0.0503) |
| ygap neg | 0.436***<br>(0.123) | 0.440***<br>(0.127) | 0.470***<br>(0.126) | 0.487***<br>(0.133) | 0.489***<br>(0.138) | 0.551***<br>(0.128) | 0.427***<br>(0.126) | 0.478***<br>(0.124) |
| debt t-1 | 0.0494***<br>(0.00815) | 0.0511***<br>(0.00893) | 0.0531***<br>(0.0102) | 0.0544***<br>(0.0113) | 0.0533***<br>(0.0127) | 0.0581***<br>(0.0134) | 0.0555***<br>(0.0124) | 0.0458***<br>(0.0120) |
| constant | −2.196***<br>(0.392) | −2.293***<br>(0.452) | −2.357***<br>(0.539) | −2.383***<br>(0.605) | −2.326***<br>(0.678) | −2.474***<br>(0.711) | −2.262***<br>(0.624) | −1.545**<br>(0.619) |
| N<br>adj.R-sq | 620<br>0.552 | 591<br>0.555 | 562<br>0.565 | 533<br>0.553 | 505<br>0.535 | 477<br>0.506 | 448<br>0.507 | 419<br>0.601 |

Sources: Authors' estimates.

Accordingly, we choose the asymmetric output gap specification that includes only pre-crisis observations summarised in equation (A.2).

$$\hat{p}_{i,t} = \hat{\alpha}_i + 0.67p_{i,t-1} - 0 \times ygap_{i,t}D_{i,t} + 0.48ygap_{i,t}(1 - D_{it}) + 0.046d_{i,t-1} \qquad \text{(A.2)}$$

where $p_{i,t}$ is the ratio of the primary fiscal balance to GDP in country $\mathbf{i}$ and year $\mathbf{t}$; $d_{i,t-1}$ is the gross public debt-to-GDP ratio at the end of the previous year; $ygap_{i,t}$ is the contemporaneous output gap; $D_{i,t}$ are dummy variables equal to 1 when the output gap is non-negative (actual output above or equal trend) and 0 otherwise; and $\hat{\alpha}_i$ are the country fixed effects.

To account for the possibility that fiscal policy can itself be a source of shocks, the primary balance is subject to a fiscal policy shock $\varphi_{i,t} \sim N(0, \sigma^2_{\varphi_i})$, where $\sigma^2_{\varphi_i}$ is calibrated on the country-specific variance of the reaction function's residuals. The overall algorithm can generate a large number of random shock sequences and their corresponding debt paths. For each year of projection, frequency distributions of debt-to-GDP ratios enable a probabilistic analysis of debt sustainability.

We also introduce the fiscal capacity ceiling $\overline{p}$ on the primary balance to guarantee that the fiscal reaction function remains plausible given country experience. Thus, the primary balance in each period is equal to the minimum of the primary balance predicted by the fiscal reaction function and the fiscal surplus maximum capacity (min $\{\hat{p}_{i,t}, \overline{p}\}$). The ceiling is defined as a cross-country average of the maximum rolling average of country-specific primary balances over five-year time periods. Based on the IMF historical database of fiscal variables (Mauro *et al.*, 2012), this number is 4 % of GDP for our country sample. The same ceiling is applied to all countries to avoid that the safe debt level merely reflects the country's own history of fiscal behaviour. Although a country's history may not contain many episodes where the government was constrained to run very high surpluses, it says little about the country's capacity to do so when the need arises.

To project the debt path corresponding to a given set of shocks, we translate the annualised VAR projections into simulated output gaps and use equation (A.2) and the conventional stock-flow identity (A.3) recursively:

$$d_t \equiv \frac{(1+r_t)d_{t-1}}{(1+g_t)} - pb_t + s_t \qquad \text{(A.3)}$$

where $r_t$ is the average effective real interest rate, $g$ is the real GDP growth rate, and $s_t$ – stock-flow adjustments, for instance due to the call of government guarantees or privatisations. Higher moments remain determined by history, although all VARs used in the paper incorporate the latest available quarterly data (end-2014) and capture in part the increased economic and financial volatility since 2007 [1]. One aspect that the CDO model cannot capture, however, is the emergence of fat tails or asymmetries since shocks are all drawn from normal distributions.

1 We compared VARs used in the remainder of the paper to estimates obtained on shorter pre-crisis samples. Significant differences – notably in the underlying steady-state values for growth and interest rates – suggest that crisis time observations have already had a meaningful impact on estimated economic dynamics.

## Annex 2. Inputs to the deterministic approach

This Annex describes the main statistical properties of the growth-adjusted interest rate and primary balance, the two main ingredients in the calibration of the model.

### *Descriptive statistics*

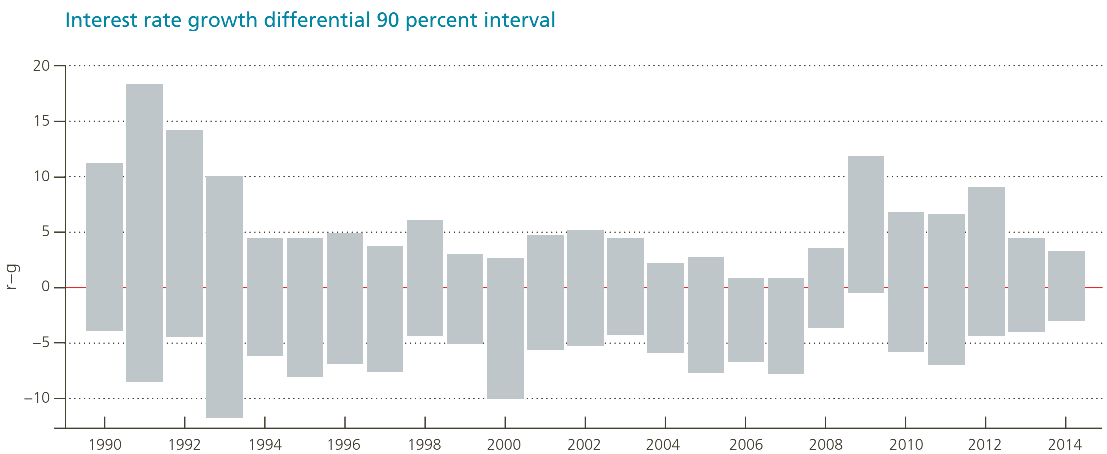
In the years prior to the great financial crisis, most advanced economies experienced very low real interest rates. In fact, two-thirds of advanced economies had on average negative interest-growth differentials in 2000-2007 (chart A.1). With the average growth rate staying close to what it was in the 1980s and 1990s, around 3 percentage points, historically low real interest rates were the key drivers of this trend. However, unlike in the 1980s when the low real interest rates were caused by high inflation and financial repression, the trend in the 2000s mostly reflected nominal interest rates.

The crisis was a powerful reminder that such loose financing conditions could not last. The average interest rate growth differential went up by around 3 percentage points in 2008-2014, which together with sharply deteriorating budget balances called debt sustainability into question for many advanced economies. Faced with sluggish growth and low inflation, record low nominal interest rates are unlikely to ensure a return to significantly and persistently negative $r - g$.

Chart A.1

**Range of growth-adjusted interest rates in advanced economies**

(1990-2014)



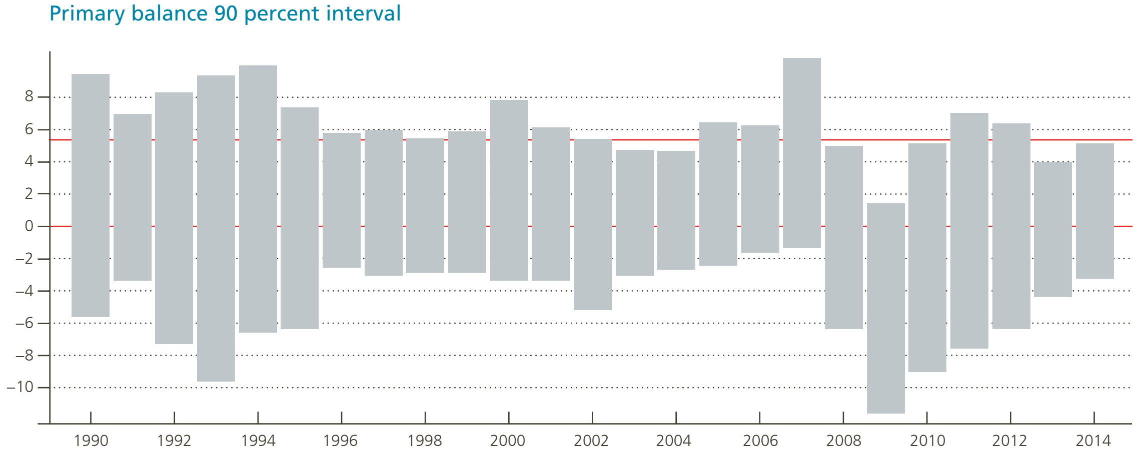

Sources: Authors' calculations.

Looking at primary balances, many advanced economies have exhibited primary surpluses for only a short time in the last two decades. In fact, the average primary balance in advanced economies has been close to zero. However, this number conceals significant variations across countries (chart A.2).

Chart A.2

**Range of primary balances in advanced economies**

(1990-2014)




Sources: Authors' calculations.

### *The growth-interest-debt nexus*

A simple regression explaining linking the interest-growth differential to potential determinants is used to calculate its conditional variance, which is in turn crucial for the calculation of safe debt levels. That relationship can be viewed as the merger of two separate fields in the literature: one investigating the relationship between debt levels and interest rates and the other looking at impact of debt on growth. We proceed by estimating the empirical model (A.4):

$$r - g_{it} = \alpha + \beta d_{it} + \delta_i + \gamma_t + \varepsilon_{it}, \qquad \text{(A.4)}$$

with $r$, the effective interest rate calculated as total interest payments divided by the previous year level of debt; $g$, the nominal GDP growth rate; $d$, current year debt to GDP ratio; the $\delta_i$s are country-fixed effects and $\gamma_t$s are time-fixed effects. The model is estimated using a sample of advanced economies, and as a first pass, it omits other determinants than debt. Yet, country-fixed effects and time effects alleviate concerns about the omitted variable bias. To take into account the effect of joining the euro area on Member States' interest rates, we re-estimate an empirical model linking the growth-adjusted interest rate to the level of the public debt allowing for different $r - g$ sensitivity to debt for euro area countries during the years 1999-2007. The results of the estimation of the above regression are presented in table A.1.

Table A.1

**Public debt and growth-adjusted interest rates in advanced economies**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | 1990-2014 | | 1990-2007 | |
| debt | 0.0663***<br>(0.0179) | | 0.0539**<br>(0.0204) | |
| debt other | | 0.0665***<br>(0.0178) | | 0.0535**<br>(0.0206) |
| debt during euro effect time | | 0.0677***<br>(0.0181) | | 0.0566***<br>(0.0201) |
| constant | −1.716<br>(1.400) | −1.717<br>(1.398) | −1.193<br>(1.543) | −1.155<br>(1.587) |
| N<br>adj.R-sq | 639<br>0.366 | 639<br>0.365 | 436<br>0.315 | 436<br>0.314 |

Sources: Authors' estimates.

We find a positive and fairly robust relationship between $r-g$ and the debt level. Both coefficients are significant, although there is no statistically significant difference between the two slopes. The coefficients from the second regression are used to obtain conditional variance of the growth-adjusted interest rate.

To quantify the effect of shock to $r-g$, the conditional variance is calculated based on the expression below:

$$r-g\ shock(debt^{*}) = InvNormal(75th\ pcl) * sd_{resid\ r-g\ if\ year>2007} + (mean_{r-g}(debt^{*}) + \text{time effect } 1990-2007) \quad \text{(A.5)}$$

We make the following assumptions when calculating the conditional variance:

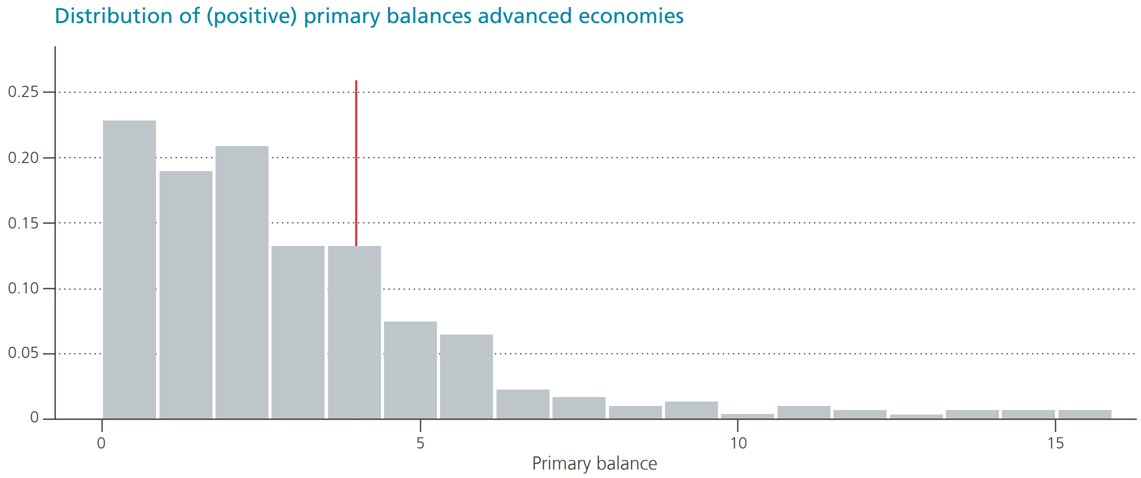
- Country-fixed effects are set to zero to limit the impact of historical high inflation or financial repression episodes.
- We correct for the crisis-time-fixed effects by subtracting average time fixed effect over 2008-2014 from the mean to limit the impact of crisis on the median $r-g$.
- Risk tolerance is set to the $75^{th}$ percentile of the distribution of conditional variance to gauge the magnitude of shock to $r-g$.

### *Fiscal behaviour*

Fiscal performance that a country is likely to achieve following a shock is determined by maximum attainable primary balance, annual adjustment effort, and the starting primary balance. To estimate the maximum attainable primary balance level that a country is likely to achieve, we take the $75^{th}$ percentile of the positive primary balance for the underlying sample of advanced economies, that is equal to 4% of GDP.

Chart A.3

**Distribution of primary surpluses**




Sources: Authors' calculations.

To quantify the magnitude of annual fiscal effort, we estimate a standard "fiscal reaction function" along the lines of Bohn (1998) based on our underlying sample of 29 advanced economies (equation A.6):

$$pbal_{it} = \alpha + \beta_1 pbal_{it-1} + \beta_2 ygap\_pos_{it} + \beta_3 ygap\_neg_{it} + \rho debt_{it-1} + \delta_i + \varepsilon_{it}, \quad \text{(A.6)}$$

where *pbal* is the primary balance in percent of GDP, ygap_pos is the positive output gap, ygap_neg is the negative output gap, debt represents the *lagged* debt level as a percentage of GDP. Results are presented in table A.2.

Table A.2

**Fiscal reaction function in advanced economies**

| | (1)<br>pbal<br>1990-2014 | (2)<br>pbal<br>1990-2007 |
|---|---|---|
| pbal t-1 | 0.687***<br>(0.0449) | 0.672***<br>(0.0604) |
| ygap pos | 0.00301<br>(0.0426) | –0.00854<br>(0.0503) |
| ygap neg | 0.436***<br>(0.123) | 0.478***<br>(0.124) |
| debt t-1 | 0.0494***<br>(0.00815) | 0.0458***<br>(0.0120) |
| constant | –2.196***<br>(0.392) | –1.545**<br>(0.619) |
| N<br>adj. R-sq | 620<br>0.552 | 419<br>0.601 |

Sources: Authors' estimates.

The estimated response of the primary balance to debt conveys useful information on the likelihood of an average country in our panel behaving in a way that ensures mean-reverting debt trajectories. However, we are primarily interested in what the *residuals* of that regression can tell us on the extent of exceptional fiscal efforts. It is the residuals that give an idea of the plausible pace of improvements in the primary balance going over and above what countries normally do in given circumstances. To gauge the extent of the annual fiscal effort that would be perceived by the markets as feasible, we use the 75$^{th}$ percentile of residuals in the Bohn equation, which is equal to 0.82 % of GDP.

## Bibliography


Amaglobeli D., N. End, M. Jarmuzek and G. Palomba (2015), *From Systemic Banking Crises to Fiscal Costs: Risk Factors*, IMF, Working Paper 15/166.

Bartolini L. and C. Cottarelli (1994), "Government Ponzi Games and the Sustainability of Public Deficits under Uncertainty", *Ricerche Economiche*, 48(1), 1-22.

Bartsch E., A. Bénassy-Quéré, G. Corsetti and X. Debrun (2020), *It's All in the Mix: How Can Monetary Policy Work or Fail Together*, Geneva Report on the World Economy 23, International Center for Monetary and Banking Studies and Center for Economic Policy Research, forthcoming.

Battistini N., G. Callegari and L. Zavalloni (2019), *Dynamic Fiscal Limits and Monetary-Fiscal Policy Interactions*, ECB, Working Paper 2268.

Bi H. (2012), "Sovereign Default Risk Premia, Fiscal Limits, and Fiscal Policy", *European Economic Review*, 56(3), 389-410.

Blanchard O. (1993), "Suggestions for a New Set of Fiscal Indicators" in Verbon, H. and F. Van Winden (eds), *The Political Economy of Government Debt*, Amsterdam: Elsevier Science.

Blanchard O. (2019), "Public Debt and Low Interest Rates", *American Economic Review*, 109(4), 1197-1229.

Bohn H. (1998), "The Behavior of US Public Debt and Deficits", *Quarterly Journal of Economics*, 113 (3), 949-963.

Bova E., Ruiz-Arranz M., E. Ture and F. Toscani (2015), *The Fiscal Costs of Contingent Liabilities: A New Dataset*, IMF, Working Paper 16/14.

Celasun O., X. Debrun and J.D. Ostry (2007), "Primary Surplus Behavior and Risks to Fiscal Sustainability in Emerging Market Countries: A "Fan-Chart" Approach", *IMF Staff Papers*, 53(3), 401-425.

Cornille D., H. Godefroid, L. Van Meensel and S. Van Parys (2019), "How risky is the high public debt in a context of low interest rates?", NBB, *Economic Review*, September, 71-95.

Debrun X., J. D. Ostry, T. Willems and C. Wyplosz (2019), "Public Debt Sustainability", Chapter 4 in Abbas, A., A. Pienkowski, and K. Rogoff (eds.) *Sovereign Debt: A Guide for Economists and Practitioners*, Oxford University Press.

Escolano J. (2010), *A Practical Guide to Public Debt Dynamics, Fiscal Sustainability, and Cyclical Adjustment of Budgetary Aggregates*, IMF Technical Notes and Manuals 10/02.

Eyraud L., A. Baum, A. Hodge, M. Jarmuzek, H. Ture, S. Mbaye and Y. Kim (2018), *How to Calibrate Fiscal Rules: A Primer*, IMF, Fiscal Affairs Department's How-To Notes.

Fall F. and J-M Fournier (2015a), *Limits to Government Debt Sustainability*, OECD Economics Department, Working Papers 1229.

Fall F. and J-M Fournier (2015b), *Macroeconomic Uncertainties, Prudent Debt Targets and Fiscal Rules*, OECD Economics Department, Working Papers 1230.

Garcia M. and R. Rigobon (2005), "A Risk Management Approach to Emerging Markets' Sovereign Debt Sustainability with an Application to Brazilian Data" in F. Giavazzi, I. Goldfajn, and S. Herrera (ed.), Inflation Targeting, Debt, and the Brazilian Experience: 1999 to 2003, chapter 5, 163-189, The MIT Press.

Ghosh A., J. Kim, E. Mendoza, J. D. Ostry and M. Qureshi (2013), "Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies", *Economic Journal*, 123(566), F4-F30.

IMF (2003), "Public Debt in Emerging Markets: Is it Too High?", Chapter 3 in *World Economic Outlook*, September.

IMF (2016a), *Assessing Fiscal Space: an Initial Consistent Set of Considerations*, IMF Policy Paper.

IMF (2016b), *Analyzing and Managing Fiscal Risks – Best Practices*, IMF Policy Paper.

Laeven L. and F. Valencia (2008), "Systemic Banking Crises Database", IMF, *Economic Review*, 61(2), 225-270.

Lian W., A. Presbitero and U. Wiriadinata (2020), "Public Debt and r-g at Risk", IMF, Working Paper 20/137.

Mauro, P., R. Romeu, A. Binder and A. Zaman (2015), "A modern history of fiscal prudence and profligacy", *Journal of Monetary Economics*, 76(C), 55-70.

Mauro, P. and J. Zhou (2020), *r minus g negative: can we sleep more soundly?*, IMF, Working Paper, 20/52.

Mendoza E. and M. Oviedo (2004), *Public Debt, Fiscal Solvency, and Macroeconomic Uncertainty in Emerging Markets: The Tale of the Tormented Insurer*, Econometric Society 2004 North American Summer Meeting 647.

Ostry J. D., A. Ghosh, J. Kim and M. Qureshi (2011), *Fiscal Space*, IMF, Staff Position Note 10/11.

Penalver A. and G. Thwaites (2004), *Analysing Sovereign Debt Sustainability: A New Probabilistic Approach*, (unpublished; London: Bank of England).

Sandleris G (2016), "The Costs of Sovereign Defaults: Theory and Empirical Evidence", *Economia*, 16(2), 1-27.

Tanner E. and I. Samake (2008), "Probabilistic Sustainability of Public Debt: A Vector Autoregression Approach for Brazil, Mexico, and Turkey", IMF, *Staff Papers*, 551, 149-182.

Wyplosz C. (2005), *Institutions for Debt Sustainability in Brazil*, in Giavazzi, F., I. Goldfajn, and S. Herrera (eds), Inflation Targeting, Debt, and the Brazilian Experience, 1999 to 2003, ed. by (Cambridge, Massachusetts: MIT Press).

Wyplosz C. (2011), "Debt Sustainability Assessment: Mission Impossible", *Review of Economics and Institutions*, 2(3), 1-37.

Yared P (2019), "Rising Government Debt: Causes and Solutions for a Decades-Old Trend", *Journal of Economic Perspectives*, 33(2), 115-140.

# An assessment of modern monetary theory

M. Kasongo Kashama *

## Introduction

Modern monetary theory (MMT) is a so-called heterodox economic school of thought which argues that elected governments should raise funds by issuing money to the maximum extent to implement the policies they deem necessary.

While the foundations of MMT were laid in the early 1990s (Mosler, 1993), its tenets have been increasingly echoed in the public arena in recent years. The surge in interest was first reflected by high-profile British and American progressive policy-makers, for whom MMT has provided a rationale for their calls for Green New Deals and other large public spending programmes. In doing so, they have been backed up by new research work and publications from non-mainstream economists in the wake of Mosler's work (see, for example, Tymoigne *et al.* (2013), Kelton (2017) or Mitchell *et al.* (2019)). As the COVID-19 crisis has been hitting the global economy since early this year, the most straightforward application of MMT's macroeconomic policy agenda – that is, money-financed fiscal expansion or helicopter money – has returned to the forefront on a wider scale. Some consider not only that it is "time for helicopters" (Jourdan, 2020) but also that this global crisis must become a trigger to build on MMT precepts, not least in the euro area context (Bofinger, 2020).

The MMT resurgence has been accompanied by lively political discussions and a heated economic debate, bringing fierce criticism from top economists including P. Krugman, G. Mankiw, K. Rogoff or L. Summers.

This short article aims at clarifying what is at stake *from a macroeconomic stabilisation perspective* when considering MMT implementation in advanced economies, paying particular attention to the euro area. The relevant points are summarised in the form of Frequently Asked Questions for didactic purposes. Specifically, we address the following questions: What exactly is MMT all about? How do MMT's theoretical foundations compare with the consensus approach? Is MMT workable in practice? Why has MMT been so popular in recent years? Does MMT share something in common with the Eurosystem's asset purchase programmes (APP and PEPP)? Is a temporary switch to MMT principles realistic in the euro area in the context of the COVID-19 crisis?

* The author would like to thank Jef Boeckx, Xavier Debrun, Arnoud Stevens, Luc Aucremanne and Marjolein Deroose for their remarks and suggestions.

## 1. What exactly is MMT all about?

MMT is a macroeconomic doctrine in that it is concerned with the operation of the economy as a whole. MMT not only draws up a macroeconomic policy agenda but it also discusses several other aspects, such as a theory of money (often described as neo-chartalism), national income accounting tenets or a labour market programme (a so-called job guarantee). From such a comprehensive exercise, one can extract two closely related building blocks to summarise the thinking about macroeconomic stabilisation:

- *A government that is the monopoly supplier of its currency never has to default because it can always meet its domestic currency-denominated payment obligations by issuing money.*
- *A government should use fiscal policy to achieve full employment with price stability, without specific regard to any increase in public deficit or debt.*

Against this background, the government can dispense with one aspect that is, however, instrumental in the conventional organisation of advanced economies, namely the issuance of government bonds to finance the fiscal deficit. Fiscal deficits must be systematically financed by "printing money", namely expanding base money (which is made up of the currency in circulation and the reserves that banks hold at the central bank as their ultimate means of settlement). Furthermore, since the central bank's job mostly boils down to accommodating fiscal needs, the elected fiscal authority and the central bank shall at any time be consolidated into a single "monetarily sovereign government". This, therefore, is another departure from the consensus approach which relies on (operational) independence for the central bank[1].

### Chart 1

**Typical example of the impact of a net increase in the fiscal deficit on the public sector using simplified balance sheets[1]**

**MMT view**

**Monetarily sovereign government**

| Assets | Liabilities |
|---|---|
| Other assets | Base money ↑ |
| | Government bonds held by the public |
| | Net worth ↓ |

**Consensus view**

**Elected fiscal authority**

| Assets | Liabilities |
|---|---|
| Account at the CB | Government bonds ↑ held by the public |
| Net equity of CB | Government bonds held by the CB |
| Other assets | Net worth ↓ |

**Independent central bank (CB)**

| Assets | Liabilities |
|---|---|
| Government bonds | Base money |
| Other assets | Government's account |
| | Net equity |

1 The arrows indicate movements due to the impact of a net increase in the fiscal deficit (that is, a net increase in government (interest) expenditure or a net decrease in taxation) on the public sector balance sheet items. Movements are judged against the counterfactual situation (no net increase in the fiscal deficit), all other things being equal. We consider here in both cases that the net increase in the fiscal deficit is associated with an immediate deterioration in the public sector balance sheet. This excludes financing of public investment programmes which serve to accumulate assets and which could lead to a strengthening of the government balance sheet (as long as the return on those assets exceeds the cost of funding them).

The MMT doctrine further prescribes that fiscal deficits can be sustained as long as substantial inflationary risks do not emerge. And, while discretionary increases in taxes must be used as the reference weapon in the fight against inflation, the government also needs to take advantage of the large array of instruments at its

1 Because macroeconomic stabilisation requires cooperation between the fiscal authority and the central bank in any case, MMT proponents consider that the conceptual consolidation of the public sector into a single entity shall apply, disregarding any existing institutional arrangement (Tymoigne *et al.*, 2013). The rules governing the relationships between the elected fiscal authority and the central bank are, however, likely to affect the balance sheets and macroeconomic outcomes of public interventions (the straightforward example being that the solvency of an independent central bank and hence, ultimately, its capacity to support the economy are determined by such rules: see, e.g., Reis (2015)), which may call for a separate balance sheet analysis of both public agencies.

disposal to be "directly involved continuously over the cycle" (Tymoigne *et al.*, 2013). Structural labour market programmes and wage scales, as well as credit controls or pricing mechanisms, are all tools that should enable the government to do so.

As regards monetary policy, the MMT doctrine requires to set permanently at 0 % (or, at any other level sufficiently close to the lower bound on nominal rates) the interest rate at which the reserves that banks hold at the central bank are remunerated. As public borrowing costs are maintained at their minimum level, this provides the best support for public spending to achieve full employment with price stability (Mitchell, 2009a). Doing so in principle implies that the cost of servicing the government's liabilities is kept below the growth rate of the economy: that enables the former not to grow without any bound, regardless of the level of the deficit or outstanding liabilities (Fulwiler, 2013). Such an assessment of interest rate growth differentials has been featuring recently in the mainstream debate as well (see also Blanchard (2019), De Grauwe *et al.* (2019) or Wren-Lewis (2019)).

## 2. How do MMT's theoretical foundations compare with the consensus approach ?

### The functional finance roots of MMT point to an unconventional monetary-fiscal assignment that should have equivalent macroeconomic outcomes as the consensus assignment, at least in theory

Broadly speaking, the MMT doctrine is not unconventional as regards how the macroeconomy works [1], what macroeconomic stabilisation policies should aim for and what instruments are in the policy toolbox.

Full employment and price stability are central targets from a macroeconomic stabilisation perspective, both under the consensus approach and under the MMT doctrine. Both approaches assume a macroeconomic environment where (not too) low and stable inflation is consistent with full potential output. This means that any policy aiming for the objective of full employment with price stability must be countercyclical: it becomes expansionary when aggregate spending falls short of potential output, countering high unemployment and possibly deflation, while it turns contractionary to fight against the induced inflationary drift when aggregate spending has been pushed beyond what the real capacities can absorb at full potential. Besides macroeconomic stabilisation, public debt sustainability should also be safeguarded, the meaning of which varies from its strongest form (the debt level is bounded by an exogenously given level, as is the case in some advanced economies [2]) to its weakest (the rise in debt should not become unbounded, which is typically what is induced by the MMT tenets).

Just like under the consensus approach, the MMT doctrine is based on a policy toolbox that includes, on the one hand, monetary policy using the interest rate as its main instrument and, on the other hand, fiscal policies that are reflected by changes in taxes and public expenditure. And, as both policies affect aggregate spending dynamics and the debt dynamics, the two can in principle be used for addressing the two targets.

Where the MMT doctrine departs from the consensus approach is hence on the prescribed assignment of responsibilities to the different policies in the pursuit of macroeconomic stabilisation. The policy assignment that is advocated by the MMT doctrine primarily relies on Lerner's initial insights (Lerner,1943) and on Minsky's further reflections (see, e.g., Minsky (1963)) as regards what one can refer to as the *functional finance approach*

1 For an assessment of how MMT theory of money compares with the consensus view, see Lavoie (2011).
2 For instance, the Stability and Growth Pact sets limits of 3 % of GDP for deficits and 60 % of GDP for debt for the European Union Member States.

*to fiscal policy*. This heterodox macroeconomic doctrine calls for public finances to contribute to the general interest of achieving full employment (and thereby price stability), by conducting countercyclical fiscal policy to help constrain any persistent fluctuations in aggregate spending [1].

On monetary policy, two functional finance viewpoints have been developed. On the one hand, it is considered that monetary policy can in principle set the interest rate at whatever level it likes based on distributional motives since the systematic fiscal adjustment approach should contribute to stabilising the debt at any given rate [2]. On the other hand, and as already explained, the viewpoint that has been adopted by most MMT proponents is that monetary policy setting the rate at a low level ensures that the rise in public debt does not follow an explosive path: debt sustainability is definitively at stake for monetary policy.

Chart 2

**A classification of the functional finance and the consensus approaches [1]**

| | Fiscal policy takes responsibility for full employment and price stability | Fiscal policy takes responsibility for debt sustainability |
|---|---|---|
| Monetary policy takes responsibility for price stability and full employment | | Consensus approach *(macroeconomy on track towards equilibrium)* |
| Monetary policy takes responsibility for debt sustainability | Functional finance approach *(macroeconomy on track towards equilibrium)* | |

1 Derived from Jayadev and Mason (2018).

In today's parlance, the functional finance approach would mean fiscal dominance: fiscal considerations determine monetary policy choices. It opposes the monetary dominance prevailing under the consensus approach: the latter being a regime where monetary policy, conducted by an independent central bank, is given a price stability (and in some jurisdictions also full employment) mandate. Under monetary dominance, political trade-offs set the balance between taxes and public expenditure so as to keep the debt sustainable: public finances are *sound*.

When both approaches adopt the same definition for debt sustainability, Jayadev and Mason (2018) demonstrate that "orthodox policy macroeconomics and [functional finance] can in principle be seen as two routes to the same goals: a combination of monetary and fiscal policy that will achieve full employment levels of output while preventing the debt ratio from rising indefinitely".

In practice, whether for the functional finance or the consensus approach, both the policies' commitments to strictly stick to their assigned mandates and their effectiveness at addressing the respective objectives are key to making sure the macroeconomy is effectively put on track towards equilibrium. Any limitations in these areas may risk the economy drifting towards unpredictable outcomes (i.e. the hatched areas in chart 2) [3], such an assessment bearing similarity with Leeper's analysis (1991) on monetary and fiscal policy interactions.

1 Strictly speaking, a lot of incarnations of the functional finance approach assume that the stabilisation role of fiscal policy would de facto imply perpetual budget deficits so as to support the productivity growth of the economy while accommodating for private agents' savings desires (see, e.g., Wray (2018)). The MMT doctrine is no exception: for further details, see section 4.

2 Fulwiller (2013) writes that it can be "show[n] that any rate of interest […] is consistent with a stable debt ratio and [the] functional finance "rule". The key is to recognize that the functional finance rule will always reduce spending whenever the deficit would otherwise be too large for potential GDP or the inflation target to be achieved and that this rule also coincidentally generates a stable debt ratio".

3 Jayadev and Mason (2018) clarify that cross effects are also of importance to assess whether the economy will effectively converge: in general, convergence applies in case the policies have larger effects on their respective assigned target than on the other target.

## 3. Is MMT workable in practice ?

### MMT is likely to be associated with commitment problems and other practical issues, with as a result inflationary drifts and / or financial instability

MMT's preference for the unconventional policy assignment to achieve full employment with price stability reflects its conviction that the elected government (using taxes and public expenditure) is better equipped than the central bank (using the interest rate) to address fluctuations in aggregate spending.

MMT proponents stress that fiscal multipliers – that is the responsiveness of economic activity to fiscal impulses – are maximised in an environment where the policy rate is kept permanently close to its lower bound. Such high effectiveness would be coupled with a high degree of flexibility to respond to the state of the economy because it is assumed that structural fiscal programmes – that could be thought of as enhanced automatic stabilisers – must prevail, thereby overcoming the inherently slow fiscal decision-making process. Furthermore, the interest rate is considered as a "blunt instrument" (Mitchell, 2009) for macroeconomic stabilisation purposes because it works through altering incentives, which is regarded, under the MMT doctrine, as a very indirect way to get traction on consumption and investment. MMT proponents further emphasise the likely distributional impact of interest changes on creditors and debtors to explain that such changes would most likely result in a net null effect on aggregate spending. If there is any net impact, it is considered that it can go against the direction intended under the consensus approach (i.e. in the MMT view, raising the interest rate tends to be inflationary while low rates are deflationary). And, in any case, it suffers from substantial transmission lags, which must be balanced against the apparent faster decision-making process of the central bank.

Building on MMT precepts, there are nevertheless signs that the MMT doctrine may face practical limitations that could lead its policy assignment to diverge from the intended functional finance approach, letting the economy drift into unpredictable outcomes. In the following, commitment problems are distinguished from other practical issues.

### 3.1 Commitment problems

One of the most powerful arguments against giving elected governments responsibility over macroeconomic stabilisation is that they have many incentives to be procyclical, for instance with fiscal savings being constrained in boom periods because of political agency problems that are worse in corrupt democracies (see, e.g., Alesina *et al.* (2008) or Lane (2003)). Regardless of the state of the economy, elected representatives are also subject to political myopia : they prefer short-run fiscal expansions associated with short-term political gains while discounting the typically longer-run inflationary consequences of unrealistic output goals. And, when the government and its agencies can finance their expenditure using money creation rather than through bond issues, they may at some point use the apparent "easy money" process for non-productive purposes : monetary financing can favour what Kornai (1986) coined as a "soft budget constraint" syndrome.

Like the experience of monetary dominance regimes, rules that constrain undesirable incentives and enforce the commitment of government agencies to their respective targets – in this case, a mandate of full employment (not beyond that) for elected representatives without interference from the central bank – seem of utmost importance.

The immediate post-WWII experience in the US has been illustrative of the failure of governments to credibly commit to the central objective of full employment with price stability. It was agreed at that time that discretionary fiscal programmes should contribute to the recovery, while the central bank made sure that the latter were financed at favourable conditions through its control of the yield curve. But, eventually, the US government's attempt to push the economy further after productive capacities had been fully restored resulted in high inflation. In more recent history, a lot of Latin American countries, including Argentina and Venezuela, or jurisdictions like Zimbabwe are also emblematic examples of functional finance aspirations failing to ensure sound economic development and sustainable growth with stable prices. Specifically, Edwards (2019) shows that most Latin American populists from the 1970s to the current period have referred to precepts very close to those praised by MMT proponents, including for instance the idea that the government should not worry about defaulting given its power to issue money or care about deficits until inflationary risks emerge. While featuring only a loose commitment to the central full employment price stability objective, these experiences often resulted in runaway inflation and macroeconomic collapses.

Moreover, expectations matter in determining macroeconomic outcomes. For instance, if private agents do not fully believe in the government's commitment to implement fiscal consolidation when inflation gets too high, rising inflation expectations can easily emerge if government spending programmes proliferate. When such expectations are sufficiently widespread, they can lead to a sudden and uncontrolled increase in actual inflation. That will require the government to implement an even larger – and hence more unpopular – fiscal consolidation to rein in excessive inflation.

### 3.2 Other practical issues: full employment emphasis, zero interest rate policy and exchange rate feedback effects

The MMT doctrine puts the emphasis on achieving full employment, with the implementation of labour market structural programmes at the core of its stabilisation agenda. This should not make a difference with central banks targeting price stability to the extent that stable prices are consistent with full capacity output. But economic inefficiencies, for instance due to monopolistic positions, can cause the natural level of output (that is, the level to which the economy converges through market forces) to lie below its potential level, which corresponds to the level that is socially optimal. Under misguided notions about potential and natural unemployment levels, policy-makers may try to address sub-par growth and employment through inappropriate policies focusing on supporting demand, rather than improving the supply side of the economy. Trying to aim for potential while the natural level is lower can lead to soaring inflation, triggering in turn upward inflation expectations (Mankiw, 2019).

Besides, the constant zero interest rate policy that is suggested by the MMT doctrine can also be problematic. Because bank reserves are the ultimate means of settlement between banks, their rate of remuneration is a key determinant for broader financial conditions in the economy. Hence, a constant zero interest rate policy becomes synonymous with permanent cheap funding whatever the economy's fundamentals, which in turn can encourage excessive risk-taking. For banks, this includes extending lending to borrowers with poor credit scores. And, as low rates are often associated with a flatter yield curve, the policy could also lead to profitability issues in the banking sector, further favouring the search for yield, not to mention that it could also seriously endanger the business model of other financial institutions like pension funds. Eventually, the permanent zero interest rate policy is thus likely to contribute to asset bubbles and risks for financial stability[1].

Acknowledging that the MMT policy agenda does include the promotion of financial stability, but preferably via structural policies for lending by the private sector, credit controls and public lending institutions, does not necessarily lead to a better assessment. In such an environment, financial stability risks might be contained despite the zero interest rate policy, but possibly at the cost of financial repression: the low borrowing rate (below the effective rate implied by credit controls and other regulations) only benefits the government. In the longer term, it means that the public sector might grow on the back of shrinking private sector initiatives.

1 Here, we disregard the risks of locking the economy into unproductive activities as the permanent zero interest rate policy might also be associated with substantial shares of zombie firms and the increasing prominence of M&A transactions.

Finally, when applied in an open economy, MMT policy prescriptions could encourage financial instability or unstable macroeconomic outcomes through their feedback effects on the exchange rate (Palley, 2014). Pursuing an independent monetary policy that entails systematic monetary financing of deficits is likely to be associated with substantial depreciation pressures[1]. And it is likely that this will exacerbate the inflationary pressures (i.e. in the form of imported-inflation effects) as the foreign exchange rate will be quick to incorporate the fears of high inflation when the commitment to inflation-consistent behaviour of government is not credible. Also, while MMT proponents consider permanent strict capital controls as stabilising devices in such a context (departing from a floating exchange rate regime would break the currency sovereignty principle on which most MMT precepts build), it remains difficult to see how such capital controls would at the same time allow for a steady accumulation of public debt. Thus, in practice, the ability of a government to sustain steady deficits for macroeconomic stabilisation purposes when it is subject to exchange market constraints could be severely constrained.

## 4. Why has MMT been so popular in recent years?

### Because the last few years' constellation of economic factors has done the marketing ...and probably some people expect it to last forever

More than ten years after the onset of the global financial crisis and the deep recession that followed, the world economy is still struggling to return to normal. The sluggish balance sheet repair and persistent desire for savings by the private sector are all factors that have kept global growth subdued. Also, despite the unprecedented period of low (policy) rates and the massive asset purchases made by central banks, inflation has remained low in most advanced economies. The last few years' bouts of recovery have steadily been challenged by continued uncertainty, which contributed to maintaining the desire for private savings at very high levels. Most recently, the COVID-19 crisis has been forcing governments to expand their budget deficits and build up even more public debt, on top of the increase under the 2008-2010 stimulus packages.

At the same time, the recent period has also been associated with a steady rise in the (perceived) need for more fiscal spending. On the one hand, the patchy economic improvements of the last few years have generally failed to tackle the rising relative poverty and inequalities in countries like the US. On the other hand, all over the world, and especially in advanced economies, the public authorities are increasingly expected to play a catalytic role for investment and innovation in the green transition challenge, which, in the view of some observers, would require mobilising unprecedented volumes of public spending for many years to come.

Such a constellation of economic factors has been instrumental in MMT's popularity. MMT provides a story to explain the current gloomy situation while suggesting that some ammunition is readily available both for counteracting the lingering economic malaise and for tackling key structural challenges lying ahead. According to MMT proponents, the current low inflation demonstrates that central banks have been too conservative and reluctant to push the economy closer to its full potential for too long, before running out of ammunition to do more. They also believe the subdued inflation signals that there is still room in the economy for higher fiscal deficit spending so idle resources are again mobilised for productive use without inducing inflation risk, at least for some time. And the fiscal space to do this is largely available in that any rise in public debt (be it monetised or not) would incur a (persistently) low cost of servicing: public debt only matches private agents' large desire for savings.

1 It follows from the impossible trinity that a government that pursues an independent monetary policy with free movement of capital will allow for fluctuations in its exchange rate.

One major caveat to this kind of observation is that it takes too simple a view of the inflation process. Even if one cannot deny that inflation has fallen short of expectations for several years in many advanced economies, the case for linking it mainly to the effect of real factors (i.e. under-employment) is not that straightforward. Nominal factors – pertaining to the process of how agents form expectations and determine wages and prices – can also play a role, and several studies have shown that this has been the case in the euro area and the US over recent years (see Corsello *et al.* (2019) for the euro area or Nautz *et al.* (2015) for the US). Most of these factors are likely to be of a temporary nature, reflecting the long-lasting fallout from the crisis (e.g. inflation expectations follow an adaptive process and can become more sensitive to past inflation after several years of low records). Besides, while the relationship between unemployment and inflation may be flat(ter) at a given state of the economy, it need not remain flat when economic conditions gradually improve: trying to push unemployment increasingly lower with higher fiscal expenditure in a (slow) recovery context could hence lead to abrupt shifts in inflation.

This notwithstanding, the MMT narrative on the global macroeconomic context of the last few years points to one very relevant aspect: in a low growth, low (under-employment-induced) inflation, low interest rate environment, fiscal policies can play a more important role with respect to macroeconomic stabilisation. Since monetary policy may run out of steam in stimulating aggregate spending when operating close to the lower bound on nominal interest rates, there can be merit in going "more direct" with fiscal expenditure. And, as the expectations channel becomes key if one wants to push the real interest rate further down while the nominal rate is constrained, the idea to allow for temporary money-financed fiscal expansions that are likely to fuel (more) inflation expectations is also contemplated on the corner of mainstream thinking, i.e. outside the MMT context (see also Turner, 2015).

But that does not mean one should give up on monetary dominance and permanently switch to the functional finance approach. It means accepting that the government will commit to larger fiscal deficits until inflation gets back to its target.

Eventually, any remaining idle resources will be absorbed by government interventions. A caveat to that is that such spending may also boost the supply side of the economy. In doing so, it could maintain a permanent pool of idle resources that can be mobilised in a non-inflationary manner. But while studies demonstrate that such supply-side channels can be important, not only in the long term but also along the cycle (Deroose *et al.*, 2019), evidence is scarce as to whether they could systematically dampen the inflation risks induced by repeated fiscal expansion.

Related to that, there is every indication that the green transition challenge as well as the fight against poverty should better be framed in terms of the necessary fiscal reallocation they require, rather than being associated with stand-alone public spending programmes that would rely on a de facto permanent pool of idle resources. While the potential of these programmes to boost the supply side of the economy should not be overlooked, such huge structural challenges would ultimately (be it now or when servicing the associated debt) need to be financed either by raising taxation or cutting expenditure elsewhere to keep any inflationary pressures under control. It is rather a matter of fiscal arbitrage that does not need to be related to any specific policy assignment for macroeconomic stabilisation.

Overall, if the risk of crowding out private investment by public expenditure appears limited at a given state of the economy, it is not necessarily set in stone. The real responsiveness of private spending could improve, for instance if the public spending is a catalyst for business confidence improvements (Buiter, 2019). From the debt sustainability angle, it also means that the borrowing rate can end up above the growth rate of the economy (because people become less willing to hold large volumes of their wealth in safe products), marking an end to the reverse snowball effect on public debt.

If anything, only the expectations that the "low growth, low inflation, low interest rate" context could last forever, trapping the economy into secular stagnation, could be conductive of a more solid support for the

MMT way out. In such circumstances, as monetary policy permanently loses traction on economic activity, the monetary financing of (a share of) the then structural fiscal deficit to be incurred is among the ultimate policy options that are left. But the policy options also include incurring permanent debt‑financed fiscal deficits while keeping the interest rate on the government debt very low forever or breaking the interest rate lower bound by abolishing cash (Turner, 2015). Disregarding the expectations or political constraints that each policy option might entail, the money‑financed and debt‑financed options should be equivalent, however. All that matters in such circumstances pertains mostly to the fiscal choices that would be made when incurring higher fiscal deficits so that the structural imbalance between savings and investment can be overcome at some point [1].

## 5. How does MMT compare with the Eurosystem's asset purchase programmes (APP and PEPP) ?

### Both share the same objective but differ in their approach

The asset purchase programmes that the Eurosystem has conducted in the past years (APP and PEPP) [2] and MMT both expand the monetary base dramatically and have similar objectives: both aim at stabilising the economy. Eurosystem asset purchases have been designed to bring back inflation to its target during periods when the Eurosystem's conventional instruments approached their limits. And, following MMT precepts, any money creation should focus in principle on funding programmes that contribute to achieve full employment with price stability.

However, their approaches to the macroeconomic stabilisation objective differ. In a context where the policy rates have approached their lower bound, Eurosystem asset purchases seek to weigh more directly on longer‑term interest rates, those being the most relevant rates for affecting private agents' investment and consumption decisions. While the purchases entail overwhelming volumes of government bond securities, they have primarily met the need to intervene in deep and liquid markets whose conditions serve as a benchmark in the pricing of a much larger spectrum of other longer‑term assets and borrowing conditions in the economy. At the same time, sub‑programmes like the corporate securities purchase programme (CSPP) where non‑government bonds are purchased have also been instrumental in providing an incentive for sustained private investment, which further demonstrates that it is a primary channel for monetary policy transmission. Furthermore, the Eurosystem's asset purchase programmes were decided and calibrated at the sole initiative of the independent Eurosystem, without any consultation of the national governments.

By contrast, under the MMT doctrine, the elected government takes the lead. Most of the central bank activity is geared towards providing the former with ample and cheap financing on a permanent basis without accumulating any assets as a counterpart for the transaction. In principle, neither government bond issuance nor repurchases by the central bank are deemed necessary on a large scale because printing money and taxation are the preferred tools to deal with macroeconomic stabilisation.

1 Summers (2014) argues that "Appropriate strategies [to counter secular stagnation] will vary from country to country and situation to situation. But they should include increased public investment, reduction in structural barriers to private investment and measures to promote business confidence, a commitment to maintain basic social protections so as to maintain spending power and measures to reduce inequality and so redistribute income towards those with a higher propensity to spend".

2 For more details on the ECB's Asset Purchase Programme (APP) and the ECB's pandemic emergency purchase programme (PEPP), see https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html and https://www.ecb.europa.eu/mopo/implement/pepp/html/index.en.html, respectively.

## 6. Is a temporary switch to MMT principles realistic in the euro area in the COVID-19 crisis context?

### The euro area is certainly not the best candidate, but it does not mean that the policy mix challenge must be overlooked in the face of the COVID-19 crisis

MMT proponents acknowledge that the euro area jurisdictions do not meet the requirements for a fully-fledged MMT regime. One key assumption under the MMT doctrine is indeed that the government operates under currency sovereignty, which implies that it can issue domestic currency – or, by extension, domestic currency-denominated debt – at will to cover any financial obligation [1].

The euro area Monetary Union context that features one independent central bank with the Union-wide inflation as a target and 19 elected governments with their respective budgets logically puts "hard financial constraints" on euro area jurisdictions' public spending. Euro area monetary policy considerations also determine the cost of funding euro area countries' debt, not only the countries' own respective governments or national central banks. Besides, from a legal perspective, the Treaty on the Functioning of the European Union (TFEU) guarantees the institutional independence of the European Central Bank (ECB) and the Member States' national central banks (Article 130) and prohibits the monetary financing of European governments by the ECB and by the national central banks (Article 123). Overall, the consolidation of the public sector into a monetarily sovereign government is in the euro area context far from straightforward.

That said, there is at the current juncture a broad consensus that macroeconomic stabilisation requires an active role – and even *instrumental role* – for fiscal policy. The liquidity, and potentially solvency, gaps that the COVID-19 crisis and its fallout have brought into private balance sheets need to be filled. And, while interest rates have been at record low levels for some time now, Eurosystem monetary policy risks being insufficiently supportive should the discounting of pandemic risks further encourage precautionary savings in future and put additional downward pressure on the natural interest rate.

As we made clear in more general terms above, this does not mean one should move to a regime of fiscal dominance and give up monetary dominance.

Therefore, one must make sure that public debt remains on a sustainable path, especially once monetary policy is expected to raise policy rates to counteract any inflationary risks that might emerge. This may involve, for instance, governments of today fully exploiting the central-bank-induced flattening of the yield curve by (further) extending the maturity of the debt that they issue to support the economic recovery. Also, the exit from any more cooperative monetary-fiscal strategy after private balance sheets have been shored up must be well-timed and carefully managed, otherwise there is a risk of being perceived as "implementing MMT through the backdoor", which could fuel inflationary and/or financial stability concerns. Against that background, recent innovative proposals, like those from Yashiv (2020) or Bartsch *et al.* (2019) – where the contingencies when closer fiscal-monetary coordination is required for achieving full employment with price stability are explicitly stated and where a proper governance framework is implemented – can provide insightful ideas but also need careful scrutiny to avoid any unpleasant surprises during the exit from them.

1 Lavoie (2011) clarifies that "there are degrees of currency sovereignty, the highest being a country where the domestic currency is the unit of account, where taxes and government expenditures are paid in this domestic currency, where the central bank is unhindered by regulations, where the public debt is issued in the domestic currency, and where there is a pure floating exchange rate regime."

Since clear institutional arrangements between the Eurosystem and the national governments are key to preserve the Eurosystem's independence and its commitment towards its price stability mandate in "normal times", they are even more crucial in "exceptional circumstances". Provided they are in place, substantial fiscal and monetary support for the economy can help a sound and sustainable recovery in the near future without jeopardising the Eurosystem's price stability mandate in the more distant future.

## 7. Conclusion

Modern monetary theory prescribes an assignment of responsibilities to fiscal and monetary policies in the pursuit of macroeconomic stabilisation that differs from the consensus assignment: the elected government should be made responsible for achieving full employment with price stability, while the central bank should only accommodate its needs in doing so.

While, in theory, such policy assignment can also put the macroeconomy on track towards equilibrium, there are reasons to think MMT precepts can lead in practice to substantially worse macroeconomic outcomes compared to the consensus institutional arrangement that features an independent central bank with a price stability (and in some jurisdictions also full employment) mandate. Inflationary risks and financial stability risks would be major concerns in an MMT world. Overall, the MMT doctrine tends to overlook the commitments that policies should take and the impact of private agents' expectations on economic outcomes. In today's context, the theory's appeal might rely too much on the persistence of the "low inflation, low interest rate, low growth" context.

The recent increased need for further fiscal support in the midst of the COVID-19 crisis context justifies an in-depth reflection about the appropriate monetary-fiscal policy mix to support a fast and sound economic recovery. Doing so does not mean that monetary dominance should be abandoned, and MMT recipes taken on board. Avoiding being perceived as opening the MMT Pandora's box is key: that will minimise the risk of having to make a painful choice between high inflation and severe fiscal consolidation in the (distant) future.

## Bibliography


Alesina A., G. Tabellini and F.R. Campante (2008), Why Is Fiscal Policy Often Procyclical ?, *Journal of the European Economic Association*, 6(5), 1006-36.

Bartsch E., J. Boivin, S. Fischer and P. Hildebrand (2019), *Dealing with the next downturn : from unconventional monetary policy to unprecedent policy coordination*, SUERF Policy Note, 105.

Blanchard O. (2019), *Public debt and low interest rates*, AEA Presidential Lecture, January.

Blanchard O. and J. Pisani-Ferry (2020), "Monetisation : do not panic", 10 April, https://voxeu.org/article/monetisation-do-not-panic.

Boeckx J. and M. Deroose (2016), "Monetary and fiscal policy in the euro area : independent but nevertheless connected", NBB, *Economic Review*, September 7-25.

Bofinger P. (2020), "Coronavirus crisis : now is the hour of Modern Monetary Theory", 23 March, https://www.socialeurope.eu/coronavirus-crisis-now-is-the-hour-of-modern-monetary-theory.

Buiter W. and C.L. Mann (2019), "Modern Monetary Theory (MMT) – What's right is not new, what's new is not right and what's left is too simplistic", Citi GPS : Global Perspectives & Solutions, April.

Coats W. (2019), "Modern Monetary Theory : a critique", *Cato Journal*, 39(3), 563-576.

Corsello F., S. Neri and A. Tagliabracci (2019), *Anchored or de-anchored ? That is the question*, Banca d'Italia Occasional paper 516.

De Grauwe P. and Y. Ji (2019), Rethinking fiscal policy choices in the euro area, 14 October, https://voxeu.org/article/rethinking-fiscal-policy-choices-euro-area.

Deroose M. and N. Cordemans (2019), "Insights from the 2017-2018 US fiscal stimulus", NBB, *Economic Review*, December, 89-104.

Deroose M., A. Rannenberg and J. Wauters (2019), "Separating the trend from the cycle : the debate on euro area potential output and implications for monetary policy", NBB, *Economic Review*, September, 7-24.

Edwards S. (2019), "Modern monetary theory : cautionary tales from Latin America", *Cato Journal*, 39(3), 529-561.

Fitzpatrick E. and K. Berro (2019), MMT : *short-term gain vs. long-term pain*, 21 March, https://am.jpmorgan.com/us/en/asset-management/institutional/insights/portfolio-insights/fixed-income/fixed-income-perspectives/mmt-short-term-gain-vs-long-term-pain/.

Fullwiler S. (2013), *Functional Finance and the Debt Ratio—Part IV*, New Economic Perspectives, 2 January, http://neweconomicperspectives.org/2013/01/functional-finance-and-the-debt-ratio-part-iv.html.

Goncalves Raposo I. (2019), "On Modern Monetary Theory", 11 February, https://www.bruegel.org/2019/02/on-modern-monetary-theory/.

Jayadev A. and J.W. Mason (2018), *Mainstream macroeconomics and Modern Monetary Theory : what really divides them ?*, John Jay College – CUNY, Department of Economics Working Paper .

Jourdan S. (2020), "Helicopter money as a response to the COVID-19 recession in the Eurozone", Positive Money, http://www.positivemoney.eu/wp-content/uploads/2020/03/Helicopter_Money_Covid.pdf.

Kasongo Kashama M. (2016), "Helicopter money and debt-financed fiscal stimulus: one and the same thing?", NBB, *Economic Review*, December, 31-40.

Kelton S. (2017), How we think about the deficit is mostly wrong, *The New York Times*, Opinion, 5 October.

Kornai J. (1986), "The soft budget constraint", *Kyklos*, 39(1), 3-30.

Krugman P. (2019), What's wrong with functional finance (wonkish), *The New York Times*, Opinion, 12 February.

Lane P. (2003), "The Cyclical Behaviour of Fiscal Policy: Evidence from the OECD", *Journal of Public Economics*, 87(12), 2661-2675.

Lerner A. P. (1943), "Functional finance and the federal debt", *Social Research*, 10, 38-51.

Lavoie M. (2013) "The Monetary and Fiscal Nexus of Neo-Chartalism: A Friendly Critique", *Journal of Economic Issues*, 47(1), 1–32.

Mankiw G. N. (2019), *A skeptic's guide to Modern Monetary Theory*, Prepared for the AEA Meeting, January 2020.

Minsky H. P. (1963), "Discussion", American Economic Review, 53(2), 401–12.

Mitchell W. (2009), "The interest rate should be set at zero", 4 May, http://bilbo.economicoutlook.net/blog/?p=1961.

Mitchell W. (2009), "The natural rate of interest is zero'", 29 August, http://bilbo.economicoutlook.net/blog/?p=4656.

Mitchell W. (2015), "Overt monetary financing – again", 18 November, http://bilbo.economicoutlook.net/blog/?p=32361.

Mitchell W., R.L. Wray and M. Watts (2019), *Macroeconomics*, Red Globe Press, London.

Mosler W. (1993), *Soft currency Economics*, www.mosler.org, Paper edition: AVM, 1995.

Nautz D. and T. Strohsal (2015), "Are US inflation expectations re-anchored?", *Economics Letters*, 127, 6–9.

Palley T. (2014), "Modern monetary theory (MMT): the emperor still has no clothes", http://www.thomaspalley.com/?p=393.

Reis R. (2015), *Different Types of Central Bank Insolvency and the Central Role of Seignorage*, NBER,Working Paper 21226.

Rogoff K. (2019), "Modern Monetary Nonsense, Project Syndicate", 4 March, https://www.project-syndicate.org/commentary/federal-reserve-modern-monetary-theory-dangers-by-kenneth-rogoff-2019-03?barrier=accesspaylog.

Shirai S. (2019), "Modern money theory and its implementation challenges: the case of Japan", 18 July, https://voxeu.org/article/modern-money-theory-and-its-challenges.

Summers L.H. (2019), "The left's embrace of Modern Monetary Theory is a recipe for disaster", *The Washington Post*, Opinion, 3 March.

Sumner S. and P. Horan (2019), How reliable is Modern Monetary Theory as a guide to policy?, Mercatus Center, George Mason University, March, *https://www.mercatus.org/system/files/sumner_and_horan_-_policy_brief_-_how_reliable_is_modern_monetary_theory_as_a_guide_to_policy_-_v1.pdf*.

Turner A. (2015), *The case for monetary finance – an essentially political issue*, 16th Jacques Polak Annual Research Conference, 5-6 November.

Tymoigne E. and R.L. Wray (2013), *Modern Money Theory 101: a reply to critics*, Levy Economics Institute of Board College, Working Paper, 778.

Weber B. (2019), What is Modern Monetary Theory (MMT)?, SUERF Policy Note, 67.

Wolf M. (2019), "States creates useful money, but abuse it", *Financial Times*, 28 May.

Wray R.L. (2018), *Functional finance: a comparison of the evolution of the position of Hyman Minsky and Abba Lerner, Levy Economics Institute of Board College*, Working Paper, 900.

Wren-Lewis S. (2019), Should we worry about temporarily raising government debt? – Blanchard's AEA Address, 12 January, https://voxeu.org/content/should-we-worry-about-temporarily-raising-government-debt-blanchard-s-aea-address.

Yashiv, E. (2020), "Breaking the taboo: the political economy of COVID-motivated helicopter drops", 26 March, https://voxeu.org/article/political-economy-covid-motivated-helicopter-drops.

# Abstracts from the Working Papers series

### *383. Multi-product exporters: Costs, prices and markups on foreign vs domestic markets, by C. Fuss, June 2020*

After establishing that exporters obtain higher margins than non-exporters, the paper takes a new look at export premia by comparing multi-product exporters' costs, prices and markups on the domestic and foreign markets. This firm-product-market analysis is made possible thanks to a unique dataset for Belgian manufacturing firms over 1996-2016. Firm-product estimates of marginal costs are obtained following De Loecker *et al.* (2016) methodology, based on firm-product production data. Combined with firm-product international transaction data, firm-product unit values can be computed separately for the domestic market and foreign markets. Markups can then be recovered at the firm-product-market level from observed unit values and estimated marginal costs. The empirical results suggest that firms select their best products, the ones with lower marginal cost, for foreign markets. They partly translate this cost advantage into lower prices, but essentially extract higher margins from these.

### *384. Economic importance of the Belgian maritime and inland ports – Report 2018, by I. Rubbrecht, K. Burggraeve, July 2020*

The paper provides an extensive overview of the economic importance and development of the Flemish maritime ports, the Liège port complex and the port of Brussels for the period 2013 to 2018 in terms of value added, employment and investment. Each of these ports plays a major role in their respective regional economies and in the Belgian economy, not only in terms of industrial activity but also as intermodal centres facilitating commodity flows.

Based on the figures of maritime traffic, the Flemish ports can be considered as real bridgeheads for trade with the UK. As the current free access for the UK to the Single Market and for EU Member States to the UK will cease to apply once the transition periods ends, the shape of the future trade relationship between the EU and the UK will have an impact on the import and export volumes in terms of tonnage. The authors try to shed some light on the macroeconomic impact of Brexit on the Belgian economy as a whole.

The initially planned publication of the study coincided with the global outbreak of the coronavirus pandemic. Therefore, a brief chapter is devoted to the economic impact of the COVID-19 crisis on the Belgian ports, and more precisely on the port of Antwerp.

### *385. Service characteristics and the choice between exports and FDI: Evidence from Belgian firms, by L. Sleuwagen, P. Smith, July 2020*

The decision to serve foreign markets through exports or foreign direct investment (FDI) has been studied within proximity-concentration models of location, mainly in the context of trade in goods. The paper adapts these models to account for the specific nature of services that are traded across borders. We show how services can be characterised by a range of attributes that collectively describe the service. These attributes are then tested to show how they affect the choice between exports and FDI using service-level data for firms in Belgium selling services abroad. Three different types of characteristics are shown to affect the export versus FDI decision: intangibility, the search‑experience‑credence framework and the requirement for either the supplier or the client to physically move to the point of production.

### *386. Low pass‑through and high spillovers in NOEM: What does help and what does not, by G. de Walque, T. Lejeune, A. Rannenberg, R. Wouters, July 2020*

The paper jointly analyses two major challenges of the canonical NOEM model: i) combining a relatively important exchange rate pass‑through at the border with low pass‑through at the consumer level, and ii) generating significant endogenous international business cycle synchronisation. These issues have been separately analysed in the literature, with extension of the NOEM with a distribution sector for mitigating the exchange‑rate pass‑through, and foreign input trade for spillovers. The authors show that introducing input trade for price‑maker firms rehabilitates the model regarding the pass‑through disconnect, which is especially helpful to model very open economies, while adding a distribution sector lacks the flexibility to do so. Moreover, these two extensions of the canonical model mitigate the expenditure‑switching effect, with implications in terms of international synchronisation.

### *387. Minimum wages and wage compression in Belgian industries, by S. Vandekerckhove, S. Desiere, K. Lenaerts, July 2020*

Measuring the effects minimum wages have on wage inequality and employment is complex, and troubled by endogeneity issues. The authors use a large longitudinal dataset and sectoral minimum wage variation to analyse trends in minimum wages and wage inequality in Belgium. Building on the model of Lee (1999) and the critique by Autor, Manning and Smith (2014), they find that minimum wage increases in Belgium cause a two‑sided compression of the wage distribution. Using wage indexation as a natural instrument, they find an additional source of endogeneity in sectoral bargaining. It appears that unions and employers' representatives prefer increasing lower wages to raising higher wages. The paper explores several hypotheses that could explain this outcome, including firm proximity to sectoral wage bargaining, and labour supply elasticity. The results suggest that a higher likelihood of firm involvement in the bargaining process does enhance endogenous wage‑setting, in which minimum wage levels and wage dispersion are simultaneously determined. A similar finding appears in the absence of white‑collar workers, pointing to different degrees of internal redistribution in sectors depending on the outside options of workers. The minimum wage effects found when including sectoral characteristics can contribute to understanding different minimum wage effects encountered in other and future research projects, and may advise policy‑makers to consider the criteria to judiciously set minimum wages at the right level through collective bargaining.

### *388. Network effects and research collaborations, by D. Essers, F. Grigoli, E. Pugacheva, July 2020*

The authors study the determinants of new and repeated research collaborations, drawing on the co‑authorship network of the International Monetary Fund's Working Papers series. Being an outlet for authors to express their views on topics of interest, and given that IMF staff are not subject to the "publish‑or‑perish" conditions of the academia, the IMF Working Papers series constitutes an appropriate testing ground to examine the endogenous nature of co‑authorship formation. The authors show that the co‑authorship network is made up of many authors with few direct co‑authors, yet indirectly connected to each other through short co‑authorship chains. They find that a shorter distance in the co‑authorship network is key for starting research collaborations. Also, higher research productivity, being employed in the same department, and having citizenship of the same region all help to start up and repeat collaborations. Furthermore, authors with different co‑authorship network sizes are more likely to collaborate, possibly reflecting synergies between senior and junior staff members.

# Conventional signs

| | |
|---|---|
| % | per cent |
| USD | US dollar |
| e.g. | *exempli gratia* |
| et al. | *et alia* (and others) |
| etc. | *et cetera* |
| excl. | excluding |
| i.e. | *id est* (that is) |
| incl. | including |
| ml | millilitre |
| p.m. | pro memoria |
| n.e.c. | not elsewhere classified |
| cl | centilitre |

# List of abbreviations

## Countries or regions

| | |
|---|---|
| BE | Belgium |
| DE | Germany |
| EE | Estonia |
| IE | Ireland |
| EL | Greece |
| ES | Spain |
| FR | France |
| IT | Italy |
| CY | Cyprus |
| LT | Lithuania |
| LU | Luxembourg |
| LV | Latvia |
| MT | Malta |
| NL | Netherlands |
| AT | Austria |
| PT | Portugal |
| SI | Slovenia |
| SK | Slovakia |
| FI | Finland |
| | |
| EA | Euro area |
| | |
| BG | Bulgaria |
| CZ | Czech Republic |
| DK | Denmark |
| HR | Croatia |
| HU | Hungary |
| PL | Poland |
| RO | Romania |
| SE | Sweden |
| | |
| EU | European Union (including UK depending on the period considered) |
| | |
| CN | China |
| IN | India |
| JP | Japan |
| RU | Russia |
| UK | United Kingdom |
| US | United States |

## Other abbreviations

| | |
|---|---|
| AEA | American Economic Association |
| ATC | After-tax cost |
| APP | Asset purchase programme |
| | |
| BCB | Banco Central do Brasil |
| BELSPO | Belgian Science Policy |
| BEPS | Base erosion and profit shifting |
| BIS | Bank for International Settlements |
| BLS | Bank lending survey |
| | |
| CB | Central bank |
| CBS | Consolidated banking statistics |
| CCTV | Closed-circuit television |
| CDO | Variant of the tool developed by Celasun, Debrun and Ostry |
| CIT | Corporate income tax |
| COICOP | Classification of Individual Consumption According to Purpose |
| COVID-19 | Disease caused by coronavirus SARS-CoV-2 |
| CPB | Netherlands Bureau for Economic Policy Analysis |
| CPI | Consumer price index |
| | |
| DFR | Deposit facility rate |
| DSGE | Dynamic stochastic general equilibrium |
| | |
| EC | European Commission |
| ECB | European Central Bank |
| EMDE | Emerging market and developing economy |
| EME | Emerging market economy |
| EUREP | Eurosystem repo facility for central banks |
| Eurostat | European Statistical Office |
| | |
| FCL | Flexible Credit Line |
| FIMA | Foreign and International Monetary Authorities Repo Facility |
| Freq | Frequency |
| FX | Foreign exchange |
| | |
| G20 | Group of Twenty |
| GDP | Gross domestic product |
| GFC | Global financial crisis |
| GFSR | Global Financial Stability Report |
| GPS | Global Perspectives & Solutions |
| | |
| HBS | Household Budget Survey |
| HICP | Harmonised index of consumer prices |

| | |
|---|---|
| ICU | Intensive care unit |
| IIP | International investment position |
| ILO | International Labour Organisation |
| IMF | International Monetary Fund |
| IP | Intellectual property |
| IPN | Inflation Persistence Network |
| IT | Information technology |
| | |
| km | Kilometre |
| | |
| LSDV | Least-squares dummy variable |
| LTRO | Longer-term refinancing operation |
| | |
| ma | Moving average |
| MCM | IMF Monetary and Capital Markets Department |
| MERICS | Mercator Institute for China Studies |
| MERS | Middle East Respiratory Syndrome |
| MMT | Modern monetary theory |
| MRO | Main refinancing operation |
| MSCI EM | Morgan Stanley Capital International Emerging Markets Index |
| | |
| NACE | Nomenclature of economic activities of the European Community |
| NBB | National Bank of Belgium |
| NBER | National Bureau of Economic Research |
| | |
| OECD | Organisation for Economic Co-operation and Development |
| OIS | Overnight Index Swap |
| OPEC+ | Organisation of the Petroleum Exporting Countries plus 10 additional oil exporters |
| OWID | Our World in Data |
| OxCGRT | Oxford COVID-19 Government Response Tracker |
| | |
| P25 | 25th percentile |
| P50 | 50th percentile |
| P75 | 75th percentile |
| PB | Primary balance |
| PBOC | People’s Bank of China |
| PELTRO | Pandemic emergency longer-term refinancing operation |
| PEPP | Pandemic Emergency Purchase Programme |
| PMI | Purchasing Managers’ Index |
| PPP | Purchasing power parity |
| | |
| QE | Quantitative easing |
| | |
| R&D | Research and development |
| RMB | Renminbi |
| RRR | Required reserve ratio |

| | |
|---|---|
| SARS | Severe Acute Respiratory Syndrome |
| SDR | Special Drawing Right |
| SLL | Short-term Liquidity Line |
| SME | Small and medium-sized enterprise |
| SOE | State-owned enterprise |
| Statbel | Belgian Statistical Office |
| SUERF | Société Universitaire Européenne de Recherches Financières |
| | |
| TFEU | Treaty on the Functioning of the European Union |
| TFP | Total factor productivity |
| TiVA | Trade in value added |
| TLTRO | Targeted longer-term refinancing operation |
| | |
| UN | United Nations |
| UNWTO | World Tourism Organisation |
| | |
| VAR | Vector autoregression |
| | |
| WEO | World Economic Outlook |
| WHO | World Health Organisation |
| WTO | World Trade Organisation |
| WWII | World War II |
| | |
| YIC | Young Innovative Company |
| YoY | Year-on-year |

National Bank of Belgium
Limited liability company
RLP Brussels – Company number: 0203.201.340
Registered office: boulevard de Berlaimont 14 – BE-1000 Brussels
www.nbb.be

Publisher

Pierre Wunsch
Governor

National Bank of Belgium
Boulevard de Berlaimont 14 – BE-1000 Brussels

Contact for the publication

Dominique Servais
Head of General Secretariat and Communication

Tel. +32 2 221 21 07
dominique.servais@nbb.be

Cover: the dealing room of the National Bank



Cover and layout: NBB CM – Prepress & Image

Published in September 2020