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Content

Non-technical summary

October 2019

This issue of Banco de Portugal Economic Studies includes three articles, whose non-technical summaries are presented below, and a synopsis titled "The Economics of The European Deposit Insurance Scheme".

An analytical assessment of the risks to the sustainability of the Portuguese public debt

Cláudia Braz, Maria Manuel Campos

In spite of recent favourable developments in sovereign debt markets and the strengthened institutional framework at the European level, in several euro area countries - including Portugal - the high government debt ratios remain a source of concern. In this context, frameworks to assess the risks to public finances sustainability (Debt Sustainability Analysis –DSA tools), which have been used for several decades by many international institutions, gained relevance. DSA tools are very useful for harmonised assessments of sovereign debt vulnerabilities in different countries and across time. However, they are very much conditional on (more or less) conventional assumptions, although with time they have become more thorough and complex.

This article presents an analytical assessment of the risks to the sustainability of the Portuguese public debt, partly based on a DSA framework developed by the Eurosystem in 2015. This framework comprises three main building blocks: (i) a deterministic DSA; (ii) a stochastic DSA; and (iii) a block of other relevant indicators capturing liquidity and solvency risks. The categories included in these blocks are assessed on the basis of sustainability scores, with a correspondent colour-scheme. An analysis of the evolution of this colour-scheme in Portugal since 2015 shows an improvement in several risk indicators.

The information embedded in the three blocks may be condensed into an overall four-colour heat map of debt sustainability risks, which provides guidance on the overall assessment of risks to debt sustainability (red for very high risk, orange for high risk, yellow for medium risk and green for contained risk). Results should, however, be interpreted with caution. In particular, small changes in the overall sustainability risk score may not imply an actual revision in the public debt vulnerability assessment. On the contrary, larger positive and persistent score changes should act as a warning system for national policies. The authors propose three different weighting schemes, based on expert judgment and representing balanced choices, to determine an overall risk score for Portugal. Results show Portugal presently classified

in the orange category, signalling high risks to public debt sustainability. However, the adoption of sound fiscal policies, coupled with a benign internal and external environment, will very likely allow the maintenance of the downward risk trajectory in the near future.

Portuguese labour market synthetic indicators

Carlos Melo Gouveia

With the increasing number of series available, relying on a single measure to assess the labour market conditions may be misleading as different series sometimes give diverse intuitions and it is not straightforward to extract the common dynamics behind different variables. Therefore, an assessment of the stance of the economy based on models such as the Phillips Curve or the Okun's Law can yield very different results depending on the measure used.

In recent years, economists have tried to find one unobservable variable that captures the common dynamics of all the labour market-related series available and drives these variables. There is no simple or obvious methodology and dimension reduction techniques are used to tackle the problem and find such latent variable.

The Portuguese labour market has been having major changes over the past years. In 2009, the unemployment rate started to grow rapidly almost doubling until the start of 2013. This increase was followed by a sharp decrease that was still visible in the end of 2018. Meanwhile, average nominal wages kept decreasing until the mid of 2014, being increasing ever since. In short, Portugal was heavily affected by the Sovereign Debt Crisis, that has produced a lot of changes in the Portuguese labour market which are worth analysing.

In this article, the Portuguese labour market is analysed through three synthetic indicators that try to capture the dynamics of that latent variable that drives all labour market-related series. The first one focuses on the cyclical behaviour of the labour market, the second looks at its quarter-on-quarter evolution, while the third one is a year-on-year approach.

In a broader sense, all the indicators behave as one would expect. They confirm that the labour market conditions deteriorate during crises and improve or remain virtually stable in regular times, having its worst period during the Sovereign Debt Crisis that heavily affected the Portuguese economy. Since 2014 until the end of 2018, the three indicators point to a sharp improvement of the labour market conditions.

It is possible to see that the indicators are heavily correlated with the unemployment rate, however displaying some different dynamics. These dissimilarities play a major role when comparing the performance of the indicators versus the unemployment rate in the context of the Okun's Law

or the Phillips Curve. In the framework of the Okun's Law, the indicators show stronger correlations with Portuguese GDP than the unemployment rate for in past and current comparisons, whereas in the spirit of the Phillips Curve, when correlated with inflation, all the indicators outperform the unemployment rate for all horizons.

The countercyclical capital buffer: A DSGE approach

Paulo Júlio, José R. Maria

The 2008 global financial crisis triggered a prolific debate on the interaction between the financial sector and the real economy. At the policy-making level, the need to come up with macro-prudential mechanisms that are able to prevent or at least cushion the effects of financial disturbances led to major regulatory reforms, most notably the Basel III framework. One of the most important mechanisms is the Countercyclical Capital Buffer (CCyB). The CCyB postulates that banks must accumulate a capital buffer in excess of the regulatory threshold when credit growth is considered excessively high by the macro-prudential authority, to be used as a cushion device in the event of fragilities in the banking system.

We contribute to the literature by evaluating the performance of the CCyB rule based on the credit-to-GDP gap under distinct business cycle fluctuations drivers. With this purpose, we make use of a Dynamic Stochastic General Equilibrium (DSGE) model for a small euro area economy, endowed with a banking system where capital requirements and credit restrictions co-exist and may trigger credit tightness and/or spread hikes under financial- or bank-driven fluctuations. Our argument is that the effectiveness of such rule greatly depends on the fluctuation source underlying the business cycle, and hence the application of the CCyB by the macro-prudential authority calls in for some discretion as regards to when to accumulate or release the buffer.

In our exercises, business cycles are solely driven by over-optimistic expectations about some future event. There is no effective change in the processes that underlie the business cycle; the fluctuation is solely driven by incorrect expectation of some future event, a mistake which agents realize latter on. When the business cycle driver (i.e. the expectational mistake) hinges on the efficiency of investment or on entrepreneurial risk—factors that bring about a largely procyclical credit demand—the CCyB rule triggers a buffer contraction during the crisis period that cushions the macroeconomic impacts of the downturn by alleviating the cost of credit, thus being able to achieve important stabilization effects. The fragile entrepreneurial sector benefits from lower spreads and fewer restrictions to credit since the buffer reduction cushions the losses that arise in the banking system. When the expectational mistake hinges within the banking system but the entrepreneurial sector is

resilient and hence able to cope with larger spreads, the CCyB still plays a stabilization role but with milder effects. The banking system recovers to some extent due to larger spreads. When the business cycle driver hinges on a growth-driven perturbation, credit becomes largely countercyclical and the CCyB rule is generally ineffective or even destabilizing as it triggers a release of the buffer in the incorrect timing.

An analytical assessment of the risks to the sustainability of the Portuguese public debt

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October 2019

Abstract
In spite of recent favourable developments in sovereign debt markets and the strengthened institutional framework at the European level, in several euro area countries - including Portugal - the high government debt ratios remain a source of concern. This article presents an analytical assessment of the sustainability of the Portuguese public debt, partly based on a framework for debt sustainability analysis (DSA) developed by the Eurosystem in 2015. The analysis shows that risks to sustainability have diminished in the recent past, although remaining elevated. In addition, it suggests that continued improvements in the risk assessment of Portuguese public debt are likely in a context of sound fiscal policies and a benign internal and external environment. (JEL: H60, H63, H68)

Introduction

In spite of recent favourable developments in sovereign debt markets and the strengthened institutional framework at the European level, in several euro area countries - including Portugal - the elevated government debt ratios remain a source of concern. This makes the assessment of government liquidity and solvency crucial for policy makers and the general public. Liquidity is related to the ability of governments to service short-run commitments and to roll-over maturing debt at reasonable cost. In turn, solvency represents the governments' ability to generate future primary budget surpluses whose net present value is, at least, as high as the net present value of the outstanding stock of debt, so that its inter-temporal budget constraint is fulfilled.[1]

Frameworks for debt sustainability analysis (DSA) allow assessing governments' liquidity and solvency conditions, while providing a synthetic

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1. Refer to Amador *et al.* (2016) and Bouabdallah *et al.* (2017) for a thorough discussion on the relevant concepts related to debt sustainability.

manner of conveying policy-relevant messages. Most international institutions have been using DSA frameworks to assess the risks to public finances sustainability for several decades. Their relevance was confirmed by the euro area sovereign debt crisis and the mounting of public debt ratios. These methodologies have evolved over time, becoming more thorough and complex, but remain very much conditional on (more or less) conventional assumptions. The future path of debt is subject to many drivers and highly uncertain.

The European Commission introduced in 2014 a DSA tool (European Commission 2014) which has been subject to refinements and improvements thereafter. It is used regularly in several analyses and published reports (see Box 1 for further details) and is an important part of the European Union (EU) multilateral fiscal surveillance mechanism, with explicit references to debt sustainability in several Stability and Growth Pact (SGP) provisions.

In 2015, the Eurosystem developed a comprehensive DSA framework for euro area sovereigns that has been used in the context of fiscal surveillance for the analysis of risks and vulnerabilities (Bouabdallah *et al.* 2017). The Eurosystem framework was reviewed in 2018 and further refinements introduced.[2] This framework comprises three main building blocks: (i) a deterministic DSA; (ii) a stochastic DSA; and (iii) a block of other relevant indicators capturing liquidity and solvency risks. The information embedded in the three blocks can be condensed into an overall four-colour heat map of debt sustainability risks (red for very high risk, orange for high risk, yellow for medium risk and green for contained risk), providing guidance on the overall assessment of risks to debt sustainability.

This article analyses the developments in the assessment of the risks to Portuguese public debt sustainability on the basis of the different blocks defined in the Eurosystem DSA tool. In addition, for a synthetic analysis, three different weighting schemes are proposed, based on expert judgement, to determine an overall risk score. It is concluded that risks to sustainability have diminished in the recent past, as the benchmark deterministic scenario is becoming more favourable and several other indicators have been showing signs of improvement. On the basis of balanced choices for the weighting schemes, Portugal would be classified in the orange category, showing high risks to public debt sustainability. However, the adoption of sound fiscal policies, coupled with a benign internal and external environment would allow the maintenance of the downward risk trajectory.

This article is organised as follows. After an overview of the Eurosystem methodology, three sections describe the main blocks of this framework. Each section presents a description of the indicators, the quantitative criteria for the

2. Based on the technical work of a Eurosystem team coordinated by C. Checherita-Westphal (ECB) (see Checherita-Westphal *et al.* (2018)). This work benefited from further feedback and comments provided by the members of the Working Group on Public Finance (WGPF).

respective evaluation and an illustration with the current results for Portugal. The following section analyses the developments since 2015 in Portugal in each of the three main blocks and computes an overall risk score on the basis of proposed alternative aggregation schemes. Finally, the last section concludes.

Overview of the Eurosystem methodology

Ideally, a DSA tool should be as comprehensive as possible and encompass medium to long-term debt projections based on credible and realistic assumptions (both economically and politically). Sensitivity analyses to adverse shocks should also be considered. Moreover, it should include a broad-based set of indicators and instruments capable of signalling as much as possible a wide range of risks. These should be sufficient to gauge the short-term liquidity risks, as well as those related to long-term solvency.

The DSA framework developed in Bouabdallah *et al.* (2017) and used in the context of the Eurosystem takes these concerns into account. Indeed, the DSA entails three blocks: a deterministic block; a stochastic block; and a block of "other indicators" - see Table 1 for a schematic depiction.

	Deterministic block		**Stochastic block**	**Other indicators**
	Benchmark	**Shock scenarios**		
Blocks	Rule-based central scenario	Narrative shocks around the benchmark: (1) No-fiscal policy change with ageing costs; (2) Historical; (3) Combined stress test; (4) Interest rate (country-specific) shock; (5) Potential output shock	BVAR-based assessment of uncertainty	(1) Liquidity risk; (2) Market uncertainty and political risk; (3) Structure of debt; (4) Scope for contingent liabilities; (5) Financial position and competitiveness; (6) Institutions and governance
Criteria	(1) Debt level in T+10; (2) Debt dynamics (3) Fiscal fatigue (benchmark)		At T+5: (1) Probability of debt standing above 90% of GDP; (2) Probability of debt not stabilizing; (3) Dispersion in simulated debt paths	Assumed thresholds or in-sample distribution
Aggregation: Heatmap				

TABLE 1. Schematic representation of the Eurosystem DSA framework

Source: Adapted from Bouabdallah *et al.* (2017), with further 2018 revisions.

The deterministic block comprises both a benchmark scenario and a set of adverse shock scenarios, all with a 10-year horizon. Regarding the benchmark, its mechanics are based on plausible assumptions for the evolution of macroeconomic and fiscal drivers of the debt ratio. It embeds a fiscal rule that assumes minimum compliance with the EU fiscal governance framework.

The shock scenarios are thought to measure the resilience of the benchmark to (more) adverse assumptions. All simulations are then evaluated in terms of the level reached by the debt ratio at the end of the horizon and its dynamics. The benchmark is also evaluated in terms of the potential for fiscal fatigue, related to the governments' likelihood of sustaining high primary surpluses given historical developments. As to the stochastic block, it provides a probabilistic measure of the uncertainty around the future debt path, considering a five-year horizon. Finally, the "other indicators" aim at signalling other short and medium to long-term risks to debt sustainability otherwise not captured in the previous blocks. The insight provided by each of the three blocks can be merged into a single country-specific sustainability score and mapped into an easy to read and communicate four-colour heatmap in which red stands for "very high risks", orange for "high risks", yellow for "moderate risks" and green for "contained risks" to debt sustainability.

The deterministic analysis

Most DSA frameworks rely to some extent on deterministic long-term projections for the debt ratio. Typically, as it is the case in the Eurosystem methodology, these projections are anchored in the following debt accumulation equation:

$$\Delta b_t = \frac{iir_t - g_t}{1 + g_t} * b_{t-1} - pb_t + dda_t \tag{1}$$

which provides a simple accounting framework to breakdown the changes in the public debt ratio (Δb_t) into: **i)** the "snowball effect" given by the difference between the implicit interest rate on public debt (iir_t) and the growth rate of nominal GDP (g_t) multiplied by the previous year debt ratio (b_{t-1}); **ii)** the primary balance as a percentage of GDP (pb_t); and **iii)** deficit-debt adjustments as a ratio to GDP (dda_t).

The benchmark deterministic scenario

The benchmark scenario is constructed for a 10-year period, with simulations carried out currently up to 2028. It essentially assumes that governments broadly comply with the minimum requirements under the SGP after the ESCB projection horizon. Moreover, this scenario relies on several other assumptions, which are presented below.

The benchmark scenario considers the fiscal projections made in the context of the European System of Central Banks (ESCB) exercises up to

year T+3[3]. From year T+4 onwards, and for countries under the preventive arm of the SGP, as is currently the case of Portugal, the minimum annual adjustment towards reaching the budgetary medium-term objective (MTO) is considered. This is determined by the 'flexibility matrix'[4] but, for prudency, the consolidation effort actually required is adjusted downwards by 0.25 percent of GDP. This figure reflects an estimate of the possible maximum deviation allowed without triggering sanctions under the SGP. In addition, the maximum effort is capped at 0.5 percent of GDP per year.[5] It should be noted that any possible additional fiscal effort required for the fulfilment of the debt rule is not reflected in the benchmark.

The evolution of the **structural primary balance** (spb) beyond T+3 is driven by the convergence to the MTO. In conjunction with an estimate for the cyclical component and an assumption for temporary measures, it allows for the determination of the **primary balance** (pb). The **cyclical component** (cyc) is derived as the product of the output gap by the budgetary semi-elasticity derived on the basis of the ESCB methodology (for an application to the Portuguese case, see Braz *et al.* 2019). **Temporary measures** ($temp$) are assumed to be nil beyond T+3.

For the computation of both the **headline balance** and the **structural balance** a projection of interest payments is required. **Interest payments** (inp) for former programme countries are calculated as the sum of interest paid on market debt (inp^{mk}) and interest paid on loans obtained from official creditors (inp^{of}):

$$inp_t = inp_t^{mk} + inp_t^{of} \tag{2}$$

Interest outlays from official loans are computed on the basis of information on the underlying interest rates and the scheduled redemption profile. Interest payments on market debt are given by the following expression:

$$\begin{aligned} inp_t^{mk} = {} & nmd_{t-1}^{mk} * iir_{t-1}^{mk} + md_{t-1}^{mk} * \frac{1}{2} * (iir_{t-1}^{mk} + amir_t) + \\ & \frac{1}{2} * (-pb_t + inp_t^{mk} + inp_t^{of} + dda_t - \Delta D_t^{of}) * amir_t \end{aligned} \tag{3}$$

3. In the case of Portugal, these fiscal projections are confidential and not made public.

4. Introduced by the European Commission Communication on 'Making the best use of the flexibility within the existing rules of the Stability and Growth Pact' in 2015. See `https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0012&from=EN`.

5. For countries subject to an Excessive Deficit Procedure (EDP) the annual structural effort required under the latest EDP recommendation is considered, unless it is above the government plans in the Stability Programme. For countries at or above the MTO, a gradual fiscal stimulus - limited to 1 percent of GDP per year - is assumed such that countries remain at, or return to, the respective MTOs.

where
nmd^{mk} - market debt with a residual maturity of more than one year;
iir^{mk} - implicit interest rate on market debt (defined as the ratio of interest payments on market debt of year t divided by the market debt stock of at the end of $t-1$);
md^{mk} - market debt with a residual maturity of one year or less;
$amir$ - average market interest rate (defined below);
pb - primary balance;
dda - deficit-debt adjustments, which, as a default assumption, are set to zero beyond the forecasting horizon;
ΔD^{of} - change in the stock of official loans.

Solving for inp_t^{mk} and assuming as a proxy for gross financing needs the following expression: $gfn_t = md_{t-1}^{mk} - (spb_t + cyc_t + temp_t) + inp_{t-1}^{mk} + inp_t^{of} + dda_t - \Delta D_t^{of}$, the previous formula can be simplified as:

$$inp_t^{mk} = \frac{nmd_{t-1}^{mk} * iir_{t-1}^{mk} + md_{t-1}^{mk} * \frac{1}{2} * iir_{t-1}^{mk} + \frac{1}{2} * (gfn_t - inp_{t-1}^{mk}) * amir_t}{1 - \frac{1}{2} * amir_t} \tag{4}$$

For market debt that does not mature within the year, the previous year implicit interest rate is assumed to hold, while for the maturing market debt a different assumption is made for each half of the year: in the first semester interest paid stems from the previous year implicit interest rate, as it is considered that all debt matures at the end of June; in the second semester, rolled-over debt is financed at the average market rates. The (proxy for) net financing needs (the headline deficit, deficit-debt adjustments and the repayment of official loans) is financed at market conditions and is considered to be issued, on average, at the middle of the year.

The **average market interest rate** ($amir$) is assumed as representative of the market interest conditions for the debt to be issued in each year. For the structure of this debt, it is used as a proxy the structure of the residual maturity of the stock of debt, split in debt with residual maturity below one year, between one and five years, and above five years. The calculation formula is as follows:

$$amir = \frac{1}{2}(stn + stn^{12m})sd^1 + \frac{1}{2}(stn^{12m} + ltn^{5y})sd^{1-5} + \frac{1}{2}(ltn^{5y} + ltn^{10y})sd^5 \tag{5}$$

where
stn - 3-month government security yield;
stn^{12m} - 12-month government security yield;
ltn^{5y} - 5-year government bond yield;
ltn^{10y} - 10-year government bond yield;

sd^1 - share of market debt with residual maturity below 1 year;
sd^{1-5} - share of market debt with residual maturity between 1 and 5 years;
sd^5 - share of market debt with residual maturity above 5 years.

The interest rate assumptions are country-specific. Across the simulation horizon, spot yields for the 12-month, 5-year and 10-year maturities are extended with forward par yields. The latter are derived from yield curves estimated with recourse to the model established by Svensson (1994)[6]. The 3-month government security yield corresponds to expectations implied in futures contracts for developments in the 3-month Euribor rate. For each country, the market debt maturity structure converges linearly to the current euro area average in 2035 ($sd^1 = 20$ percent; $sd^{1-5} = 40$ percent; $sd^5 = 40$ percent).

Lastly, it is important to note that, once the MTO has been reached or overachieved, any further interest payments savings resulting from debt reduction or lower implicit interest rate are considered to be used for fiscal easing (and not towards further debt reduction) for prudency reasons. Also, in order to avoid a structural break between T+3 and T+4, an adjustment is carried out to smooth the transition from the forecast exercise period to the more extended horizon, on which interest payments projections are reliant on the above-mentioned formula.

Regarding **macro variables**, the ESCB projections are considered within the forecast horizon, with the exception of **potential GDP** for which projections are made for the whole DSA time horizon.[7] From T+4 onwards, **real GDP** growth (y) projections are derived from a simple stylised model that takes into account persistence effects (through an autoregressive process), potential GDP growth (y^p) and the previous year output gap (OG)[8], as well as the impact of additional fiscal consolidation or stimulus (measured by the change in the structural primary balance - ΔSPB) through a fiscal multiplier,

6. In order to derive the implicit average annual interest rate from the market price of a coupon bearing bond, each future interest payment on this bond has to be discounted by the different current average interest rates related to the time at which the future payment occurs. To facilitate the term structure estimation, it is useful to impose a functional form between interest rates and time to maturity. The ECB has chosen a functional form proposed by Nelson and Siegel - and extended by Svensson. The respective parameters are estimated and made public by the ECB on a daily basis; see ECB (2008).

7. The Eurosystem's DSA takes into account estimates for potential output produced by the ESCB Working Group on Forecasting. For specific details on the estimation of potential output for Portugal, refer to Braz *et al.* (2019).

8. In the absence of additional fiscal consolidation or stimulus, the closure of the output gap is ensured in 5 years.

set at 0.55. Specifically,

$$y_t = \begin{cases} 0.5y_{t-1} + 0.5y_t^p - 0.55\Delta SPB_t - 0.2OG_{t-1} \text{ if } (y_{t-1} - y_t^p) * OG_{t-1} > 0 \\ y_t^p - 0.55\Delta SPB_t - 0.2OG_{t-1} \text{ if } (y_{t-1} - y_t^p) * OG_{t-1} < 0 \end{cases} \quad (6)$$

The two-regime representation ensures a smoother path for real GDP growth by not including the autoregressive term in the cases where the output gap is already closing [$(y_{t-1} - y_t^p) * OG_{t-1} < 0$].

The **GDP deflator** growth rate is assumed to converge linearly, after the short-term forecasting horizon, to the ECB objective for price stability.

The deterministic shock scenarios

In order to reflect the uncertainty around the projection of future debt path and its sensitiveness to the underlying assumptions, the deterministic block of the Eurosystem's DSA encompasses several alternative adverse scenarios. These result from specific narrative shocks applied as of the first year of the simulations (T+1). Although they are homogeneously applied to each country, the shocks are inherently country-specific. Adverse shocks affecting real GDP growth impact the evolution of primary balances through country-specific fiscal elasticities. Moreover, the fiscal rule embedded in the benchmark scenario does not operate, so that fiscal policy does not react to deteriorations in structural positions. Shocks to interest payments, in turn, are captured through a risk premium channel according to which a 1 pp increase in the deficit-to-GDP or in the debt ratios implies an increase in spreads by, respectively, 25 and 4 basis points. Specific details on each of the shock scenarios are provided below.

Historical. Keeps all the assumptions of the benchmark unchanged, except as regards real GDP growth and the primary balance (net of support to the banking sector). In particular, as of T+1, both variables are assumed to converge within three years to their historical averages recorded over 2001-2013. Convergence to the long-run historical figures typically implies lower economic growth and smaller primary balances compared to the benchmark scenario, thus providing insight on the uncertainty around some of the key driving assumptions of the debt path.

No-fiscal policy-change with ageing costs. Assumes the absence of consolidation as of T+3. In particular, this implies that the structural primary balance remains constant at the level corresponding to the last year of the ESCB projection. Additionally, the fiscal burden associated with population ageing (as estimated in the risk scenario of the 2018 Ageing Report) is taken into account, rendering this scenario particularly adverse for countries projected

to face higher ageing-related challenges (and those for which the structural balance is forecast to fall short of the MTO in T+3).

Combined stress test. In this scenario, shocks are applied to real GDP growth, the GDP deflator and the 10-year sovereign bond spreads. These are calibrated as per the country-specific assumptions underlying the adverse systemic risk scenario from the 2018 bank stress tests performed by the European Banking Authority (EBA). In practice, these shocks are applied from 2019 to 2021 and imply that, at the end of 2020, real GDP stands below the level recorded in 2017, yielding negative growth rates in that period. In addition, the scenario assumes an hysteresis effect through which (half of) the shock to real GDP affects potential growth in the longer-term, thus yielding a further deterioration in the structural fiscal position. This is the most adverse scenario considered in the DSA, rendering the highest debt-to-GDP ratio at the end of the horizon.

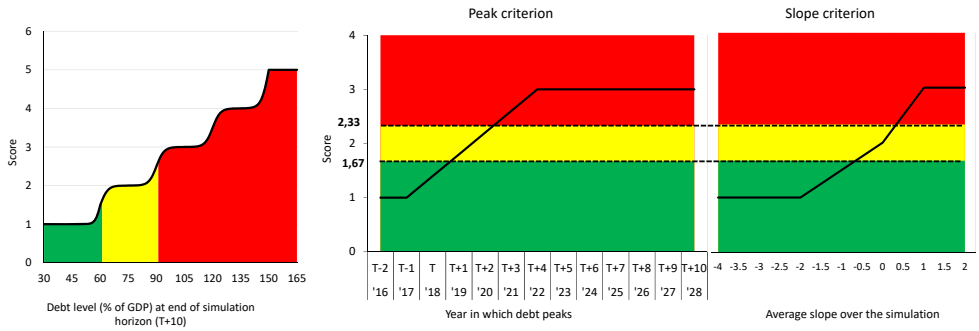
Country-specific interest rate shock. For each country, the interest rate-growth differential converges to its historical average (computed over 1999-2017) by the end of the simulation horizon. The shock is applied to the implicit interest rate on market debt, holding GDP growth and inflation as in the benchmark scenario and assuming no additional consolidation efforts. This implies that the shock affects the debt path gradually over the horizon, as market debt matures and is replaced by new issuance. In order to ensure that this remains an adverse scenario, in the case of countries for which the historical interest-rate growth differential is either negative or stands below the benchmark, it is assumed to converge to 0.5 pp.

Structural shock. Potential GDP growth is negatively affected by a shock calibrated on the basis of an empirical measure of past uncertainty. In particular, the contributions of capital and total factor productivity converge in 10 years to the medians of the respective historical distributions, reduced by one standard-deviation. Regarding the labour factor, it is kept as in the benchmark. Note that this downward shock to potential growth does not allow it to become negative, as the resulting rates are floored at zero. As to the remaining macroeconomic and fiscal variables, they are assumed to evolve in line with the scenario of no-fiscal policy-change with ageing costs.

Quantitative evaluation criteria

Both the benchmark and the alternative shock scenarios are evaluated in terms of the debt level at the end of the 10-year simulation horizon and the dynamics exhibited by the debt ratio over that period. The benchmark is further evaluated against a fiscal fatigue indicator.

The rationale for the **debt level** criterion lies in the notion that a high level of public debt implies stronger sustainability risks. It is typically associated with larger gross financing needs and requires the maintenance of higher primary balances to make it sustainable over the long-term, thereby reducing the margin for counter-cyclical fiscal policy. In the short-term, it may also have unfavourable effects if perceived by market participants as a signal of fiscal distress, potentially triggering liquidity crises. The Eurosystem's DSA evaluates the debt level as a percentage of GDP at T+10 both in the benchmark and in the shock scenarios on the basis of five thresholds: 30%; 60% (as embedded in the EU fiscal surveillance framework); 90%; 120%; and 150%. In order to mitigate cliff effects in the vicinity of these thresholds, the score is derived using a continuous scheme with non-linear smoothing around them. Panel (A) in Figure 1 illustrates this scheme. In terms of the traffic-light colour system, green is allocated to countries for which, at T+10, the debt ratio is at or below 60% of GDP, ratios between 61% and 90% yield a yellow, whereas red corresponds to debt-to-GDP levels above 90%.



(A) Debt level criterion (B) Dynamics criterion

FIGURE 1: Scoring systems for evaluating the debt level and dynamics criteria

Sources: Own illustration, based on the Eurosystem method.
Notes: For convenience, the horizontal axis in the chart referring to the peak criterion presents the relevant years for assessment in the June 2019 DSA exercise (in which T=2018).

Regarding the **debt dynamics** criterion, it aims at capturing the fact that a continuously downward debt path can be perceived by market participants as a sign of improving conditions, even if the level remains high. By the same token, rising debt levels may generate sustainability concerns. In order to reflect these considerations, two dimensions are taken into account when evaluating the debt paths in both the benchmark and the shock scenarios: the year in which debt peaks and the slope of its trajectory.

In particular, the later the debt ratio reaches its peak, the higher the corresponding risk score. Countries in which the debt peaked at least

two years before the start of the simulation period (*ie*, in or before T-1, corresponding to 2017 or earlier in the current exercise), have the lowest risk score of 1. The score increases by 0.4 for each additional year of delay up to a score of 3 if debt peaks after T+3 (or if it fails to reach a maximum within the simulation period). For the slope sub-criterion, the score is a function of a weighted average of the annual changes of the debt ratio over the simulation period. Reflecting the higher uncertainty around the final years of the simulation, the largest weight is given to the change in the first year (T+1, weighting 10) and it decays to a weight of 1 in the last year. The average slope is granted a score from 1 to 3, being more (less) favourable for countries simulated to have sharper declines (increases) over the horizon. Panel (B) in Figure 1 illustrates the scoring schemes applicable to the peak and the slope sub-criteria.

Finally, the overall score for the dynamics criterion is derived as the average between the scores referring to the peak and the slope indicators. The only exception refers to countries where the debt level remains below 30% of GDP throughout the simulation horizon, which get a score of 1 in the dynamics criterion. Overall scores of 1.67 or below are allocated to the green risk category, while yellow corresponds to scores higher than 1.67 but lower than 2.33. A score of 2.33 or above yields a red classification.

The DSA benchmark scenario is also evaluated in terms of a **fiscal fatigue** criterion gauging the governments' ability to sustain primary surpluses. Indeed, the benchmark assumes compliance with SGP fiscal commitments (though only to the minimal extent required to avoid sanctions). This makes it a somewhat benign scenario in the sense that structural primary balances are not allowed to post significant deteriorations. Such assumption may imply the maintenance of large primary surpluses for a long period, which, depending on the past track-record, may not be credible. In order to capture the inherent risks, the fiscal fatigue criterion is based on the comparison between the simulated behaviour of the primary balance over the horizon with the following benchmarks: a country-specific historical threshold corresponding to the highest of the five-year moving averages (MA5) of primary balance recorded from 1999 to 2018 (B); a country-specific historical benchmark that takes into account the fact that current debt levels may be different from those recorded in the past in the same country ($B_{adj,t}$)[9]; and common thresholds of 3.1% and 4% of GDP, derived from the literature.

9. When estimating a fiscal reaction function for a panel of euro area countries, Checherita-Westphal and Zdarek (2017) found a coefficient of 0.04 for the impact of a change in the debt level in the primary balance. In line with this estimate, $B_{adj,t} = B + 0.04 \cdot Diff_{debt,t}$, where $Diff_{debt,t}$ corresponds to the difference between each MA5 of the debt ratio in the simulation period and the debt ratio recorded in the year of the highest MA5 primary balance over 1999-2018.

In particular, for each year of the simulation period, the relevant thresholds are defined on the basis of the relationship between B and $B_{adj,t}$:

- A score of 1 (low risk) is given if the MA5 of the primary balance is below $min(B, B_{adj,t})$;
- If it falls between $min(B, B_{adj,t})$ and $max(B, B_{adj,t})$ **or** if the average primary balance over the simulation is higher than 3.1% of GDP but lower than 4%, the score is set at 2 (medium risk);
- High risks of fiscal fatigue, with a score of 3, correspond to years in which the five-year average exceeds $max(B, B_{adj,t})$ **or** the 10-year simulated average primary balance is, at least, as high as 4% of GDP.

The final fiscal fatigue score corresponds to the highest score recorded over the simulation period.

Results of the deterministic analysis for Portugal

In the benchmark scenario, Portugal's debt ratio is estimated to decline gradually, standing at 89.1% in 2028 (Figure 2). The debt level criterion points, as such, to medium-risks (corresponding to a 2.4 score). A -3.5 p.p. weighted average slope over the simulation horizon, together with a score of 1 for the peak criterion, yields a low risk score in the overall dynamics criterion. Regarding the structural balance, the MTO deducted by the maximum deviation allowed to avoid sanctions under the SGP (0.25% of GDP) would be reached in 2022 and maintained thereafter. The cyclical component would converge rapidly to zero, temporary measures are assumed to be nil after 2022 and interest payments as a ratio to GDP decline up to 2022 and increase only slightly in the last years of the simulation horizon. As a result, the primary balance stands in the [2.7; 3.5]% of GDP range, averaging 2.9% of GDP between 2019 and 2028. This implies high risks related to fiscal fatigue.[10] The average growth of nominal GDP underlying the simulation is around 3%.

Figure 3 shows that the most severe scenario for Portugal is the one referring to the combined stress test. Both in this and in the historical scenario, the debt-to-GDP ratio would fail to stabilize within the simulation horizon (yielding a score of 3 in the dynamics criterion, as per Figure 1) and would reach a high level in T+10 (respectively yielding scores of 5 and 4.1, in line with panel (A) of the same figure). The remaining scenarios would also result in a higher debt level at the end of the horizon, but would not jeopardize the downward slope exhibited since 2014 and prolonged in the benchmark.

10. It should be noted that for the purpose of determining the fiscal fatigue score, the highest MA5 of the primary balance (B) in the 1999-2018 period in Portugal is 0.8% of GDP and the benchmark adjusted for debt levels ($B_{adj,t}$) varies in the [-0.5; 0.1]% of GDP interval.

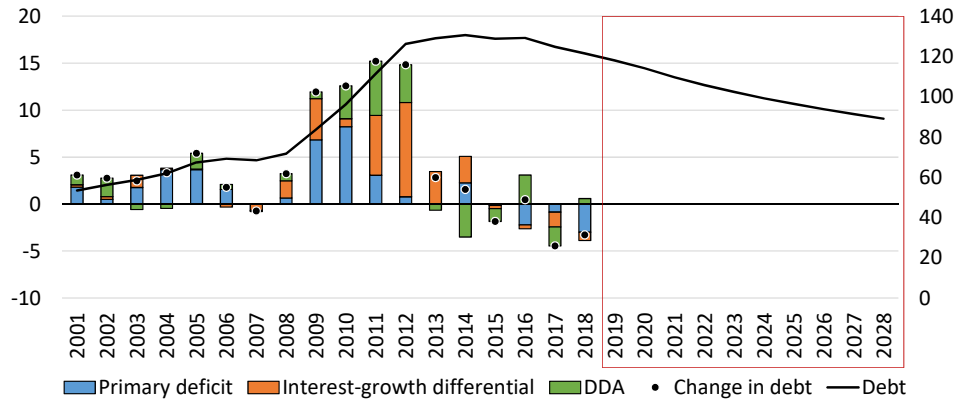


FIGURE 2: Benchmark debt path and its breakdown in Portugal | In percent of GDP

Sources: Statistics Portugal, Banco de Portugal and authors' calculations.

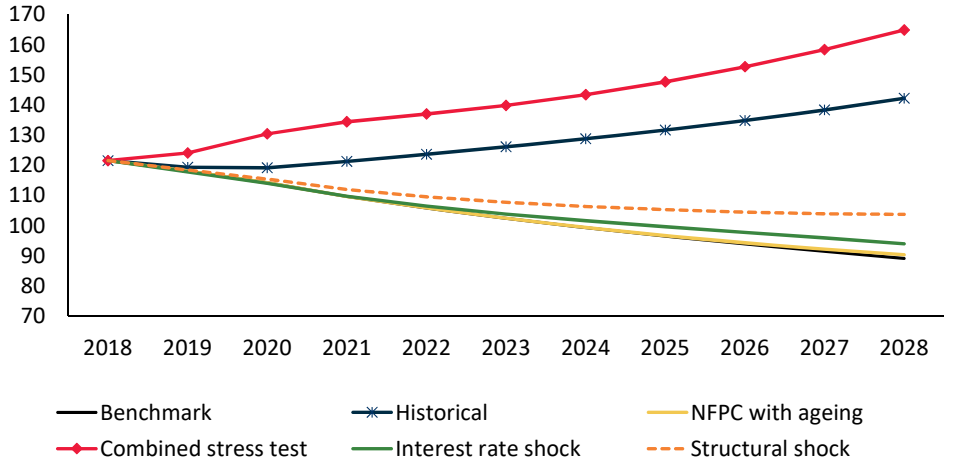


FIGURE 3: Portuguese public debt path in alternative scenarios | In percent of GDP

Sources: Statistics Portugal, Banco de Portugal and authors' calculations.

The stochastic analysis

The deterministic component of the DSA is complemented by a stochastic analysis (SDSA). The latter relies on a set of probabilistic scenarios for the future evolution of public debt, developed on the basis of its empirical relationship with its drivers. In particular, given past responses, macroeconomic drivers are projected according to stochastically simulated

shocks and plugged-in the debt change equation (1) following the same mechanics as in the benchmark scenario, generating alternative debt paths.

In the Eurosystem's DSA, the shocks are simulated from the residuals of a quarterly two-lag VAR model estimated using a Bayesian approach (BVAR) (see Bouabdallah and Cozmanca 2019). The model encompasses four endogenous variables (real GDP growth, GDP deflator growth, short-term government security yields and the real effective exchange rate) and two exogenous variables (a commodity price index and US LIBOR), assuming block-exogeneity. Currently, the estimation sample spans the 1996Q2-2018Q4 period. An independent Normal-Wishard prior is assumed. The priors for the auto regressive parameters are set at 0.5, whereas the prior means of the exogenous coefficients are set at 0, as implied by block-exogeneity.

The independent Normal-Wishard prior implies that the residual covariance is treated as unknown and that the variance of the distribution of coefficients has a flexible structure. In this set-up, parameters cannot be analytically estimated and, thus, the posterior distributions are obtained numerically. In particular, the Eurosystem's SDSA relies on the iterative Gibbs sampling method with 10.000 iterations to obtain random draws from the unconditional posterior distribution of the parameters of interest.

The covariance matrices obtained from Gibbs' method are used to simulate a high number of possible paths for the aforementioned macro variables. Finally, alternative debt paths are generated over a five-year period through the same mechanics as in the benchmark, including the working of the fiscal rule, and considering the simulated cyclical developments.

The large number of debt paths that are simulated using this procedure allow for the derivation of a stable distribution that can be characterised on the basis of several moment statistics or probabilistic analyses. In the Eurosystem's DSA, the simulated distribution is evaluated using three criteria, all focusing at the end of the five-year horizon:

- The uncertainty around the simulations, measured as the difference between the 5^{th} and the 95^{th} percentiles of the distribution of the debt ratio at T+5. For each country, this dispersion is benchmarked against that referring to the euro area sample and, if it stands above the respective 66^{th} percentile, countries are granted a risk score of 3 (meaning that higher uncertainty is associated with higher sustainability risks). If dispersion is between percentiles 66 and 33, countries are assigned to the medium risk category (score of 2), whereas for countries ranked below the 33^{th}, the risk score is 1, signalling low risks.
- The probability of debt standing above 90% of GDP in T+5.
- The probability of debt not stabilizing by T+5.

For the two last criteria, probabilities above 66% receive a score of 3 and are allocated to the red risk category. If the probabilities stand between 33 and 66%, countries are placed in the yellow category and receive a score of 2.

Finally, if they are lower than 33%, signalling low risks for debt sustainability, countries are granted a score of 1 and placed in the green category. The overall score for the SDSA is obtained as the simple average between the scores of the three indicators.

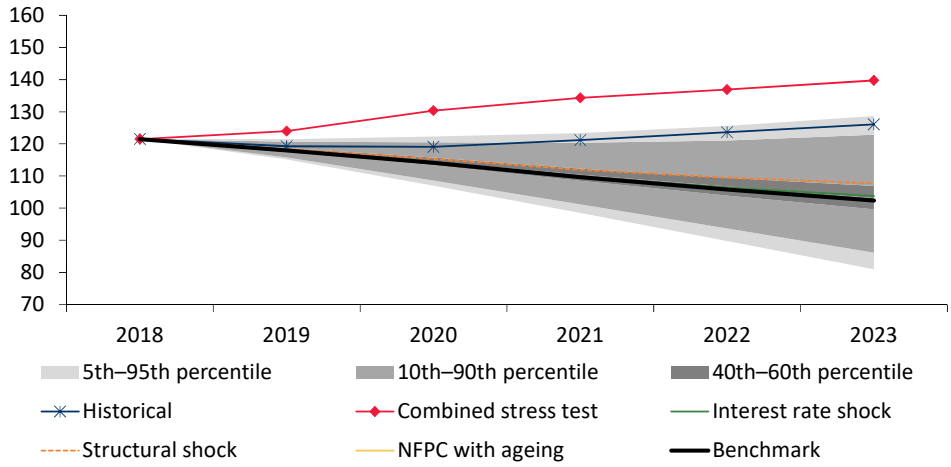


FIGURE 4: Stochastic DSA results for Portugal | In percent of GDP

Sources: Statistics Portugal, Banco de Portugal and authors' calculations.

Figure 4 depicts a fan chart illustrating confidence bands that represent different degrees of uncertainty in the debt paths simulated for Portugal in the latest SDSA iteration. They show that the benchmark scenario largely coincides with the median of the respective distribution. The figure also highlights that the paths corresponding to the most severe adverse scenarios (historical and combined stress test) should be interpreted as highly unlikely, given past developments.

Based on the results summarized in Figure 4, Portugal is placed in the intermediate risk category as regards the dispersion indicator. Unsurprisingly, given the current debt-to-GDP level, the probability of debt standing above 90% of GDP in T+5 (2023) is assessed to be high (red category). Nonetheless, the likelihood of it remaining on a declining trend is also high, yielding a low probability of debt not stabilizing within the five-year horizon (green risk category). Overall, the SDSA score for Portugal is 2, signalling medium risks to debt sustainability.

Other indicators

In addition to the deterministic and stochastic DSA blocks, the Eurosystem's DSA also relies on six groups of other indicators that aim at signalling short-

and medium to long-term sustainability risks, so as to capture potential liquidity and solvency vulnerabilities. In particular, there are two blocks focusing on short-term risks (liquidity risk, and market uncertainty and political risk) and four other blocks providing a longer-term perspective (structure of public debt, scope for contingent liabilities, net financial position of the economy, and institutional and governance factors).

The **liquidity risks** are assessed on the basis of the short-term financing needs [11]. The latter reflect the gross needs related to financing the budget deficit and the debt maturing within one year[12], net of liquid financial assets (currency and deposits). In turn, indicators for **market uncertainty and political risk** aim at gauging the current ease of refinancing. This assessment is based on the markets' perception of sovereign risk (as measured by the 10-year government bond spread vis-à-vis the German Bund and the current sovereign rating) and the political risk indicator produced by a private entity, the PRS Group. Larger financing needs and political risks and poorer market risk perception naturally imply higher short-term sustainability (liquidity) risks.

Potential sources of concern in terms of medium- to long-term sustainability are captured by the four additional blocks of indicators. Indicators for the current **structure of debt** take into account its maturity and its composition in terms of currency and type of interest rate. Higher shares of short-term debt, debt denominated in foreign currencies and debt with a variable interest rate are, in principle, associated with higher vulnerability to adverse shocks which translates into higher sustainability risks.

Higher sustainability risks are also *a priori* associated with a wider **scope for contingent liabilities**. The latter refer to the potential fiscal costs that may arise should certain events materialize. These include the costs related with demographic changes, captured by an "ageing indicator" hinging on the Commission's long-term sustainability indicator S2 and the latest Ageing Report[13]. Moreover, other contingent liabilities are accounted for using a

11. Financing needs estimated for the current year in the June exercise or the following year in the December exercise.

12. The debt maturing in the year encompasses long-term securities maturing within the following 12 months, the stock of short-term debt outstanding at the end of the previous year (both taken from the ECB Centralized Securities Database) and the scheduled repayment of official loans.

13. In particular, the ageing indicator is obtained as the average (2/3; 1/3) between a score compatible with the Commission's long-term sustainability indicator (countries are assigned 1, 2 or 3 depending on the long-term sustainability risks as signalled by the S2 indicator) and the score applicable to the debt level obtained by adding the estimated long-term costs of ageing to the debt level at the end of the DSA period in the benchmark scenario. The estimated costs of ageing correspond to the cumulative impact of age-related spending in the debt level over the 2028-2060 period, as per the AWG risk scenario in the 2018 Ageing Report. In the latest Commission's Fiscal Sustainability Report, the score compatible with the S2 indicator for Portugal stands at 1 (as the S2 indicator signals low risks). In turn, adding the estimated

synthetic indicator that is based on the existing stock of guarantees granted by the general government, the amounts under public-private partnerships (PPP) and non-performing loans granted by government entities. Additional contingent liabilities related to the financial sector are also captured by a financial risks indicator derived from the overall assessment of risk and vulnerabilities in the regular ECB Macro-Prudential Report, which is not publicly available.

The risks to public debt sustainability stemming from the **net financial position of the economy** are assessed through indicators deemed to have high predictive power in signalling sovereign distress: the net international investment position; the private sector stock of debt; and a set of external competitiveness indicators from the EU's Macroeconomic Imbalance Procedure (MIP) scoreboard. The latter refer, in particular, to the changes in unit labour costs and the real effective exchange rate (over the last three years), the (three year average) current account balance and the change in the export market shares (over the last five years).

Finally, risks stemming from each country's **institutional and governance** framework are factored in through a set of indicators providing some insight on the quality of institutions. In particular, this category includes the World Bank's worldwide governance indicators and the Transparency International's corruption perception index. These indicators are intended to proxy the governments' proneness to payback its debt, with higher institutional quality being associated with lower sustainability risks.

Each individual indicator is evaluated using thresholds derived from the empirical literature or based on the reference figures used by the European Commission (when assessing fiscal sustainability risks or in the context of the MIP) and the IMF. When such benchmarks are not available, the thresholds are determined on the basis of the percentile distribution in a sample of advanced economies as defined by the IMF. The only exception is the sub-indicador referring to the share of debt with variable interest rate, for which the relevant sample corresponds to euro area countries across 2001-2018.

Depending on the relevant figures for a specific country and the respective thresholds, each individual indicator is given a score of 1 (indicating low risk), 2 (for medium risk) or 3 (high risk). For each block of indicators - liquidity, market uncertainty and political risk, structure of debt, scope for contingent liabilities, net financial position of the economy, and institutions and governance - an overall score is derived on the basis of the individual scores and a weighting scheme. Finally, the score for each block is classified according to the heatmap colours using the appropriate thresholds: green for

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cumulative costs of ageing to the debt level at the end of 2028 in the DSA benchmark scenario puts the debt-to-GDP ratio close to 120%, which, according to the criterion described in panel (A) of Figure 1, yields a score of 3.4.

scores below 1.67; yellow for scores ranging between 1.67 and 2.33; and red for scores above 2.33.

The results currently obtained for Portugal show that, out of the full set of indicators, the most relevant risks to Portuguese public debt sustainability stem from the weak net financial position of the economy, the high share of short-term debt and the sizeable stock of contingent liabilities (see Table 3 for the aggregate scores of each category of indicators).

Sustainability assessment for Portugal: recent developments

In Portugal, several risk indicators included in the three DSA blocks have been improving since 2015 (Table 2). On the basis of the colour-scheme, the favourable evolution is noticeable in the debt level and dynamics criteria in both the benchmark and the "no-fiscal-policy-change with ageing" deterministic scenarios, in the stochastic DSA and in some categories of the other indicators.

Regarding the improvement in the deterministic and stochastic blocks, it is worth highlighting that the current perspective for debt ratio developments is much more favourable than the one existing in 2015. Different factors concur to this outcome: revisions of the debt ratio in the base year; lower deficits, which one can typically expect given the prudency principle applied in the elaboration of ESCB fiscal projections and also the stronger than anticipated drop in interest rates; and higher than expected nominal GDP growth. While this more benign developments translate relatively fast to the risk assessment based in the level and dynamics criteria of the deterministic scenarios, they will take much longer to be reflected in the fiscal fatigue criterion.

On the other indicators block, the improvement in both the 10-year Portuguese government bond spreads and the sovereign ratings contributed to the positive evolution of the risk assessment in the liquidity and uncertainty and political risk categories. Regarding the structure of debt, the relatively high share of short term debt continues to weigh on this risk indicator, but the reduction in the share of debt with variable interest rate and in foreign currency had a small favourable impact. The financial sector risks, on the contingent liabilities category, have declined somewhat, while the overall score of the indicators on the financial position and competitiveness and on institutions and governance remained broadly unchanged.

The risks to debt sustainability as highlighted in the three DSA blocks can be summarised in a single sustainability score providing an encompassing assessment that is easy to understand and communicate. The aggregation of the scores of each block into a single indicator is conditional on the choice of a weighting scheme. Such choice may take into account empirical

	2015	2016	2017	2018	2019
Deterministic DSA block					
Benchmark					
Level					
Dynamics					
Fiscal fatigue					
Shock scenarios					
Historical scenario					
Level					
Dynamics					
No-fiscal policy change with ageing					
Level					
Dynamics					
Stress test scenario					
Level					
Dynamics					
Country-specific interest rate shock					
Level					
Dynamics					
Structural shock					
Level					
Dynamics					
Stochastic DSA					
Other indicators					
Liquidity risk					
Uncertainty and political risk	-	-	-	-	
Structure of debt					
Scope for contingent liabilities					
Financial position and competitiveness					
Institutions and governance					

TABLE 2. Evolution of the DSA main indicators in Portugal

Source: Authors' calculations.
Note: The assessment in each year is consistent with the information available in the June projection exercises. Results for 2019 and the previous years are not fully comparable due to a methodological review. In particular, most of the indicators currently underlying the liquidity risk and uncertainty and political risk categories were before grouped in one single category.

considerations, the perceived signalling power of each indicator or simple expert judgement.

Table 3 presents three options to weight the different indicators, all based on expert judgement. The **first option** is more balanced, in the sense that it gives more weight to the benchmark deterministic scenario (25%), equal weigh to each of the deterministic shock scenarios and the stochastic DSA (7.5%) and the remaining weight (30%) is distributed evenly by each of the six other indicators' categories. The **second option** for the weighting scheme is meant to capture more forcefully the risks stemming from the adverse scenarios: it increases the weight of each deterministic shock scenarios and the stochastic DSA to 10%, at the expense of a reduction in the weight of

the benchmark scenario to 10%. Finally, the **third option** favours the other indicators in the overall risk assessment, increasing their joint weight to 45%, while counterbalancing it by a cut to 10% in the weight of the benchmark scenario.

	Block/indicator	Score	Weighting options[(a)] 1	2	3
1	**Deterministic DSA block**		**62.5%**	**60.0%**	**47.5%**
1.1	**Benchmark**		**25.0%**	**10.0%**	**10.0%**
	Level	2.4	10.0%	4.0%	4.0%
	Dynamics	1.0	10.0%	4.0%	4.0%
	Fiscal fatigue	3.0	5.0%	2.0%	2.0%
1.2	**Shock scenarios**		**37.5%**	**50%**	**37.5%**
	Historical scenario		**7.5%**	**10%**	**7.5%**
	Level	4.0	3.8%	5.0%	3.8%
	Dynamics	3.0	3.8%	5.0%	3.8%
	No-fiscal policy change with ageing		**7.5%**	**10.0%**	**7.5%**
	Level	2.5	3.8%	5.0%	3.8%
	Dynamics	1.0	3.8%	5.0%	3.8%
	Stress test scenario		**7.5%**	**10.0%**	**7.5%**
	Level	5.0	3.8%	5.0%	3.8%
	Dynamics	3.0	3.8%	5.0%	3.8%
	Country-specific interest rate shock		**7.5%**	**10.0%**	**7.5%**
	Level	2.9	3.8%	5.0%	3.8%
	Dynamics	1.0	3.8%	5.0%	3.8%
	Structural shock		**7.5%**	**10.0%**	**7.5%**
	Level	3.0	3.8%	5.0%	3.8%
	Dynamics	1.0	3.8%	5.0%	3.8%
2	**Stochastic DSA**	**2.0**	**7.5%**	**10%**	**7.5%**
3	**Other indicators**		**30.0%**	**30.0%**	**45.0%**
	Liquidity risk	2.0	5.0%	5.0%	7.5%
	Uncertainty and political risk	1.6	5.0%	5.0%	7.5%
	Structure of debt	1.8	5.0%	5.0%	7.5%
	Scope for contingent liabilities	1.7	5.0%	5.0%	7.5%
	Financial position and competitiveness	2.6	5.0%	5.0%	7.5%
	Institutions and governance	1.4	5.0%	5.0%	7.5%
Overall results for Portugal: sustainability risk score and category			**2.18**	**2.27**	**2.17**

TABLE 3. Overall debt sustainability assessment in Portugal

Source: Own representation.
Notes: (a) The three weighting schemes and the resulting overall scores were defined by the authors for illustrative purposes.

The overall risk score for each of the weighting options is also shown in Table 3. Having in mind the classification in the four-colour scheme (red - very high sustainability risks for scores above 2.5; orange - high risks for scores between 2.5 and 2.0; yellow - moderate risks if the score stands

between 2.0 and 1.5; and green - contained risks for scores lower than 1.5), Portugal currently emerges as a high risk country (orange category) in the three alternative schemes. Although the overall risk classification depends ultimately on the selected weighting scheme, the high number of indicators considered in the analysis ensures a robust score in case a balanced approach is adopted. Also, moving forward, it appears likely that in the absence of external shocks and under the maintenance of the recent trajectories - anchored in sound fiscal policies, a low interest rate environment and resilient growth - Portugal may transit to the moderate risk category in a relatively short period of time.

Concluding remarks

DSA frameworks are very useful tools for harmonised assessments of sovereign debt vulnerabilities in different countries and across time. Similarly to other methodologies, in the Eurosystem DSA tool the trade-off between comprehensiveness and simplicity becomes apparent when methodological aspects are analysed in some detail. The tool is extremely rich and thorough, covering different instruments and indicators. This comes at the cost of a certain degree of complexity, which is mitigated by the presentation of results in a heatmap colour-scheme and the possibility of aggregation in a single score.

Although the framework allows for the possibility of an easy-to-grasp quantitative assessment, its importance should not be overstated as the determination of a single score is somehow dependent on the weighting of the different indicators. As such, results should be interpreted with caution. In particular, small changes in the overall sustainability risk score may not imply an actual revision in the public debt vulnerability assessment. Larger positive and persistent score changes should, however, act as a warning system for national policies. In addition, the tool does provide valuable insights on the evolution of the several determinants of debt sustainability and allows for comparative analysis when applied cross-country.

The results obtained for Portugal point to the existence of high risks to the sustainability of public debt. These stem not only from the currently high level of government indebtedness and the resulting vulnerability to adverse shocks (as illustrated in the deterministic shock scenarios), but also from structural imbalances (as captured by the financial position and competitiveness indicators). However, when compared to results obtained in previous years, the most recent data points to an improvement in several dimensions of sustainability as captured by the Eurosystem's DSA tool. Also, further improvements in the sustainability assessment are likely to occur, provided that the conduct of fiscal policy remains compatible with the maintenance of high primary surpluses and fiscal buffers are built-up,

particularly taking advantage of the current low interest rate environment. This is crucial to increase the resilience of the Portuguese public debt downward path to adverse shocks.

Box 1. The European Commission's DSA framework

The assessment of fiscal sustainability is a major component of EU's surveillance framework. The European Commission regularly issues reports focusing on the matter, including the Ageing Report, the Fiscal Sustainability Report (both published every three years) and the annual Debt Sustainability Monitor. The Commission's framework provides an overall classification of risks to public finances that largely relies on its sustainability indicators: S0, an early-warning indicator focusing on short-term risks; S1, measuring the fiscal effort required for the debt-to-GDP ratio to reach 60% in the medium-term; and the long-term sustainability indicator S2, which represents the fiscal effort required to stabilise the debt-to GDP ratio over an infinite horizon, taking into account ageing costs. Since 2015, the Commission includes a DSA as part of its overall sustainability assessment, by combining it with S1 when gauging medium-term challenges. This ensures that the impact of different macroeconomic and fiscal assumptions on debt dynamics is dully accounted for. As of 2018, this DSA framework is also used to assess long-term sustainability in conjunction with S2, in order to overcome the limitations of this indicator.[a]

Like the Eurosystem's methodology, the Commission's DSA relies on deterministic debt projections for a 10-year horizon and a stochastic analysis focusing on a five-year period. The deterministic part consists of a baseline scenario assuming no-fiscal policy change (with the structural primary balance remaining constant at the level corresponding to the last year in the Commission's forecast), taking into account ageing-related expenditures, and a historical scenario (according to which the structural primary balance converges to its historical average in four years).[b] The risk assessment focuses on three indicators: the debt-to-GDP level at the end of the 10-year simulation period; the year at which the debt ratio peaks; and the comparison between the average structural primary balance over the simulation horizon and a benchmark provided by the distribution of the same variable in a sample of EU-28 countries (currently over 1980-2018). Thus, this assessment partly disregards the signals in terms of debt dynamics captured by the slopes of the simulated paths. Moreover, gauging the plausibility of primary balances over the simulations could benefit from a stronger country-specific component - as it is the case with the fiscal fatigue indicator in the Eurosystem's DSA framework. The resilience of the deterministic paths is assessed by

applying standardized shocks to the growth rate of GDP, the interest rate and the primary balance, and looking at the resulting debt-to-GDP ratio at the end of the horizon and at the peak year.

Regarding the stochastic analysis, it is based on the simulation of a large number of shocks (2000) derived on the basis of the country-specific historical volatilities and affecting the primary balance, real GDP growth, interest rates and the exchange rate. The resulting simulations are evaluated in terms of the probability of debt standing above the initial level after a five-year period and the dispersion of the distribution of simulated debt paths.

Note that, although not relevant for the determination of the risk category, the Commission's framework includes other alternative scenarios. The respective results may be used complementarily as additional risk or mitigating factors for the purpose of an overall assessment. Such assessment may also take into account additional sensitivity tests and other indicators such as short- and long-term projections for financial needs, market perception, the existing debt profile in terms of maturity, type of currency and holders, as well as governments' assets and liabilities. Most of these considerations are an integral part of the Eurosystem's DSA, which further incorporates risks stemming from institutional factors.

The Commission's overall assessment of fiscal sustainability risks is not summarised in a single score. It rather relies on a three-colour scheme (red, yellow and green, respectively for high, medium or low risks) that may apply differently across time horizons (short, medium or long-term). While the short-term assessment is based solely on the S0 indicator, the results of the DSA contribute to the evaluation of the medium and long-term risk categories, as mentioned before.

In particular, for the overall classification of medium-term fiscal risks, the DSA and the S1 indicator have equal contributions. However, for the sake of prudence, if they point to different categories, the one implying higher risks prevails. As regards the long-term, the S2 indicator prevails over the DSA if the latter points to a lower risk category. On the contrary, if the DSA points to higher risks, the overall classification corresponds to the category immediately above the one implied by S2 (eg, if the DSA points to high or medium risks and S2 signals low risks, risks to debt sustainability would be classified as medium in the long-term).

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a. In particular, the S2 indicator does not capture vulnerabilities stemming from the fact that debt ratios may stabilize at a very high level.

b. For additional details on the assumptions underlying the various scenarios in the Commission's DSA, refer to Box 1.1 in the 2018 Fiscal Sustainability Report.

References

Amador, J., C. Braz, M.M. Campos, S. Sazedj, and L. Wemans (2016). "Public debt sustainability: Methodologies and debates in European institutions." Banco de Portugal Occasional Paper 1.

Bouabdallah, O., C. Checherita-Westphal, T. Warmedinger, F. Drudi, R. Setzer, R. De Stefani, and A. Westphal (2017). "Debt sustainability analysis for euro area sovereigns: a methodological framework." Occasional Paper Series 185, European Central Bank.

Bouabdallah, O. and B. Cozmanca (2019). "Stochastic debt sustainability analysis for euro area countries: a novel approach." Presentation delivered in the Central Bank of Malta Public Finance Workshop.

Braz, C., M. Campos, and S. Sazedj (2019). "The new ESCB methodology for the calculation of cyclically adjusted budget balances: an application to the Portuguese case." *Banco de Portugal Economic Studies*, V(2), 19–42.

Checherita-Westphal, C., O. Bouabdallah, J. Domingues-Semeano, S. Van Parys, J. Zimmer, D. Papaoikonomou, M. Alloza, P. Burriel, P. Rizza, M. Polemidiotis, O. Delobbe, M. Campos, and J. Kivisto (2018). "Technical revisions to the ESCB debt sustainability analysis (DSA) method." Mimeo.

Checherita-Westphal, C. and V. Zdarek (2017). "Fiscal reaction function and fiscal fatigue: evidence for the euro area." Working Paper 2036, European Central Bank.

ECB (2008). "The new euro area yield curves." *ECB Monthly Bulletin*, February.

European Commission (2014). "Assessing public debt sustainability in EU member states: a guide." *Occasional Papers*, 200, September.

Svensson, L. (1994). "Estimating and interpreting forward interest rates: Sweden 1992-1994." *NBER Working Paper*, (4871).

Portuguese labour market synthetic indicators

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Abstract
This article describes three indicators which summarize the comovements between labour market series. These are obtained by principal component analysis and are constructed with 27 monthly Portuguese variables that are published on a regular basis. The three indicators point to a sharp deterioration in labour market conditions from 2011 to 2013, with an improvement from 2013 until the end of the sample period. It is also shown that all the indicators are more correlated with inflation and economic activity than the unemployment rate. (JEL: E24, E66, J20)

Introduction

Janet Yellen, in her speech about labour market dynamics, said "The assessment of labour market slack is rarely simple and has been especially challenging recently" (Yellen 2014, page 4). Relying on a single measure may be misleading as different series sometimes give different intuitions and, as the quantity of series available is increasing, it is not straightforward to extract the common dynamics behind different variables. Therefore, an assessment of the stance of the economy based on models such as the Phillips Curve or the Okun's Law can yield very different results depending on the measure of slack used.

In recent years, more literature related to this topic has emerged, as economists are interested in finding the latent variable that drives labour market-related series. There is no simple or obvious methodology and dimension reduction techniques are used to tackle the problem and find such latent variable.

The Portuguese labour market has been having major changes over the past years. In 2009, the unemployment rate started to grow rapidly almost doubling until the start of 2013. This increase was followed by a sharp

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decrease that was still visible in the end of 2018. Meanwhile, average nominal wages kept decreasing until the mid of 2014, being increasing ever since. In short, the Portugal was heavily affected by the Sovereign Debt Crisis, that has produced a lot of changes in the Portuguese labour market which are worth analysing.

In this article, the Portuguese labour market is analysed through three synthetic indicators. The first one focuses on the cyclical behaviour of the labour market, the second looks at its quarter-on-quarter evolution, while the third one is a year-on-year approach.

All the indicators point to a positive evolution of the labour market conditions in the recent period. The first one indicates that the Portuguese labour market is already above its trend value while the other two suggest that the labour market is improving faster than the historical average. Also, these indicators show their relevance by being more correlated with evolutions of the inflation and activity than the unemployment rate.

This article is organized as follows. In the next sections, a brief description of the literature is presented, the methodology behind Principal Component Analysis is described and a description of the data used is provided. Then, the indices are presented, along with the respective results. The indicators are then compared with the unemployment rate and some possible applications are shown. The last section concludes.

Literature review

With the increase in labour market data availability, many economists tried to get a synthetic measure of the labour market. The first contribution dates back to Barnes *et al.* (2007). They built a summary measure of labour market pressure for the U.S., which was obtained as the first principal component of 12 labour market series. Those variables were filtered with the Hodrick-Prescott filter in order to capture their cyclical movement. These authors argued that this new series is quite similar to the unemployment gap over the past 35 years. Furthermore, they show that the development of wage inflation is better linked to the summary measure than to the unemployment gap in the last years of their study.

Hakkio and Willis (2013) used the same statistical procedure with 23 labour market variables. They captured the first and second principal components in order to construct a series representing the level of activity, and another related to its rate of change. Their goal was different from the one pursued by Barnes *et al.* (2007), as the authors were more interested in the level rather than in the cyclical component. They used their indices to predict when the level of activity measure would reach its historical average.

After the argument proposed by Erceg and Levin (2013), which pointed out that the unemployment rate, although informative, may not be sufficient

for gauging overall labour market conditions, Zmitrowicz and Khan (2014) created comparable measures of labour market activity for the U.S. and Canada. The same technique as in Barnes *et al.* (2007) is used, detrending the eight series with the Hodrick-Prescott filter. Their indicator was used to assess labour market conditions and the authors concluded that, while in Canada the evolution of the labour market conditions were largely in line with the dynamics of the unemployment rate, in the U.S., the unemployment rate appeared to have significantly overstated the improvement in broader labour market conditions.

Chung *et al.* (2014) developed a measure that extracts the common movement from 19 labour market variables with a dynamic factor model. To stationarize all series, instead of using the Hodrick-Prescott filter, the authors resorted to the LOWESS filter with a bandwidth of 16 years. Since all the trends were removed, this index was, like the ones created by Barnes *et al.* (2007) and Zmitrowicz and Khan (2014), a cyclical approach. They argued that their index is one way to organize discussions of the signal value of a number of different labour market indicators in situations when the several series might be sending diverse signals. The authors also corroborated the idea that the unemployment rate has improved slightly faster than the other variables. Their index was used by the Federal Reserve until mid-2017, when it was discontinued. The reasons behind that are not totally clear, but several economists argued that the index was too perfectly correlated with the unemployment rate to be useful.

This kind of methodology inspired the Reserve Bank of New Zealand to do the same. Armstrong *et al.* (2016) used principal component analysis of 17 labour market-related series. The stationarization procedure was exclusively applied to those that are clearly non-stationary and consisted in the transformation of those variables in annual percentage changes. Their index correlation with the output gap, which was not an input variable of the procedure, was 80%. Also, they found that using their index as a predictor of most of the data used as input outperforms a baseline autoregressive model in forecasting for all horizons.

Grant *et al.* (2016) used 16 labour market variables and created an index for Australia. However, their index was more correlated with wage growth than with the unemployment rate. They stationarized their series by using 12-month differences and 12-month log-differences and argue that their index can be used as a leading indicator of wage growth.

Furthermore, with the growing literature about whether the Phillips curve is dead or not,[1] some authors started using this kind of broader labour market indices in their studies. Albuquerque and Baumann (2017) created an index with principal component analysis of eight labour market variables and used

1. For more details about the Portuguese case, see Serra (2018).

it as an alternative measure of slack. They argued that the index is among the best performing measures for forecasting inflation out-of-sample.

Principal component analysis

Principal Component Analysis is one of several methods that can be used to determine the common movement among various series. This method was popularized by Stock and Watson (2002) and is widely used as a dimension reduction procedure.

To apply this method, the input variables must be stationary and standardized. The standardization procedure is as given in equation (1), where X_i is the stationary variable, $\bar{X}_i$ and $\mathrm{sd}(X_i)$ denote its mean and standard deviation, respectively, and X_i^{std} is the standardized X_i:

$$X_i^{std} = \frac{X_i - \bar{X}_i}{\mathrm{sd}(X_i)} \tag{1}$$

Then, the N variables are arranged in a $T \times N$ matrix M, where T corresponds to the number of time periods:

$$M = \begin{bmatrix} X_1^{std} & X_2^{std} & \dots & X_N^{std} \end{bmatrix} \tag{2}$$

The following step is to form the $N \times N$ variance-covariance matrix (Ω) as in equation (3):

$$\Omega = \frac{1}{T} M'M \tag{3}$$

Since Ω is a square matrix, extracting its eigenvalues and eigenvectors is an easy task. Define Λ as the matrix with all the eigenvectors (v_i) of Ω:

$$\Lambda = \begin{bmatrix} v_1 & v_2 & \dots & v_N \end{bmatrix} \tag{4}$$

Λ is called the loading matrix and is N-by-N. This matrix should be arranged so that v_1 is the eigenvector associated with the largest eigenvalue and v_N with the smallest one.

The resulting components are linear combinations of the variables used in the analysis and each column in the principal component matrix is associated with the respective eigenvector.

$$PC = M\Lambda = \begin{bmatrix} PC_1 & PC_2 & \dots & PC_N \end{bmatrix} \tag{5}$$

There are some methods to find how many principal components are statistically significant, but our proposed indices only use the first principal component, which captures the largest fraction of the variance of the series used.

Data

The database includes 27 monthly variables, all related to the Portuguese labour market. This article uses data from January 2001 until December 2018. Every variable is seasonally and calendar adjusted.[2] The variables, their sources and the way they were grouped are presented in Table 1.

As some series refer to the quarter ended in the reference month,[3] a moving average of three months is applied to all the other variables. This reduces the volatility of the data, while making all series comparable. Since these indices will be regularly monitored, they use monthly instead of quarterly data. However, this restricts the embodiment of the Portuguese Employment Survey's variables. All nominal data are deflated using the Harmonized Index of Consumer Prices (HICP) working day and seasonally adjusted.[4]

2. The adjustment is provided by the original source, when available, or performed through a X13-ARIMA procedure, as recommended in Eurostat (2015).

3. Statistics Portugal uses centred moving quarters where the reference month corresponds to the central month of each moving quarter. In this work, a shift of one month in those series is applied in order to have the last month of the quarter.

4. This variable is retrieved from the ECB - Statistical Data Warehouse.

Categories	Variables	Source
Employment and Unemployment	Unemployment rate Employment rate Working population	Statistics Portugal
	Job vacancies Job applications First job-seekers New job-seekers	IEFP[a]
	Unemployment allowance beneficiaries	MTSSS[b]
	Employees	IISS[c]
Nominal Series	Average monthly wages	Statistics Portugal
	Index of gross wages and salaries in services Index of gross wages and salaries in manufacturing industry Index of gross wages and salaries in construction industry Index of gross wages and salaries in retail trade	
Sectoral Employment	Index of employment in services Index of employment in manufacturing industry Index of employment in construction industry Index of employment in retail trade	
Population	Labour force participation rate Labour force Total population	
Business and Consumer Surveys	Consumers - Unemployment over next 12 months Manufacturing Industry – Employment expectations Services – Evolution of employment over the past three months Services – Evolution of employment expected over the next three months Retail trade – Employment expectations Construction industry – Employment expectations	European Commission

TABLE 1. Composition of the dataset.

a. *Instituto do Emprego e Formação Profissional* (Institute for Employment and Vocational Training).

b. *Ministério do Trabalho, Solidariedade e Segurança Social* (Ministry of Labour, Solidarity and Social Segurity).

c. *Instituto de Informática da Segurança Social* (Social Security Informatics Institute).

Labour market conditions indicators

A cyclical indicator

The indicator presented below is a cyclical approach to the Portuguese labour market, being analogous to the cyclical indicators used in other countries. Since this indicator aims to capture cyclical components, the stationarization is done by detrending.

There are several methods of detrending. Since it is the most common and well-known, a Hodrick-Prescott (HP) filter is used. The smoothing factor, λ, is 129600, as proposed by Ravn and Uhlig (2002).

Since the HP filter is two-sided, the observed data is extended with five years of data (60 months) through an autoregressive (AR) process in order to mitigate the endpoint bias. The number of AR terms is selected by the minimization of the Bayesian Information Criterion. The HP filter is applied to the extended sample and then the extended period is deleted. This procedure is quite similar to the one developed by Chung *et al.* (2014), but, instead of using the LOWESS filter, the HP filter is used.

With the detrended variables standardized, principal components are extracted. The first principal component explains 43.2% of the overall variance in the dataset.[5]

If the index value is zero at a given period, it means that the Portuguese labour market is in its trend state, as defined by the HP filter. Therefore, the distance from zero should be interpreted as the relative distance to the trend. Any level interpretation should be regarded as deviations from the cycle and intertemporal comparisons are limited because the underlying trend is changing.

The eigenvector associated with the largest eigenvalue and the correlations between the cyclical indicator and the cyclical component of each variable are presented in Table 2.

In Table 3, employment series emerge as the ones driving the behaviour of this indicator.

In Figure 1, it is visible that the maximum deviation from the trend value occurred in mid-2011. However, this implies that the labour market was overheated. Also, it is important to note that, as the HP filter is two-sided, future information affects the trend captured in each moment. This is of utmost importance when looking at the chart because it means that the downfall in 2013 affects the cyclical part of the series in 2011. Nonetheless, the

5. The second and third principal components explain 18.4% and 10.4% of the whole variance, respectively.

	Eigenvector	Correlation (%)
Unemployment rate	-0.2676	-91.4
Employment rate	0.2767	94.5
Working population	0.2810	95.9
Job vacancies	0.0668	22.8
Job applications	-0.2724	-93.0
First job-seekers	-0.2240	-76.5
New job-seekers	-0.2576	-88.0
Unemployment allowance beneficiaries	-0.2298	-78.5
Employees	0.2666	91.0
Average monthly wages	0.0695	23.7
Index of gross wages in services	0.0559	19.1
Index of gross wages in manufacturing	0.1516	51.8
Index of gross wages in construction	0.1068	36.5
Index of gross wages in retail trade	0.1727	59.0
Index of employment in services	0.2539	86.7
Index of employment in manufacturing	0.2469	84.3
Index of employment in construction	0.2495	85.2
Index of employment in retail trade	0.2657	90.7
Labour force participation rate	0.1662	56.8
Labour force	0.1805	61.6
Total population	0.1483	50.6
Consumers - Prospective evolution	-0.0876	-29.9
Manufacturing - Employment expectations	0.0827	28.2
Services - Retrospective evolution	0.0858	29.3
Services - Prospective evolution	0.0129	4.4
Retail trade - Employment expectations	0.1043	35.6
Construction - Employment expectations	0.0909	31.1

TABLE 2. Eigenvector and correlation of the indicator with filtered variables.

	Correlation (%)
Employment and Unemployment	97.8
Nominal Series	54.6
Sectoral Employment	94.9
Population	63.2
Business and Consumer Surveys	37.1

TABLE 3. Correlation between the cyclical indicator and the categories of variables.

Note: Each category's series is calculated with the weights estimated in the principal component analysis.

indicator shows that the labour market conditions suffer in crises periods, as expected.[6]

6. Using $\lambda = 622080$, following Félix and Almeida (2006), and comparing with this indicator, the correlation between them is 95.2%. Results available upon request to the author.

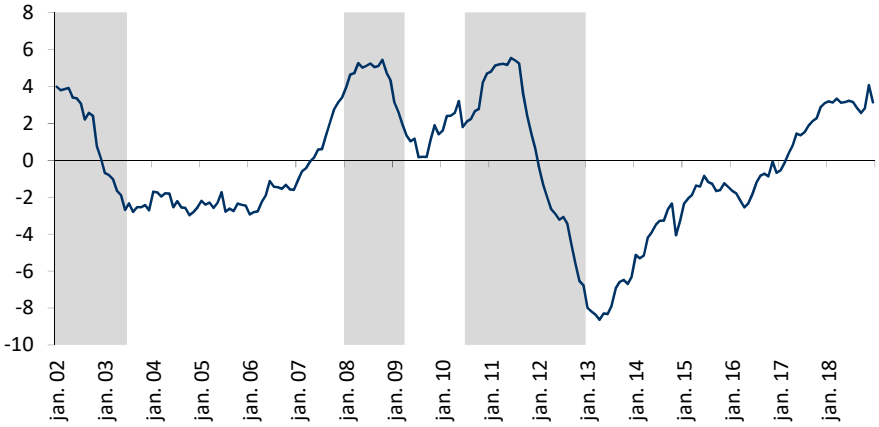

FIGURE 1: The cyclical indicator: 2002 M1 - 2018 M12.

Note: The shaded areas correspond to the periods between peaks and troughs of the Portuguese economic cycles, as defined in Rua (2017).

By looking at the most recent period, this indicator shows that the cyclical component is reaching its peak, already close to the values of the beginning of 2002 and the end of 2008 and 2011.

A quarter-on-quarter indicator

The quarter-on-quarter indicator is constructed also by principal component analysis and the key difference is the transformation performed to stationarize the variables.

Whereas in the previous index the stationarization is done by detrending, in this one it is done by differentiating. This index is, therefore, an evolution indicator that allows the policymaker to make inference on the rate of change of the labour market conditions.

This indicator is relevant for quarter-on-quarter comparisons since the differences are performed between the current value and the value three months before.

In this indicator, only inference about acceleration or deceleration of the labour market conditions can be made. One should take into account that the indicators' average is zero, which not mean that the original series are stable overall.

Applying the methodology described above, the first principal component captures 32.4% of the variance of all the series used. This number is lower than

in the case of the cyclical indicator due to the noise associated with quarter-on-quarter differences.[7]

The eigenvector associated with the largest eigenvalue and the correlations between the quarter-on-quarter indicator and the variables used are displayed in Table 4.

	Eigenvector	**Correlation (%)**
Unemployment rate	-0.2900	-85.8
Employment rate	0.2909	86.1
Working population	0.2919	86.4
Job vacancies	0.0068	2.0
Job applications	-0.3011	-89.1
First job-seekers	-0.2319	-68.6
New job-seekers	-0.2979	-88.1
Unemployment allowance beneficiaries	-0.2503	-74.1
Employees	0.3062	90.6
Average monthly wages	-0.0035	-1.0
Index of gross wages in services	0.0389	11.5
Index of gross wages in manufacturing	0.0696	20.6
Index of gross wages in construction	0.0101	3.0
Index of gross wages in retail trade	0.0974	28.8
Index of employment in services	0.2550	75.5
Index of employment in manufacturing	0.2537	75.1
Index of employment in construction	0.2483	73.5
Index of employment in retail trade	0.2804	83.0
Labour force participation rate	0.1344	39.8
Labour force	0.1302	38.5
Total population	0.0169	5.0
Consumers - Prospective evolution	-0.0763	-22.6
Manufacturing - Employment expectations	0.0751	22.2
Services - Retrospective evolution	0.0633	18.7
Services - Prospective evolution	0.0396	11.7
Retail trade - Employment expectations	0.1060	31.4
Construction - Employment expectations	0.0854	25.3

TABLE 4. Eigenvector associated and correlation of the indicator with quarter-on-quarter differences of the variables.

The correlation of the categories of series with the quarter-on-quarter indicator is presented in Table 5, which shows that the index is highly correlated with Employment and Unemployment and Sectoral Employment series.

The index is presented in Figure 2 and, as the cyclical one, it shows that the labour market conditions get worse during crises. According to this indicator, the labour market conditions have been growing above average since the middle of 2013 after a period where its evolution was sharply below average.

7. The second and third principal components explain 12.5% and 10.6%, respectively.

	Correlation (%)
Employment and Unemployment	98.3
Nominal Series	28.2
Sectoral Employment	91.8
Population	39.0
Business and Consumer Surveys	34.4

TABLE 5. Correlation between the quarter-on-quarter indicator and the categories of variables.

Note: Each category's series is calculated with the weights estimated in the principal component analysis.

During the years of 2016 and 2017, the labour market conditions were improving at the highest pace in the sample. However, during 2018 one can see that they were decelerating, but still above average.

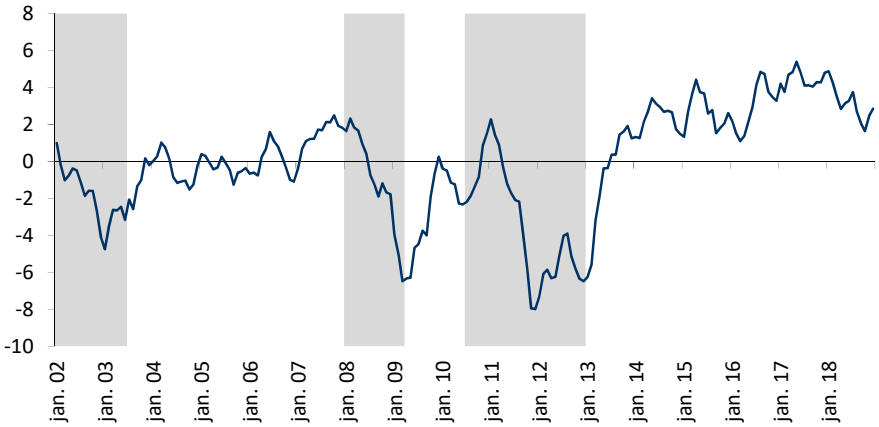

FIGURE 2: The quarter-on-quarter indicator: 2002 M1 - 2018 M12.

Note: The shaded areas correspond to the periods between peaks and troughs of the Portuguese economic cycles, as defined in Rua (2017).

A year-on-year indicator

The same methodology is applied to year-on-year differences. In this case, the first principal component explains 42.4% of the overall variance (the following principal components explain 18.8% and 13.5%, respectively).

As in the previous indicators, the eigenvector associated with the largest eigenvalue and the correlations between this indicator and the variables are shown in Table 6.

	Eigenvector	Correlation (%)
Unemployment rate	-0.2722	-92.1
Employment rate	0.2815	95.3
Working population	0.2821	95.5
Job vacancies	0.0435	14.7
Job applications	-0.2724	-92.2
First job-seekers	-0.2268	-76.8
New job-seekers	-0.2652	-89.8
Unemployment allowance beneficiaries	-0.2187	-74.0
Employees	0.2782	94.2
Average monthly wages	0.0449	15.2
Index of gross wages in services	0.1143	38.7
Index of gross wages in manufacturing	0.1618	54.8
Index of gross wages in construction	0.0369	12.5
Index of gross wages in retail trade	0.1772	60.0
Index of employment in services	0.2668	90.3
Index of employment in manufacturing	0.2167	73.4
Index of employment in construction	0.2513	85.1
Index of employment in retail trade	0.2582	87.4
Labour force participation rate	0.1516	51.3
Labour force	0.1204	40.7
Total population	0.0168	5.7
Consumers - Prospective evolution	-0.1254	-42.4
Manufacturing - Employment expectations	0.1033	35.0
Services - Retrospective evolution	0.1161	39.3
Services - Prospective evolution	0.0771	26.1
Retail trade - Employment expectations	0.1401	47.4
Construction - Employment expectations	0.1372	46.4

TABLE 6. Eigenvector associated and correlation of the indicator with year-on-year differences of the variables.

Like in the other two indices, this indicator is more correlated with Employment and Unemployment and Sectoral Employment series, as can be seen in Table 7.

	Correlation (%)
Employment and Unemployment	97.3
Nominal Series	56.1
Sectoral Employment	94.7
Population	45.0
Business and Consumer Surveys	49.5

TABLE 7. Correlation between the year-on-year indicator and the categories of variables.

Note: Each category's series is calculated with the weights estimated in the principal component analysis.

The year-on-year indicator is presented in Figure 3. The conclusions taken with this index are in concordance with the ones taken with the quarter-on-quarter index. Both point to an improvement above average of the labour market conditions since the second half of 2013 and to a deceleration in the recent years. Nonetheless, the same caveats apply.

According to this index, it is clear that from 2009 until 2013, the labour market conditions were evolving below average, assuming a notoriously negative pace during 2012. 2014 marks the year that the labour market conditions started to improve in the highest pace in the sample.

The highest value of the indicator marks 2017 as the year that the labour market conditions improved the most, however 2018 presents a deceleration.

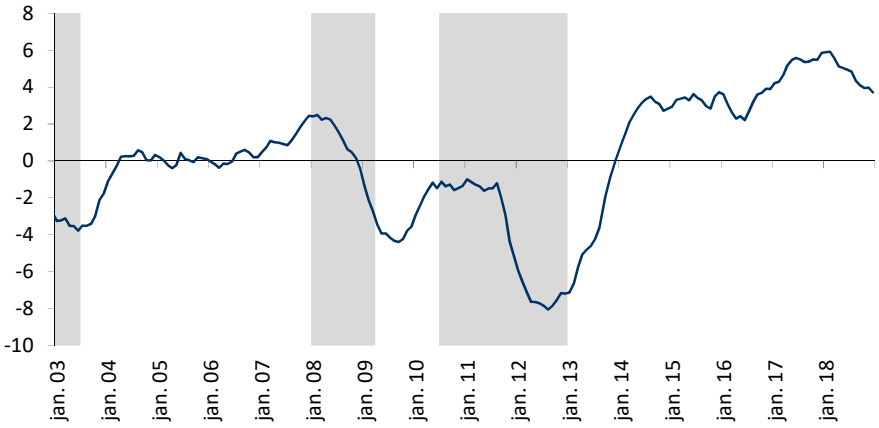

FIGURE 3: The year-on-year indicator: 2003 M1 - 2018 M12.

Note: The shaded areas correspond to the periods between peaks and troughs of the Portuguese economic cycles, as defined in Rua (2017).

Further results

With the three indices presented, one can compare them with the most used variable when assessing labour market conditions or labour market slack: the unemployment rate.

In Figure 4, the cyclical indicator is displayed with the cyclical unemployment rate in inverted scale. This cyclical variable was obtained by detrending the unemployment rate with the HP filter after an AR augmentation, just like how it was done when building the indicator.

In Figures 5 and 6, the quarter-on-quarter and year-on-year indicators are compared with the quarter-on-quarter and year-on-year differences of the unemployment rate in inverted scale, respectively.

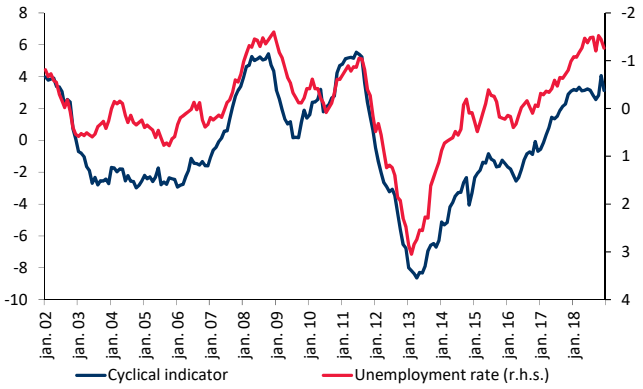

FIGURE 4: Cyclical indicator and the unemployment rate.

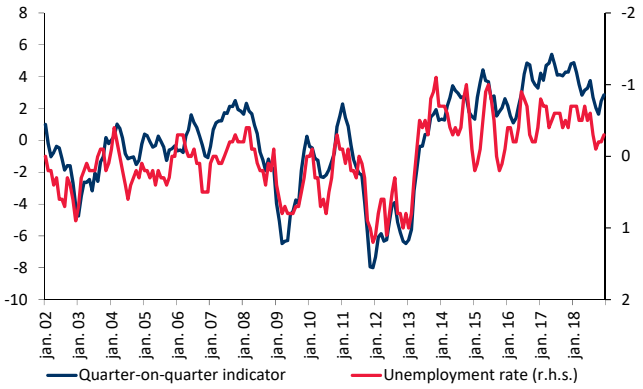

FIGURE 5: Quarter-on-quarter indicator and the unemployment rate.

The year-on-year indicator stands as the one with highest correlation with unemployment rate. However, they often show some differences such as in the beginning of 2014. The quarter-on-quarter indicator is the least correlated with the unemployment rate.

With these comparable variables, these indicators can be confronted with the unemployment rate when estimating the Okun's Law or the Phillips Curve.

Since it is not in the scope of this article to discuss how to correctly perform this estimation, only simple linear correlations will be displayed.

Okun's Law

The Okun's Law shows the empirical relationship between the labour market and activity.

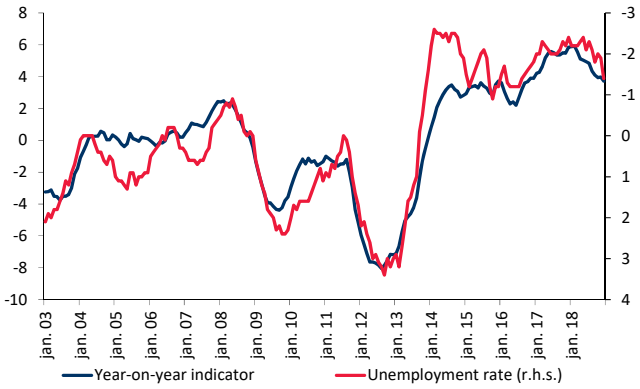

FIGURE 6: Year-on-year indicator and the unemployment rate.

Usually, as previously mentioned, the labour market variable used is unemployment rate, whereas GDP is used for economic activity.

Since GDP is published quarterly, the unemployment rate refers to the quarter ended in the reference month and all the variables used when constructing the indicators are in three-month moving averages, the values used for this comparison will be the ones refering to March, June, September and December.

To correctly perform this analysis, one should use the cyclical indicator and the cyclical unemployment rate as presented before, look at their evolution and correlate them with a comparable measure of GDP. To do this, cyclical GDP was estimated by detrending with the same procedures used previously.

By analysing Figure 7, where the correlogram is displayed, it is easy to see that the cyclical indicator is more correlated with current and past GDP than the unemployment rate. Note that in the x-axis, +1 means GDP one-quarter ahead and so on.

For the other indices, the method is more straightforward, as the correlations were taken using the index and the comparable unemployment rate variation with the quarter-on-quarter or year-on-year rates of change in GDP. The correlograms are presented in Figures 8 and 9.

In both cases, the indicator presents a higher correlation with GDP than the unemployment rate.

The Phillips Curve

A similar exercise was conducted for the Phillips Curve, which relates some measure labour market slack and inflation. In this case, the year-on-year rate of change of the Harmonized Index of Consumer Prices (HICP) is used as a measure of inflation.

FIGURE 7: Correlation between the cyclical indicator and the cyclical unemployment rate with the cyclical GDP t quarters apart.

FIGURE 8: Correlation between the quarter-on-quarter indicator and the quarter-on-quarter difference of the unemployment rate with the quarter-on-quarter rate of change of GDP t quarters apart.

As with GDP, the correlations should be taken with comparable measures of the evolution of prices. In the first case, as the indicator is cyclical, a cyclical approach to inflation should be used. So, inflation was detrended with the HP

FIGURE 9: Correlation between the year-on-year indicator and the year-on-year difference of the unemployment rate with the year-on-year rate of change of GDP t quarters apart.

filter after the augmentation through an AR process. In the other two cases, a measure of acceleration in prices should be used, so the correlations are made with the three and twelve-month difference of inflation.

Figures 10 to 12 display the correlograms. In the x-axis, +1 means the measure used for prices is one-month ahead.

In the three cases, the indicators present higher correlation with the evolution of prices than the unemployment rate.

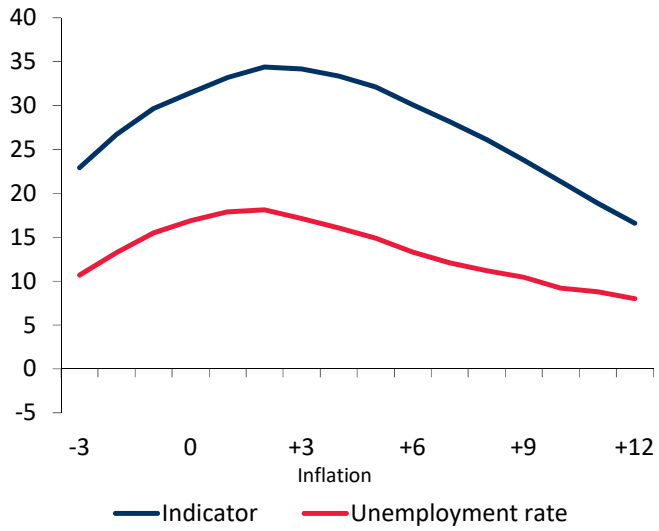

FIGURE 10: Correlation between the cyclical indicator and the cyclical unemployment rate with the cyclical inflation t months apart.

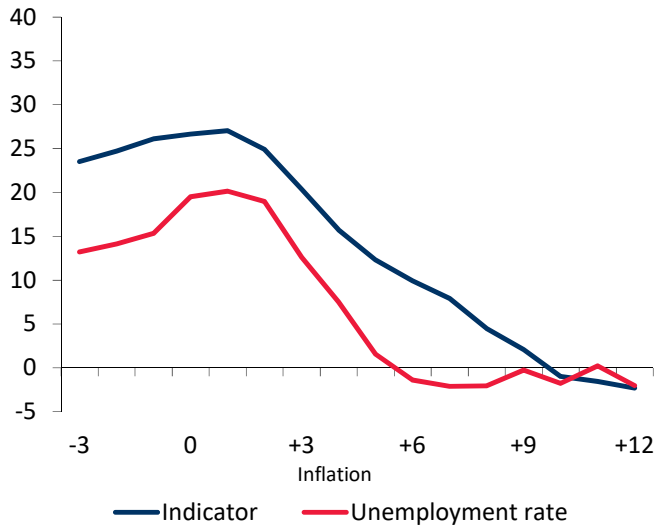

FIGURE 11: Correlation between the quarter-on-quarter indicator and the quarter-on-quarter difference of the unemployment rate with the quarter-on-quarter difference of inflation t months apart.

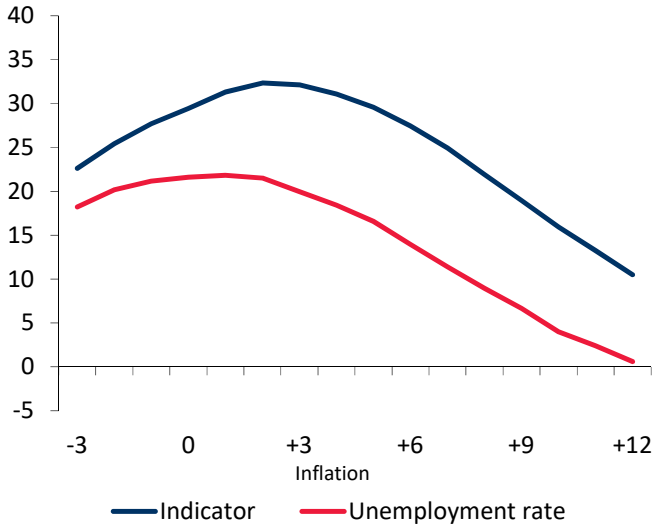

FIGURE 12: Correlation between the year-on-year indicator and the year-on-year difference of the unemployment rate with the year-on-year difference of inflation t months apart.

Main conclusions

This article presents three different indicators for the Portuguese labour market: cyclical, quarter-on-quarter and year-on-year. The three indicators are highly correlated with real series, as expected due to the large amount of employment and unemployment variables in the dataset.

Even though they have different interpretations, all point to a great deterioration of labour market conditions in the negative phases of the economic cycle in Portugal and to a deceleration in the most recent period, after some years of considerable growth.

Compared to the unemployment rate, these indicators seem to be more correlated with past and current values of GDP, but less with future values, except in the case of the quarter-on-quarter indicator. In the context of the Phillips Curve, all indicators show greater correlation with inflation than the unemployment rate, displaying some leading features over the evolution of prices.

Although all indicators can suit different purposes, the quarter-on-quarter indicator is not significantly outperformed by the unemployment rate regarding correlation with GDP, and given that it displays the same features as the other indicators in the framework of the Phillips Curve, it should be preferred for economic analysis.

References

Albuquerque, Bruno and Ursel Baumann (2017). "Will US inflation awake from the dead? The role of slack and non-linearities in the Phillips curve." *Journal of Policy Modeling*, 39(2), 247–271.

Armstrong, Jed, Günes Kamber, and Özer Karagedikli (2016). "Developing a labour utilisation composite index for New Zealand." Reserve Bank of New Zealand Analytical Notes series AN2016/04, Reserve Bank of New Zealand.

Barnes, Michelle L., Ryan Chahrour, Giovanni P. Olivei, and Gaoyan Tang (2007). "A principal components approach to estimating labor market pressure and its implications for inflation." *Public Policy Brief*.

Chung, Hess, Bruce C. Fallick, Christopher J. Nekarda, and David Ratner (2014). "Assessing the Change in Labor Market Conditions." Finance and Economics Discussion Series 2014-109, Board of Governors of the Federal Reserve System (US).

Erceg, Christopher and Andrew Levin (2013). "Labor Force Participation and Monetary Policy in the Wake of the Great Recession." CEPR Discussion Papers 9668, C.E.P.R. Discussion Papers.

Eurostat, European Commission. (2015). *ESS Handbook Seasonal Adjustment: 2015 Edition*. Manuals and guidelines, Publications Office.

Félix, Ricardo Mourinho and Vanda Almeida (2006). "Computing Potential Output and the Output Gap for the Portuguese Economy." *Banco de Portugal - Economic Bulletin Articles*, (Autumn), 73–88.

Grant, Angelia, Wilma Gillies, Ray Harris, and Melissa Ljubic (2016). "An Australian Labour Market Conditions Index." Treasury Working Papers 2016-04, The Treasury, Australian Government.

Hakkio, Craig S. and Jonathan L. Willis (2013). "Assessing labor market conditions: the level of activity and the speed of improvement." *Macro Bulletin*, pp. 1–2.

Ravn, Morten O. and Harald Uhlig (2002). "On adjusting the Hodrick-Prescott filter for the frequency of observations." *The Review of Economics and Statistics*, 84(2), 371–375.

Rua, António (2017). "Dating the Portuguese business cycle." *Banco de Portugal Economic Studies*, 3(1), 43–58.

Serra, Sara (2018). "Is the Phillips curve dead? - results for Portugal." *Banco de Portugal Economic Studies*, 4(2), 25–44.

Stock, J.H. and M.W. Watson (2002). "Forecasting Using Principal Components From a Large Number of Predictors." *Journal of the American Statistical Association*, 97, 1167–1179.

Yellen, Janet L. (2014). "Labor Market Dynamics and Monetary Policy: a speech at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming." Speech 815, Board of Governors of the Federal Reserve System (U.S.).

Zmitrowicz, Konrad and Mikael Khan (2014). "Beyond the Unemployment Rate: Assessing Canadian and U.S. Labour Markets Since the Great Recession." *Bank of Canada Review*, (Spring), 42–53.

The countercyclical capital buffer: A DSGE approach

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Abstract
We address the stabilization performance of the Countercyclical Capital Buffer (CCyB) under distinct sources of expectation-driven business cycle fluctuations. Our environment is a Dynamic Stochastic General Equilibrium (DSGE) model for a small euro area economy. The model is endowed with a banking system where capital requirements and credit restrictions may trigger credit tightness and/or interest rate spread hikes. For fluctuation sources impacting a largely procyclical credit demand, the CCyB rule based on the credit-to-GDP gap is endowed with the proper stabilization timing and has important stabilization effects by alleviating the cost of credit of a fragile entrepreneurial sector. This is achieved at the expense of private consumption, depressed by the wealth reduction associated with the buffer build up. Under cycles affecting credit supply, the CCyB still plays a stabilization role but with milder effects as the entrepreneurial sector is more resilient and able to cope with interest rate spread hikes imposed by the banking sector. For fluctuation sources where credit is countercyclical the CCyB may have a destabilizing role, since the buffer is not released in the proper timing. (JEL: E32, E37, E44)

Introduction

The 2008 global financial crisis triggered a prolific debate on the interaction between the financial sector and the real economy. Undesirable loops associated with financial instability cast doubts on the quality of micro- and macro-prudential tools as a means to stabilize the business cycle. As a result, the economics profession started an extensive discussion on alternative ways to better cope with financial disturbances and ensure a more prominent macro-stability.[1]

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1. Policy challenges are often complex, multidimensional and with tradeoffs that are difficult to assess. For instance, there may exist a conflict between micro- and macro-prudential policies,

Policy goals also became more challenging as the zero lower bound on nominal interest rates rendered standard monetary policy reactions ineffective as a stabilization device. The new economic environment triggered a debate on how monetary and macro-prudential policies can interact with one another as a nationwide stabilizing device (Angelini *et al.* 2014; Clancy and Merola 2017). In small economies integrated in monetary unions, where official interest rates are effectively exogenous, macro-prudential policy can be an effective tool to mitigate credit supply shortages during periods of crisis.

At the policy-making level, the need to come up with macro-prudential mechanisms that are able to prevent or at least cushion the effects of financial disturbances led to major regulatory reforms, most notably the Basel III framework (Committee 2010).[2] One of the most important stabilization tools at the macro-prudential level proposed therein is the Countercyclical Capital Buffer (CCyB), whose main goal is to ensure as far as possible a regular supply of credit over the business cycle. This is achieved by establishing adequate capital buffers in periods when vulnerabilities accumulate above normal (*i.e.* when credit expansion is considered excessive *vis-à-vis* economic fundamentals), and to promptly allow for a buffer reduction in periods of credit shortage.[3]

Figure 1 plots the Gross Domestic Product (GDP) and the Gross Fixed Capital Formation (GFCF) growth rates for Portugal and the euro area since 1999. The plots depict high volatility levels, particularly for the Portuguese GFCF growth, and large slumps during the 2007–2009 financial turmoil and the ensuing euro area sovereign debt crises. The question that emerges is whether a CCyB rule could have mitigated the real effects during this period, by building up resilience in the banking sector prior to the crisis to cushion the effects from issues emerging in the banking and financial systems.

We contribute to the literature by evaluating the performance of the CCyB rule based on the credit-to-GDP gap under distinct business cycle fluctuations drivers. We make use of a Dynamic Stochastic General Equilibrium (DSGE)

since individual banks may not internalize costly spillovers that could harm the broader financial system (Liang 2017). Domestic incidents can easily become a multi-country problem, given the international banking system interconnection.

2. Under Basel III there exists not only national authority-specific guidances, but also multi-country institutional designs, namely a reciprocity regime in which domestic policy decisions have consequences on jurisdictions abroad.

3. The CCyB has already been implemented in many countries (Edge and Liang 2019). Pro-cyclical effects may emerge if banks have to improve their resilience by building up capital in crisis times (Kowalik 2011). Tightening capital requirements may have asymmetric effects on output, triggering a larger contraction in crisis times and slowing down growth in good times, while inducing risk taking (Jiménez *et al.* 2017). Identification problems—known as the "this time is different" fallacy—may also arise when managing capital requirements, particularly when cyclical events cannot be easily distinguished from structural changes (Bonfim and Monteiro 2013). The range of practices in implementing the CCyB has been evaluated in Committee (2017).

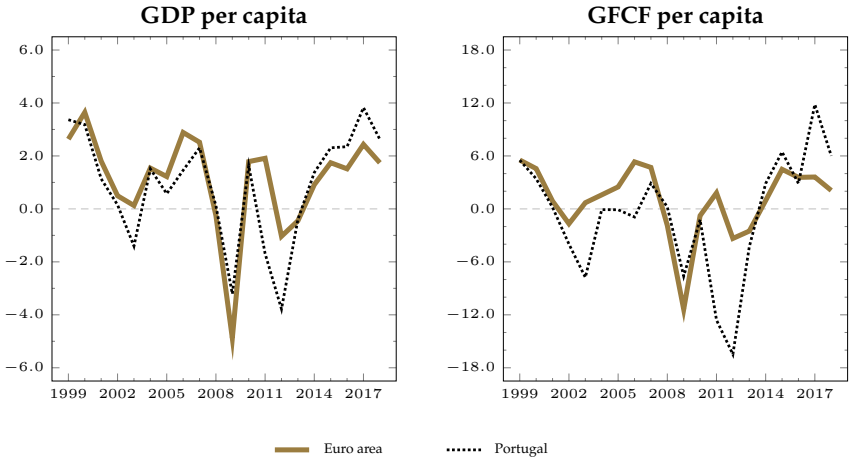

FIGURE 1: Key macroeconomic variables.

Source: Eurostat and Statistics Portugal.

Notes: both figures plot rates of change of real annual data, in percentage, since 1999; per capita refers to total population.

model, for a small euro area economy.[4] The model is endowed with a banking system where capital requirements and credit restrictions co-exist and may trigger credit tightness and/or interest rate spread hikes. Financial shocks—which spill over to the banking sector *via* bankruptcy losses hence depressing bank returns—and issues directly affecting the banking system, come into life in the form of larger spreads and credit restrictiveness. This has obvious feedback effects on the entrepreneurial sector, whose impact depends on their resiliency to absorb shocks, *viz.* their leverage. The interaction between real and financial variables builds up directly from capital demand and supply shifts, coupled with firms' need for external finance. This interaction rapidly spills over to the rest of the economy, deepening the slump. The CCyB rule features a buffer component that builds up whenever the credit-to-GDP ratio surpasses the steady-state value.

In our exercises, business cycles are solely driven by over-optimistic expectations about some future event such as in Lozej *et al.* (2018) and Clancy and Merola (2017). That is, fluctuations have no underlying economic fundamental, triggering an outcome characterized by excess credit.[5] Our analysis moves apart from the one in those articles along two key

4. That is, a structural model where nominal exchange rates are irrevocably unchanged and official interest rates are effectively exogenous.

5. Forward-looking models, which do not suffer from "this time is different" fallacies, are particularly suited to evaluate alternative policies under such circumstances.

dimensions. First, our banking system embodies due loans in conjunction with occasional binding credit restrictions, two important mechanisms to explain the dynamics of the banking sector and that affect the activation of the CCyB. Second, we carry out four distinct business cycle perturbations, on growth, investment efficiency, entrepreneurial risk, and bank returns. Each is endowed with unique features that drive the results. While under a growth perturbation credit is countercyclical, under the remaining credit is procyclical. Furthermore, while fluctuations in investment efficiency and entrepreneurial risk mostly impact the demand for credit, bank returns are an important driver of credit supply.

We show that, when the business cycle driver hinges on investment efficiency or on entrepreneurial risk, the CCyB rule triggers a buffer contraction during the crisis period that cushions the macroeconomic impacts of the downturn by alleviating the cost of credit, thus being able to achieve important stabilization effects. This is attained at the expense of lower private consumption, which suffers from a negative wealth effect associated with the buffer build up. When the business cycle driver hinges within the banking system but the entrepreneurial sector is resilient and hence able to cope with larger spreads, the CCyB still plays a stabilization role but with milder effects. The banking system recovers at the ride of larger spreads. When the business cycle driver hinges on a growth-driven perturbation, credit becomes largely countercyclical and the CCyB rule is generally ineffective or even destabilizing as it triggers a release of the buffer in the incorrect timing.[6]

A parallel discussion taking place in the literature relies on the costs and benefits of rules versus discretion (Kowalik 2011; Clancy and Merola 2017). Our focus herein is solely targeted to the effects of the CCyB rule under distinct underlying shocks. However, our byproduct that the rule may not be activated at the proper timing calls for some discretion for when to release the buffer.[7] In addition, we abstract from the housing sector and house price movements, from risk weights, and from specifics of the legislation in place, not included in the model to keep the key mechanisms sufficiently simple and tractable.[8]

6. The model used herein is an updated version of Júlio and Maria (2018a). The DSGE literature on this topic include Karmakar (2016), Clancy and Merola (2017), Lozej *et al.* (2018) or Faria e Castro (2019). The impact of macro prudential regulation has been examined both on empirical and theoretical grounds. A pioneer investigation with bank-firm-level Spanish data can be seen in Jiménez *et al.* (2017), and an evaluation of several CCyB rules using Portuguese data can be found in Bonfim and Monteiro (2013).

7. This is somewhat in line with Drehmann *et al.* (2010), who finds that the credit-to-GDP gap is the best performing indicator to signal in advance the build up of systemic risks in a wide set of crises and countries, but are unable to find any single variable that consistently signals when to release the buffer.

8. According to the legislation, changes in the CCyB are not the result of a linear mechanical rule. The business cycle and credit cycle indicators are guiding tools, but the macroprudential

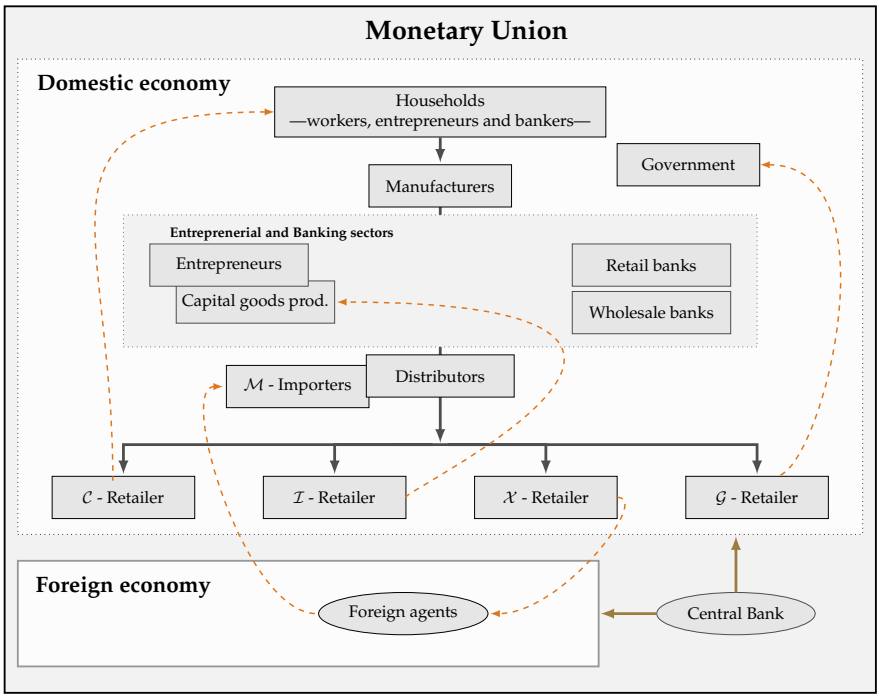

FIGURE 2: Interactions between agents.

Notes: Identifier $\mathcal{C}$ stands for consumption goods, $\mathcal{I}$ for investment goods, $\mathcal{G}$ for government consumption goods, $\mathcal{X}$ for export goods, and $\mathcal{M}$ for import goods. The financial accelerator mechanism comprises capital goods producers, entrepreneurs, and banks.

The non-financial block: households, production, and the foreign economy

The Portuguese economy is modeled as a stylized system of equations that can be solved to find equilibrium outcomes in labor, product and financial markets. The domestic economy is composed of nine types of agents: households, intermediate goods producers (manufacturers), final goods producers (distributors), retailers, capital goods producers, entrepreneurs, banks, the government and importers. The model embodies also foreign agents (the remaining euro area) and a Central Bank which sets the euro area's official interest rate. Key interactions between all agents is clarified in Figure 2.[9]

Households are composed of workers, entrepreneurs and bankers. Workers rent labor services to intermediate good producers (termed

regulator must provide the banks with a time to increase the CCyB, which can only change in multiples of 0.25 percentage points.

9. For details, see Júlio and Maria (2018a) and Júlio and Maria (2018b).

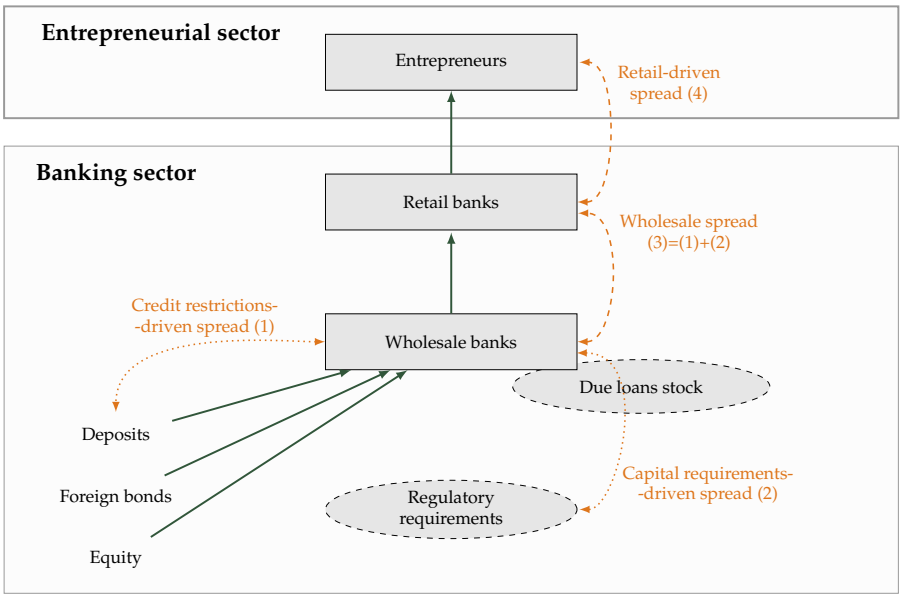

FIGURE 3: The financial sector.

Notes: The due loans stock is managed by wholesale banks. Before the end of each period, retail banks are assumed to transfer all their due loans to wholesale banks.

"manufacturers"). Final good producers ("distributors") combine domestic intermediate goods with imported goods to produce a final good, which retailers allocate to four different agents. Consumption goods are acquired by households, government consumption goods by the government, investment goods by capital goods producers, and export goods by foreign distributors. The interaction between capital goods producers, entrepreneurs and banks are assumed to capture key elements of the financial intermediation sector.

The financial sector: entrepreneurs and banks

Our financial and banking system brings together several strands of literature and adds a completely novel feature, *viz.* due loans management and endogenous write-offs. Figure 3 provides a simple diagram representing the financial sector of the model.[10]

The financial transmission mechanism is inspired on Bernanke *et al.* (1999), Christiano *et al.* (2010), and Kumhof *et al.* (2010). Entrepreneurs do not have

10. The exposition here is an improvement of the model presented in Júlio and Maria (2018a) and Júlio and Maria (2018b).

access to sufficient internal resources to finance desired capital purchases, but can borrow the difference from banks at a cost. They face an idiosyncratic shock that changes the value of the firm after decisions have been made. When hit by a severe shock, the value of assets collapses and the entrepreneur must declare bankruptcy, handing over the value of the firm to the bank. When hit by a milder shock, the entrepreneur survives but is unable to immediately reimburse the loan, which is reclassified by the bank as due.

The banking system builds on Benes and Kumhof (2015), and is composed of retail branches and wholesale banks. Retail branches operate in a perfectly competitive environment, celebrating loan contracts with entrepreneurs. These contracts set an unconditional, non-state contingent lending rate. Since entrepreneurs are risky, so are the individual loans of retail banks, who therefore charge a spread over the wholesale lending rate—the cost of obtaining funds from the wholesale bank—to cover the losses stemming from the mass of entrepreneurs that declare bankruptcy. Since a given retail branch lends to many entrepreneurs, by the law of large numbers the aggregate loan portfolio is risk-free, and hence *ex-ante* profits are zero. Retail branches are however exposed to non-diversifiable aggregate risk given the non-state contingent lending rate, and thus *ex-post* profits—to be transferred to wholesale banks—may differ from zero.

Wholesale banks finance their loans to retail branches and due loans through equity, deposits, and foreign funds. We assume that due loans accumulate on their balance sheet. Over time, some exogenous fraction of the total stock of due loans is recovered, while another fraction, endogenously decided, is written-off from the balance sheet. We term this latter fraction impairment rate and the corresponding costs impairment losses. Wholesale banks face two orthogonal idiosyncratic shocks, one affecting the return on their overall loan portfolio and the other specifically targeting the value of their due loans portfolio. These shocks, coupled with potential losses from retail branches, may trigger balance sheet effects and/or credit supply restrictions. Banks are subject to both regulatory capital requirements and due loans requirements, and non-compliance with either results in penalties and reputation costs. Banks therefore endogenously set buffers which allow them to cushion adverse shocks. For simplicity, we rule out bank failure.

Credit supply restrictions arise endogenously from a modified moral hazard/costly enforcement problem inspired in Gertler and Karadi (2011), Gertler *et al.* (2012), and Gertler and Karadi (2013). The banker has the option to divert a fraction of funds, though this only becomes attractive when the bank's value collapses well below the steady-state level (*i.e.* under bad financial shocks). Creditors recognize this fact and restrain the amount of funds placed at the bank until the banker's incentives to divert funds are aligned with their interests. In this way, wholesale banks become supply constrained with respect to the resources they can make available to the entrepreneurial sector.

Monitoring companies hire workers to perform three oversight activities. First, they help retail branches to repossess assets from bankrupted entrepreneurs. Second, they aid wholesale banks in recovering a fraction of the loans that are due. And finally, they supervise bankers when there is the risk of funds diversion, preventing any misreport of the banks' value.

The financing cost of wholesale banks corresponds to the costs of borrowing abroad, *viz.* the foreign interest rate plus a nationwide risk premium. An arbitrage condition matches this rate to the deposits rate. The premium between the wholesale rate and the deposits rate reflects both balance sheet risk—triggered by the probability of having capital or due loans outside regulatory thresholds—and moral hazard/costly enforcement problems. The former generates an expected cost for the bank—penalty, adjustment, or other—which is covered through a given spread. The latter triggers a quantity restriction in the amount of credit available—an upward shift in the supply of credit. Intuitively, households and foreign agents restrict the amount they deposit and foreign finance up to the point where the banker's incentives to divert funds are fully canceled out. This creates a wedge between the interest rate wholesale banks are willing to supply funds and the rate that creditors are willing to pay for funds. Finally, the retail rate is at another premium over the wholesale rate, to compensate for the fact that some entrepreneurs will declare bankruptcy and be unable to meet their debt obligations. We term this difference external finance premium. Naturally, the larger is entrepreneurial leverage, the greater are the unexpected losses of the banking sector. These are reflected into larger spreads, thus feeding back on the leveraged entrepreneurial sector which has to cope with even larger financing costs .

Due loans are associated with endogenous impairment recognition and management costs, which may depress bank equity and thus contribute to higher expected costs and hence spreads, under the umbrella of balance sheet risk. The optimality condition with respect to due loans balances, on the one hand, the cost of recognizing one unit of due loans as impairment loss net of the incentives to divert funds, and on the other, the expected cost of carrying-over that unit to the next period. The latter is composed of the opportunity, management and holding (penalty) costs—both direct and indirect, through their effect on the compliance of capital requirements. Larger impairment losses push down the gain from diverting assets, and thus the incentive compatibility condition becomes "less binding."

The occasionally binding nature of credit restrictions is able to generate powerful asymmetric responses to financial or banking shocks—those whose nature is endowed with important effects on the banking system. Under "good shocks" that expand banks' value, credit restrictions remain slack and play no role whatsoever. In contrast, under "bad financial shocks" depleting banks' capital negatively credit restrictions may become binding for

some time and greatly affect the model dynamics, amplifying and increasing business cycle persistence.

Parametrization

We calibrate the model to match long-run data or studies for Portugal and euro area economies. Some parameters are exogenously set by taking into consideration common options in the literature, available historical data, or empirical evidence, whilst others are endogenously determined to match great ratios or other measures.[11]

We set the interest rate target at 3.2 percent per year, matching the pre-crisis average for the 3-month Euribor. Steady-state inflation is set at 2 percent per year, in line with the ECB's price stability target. The inverse Frisch elasticity is set to 2.5 and the discount factor to 0.996. The resulting net foreign asset position is around -50 percent of GDP. Household deposits amount to 40 percent of GDP.

Steady-state price markups are set at approximately 30 percent for wage setting, 20 percent for the intermediate goods sector, 10 percent for the final goods sector, and 5 percent for the import goods sector. The elasticity of substitution between capital and labor is close to 1, whereas the elasticity of substitution between domestic and imported goods is 1.5. The depreciation rate of capital is calibrated at 10 percent per year. Calvo parameters imply an average contract duration and intermediate goods average price duration of one year, and a final and imported goods average price duration of half a year. We assume no indexing.

On the entrepreneurial side, the model is endogenously calibrated to match a target leverage (net worth-to-debt ratio) of 1.2 and a yearly bankruptcy probability of 2 percent. The loss given bankruptcy is close to 40 percent and the retail-wholesale spread is 80 basis points.

For the banking sector, we set capital requirements to 8 percent and let banks build an endogenous capital buffer of 2.5 percentage points in line with the literature (*e.g.* Benes and Kumhof 2015; Clancy and Merola 2017), yielding a steady-state capital-to-loans ratio of 10.5 percent. The probability of non-complying with regulatory requirements is set at 2 percent per year, and the spread between the wholesale interest rate and the deposits rate is 1.2 percentage points. The sum of the retail and wholesale spreads matches the interest rate spread paid by non-financial corporations *vis-à-vis* the deposit rate. The fraction of bankers going out of business is 5 percent—the banker stays on the job on average around 5 years.

11. Here we provide only a brief sketch of the main calibration features. For further details see Júlio and Maria (2018a).

In the steady state, we set the due loans' threshold level to 5 percent of total credit, impose a buffer of 1.5 percentage points (and hence a due-loans-to-credit ratio of 3.5 percent), and a probability of non-complying with the threshold of 10 percent. The recovery rate is set to 6 percent and the resulting steady-state impairment rate is 7.7 percent. However, we let the threshold level along the dynamics deviate from the steady-state level, depending on both impairments and the total amount of due loans. The recovery cost is calibrated at 10 percent of the total stock of due loans. Agency problems are endogenously calibrated to be triggered in the presence of shocks with large negative impacts on banks' value. While important for the model, all these parameters play little influence on the main message of this article.[12]

The countercyclical capital buffer

Our aim in this article consists in addressing the stabilization effects of the CCyB for different fluctuation sources. For this purpose, we consider that the regulatory capital requirement, say γ_t, fluctuates according to a non-linear rule[13]

$$\gamma_t = (1-\rho)\gamma^{ss} + \rho\gamma_{t-1} + \mathrm{BUFFER}_t \tag{1}$$

where

$$\mathrm{BUFFER}_t = \max\left\{0, \rho_{rat}\left(\frac{\mathrm{CREDIT}_t}{\mathrm{GDP}_t} - \frac{\mathrm{CREDIT}_{ss}}{\mathrm{GDP}_{ss}}\right)\right\} \tag{2}$$

The subscript ss denotes steady-state figures, the element γ^{ss} is the steady-state value for the regulatory capital requirement, ρ is an autoregressive parameter that captures inertia, and ρ_{rat} is the sensibility of the buffer with respect to the credit-to-GDP ratio. The element CREDIT_t corresponds to total credit in quarter t and GDP_t is the Gross Domestic Product over the last four quarters. Note that the buffer builds up and is released gradually over time—*i.e.* there are no discrete jumps—and is capped from below at zero—implying that the regulatory capital requirement is capped from below at the steady state level γ^{ss}.[14] That is, banks are forced to accumulate larger amounts

12. Additional results are available from the authors upon request.

13. This is an option commonly found in the literature (*e.g.* Lozej *et al.* 2018)

14. Some authors (*e.g.* Drehmann *et al.* 2010) argue for prompt and sizable releases of the buffer instead of gradual releases. However, this remits to a parallel discussion of rules versus discretion, an issue besides the scope of this article.

of capital during (credit) expansions, to be used as a cushion device during downturns.

The autoregressive parameter ρ is set at 0.8, and the sensibility parameter ρ_{rat} at 0.2 for illustrative purposes. This implies a 2 percentage point increase in the buffer for a 10 percentage points deviation in the credit-to-GDP ratio from the steady-state level.[15]

A brief description of the exercise

We analyse the relative performance of the CCyB rule against the benchmark case of unchanged regulatory capital requirements, and plot selected impulse response functions under four representative boom-bust scenarios. All are based on overly optimistic expectations on some future event. Agents expect some shock with positive macroeconomic impacts to occur in the future (specifically within 3 years) and take that information into account immediately. This triggers a boom in the economy. When that moment arrives, they realize that no shock occurs, and revise expectations accordingly. This creates a subsequent bust as agents correct for their overly optimistic expectations. This is a common way in the literature to generate boom-bust cycles (*e.g.* Lozej *et al.* 2018; Clancy and Merola 2017).[16]

The four scenarios proposed herein intend to capture important drivers of expectation-driven business cycle fluctuations. The first is a growth-driven boom-bust cycle. The second consists of an expected increase in the marginal efficiency of investment. The last two are of financial nature—a decline in entrepreneurial risk and an increase in bank returns. All expected shocks have an half-life of around 1.5 years. We do not include any sensibility analysis in the article since the driving force of our results is basically of timing and of fluctuation sources, and not of magnitude. Changes in parameterization have little impact along these dimensions.

Expectation-driven boom-bust growth cycle

We start our analysis with a boom-bust cycle triggered by future growth expectations—a case depicted in Figure 4.[17] In this scenario, agents expect a

15. According to decisions taking place at the Basel Committee, transposed to European legislation through the Capital Requirements Directive (CRD IV), the buffer is capped from above at 2.5 percent. However, national authorities can implement a buffer in excess of 2.5 percent if it is deemed appropriate.

16. Similar conclusions would be achieved if one generates a boom-bust cycle through a materialized positive shock today, followed by some unexpected negative shock in the future.

17. Specifically, this shock corresponds to an expected increase in the growth rate of total factor productivity.

higher growth rate within three years, and this increases wealth and demand today. As a result, there is a boost in factor demand and prices, which raises the value of firms and diminishes the need for external finance on impact. Both credit and the corresponding spreads fall in the short run. The key feature driving this result is that the price of capital, *a.k.a.* the Tobin's Q, jumps on impact with agents' expectations, but capital takes time to accumulate due to real inertia. On the short run firms use the higher value of internal funds to finance the gradual increase in the capital stock and, simultaneously, diminish the degree of external finance. When agents realize they were making decisions based on wrong expectations, the reverse occurs: asset prices collapse due to fading demand and there is an increased need for external finance. This is accompanied by higher wholesale spreads so that banks are able to cope with the increased risk triggered by a more leveraged entrepreneurial sector.[18]

In this case, the CCyB has non-stabilizing effects and increases output volatility. In this simulation, the business cycle is not driven by a problem of credit nor of the financial/banking system. The collapse in asset prices when agents correct for their overoptimistic expectations decreases the value of firms' internal finance and contemporaneously leads to an increased need for external finance, despite the GDP drop. As a result, credit is countercyclical in this exercise. The banks' capital level is therefore not a major concern for the banking system. Hence, the buffer is only used when the credit market effectively fades, being unable to cushion the trough.[19]

Expectation-driven boom-bust investment efficiency cycle

The outcome is slightly different under a boom-bust cycle triggered by future investment prospects which do not materialize (Figure 5). In this case, there is an immediate increase in credit demand, so that firms can take advantage of a higher capital stock at the timing of the shock. The wholesale spread faces minor changes nevertheless, since leverage stays nearly constant, supported by identical increases in both external and internal finance. The latter is held up by higher asset prices following the boost in capital demand. When agents realize their expectational mistakes, asset prices and hence internal finance collapse, and the wholesale spread hikes while entrepreneurs strive to deleverage.

In this case, the CCyB has important stabilization effects. The main difference relative to the growth-based boom-bust cycle is that credit is

18. The hump-shaped pattern in the first three years of the simulation is explained by the dynamics of the trade balance, which declines only in the medium term due to real inertia.

19. Lozej *et al.* (2018) also find that credit is countercyclical under in some simulations.

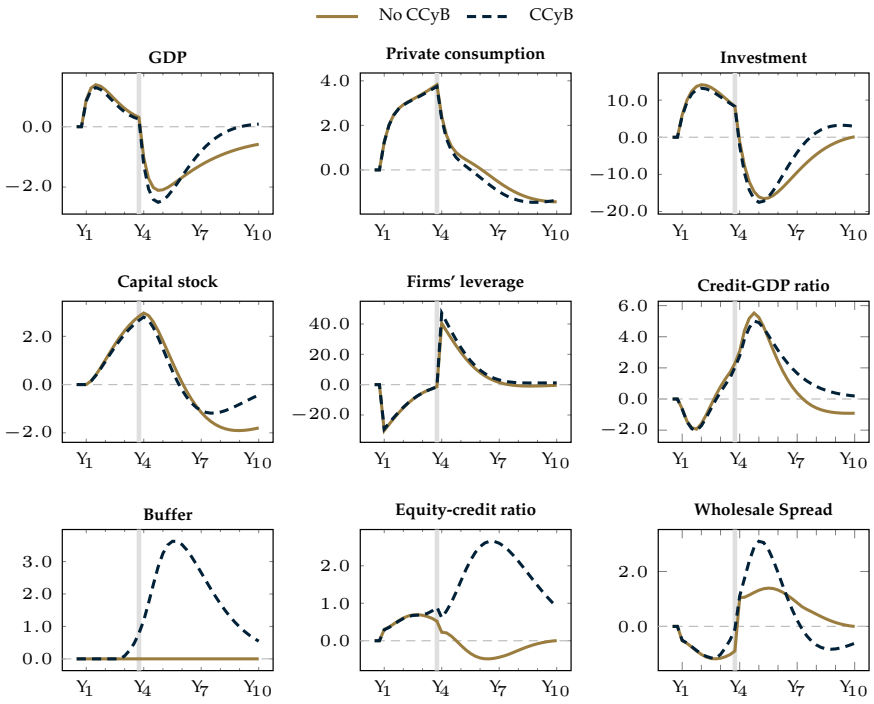

FIGURE 4: A boom-bust triggered by future growth expectations.

Notes: The figure represents an expected increase in growth of 1 percentage points to occur in the third year, which does not materialize. Vertical lines identify the period when agents revise their expectations. Variables are in percentage deviations from steady-state values except leverage, the buffer and the spread, which are in percentage points deviations. Notation Y_x refers to the first quarter of year x.

procyclical in this case, though with a lagged response. The expected future shock affects investment efficiency, which in turn determines firms' need for external finance. As investment prospects are directly related with the news, credit starts shrinking immediately after agents realize that they were overoptimistic about the future (i.e. around the third year). The decline in credit, coupled with the increased entrepreneurial risk due to excess leverage, pushes bank returns immediately downwards, affecting their equity level, to which banks responds through a spread hike. Using the accumulated buffer during this period cushions the decline in bank returns. This results in fewer costs for the banking system during the downturn and concomitantly in a smaller increase in the wholesale rate and a lesser decline in credit demand.

The stabilization effect works mostly through investment, which becomes less volatile. This comes at a cost, however: private consumption under the CCyB rule is always below that of the no rule case until the 8th year of the simulation. This is explained by the decline in wealth associated with the

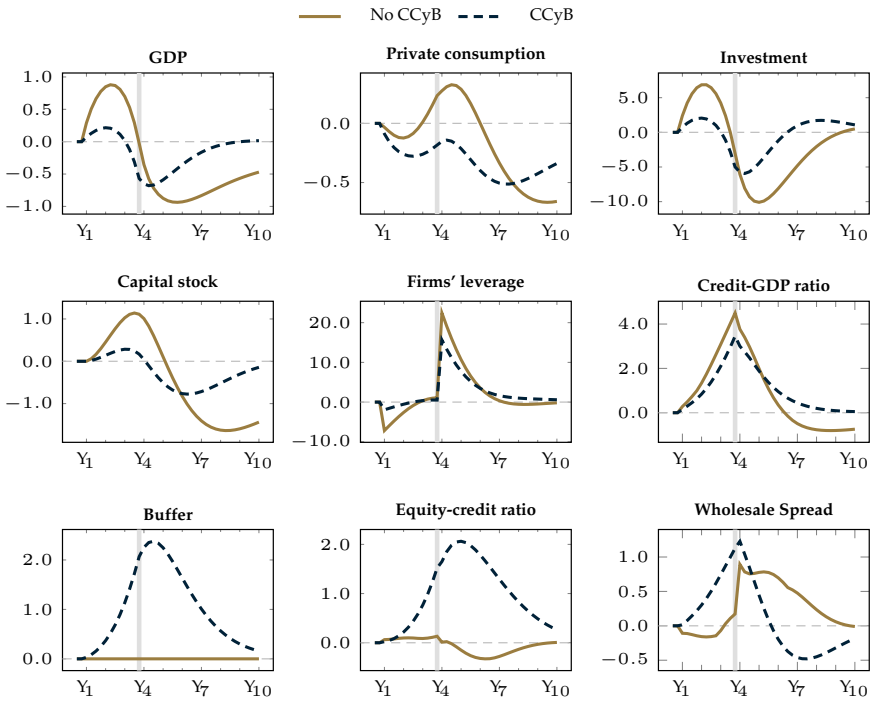

FIGURE 5: A boom-bust triggered by future investment efficiency expectations.

Notes: The figure represents an expected increase in investment efficiency of 10 percent to occur in the third year, which does not materialize. Vertical lines identify the period when agents revise their expectations. Variables are in percentage deviations from steady-state values except the buffer and the spread, which are in percentage points deviations. Notation Y_x refers to the first quarter of year x.

buffer accumulation. Specifically, as banks are required to increase capital levels during the expansion phase, the spread hikes and the cost of credit increases. As a result, there is a widespread increase in factor prices, pushing downwards the profitability of firms, a determinant of wealth. Households are only able to recover lost wealth when the buffer is close to depletion and the effects of the spread hike are fully reversed.

Expectation-driven boom-bust cycle triggered by financial risk

In this section we address the role of the CCyB in the case of a boom-bust cycle driven by expectational mistakes in the financial sector. Specifically, we consider that agents expect a decline in financial risk, to occur within three years. When the time comes they observe no change whatsoever and correct for their overoptimistic expectations. This generates a boom, supported by

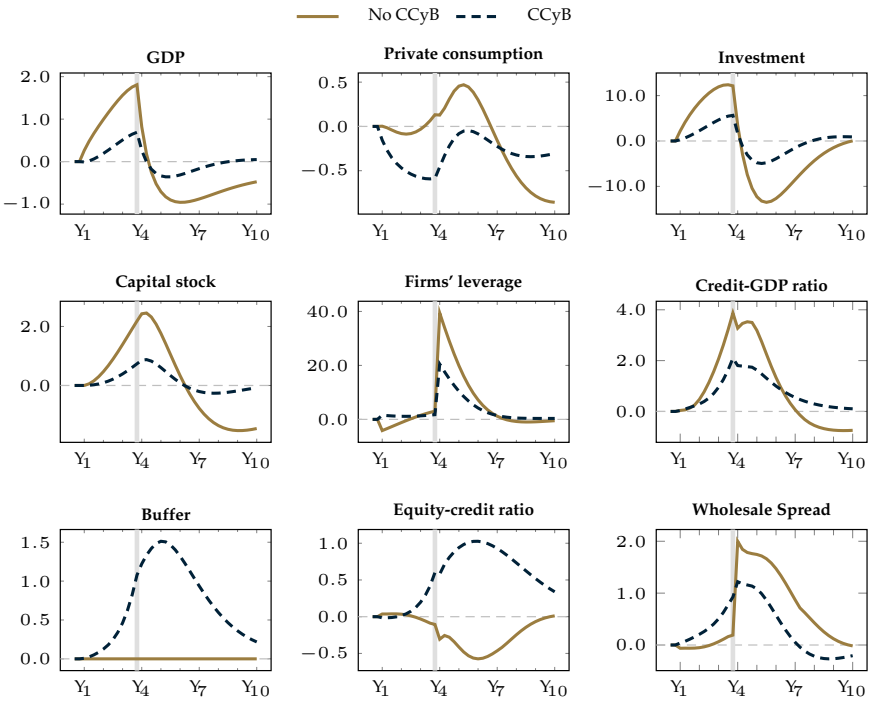

FIGURE 6: A boom-bust triggered by risk expectations.

Notes: The figure represents an expected risk shock of 20 percent to occur in the third year, which does not materialize. Vertical lines identify the period when agents revise their expectations. Variables are in percentage deviations from steady-state values except the buffer and the spread, which are in percentage points deviations. Notation Y_x refers to the first quarter of year x.

higher asset prices and consequently a more resilient entrepreneurial sector, followed by a bust (Figure 6). Asset prices and firms' value collapse when agents receive the updated news, and as a result leverage and bankruptcy probabilities hike. The banking sector is severely damaged by defaults and responds by restricting credit and charging a larger spread, as they cope with the downfall in their capital ratios.

As expected, the buffer plays a central role in this case, as it is well suited to address issues in the financial sector. Since credit is now procyclical and greatly coincident with GDP, the buffer accumulates during the credit expansion phase, providing a cushion for the banking system as it copes with the credit losses that emerge during the recession phase. As a result, credit restrictiveness becomes less severe and the wholesale spread faces a more moderate increase. This in turn cushions the feedback triggered by the losses in the banking system to a fragile entrepreneurial sector, taming the severity of the financial crisis.

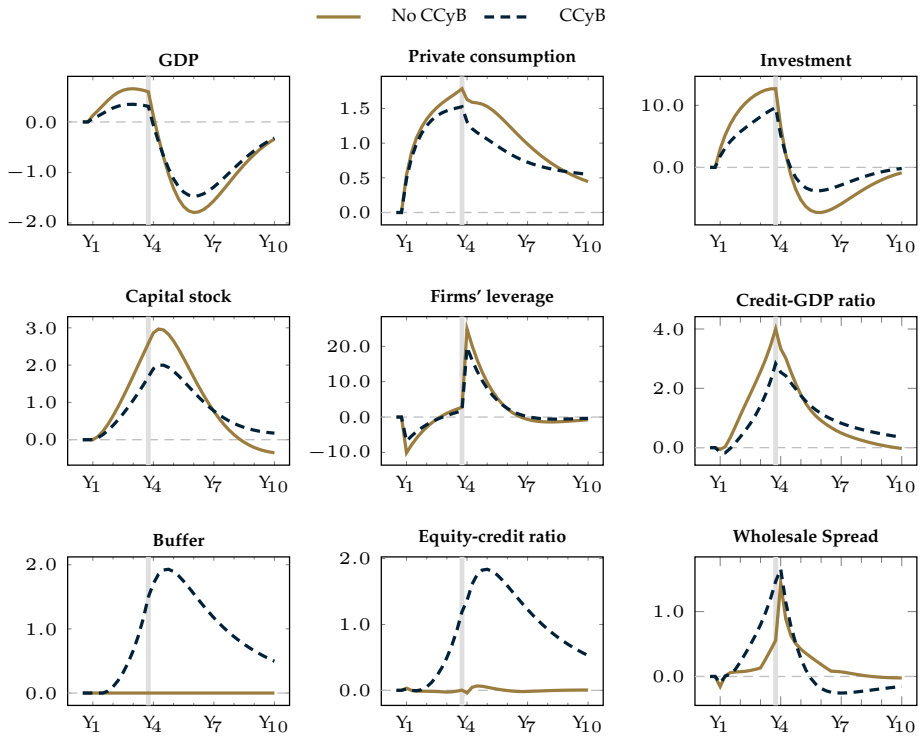

FIGURE 7: A boom-bust triggered by bank returns expectations.

Notes: The figure represents an increase in bank returns amounting to 1 percentage point to occur in the third year, which does not materialize. Vertical lines identify the period when agents revise their expectations. Variables are in percentage deviations from steady-state values except the buffer and the spread, which are in percentage points deviations. Notation Y_x refers to the first quarter of year x.

As in the previous simulation, the stabilization effect works mostly through investment, as private consumption is below the no buffer case until the 7th year of the simulation. The reason is identical: by requiring a spread hike, the buffer decreases the net income of firms and hence households' wealth, which takes time to recover.

Expectation-driven boom-bust cycle triggered by bank returns

In this section we address a boom-bust cycle emerging directly in the banking system and propagating to the rest of the economy through shifts in credit tightness and spread (Figure 7). In this scenario, agents expect an improvement in future bank returns, but when the time comes (in three years) they correct for their over-optimistic expectations. As in the previous

section, this generates a boom, supported by higher asset prices triggered by an expected future decline in the interest spread. The entrepreneurial sector becomes less leveraged and more resilient, and concomitantly increases the demand for credit right away. In general equilibrium, the wholesale spread remains nearly unchanged, on the one hand pushed down based on future return prospects, and on the other hand pressed upwards due to the increased credit demand. When agents realize they were making decisions based on expectations which do not materialize, asset prices collapse and the entrepreneurial sector finds itself with excess leverage and hence too risky. The wholesale spread hikes as banks face a double hit. Directly because they revise their return expectations downwards and must generate higher interest income to cope with unexpected losses, and indirectly due to the increase in the bankruptcy rate of firms. In addition, credit restrictions emerge as banks must cap their leverage limit in order to finance their operations.

The tight relationship between credit, the latent shock, and the concomitant capital problems in the banking system, endow the CCyB with the proper stabilization features, while the contemporaneous correlation with GDP provide the correct timing dimension for the rule to be successfully activated. However, the stabilization dimension in this case is smaller than that from the previous two exercises. Since the shock impacts the supply of credit and not the demand, firms are able to better cope with the spread hike and still achieve reasonable levels of investment. This confines the spillovers triggered by the losses in the banking system to the rest of the economy as compared with our two previous simulations, and hence the effectiveness of the buffer as a stabilization device.

Concluding remarks

In this article we use a dynamic stochastic general equilibrium model for a small euro area economy to address the stabilization performance of the countercyclical capital buffer rule under different underlying fluctuation sources.

We conclude that the effectiveness of the rule greatly depends on the relationship between output and credit, and on whether the underlying shock affects the demand or the supply of credit. Fluctuations based on expectation-driven perturbations on investment efficiency or riskiness tend to generate credit movements which are largely procyclical, affecting mostly the demand for credit. In these cases the countercyclical buffer plays an important stabilization role, by limiting losses in the banking system and spread hikes when the entrepreneurial sector is fragile and the demand for credit low. However, this is achieved at the expense of private consumption, depressed by the wealth reduction associated with the buffer build up. In the case of

a banking-based business cycle fluctuation, the countercyclical buffer is still effective although to a lesser extend. Since the source of fluctuation affects the supply of credit, firms are able to better cope with spread hikes generated within the banking system. Finally, under a growth-driven business cycle fluctuation, the countercyclical buffer is endowed with a destabilizing effect, due to the countercyclical relationship between credit and output. In this case, the buffer is not released in the proper timing, contributing to deepen the slump.

As it is common in the literature, an analysis such as the one performed herein has some caveats worth mentioning. First, we neglect micro prudential aspects. Second, we abstract from the housing sector and house price movements, which have important impacts on the banking system and may constitute a business cycle driver (sharp increases in house prices have also been pointed out as potentially useful indicators to activate the countercyclical capital buffer; see Bonfim and Monteiro 2013). Finally, the model does not feature international spillovers, balance sheet risk weights, nor takes into account the specifics of the legislation in place.

References

Angelini, Paolo, Stefano Neri, and Fabio Panetta (2014). "The Interaction between Capital Requirements and Monetary Policy." *Journal of Money, Credit and Banking*, 46(6), 1073–1112.

Benes, Jaromir and Michael Kumhof (2015). "Risky bank lending and countercyclical capital buffers." *Journal of Economic Dynamics and Control*, 58(C), 58–80.

Bernanke, Ben S, Mark Gertler, and Simon Gilchrist (1999). "The financial accelerator in a quantitative business cycle framework." *Handbook of macroeconomics*, 1, 1341–1393.

Bonfim, Diana and Nuno Monteiro (2013). "The implementation of the countercyclical capital buffer: rules versus discretion." *Financial Stability Report*, pp. 87–110.

Christiano, Lawrence, Roberto Motto, and Massimo Rostagno (2010). "Financial factors in economic fluctuations." Working Paper 1192, European Central Bank.

Clancy, Daragh and Rossana Merola (2017). "Countercyclical capital rules for small open economies." *Journal of Macroeconomics*, 54, 332–351.

Committee, Basel (2010). "Guidance for national authorities operating the countercyclical capital buffer." Basel Committee on Banking Supervision.

Committee, Basel (2017). "Range of practices in implementing the countercyclical capital buffer policy." Basel Committee on Banking Supervision.

Drehmann, Mathias, Claudio Borio, Leonardo Gambacorta, Gabriel Jiminez, and Carlos Trucharte (2010). "Countercyclical capital buffers: exploring options." BIS Working Papers 317, Bank for International Settlements.

Edge, Rochelle M. and J. Nellie Liang (2019). "New Financial Stability Governance Structures and Central Banks." Finance and Economics Discussion Series 2019-019, Board of Governors of the Federal Reserve System.

Faria e Castro, Miguel (2019). "A Quantitative Analysis of Countercyclical Capital Buffers." Working Papers 2019-8, Federal Reserve Bank of St. Louis.

Gertler, Mark and Peter Karadi (2011). "A model of unconventional monetary policy." *Journal of monetary Economics*, 58(1), 17–34.

Gertler, Mark and Peter Karadi (2013). "QE 1 vs. 2 vs. 3. . . : A Framework for Analyzing Large-Scale Asset Purchases as a Monetary Policy Tool." *International Journal of Central Banking*, 9(1), 5–53.

Gertler, Mark, Nobuhiro Kiyotaki, and Albert Queralto (2012). "Financial crises, bank risk exposure and government financial policy." *Journal of Monetary Economics*, 59, S17–S34.

Jiménez, Gabriel, Steven Ongena, José-Luis Peydró, and Jesús Saurina (2017). "Macroprudential policy, countercyclical bank capital buffers, and credit supply: evidence from the Spanish dynamic provisioning experiments." *Journal of Political Economy*, 125(6), 2126–2177.

Júlio, Paulo and José R. Maria (2018a). "An integrated financial amplifier: the role of defaulted loans and occasionally binding constraints in output fluctuations." Working Papers 13, Banco de Portugal, Economics and Research Department.

Júlio, Paulo and José R. Maria (2018b). "Interest rate spreads hikes: What lies behind them?" *Economic Bulletin and Financial Stability Report Articles and Banco de Portugal Economic Studies*.

Karmakar, Sudipto (2016). "Macroprudential regulation and macroeconomic activity." *Journal of Financial Stability*, 25, 166–178.

Kowalik, Michał (2011). "Countercyclical capital regulation: should bank regulators use rules or discretion?" *Federal Reserve Bank of Kansas City Economic Review*, (Second Quarter), 59–80.

Kumhof, Michael, Dirk Muir, Susanna Mursula, and Douglas Laxton (2010). "The Global Integrated Monetary and Fiscal Model (GIMF) - Theoretical structure." IMF Working Paper 10/34, International Monetary Fund.

Liang, J. Nellie (2017). "Financial Regulations and Macroeconomic Stability." Keynote address at the International Finance and Banking Society, July 15-17, Oxford University.

Lozej, Matija, Luca Onorante, and Ansgar Rannenberg (2018). "Countercyclical capital regulation in a small open economy DSGE model." Working Paper Series 2144, European Central Bank.

Economics Synopsis
The Economics of The European Deposit Insurance Scheme

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After the systemic banking and sovereign crisis of 2010-2012, the European Union recognized the need to strengthen the Economic and Monetary Union by implementing a Banking Union, with the objective of further enhancing financial stability and risk sharing, and weakening the link between banks and national sovereign debts. To this end, the Four Presidents' Report (Van Rompuy *et al.* 2012) was the first to stress the need to "elevate responsibility for [bank] supervision to the European level, and provide for common mechanisms to resolve banks and guarantee customer deposits". However, despite the acknowledgment of the importance of these three policies since the very beginning, the organization of the Banking Union started with the introduction of only two pillars: the Single Supervisory Mechanism (SSM) in 2014 and the Single Resolution Mechanism (SRM) in 2016.[1] In this context, a common deposit insurance scheme was considered to be tackled at a later stage. In 2012, the European Commission proposed the introduction of mandatory mutual borrowing and lending between national deposit guarantee schemes but the proposal was rejected by the Council, and in 2014 the Deposit Guarantee Scheme Directive was introduced to harmonize deposit insurance across the Union with respect to some critical characteristics, such as maximum coverage and period of reimbursement. However, some important differences still remain across member States (for example, on the conditions to declare deposits unavailable,

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1. The set-up of the SSM and SRM were also accompanied in 2013 by the Capital Requirement Regulation and the Capital Requirement Directive, to adopt the Basel III agreement in the EU legal framework.

on their eligibility, and on the financing and use of the funds) mainly due to the transposition of the Directive at national levels.

In November 2015 the European Commission published a technical report highlighting the need to go beyond these differences and complete the Banking Union with a European Deposit Insurance Scheme (EDIS). In the words of the "Five Presidents' Report" (Juncker *et al.* 2015) this instrument would increase the resilience of the EMU "to large local shocks (in particular when the sovereign and the national banking sector are perceived to be in a fragile situation)", break the *doom loop* between banking and sovereign crises, and create a level-playing field within the Banking Union for depositors and banks seeking to attract them. This would be achieved by progressively transferring funds and payout management away from national deposit insurance schemes to a common fund, administered by a Single Resolution and Deposit Insurance Board inside the Single Resolution Board. Nevertheless, the discussion in the European Parliament and the Council got to a stalemate due to disagreements about the design of the system at its final stage, the timing of the setting up, and the different degree of legacy issues and moral hazard present in the various national banking systems.

In the light of this narrative, the aim of the present synopsis is to outline the case for the EDIS coming from the economic literature. To this end, I will start by explaining the rationale for deposit insurance, as a necessary complement to other types of government interventions aiming at managing depositors' self-fulfilling expectations that might trigger bank runs. I will also present the economic arguments that justify the introduction of a cross-border deposit insurance scheme like the EDIS, based on financial integration and several channels of financial contagion. In the second part of the synopsis, I will instead describe the European Commission's proposal for the EDIS, and the issues that it allegedly raises. I will also analyze and compare two proposals to resolve them, by Gros (2015) and the so-called "Franco-German Group" (Bénassy-Quéré *et al.* 2019) and summarize an empirical analysis by Carmassi *et al.* (2018) on the possible extent of cross-subsidization across EU member states that EDIS might create. Finally, I will conclude.

The rationale for deposit insurance: self-fulfilling runs

The economic literature stresses that banks occupy a critical position among the financial institutions that populate the financial system: They operate as intermediaries between a vast public of savers (often small and unsophisticated) and borrowers, guaranteeing to the first a safe management of their resources, and to second a stable flow of funding. To this ends, banks engage in a very specific activity, that represents their very essence: liquidity and maturity transformation. In fact, the banks issue short-term liquid liabilities in the form of deposits for savers, and use them to finance

long-term illiquid assets in the form of loans to borrowers. In this way, the banking system can create value for the whole economy, by pooling the idiosyncratic liquidity risk of its depositors and collecting information and monitoring through time the activities of its borrowers (Diamond and Dybvig 1983; Diamond 1984; Holmstrom and Tirole 1998).

However, liquidity and maturity transformation have a "dark side". In fact, they create a mismatch in banks' balance sheets, in terms of both liquidity and maturity of their assets and liabilities. This mismatch, which is necessary for the correct functioning of the banking system itself, has the unfortunate consequence of making it subject to financial fragility. This can happen for two reasons. First, the depositors might receive bad news about their banks, for example about the borrowers to which they have lent, that press them to withdraw their deposits. Second, the depositors might expect that, independently of the state of the banks, all the other depositors will withdraw, and are afraid that the banks might completely liquidate their asset portfolios to serve them, thus leaving little or nothing if they do not withdraw as well. The first case is what the economic literature calls a "fundamental" run, while the second case represents a panic-based "self-fulfilling" run. The difference between the two is critical. In fact, absent any other friction that might distort the banking system, fundamental runs are Pareto-efficient: there is no way in which a regulator can intervene in the economy and make some agents better off while keeping all the other agents at least as well off as without the intervention (Allen and Gale 1998, 2004). In contrast, self-fulfilling runs are coordination failures among atomistic depositors who cannot perfectly infer the behavior of their peers. Therefore, a government can and should intervene to calm depositors' expectations, and coordinate the economy on a "good equilibrium".

How can a government calm depositors' expectations and rule out self-fulfilling runs? Historically, the first type of intervention in that direction was a commitment of central banks to intervene as lenders of last resort for illiquid but solvent banks, possibly at penalty rates and against good collateral (Bagehot 1873).[2] However, the required speed of intervention during a run makes a clear distinction between illiquid and insolvent banks almost impossible, and the need to avoid financial contagion might force a central bank to help as many banks as possible (Goodhart 1987). Moreover, the anticipation of such an intervention might increase bank risk taking (Repullo 2005; Acharya and Yorulmazer 2007; Ratnovski 2009) and hinder incentives for peer monitoring among banks (Rochet and Tirole 1996). For these reasons, governments have also introduced interventions that could prevent the effects of self-fulfilling runs instead of just curing them ex post.

2. In the words of Tucker (2015), "If "no monetary financing" is the golden rule for a credible nominal anchor, so "no lending to irretrievably insolvent borrowers" should be the golden rule for the liquidity reinsurer".

These types of interventions can be implemented in several ways. First, the government could announce a commitment to suspend the convertibility of deposits and block excessive depositors' withdrawals. By doing that, the government induces in all depositors the belief that the banks will have sufficient resources in the future to keep financing the corporate sector and repay them, thus calming their expectations. However, the success of this intervention crucially depends on the commitment of the government to suspend convertibility as soon as a run starts. In fact, if the government is not committed (or cannot commit) to this strong intervention, the depositors will anticipate it and run anyway. This is not a mere possibility, because the government commitment to an immediate suspension of convertibility is time inconsistent, in the sense that it makes sense from an ex ante point of view, but not ex post: if a run really takes place, the government might be willing to postpone suspension, for fear of leaving some depositors without withdrawals. Thus, suspension of convertibility rarely resolves self-fulfilling runs (Ennis and Keister 2009).

The second ex-ante intervention that might prevent self-fulfilling runs is liquidity regulation: The government can force the banks to hold liquid reserves to repay the depositors, even in the case of a complete run. In that case, the depositors would anticipate that there is no reason for them to withdraw, and a run would not be triggered in the first place. However, this intervention, while being effective at stabilizing depositors' expectations, works only if it forces banks to hold sufficiently large reserves. The most extreme case of such a liquidity regulation is one that forces the banks to be "narrow" and invest 100 percent of their liabilities in safe liquid assets. However, this policy would destroy liquidity and maturity transformation (Wallace 1996). Moreover, it might distort the allocation of savings to the corporate sector, and generate a credit tightening with potentially large effects on the real economy. That is the reason why liquidity regulation is generally implemented but is never tight enough to completely rule out self-fulfilling runs.

All these arguments provide a rationale for complementing government intervention against self-fulfilling depositors' runs with deposit insurance. According to the IMF (Demirguc-Kunt *et al.* 2015), around 111 countries in the world have introduced such a scheme, most of them in the last thirty years (with the notable exception of the U.S., which introduced it in 1933). In most cases (87 countries) deposit insurance is privately funded. However, insurance premia are generally tiny,[3] and not sufficient to cover potential self-fulfilling runs, especially if systemic: the average coverage-to-GDP ratio in the sample is of more than 600 percent. That is the reason why in 29 out of those 87 countries

3. In an older version of the IMF database, the highest insurance premium was 3.2 percent in Slovenia, but in most countries was between 0.01 and 0.8 percent of total covered deposits.

with privately funded schemes, deposit insurance also has a public backstop, and 53 countries in total have either a publicly or jointly funded scheme or a backstop. Moreover, 98 out of 111 schemes are administered either by a public authority or by a joint private-public one.

These numbers highlight the fact that the government plays a critical role to ensure the credibility of deposit insurance. In turn, the government credibility to guarantee deposits raises one further issue: a self-fulfilling run, especially if systemic, might be too costly for a government to counteract, and threaten sovereign solvency as a consequence (Schoenmaker 2018). On top of that, the channel of causation can go in the opposite direction: a sovereign debt crisis might impair the ability of a government to credibly guarantee deposits, and therefore trigger a self-fulfilling run. Put differently, there exists the possibility of a "doom loop" (Farhi and Tirole 2017), i.e. a two-way feedback mechanism between self-fulfilling runs and sovereign debt crises. As a consequence, an increase in the level of guarantees might have a positive or negative effect on financial fragility depending on the specific characteristics of the economy, such as the size of the banking system, its productivity relative to the public sector, the level of public expenditure and the tax burden (Leonello 2018).

The rationale for the EDIS

The previous section summarized the economic rationale for the introduction of deposit insurance, and highlighted the role of government commitment in guaranteeing its credibility, thus connecting the possibility of self-fulfilling runs to sovereign debt crises. Still, this is not sufficient to justify the introduction of an international deposit insurance scheme like the EDIS. Indeed, the fact that a country is hit by a self-fulfilling run on its banking system does not justify per se that other countries should share a deposit insurance scheme with it. For that, one or more channels of cross-border financial integration must be present.

Completing a banking union

The first economic argument that justifies the introduction of an international deposit insurance scheme on the base of financial integration is the need to complete a banking union. The typical motivation for that lies in the observation that financial integration justifies the centralization of bank regulation and supervision, as the simple coordination among local authorities might break down during financial crises (Freixas 2003).[4] In turn,

4. In this respect, the case of Fortis is instructive. Fortis was a systemically-important bank for both the Netherlands and Belgium, two highly integrated economies. Nevertheless, when the

regulatory and supervisory centralization might create conflicts between local deposit insurance and the central authority (Repullo 2018) or agency problems between them (Carletti *et al.* 2019) that only the further centralization of deposit insurance can solve. In fact, on the one hand the authorities responsible for local deposit insurance might have a tendency to blame an "unfair" central authority for not recognizing the strength of their banks. On the other hand, a central authority might not fully internalize the fiscal costs of financial distress on local public finances (Gros and Schoenmaker 2014). Moreover, the absence of a common deposit insurance scheme might distort the corporate governance of multinational banks (Grubel 1979). In fact, a local deposit insurance authority might tend to encourage the cross-border expansion of domestic banks through subsidiaries rather than through branches, based on the fact that subsidiaries are subject to the deposit insurance of the destination country, while branches are subject to the deposit insurance of the country of origin (Valle-e-Azevedo and Bonfim 2019).

Financial contagion

The economic literature highlights a second channel through which financial integration justifies an international deposit insurance scheme: because financial integration creates financial contagion. Broadly speaking, financial contagion is a situation in which financial troubles in one entity (a bank, a region or a country) are transmitted to other entities. In that sense, in the same way as self-fulfilling runs are the dark side of maturity transformation, financial contagion is the dark side of financial integration.

In support of this argument, the economic literature focuses its attention on three channels of financial contagion of self-fulfilling runs that might be critical. First, financial contagion might arise when banks are integrated among themselves, either as a consequence of cross-border consolidation (Allen and Gale 2000) or in the interbank market to hedge against idiosyncratic liquidity shocks (Brusco and Castiglionesi 2007) or in the payment system (Aghion *et al.* 2000; Freixas *et al.* 2000). Then, a self-fulfilling run on the banking system of a country might spread across borders if it conveys information about impairments in the balance sheets of the banks in other countries (Dasgupta 2004).

Second, there can be financial contagion of self-fulfilling runs through national sovereign debts. This can happen if banks hold a portfolio of sovereign debts of different countries to diversify sovereign risk (Bolton and Jeanne 2011). Moreover, the sovereign debts of different countries might be connected by a common institutional background. This can happen if

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global financial crisis took the bank to the verge of insolvency, the Belgian authorities wanted to save the whole bank, while the Dutch authority wanted to split the bank to return the control of the Dutch part under national control.

countries share a common currency and high sovereign risk on one of them put that into strain, thus creating redenomination risk (De Santis 2018). On top of that, the common institutional background monitors and directs government intervention against self-fulfilling runs, and eventually against run-induced sovereign crises. Thus, a self-fulfilling run on the banks of one country might signal how other governments are going to intervene in future crises, thus possibly spreading self-fulfilling uncertainty.

Third, financial contagion might happen even if national banking systems or sovereign debts are not internationally integrated, when capital markets are integrated. Then, self-fulfilling runs might generate information externalities (Chen 1999) and shrink the common pool of liquidity, thus triggering an aggregate liquidity shortage (Diamond and Rajan 2005) or fire sales (Cifuentes *et al.* 2005). Similarly, a self-fulfilling run might spread to other countries because the resulting wealth loss suffered by the investors might make them more risk averse and willing to withdraw from their investments in other countries too (Goldstein and Pauzner 2004) or because it might trigger a portfolio rebalancing (Lagunoff and Schreft 2001) or a "flight to quality" (Bernanke *et al.* 1996).

Evidence

In the light of the previous theories, we can evaluate which channels of financial integration justify in practice the introduction of the EDIS. On the one hand, the first argument is the strongest. In fact, in the current EU regulatory framework bank supervision and resolution are centralized via the first two pillars of the Banking Union, but the consequences of bank failures are still essentially borne at national level. For example, had the Spanish bank Banco Popular Español failed in 2017, instead of being bought by Banco Santander, the Portuguese deposit insurance scheme would have had to refund depositors in the local subsidiary, even if the bank was supervised and resolved at EU level (Nouy 2017). Hence, there exists the need to complete the Banking Union in order to avoid possible conflicts of jurisdictions across different cross-border regulatory levels.

On the other hand, not all the aforementioned channels of financial contagion have been significant during the 2010-2012 crisis, or will be significant in the incoming future. First, there is little evidence of bank cross-border holdings of government bonds. To the contrary, there is evidence of home bias among banks in more vulnerable countries (Horvath *et al.* 2015). Moreover, domestic government bonds represent around 60 percent of the total bank sovereign exposure also in large EU countries (Craig *et al.* 2019). On top of that, publicly-owned, bailed-out and poorly capitalized banks in the euro area seem to have increased their holdings of domestic government bonds more than other banks in 2011 and 2012 (Altavilla *et al.* 2017). Clearly, there is instead a strong connection between national sovereign debts because

of the institutional background that the member states share inside the EU. In that respect, the irreversibility of the euro ruled out redenomination risk. However, Constâncio (2012), talking about the start of the 2010-2012 crisis, still argues that the rise in bond yields for Ireland, Portugal, Spain and Italy "can be largely explained by the concerns raised by the scope and possible extent of the private sector involvement in Greece, which was set as a condition for a second programme [sic] at the euro area summit of 21 July [2011]".

Second, bank integration has not been particularly strong in the EU in the past decades, from different points of view. Fostering cross-border bank consolidation for example has been a matter of debate at the EU level. In fact, on the one hand there is the recognition that it has the potential to create economies of scale and enhance cross-country risk sharing and the resilience of the financial system to aggregate shocks, while preserving competition in the local markets (European Central Bank 2017). On the other hand, consolidation could also represent a threat to financial stability, not only because it could create institutions that are "too-big-to-fail" (Kareken and Wallace 1978) or "too-interconnected-to-fail" (Drehmann and Tarashev 2013), but also because it might disproportionally penalize smaller banks and harm diversification, which policymakers believe to be a key feature to guarantee financial stability (European Parliament 2018).

In a similar way, bank integration via interbank markets was not particularly strong during 2010-2012, as interbank markets were still recovering from the considerable dry-up that they suffered during the preceding global financial crisis. Yet, interbank markets are currently regaining their role for the circulation of liquidity in the European banking system. Finally, also capital market integration has not been particularly strong in the EU in the past decades, essentially due to regulatory barriers across countries. The European Commission has been addressing this point in the last years, with several proposals aiming at building a Capital Markets Union that could complement bank financing, unlock and put into work capital around Europe, give to savers more investment choices and to non-financial corporations larger funding at lower costs, irrespective of their location (European Commission 2019).

Taking stock

To sum up, the economic literature highlights that several channels of financial contagion have been at play in the EU during the 2010-2012 crisis. On top of that, further developments of cross-border bank integration and the Capital Markets Union have the potential to benefit the EU economy as a whole, but also bring about higher risk of financial contagion. These observations, together with the need to complete the Banking Union to avoid possible conflicts between different levels of decision making, rationalize from an economic point of view the need to go beyond a mere coordination of

national deposit insurance schemes, and complete the Banking Union with the introduction of the EDIS.

The European Commission's proposal for the EDIS

The European Commission's legislative proposal for the EDIS was laid down in two different communications (European Commission 2015, 2017). It prescribes the establishment of the EDIS in addition to the existing national insurance schemes, which would always remain operational in the future as part of the common scheme. The EDIS would cover all the deposits below 100,000 euros of all the banks affiliated to any of the current national insurance scheme in the Banking Union, and would intervene when a bank either is liquidated or is resolved and the transfer of the deposits to another institution needs to be supported so that deposit access is not disrupted.

According to the 2015 proposal, the introduction of the EDIS would follow three phases:

1. Three years of reinsurance, during which the EDIS would provide a specified amount of liquidity assistance and absorb a specified amount of losses of the national insurance schemes eventually in distress;
2. Four years of coinsurance, during which the national insurance schemes and the EDIS would jointly intervene, and the latter would absorb an increasing share of the costs of intervention;
3. A final phase of full-coverage, when the EDIS would substitute the national insurance schemes, and cover all liquidity needs and losses.

The Deposit Insurance Fund should be equivalent to 0.8 percent of the total covered deposits of all the banks in the Banking Union by the time it reaches the third phase, and it would be gradually built up over a period of 8 years. Banks' insurance premia would be set so as to achieve the coverage target of 0.8 percent, and be based on each bank's own share of covered deposits and risk profile, calculated with respect to the other national banks in the reinsurance phase and to all insured banks in the coinsurance phase.

In order to limit the liability for the Deposit Insurance Fund, reduce moral hazard at the national level and avoid a first-mover advantage, the proposal further advised for the introduction of several safeguards. In the reinsurance phase, the national insurance schemes would access the common fund only when the corresponding member State has fully complied with the 2014 Deposit Guarantee Scheme Directive. Moreover, in the first two phases the Deposit Insurance Fund would only intervene if the national insurance scheme in distress had first exhausted all its own funding, and contribute only up to a specified percentage of the shortfall, subject to an overall cap.

To address the divergences that emerged during the discussion with the European Parliament and the Council, in 2017 the Commission presented

a communication with some ideas of possible revisions. In particular, it suggested to slow down the introduction of the EDIS, and make the progress along the three phases less automatic. First of all, in the reinsurance phase the EDIS could not cover a national insurance scheme's losses, but only its illiquidity. This would be achieved with an increasing coverage of 30 percent of the total liquidity shortfall in the first year, 60 percent in the second and 90 percent in the third, and any transfer of resources from the EDIS would be treated as a loan to the national insurance scheme (and therefore be repaid in the years following the intervention).

To address concerns related to legacy risk and moral hazard, at the end of the reinsurance phase the move to coinsurance would depend on the realization of a set of conditions. These would include a targeted Asset Quality Review to assess non-performing loans and level-III assets, eventually followed by the solution of the identified problems. The Asset Quality Review should be conducted during the reinsurance phase, to ensure that banks address legacy risks within the banking sectors where they were generated. Once these conditions are met and the coinsurance starts, the EDIS would provide full liquidity assistance and also progressively cover losses starting from 30 percent of the total amount, provided that all conditions are continuously met. The national insurance schemes and the EDIS would contribute in parallel from the first euro of losses.

The economic debate on the EDIS

The proposed modifications by the European Commission showed that the original plan for the EDIS suffered from a fundamental weakness: some member States perceived it as proposing excessive risk sharing, in particular in the light of the heterogeneity still present across the banking systems of the Banking Union. Risk sharing was deemed excessive with respect to both the level of risk with which the member States would enter the first phase of the transition to a common insurance scheme (the so-called "legacy risk"), the speed and the automatism of the transition itself, and the moral hazard and resulting excessive risk taking that would entice in the future. On top of that, in practice the discussion on the EDIS became secondary in the priorities of the policymakers due to the improved economic conditions of the EU, and as time progressed additional layers were added to the discussions. Therefore, despite the general acknowledgement that the EDIS is necessary to complete the Banking Union, the process went on hiatus. Yet, these arguments did not stop the debate among policymakers and academics regarding the design of the EDIS, and the timing of its introduction.[5]

5. A more general debate revolves around the question of whether deposit insurance creates bank moral hazard. Some studies find that the probability of banking crises is significantly

The Gros' proposal

In two early policy briefs (Gros 2013, 2015), Daniel Gros offers an argument about the best way to design the EDIS. On the one hand, he argues that it makes sense to centralize bank supervision and resolution, to limit a country's discretion in these matters and the possible spillovers to the whole Union that might come from it. On the other hand, deposit insurance applies to all banks automatically, and its benefits are rather local. Thus, there is no direct need to centralize deposit insurance, too. The only case in which a common insurance scheme would be helpful is when a systemic banking crisis hits a country, and its public finances are put in distress as a consequence. However, in that case, as the shock is probably idiosyncratic at the Union level, a mechanism of reinsurance across member States would be more appropriate than coinsurance.

According to Gros' proposal, the reinsurance scheme must be compulsory, to avoid stigma and adverse-selection biases. As for any reinsurance contract, it should include a "deductible" paid by the national insurance scheme, and explicit triggers that should target the losses from a banking crisis as a percentage of a country's GDP. Importantly, the reinsurance scheme should be able to cover a systemic banking crisis in a small- or medium-sized member State. For example, given that the average cost of a banking crisis is of around 5 percent of GDP, Gros calculates that covering a banking crisis in the Netherlands would require a disbursement of around 40 Billion euros. Therefore, around one third to one half of the total bank risk premia collected by the national insurance schemes should be devoted to reinsurance.

One crucial detail of the reinsurance proposal is the pricing of risk. As the system reinsures the national insurance schemes against the realization of systemic events, Gros argues that it should target macroeconomic conditions more than bank-specific risk parameters or a coverage ratio.[6] In that sense, the management of a European reinsurance fund should require no expertise in bank management or accounting, but only in the analysis of macroeconomic risk, as the European Systemic Risk Board already does. Clearly, pricing the macroeconomic risk of an event as rare as a systemic banking crisis is problematic. For this reason, Gros suggests to introduce some elements of "experience rating": the premium that a national insurance scheme has to pay should increase after the occurrence of an insured event. This would

higher in countries where deposit insurance is into place, and justify this by showing that there exists a positive correlation between deposit insurance and bank moral hazard (Demirguc-Kunt and Detragiache 2002; Anginer *et al.* 2014). However, some more recent evidence, using a different method to date banking crises, shows that the probability of banking crises is predicted neither by the presence of deposit insurance nor by its generosity (Boyd *et al.* 2019).

6. Jokivuolle and Pennacchi (2019) further highlight that setting insurance premia according to a fund-to-deposit coverage ratio would imply countercyclical premia, which could exacerbate the volatility of the credit cycle.

essentially work as a clawback provision, and allow a national insurance scheme to repay its debt with the reinsurance fund in the long run. To account for the fact that systemic banking crises might be only partially a consequence of macroeconomic mismanagement or lack of bank supervision at the national level, the clawback might also be partial.

The Franco-German proposal

In a recent book published by the CEPR (Bénassy-Quéré *et al.* 2019), seven French economist and seven German economists propose a comprehensive reform agenda for the euro area. The rationale for the agenda is based on the argument that the current fiscal and financial architecture of the Economic and Monetary Union has not resolved its main issues: The "doom loop" between banking and sovereign crises still represents a threat; the Stability and Growth Pact is procyclical and not very effective; there is still no clear view of how to deal with member States with extreme budgetary problems, other than by offering liquidity assistance in exchange for fiscal adjustments. The debate over how to resolve these three issues revolves around the trade-off between risk sharing and incentives: on the one hand, some argue that risk sharing is crucial to mitigate future crises as much as possible; on the other hand, some others are afraid that excessive risk sharing would undermine market discipline, and further postpone overdue reforms at national level.

The main argument of the Franco-German proposal is the refusal of this trade-off, and the belief that risk sharing and incentives are complementary to one another. This is because a robust monetary union requires both crisis prevention (through incentives) and mitigation (through risk sharing). Moreover, risk sharing can be designed so as not to harm incentives, and is actually necessary for them to work properly.

In the light of this argument, the authors suggest six areas of intervention, among which a critical role is played by the EDIS.[7] In line with the idea of complementarity between risk sharing and incentives, the EDIS should be introduced in parallel with two more policies: a tighter treatment of non-performing loans, and a sovereign concentration charge. The first would have the effect of attenuating legacy risk during the first phases of the scheme. The second is to avoid that national governments exploit their local

7. The other five areas are: (i) replacing the current system of fiscal rule focused on "structural deficit" by a simple expenditure rule guided by a long-term debt reduction target; (ii) creating the economic, legal and institutional underpinnings for the orderly sovereign-debt restructuring of countries whose solvency cannot be restored through conditional crisis lending; (iii) creating a euro area fund, financed by national contributions, that helps participating member countries absorb large economic disruptions; (iv) creating a synthetic euro area safe asset that would offer investors an alternative to national sovereign bonds; (v) reforming the euro area architecture by creating an independent fiscal watchdog and assigning the Presidency of the Eurogroup to the Commission.

banking systems to get preferential access to credit. Moreover, a sovereign concentration charge would have the effect of breaking the doom loop by resolving the banks' home bias in sovereign bond holdings.

The Franco-German proposal further suggests, differently from Gros and in line with the European Commission, the gradual disappearance of the national insurance schemes and their substitution with a common EU-wide scheme that could ensure "country-blind protection". The rationale for this lies in the acknowledgment that only a common scheme can establish full trust in the EDIS. In fact, deposit insurance works only if it acts fast, and its commitment is credible. In that sense, a system that merely reinsures the national insurance schemes of its members would arguably be slow, and still be subject to uncertainties due to national policies or disagreements at the EU level, as the case of Cyprus in March 2013 illustrated.

Contrarily to the country-blindness of depositors' service, the proposal instead puts forward a country-specific funding mechanism, through which the EDIS could take into account the still-existing differences between the banking systems of its member States. In particular, the authors calls for two approaches to differentiate funding across members. First, part of the fees should reflect country-specific characteristics, including the quality of a country's legal framework and creditor protection. These could be measured by several structural indicators, and be possibly evaluated by an independent agency or a reinforced European Systemic Risk Board. Second, in the case of a bank failure the corresponding payout should be levied on banks of the same country in the case of smaller idiosyncratic shocks, but mutualized in the case of systemic crises. Accordingly, the EDIS should consist of "national compartments", much like in the transition phase of the Single Resolution Fund. The system could instead achieve the mutualization of the costs of systemic crises in two ways: either by creating a common compartment, financed by each member with a fixed percentage of the premia, or by imposing a joint payout by each compartment in case one of them is depleted. In both cases, if a national compartment is depleted, the system will replenish it by levying fees on the banks of the corresponding country, irrespective of their individual risk profiles. If instead the common fund is depleted, the European Stability Mechanism will refill it with a loan, reimbursed ex post by the banks with an appropriate fee increase.

To sum up, the Franco-German proposal works "in the spirit of a reinsurance system", in the sense that the first losses are always covered by the country of the banks in distress. However, different from Gros (2015), this proposal suggests a different institutional setting based on the provision to depositors of a direct insurance for their deposits, rather than a reinsurance of the insurance schemes of their corresponding country. Moreover, the authors highlight that the country-level differentiation that the system incorporates "would have nothing to do with a country's sovereign credit, and would therefore not contribute to the bank-sovereign vicious circle".

Quantitative evaluation of the EDIS

While the preceding proposals are both based on sound economic reasoning and address the perceived issues of the European Commission's proposal, it is true that they miss empirical foundations. In a recent paper, Carmassi *et al.* (2018) try to provide them, by questioning whether the fear of cross-border subsidization of the banking systems in more vulnerable countries by less vulnerable ones is well-founded. To this end, they develop a quantitative early-warning model that accounts for bank- and country-specific risk factors, and use it to calculate the possible exposure of the EDIS to bank failures under different stress scenarios.[8] Their findings highlight that a fully funded EDIS, targeting 0.8 percent of total covered deposits, would be sufficient to offset losses in banking crises even more severe than the 2007-2009 global financial crisis, without imposing excessive costs on either small or large banks. This result hinges only in part on the introduction of the EDIS per se, but more on the fact that European banks have already significantly reduced their risk profiles and increased their loss-absorbing capacity. In turn, this is a consequence of higher levels of bank capital, and of the recent introduction of the requirement on Total Loss-Absorbing Capacity (TLAC) for Global Systemically Important Banks (G-SIBs) and the new Minimum Requirement for own funds and Eligible Liabilities (MREL) for all European banks.

In the second part of the paper, the authors instead calculate the bank-specific risk-based contributions to a common insurance fund based on different indicators, both at bank and country level, and compare them to the EDIS exposures developed in the first part of the paper. Importantly, the authors calculate the contribution of each bank relative to its peers in the whole Banking Union, and simulate aggregate as well as country-specific financial shocks. Under these assumptions, they find that a fully-fledged EDIS would create cross-subsidization among member States (calculated as the exposure-to-contribution ratio) only for extremely high loss rates, even higher than those that emerged during the global financial crisis.

Finally, the authors analyze cross-subsidization in mixed insurance schemes with national compartments, like in the Franco-German proposal. To this end, they modify the bank contributions by calculating them relative to national instead of union-wide benchmarks. Moreover, they assume that both the national compartments and the common compartment target a fixed 0.4 percent of total covered deposits, so that the overall target remains 0.8 percent. In other words, while inside each country the bank contributions change, the total contribution of each country to the common compartment is fixed at 0.4 percent of total domestic covered deposits. The results indicate that with

8. The stress scenarios are a simultaneous failure of the riskiest 3 or 10 percent of banks, in combination with different levels of bank losses, ranging from 5 to 25 percent of total assets in the case of resolution and 7.5 to 37.5 percent in the case of insolvency.

the introduction of national compartments Cyprus, Germany, Spain, Greece, Ireland, Italy and Portugal would pay less than under a fully-fledged EDIS, while Austria, Belgium, Finland, France, Lithuania, Luxembourg, Malta, the Netherlands and Slovenia would pay more. This would have in turn an effect on cross-subsidization, but only in extreme scenarios. Under a simultaneous failure of the riskiest 3 percent of the banks in the Banking Union, simulations show an increase in cross-subsidization limited to Spain and Greece for losses of 25 percent of total assets at resolution and 37.5 percent at insolvency. Under a simultaneous failure of the riskiest 10 percent of the banks in the Banking Union, the simulations instead show an increase in cross-subsidization also in Belgium and Cyprus.

To sum up, from their analysis the authors conclude that cross-subsidization can be seen as a form of desirable risk-sharing mechanism against severe crises. However, this is different from a systematic unwarranted transfer of resources from the less vulnerable to the more vulnerable countries of the Banking Union, for which there seems to be no evidence regardless of its design with or without national compartments.

Concluding remarks

The present synopsis summarized the economic case for completing the European Banking Union with a common deposit insurance scheme. It highlighted its role against self-fulfilling bank runs that might trigger sovereign crises in a doom loop, and spread across the Banking Union via several channels of financial contagion. In that respect, the main takeaways that one can draw from the economic literature are three. First, the mere coordination of national insurance schemes, or the institution of a reinsurance system among them, might not be sufficient to calm depositors' self-fulfilling expectations, because deposit insurance can be successful only if it acts fast and its commitment to intervene is perceived as credible. Second, there seems to be little evidence that a common deposit insurance scheme will generate an unwarranted cross-subsidization from the less vulnerable to the more vulnerable countries of the Banking Union. Third, there exist several mechanisms to correct bank incentives against the effects of legacy risk and moral hazard, and many of them (like tighter capital regulation, and the TLAC and MREL requirements) are already into place. Put differently, risk sharing and incentives are not incompatible, but can complement and mutually reinforce each other.

Finally, I conclude with some words of caution. As deposit insurance only aims at traditional commercial banking, it does not take into account that financial innovation and an increased regulatory burden might push investors and banks towards the unregulated shadow banking system. In

principle, institutions operating in this market also issue short-term money-like liabilities akin to bank deposits, thereby engaging in liquidity and maturity transformation. In that sense, they are prone to self-fulfilling uncertainty in the same way as traditional commercial banks (Gorton 2019) and might represent a further channel of financial fragility and contagion, as the global financial crisis famously showed (Gorton and Metrick 2012). Hence, the completion of the Banking Union with the introduction of the EDIS will most probably not resolve self-fulfilling uncertainty once and for all. More than ever, a continuous monitoring of the financial system, over and above standard banking supervision, will be necessary to guarantee financial stability in the future.

References

Acharya, Viral V. and Tanju Yorulmazer (2007). "Too many to fail – An analysis of time-inconsistency in bank closure policies." *Journal of Financial Intermediation*, 16(1), 1–31.

Aghion, Philippe, Patrick Bolton, and Mathias Dewatripont (2000). "Contagious bank failures in a free banking system." *European Economic Review*, 44(4-6), 713–718.

Allen, Franklin and Douglas Gale (1998). "Optimal Financial Crises." *Journal of Finance*, 53(4), 1245–1284.

Allen, Franklin and Douglas Gale (2000). "Financial Contagion." *Journal of Political Economy*, 108(1), 1–33.

Allen, Franklin and Douglas Gale (2004). "Financial Intermediaries and Markets." *Econometrica*, 72(4), 1023–1061.

Altavilla, Carlo, Marco Pagano, and Saverio Simonelli (2017). "Banks Exposures and Sovereign Stress Transmission." *Review of Finance*, 21(6), 2103–2139.

Anginer, Deniz, Asli Demirguc-Kunt, and Min Zhu (2014). "How does deposit insurance affect bank risk? Evidence from the recent crisis." *Journal of Banking & Finance*, 48, 312–321.

Bagehot, Walter (1873). *Lombard Street: A Description of the Money Market*. Henry S. King & Co., London, UK.

Bénassy-Quéré, Agnès, Markus K. Brunnermeier, Henrik Enderlein, Emmanuel Farhi, Marcel Fratzscher, Clemens Fuest, Pierre-Olivier Gourinchas, Philippe Martin, Jean Pisani-Ferry, Hélène Rey, Isabel Schnabel, Nicolas Véron, Beatrice Weder di Mauro, and Jeronim Zettelmeyer (2019). "How to reconcile risk sharing and market discipline in the euro area." In *Risk Sharing Plus Market Discipline: A New Paradigm for Euro Area Reform?*, edited by Jean Pisani-Ferry and Jeronim Zettelmeyer. CEPR Press.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist (1996). "The Financial Accelerator and the Flight to Quality." *The Review of Economics and Statistics*,

78(1), 1–15.

Bolton, Patrick and Olivier Jeanne (2011). "Sovereign Default Risk and Bank Fragility in Financially Integrated Economies." *IMF Economic Review*, 59(2), 162–194.

Boyd, John H., Gianni De Nicolo, and Tatiana Rodionova (2019). " Banking crises and crisis dating: Disentangling shocks and policy responses." *Journal of Financial Stability*, 41(1), 45–54.

Brusco, Sandro and Fabio Castiglionesi (2007). "Liquidity Coinsurance, Moral Hazard, and Financial Contagion." *Journal of Finance*, 62(5), 2275–2302.

Carletti, Elena, Giovanni Dell'Ariccia, and Robert Marquez (2019). "Supervisory Incentives in a Banking Union." *Management Science*, forthcoming.

Carmassi, Jacopo, Sonja Dobkowitz, Johanne Evrard, Laura Parisi, André Silva, and Michael Wedow (2018). "Completing the Banking Union with a European Deposit Insurance Scheme: who is afraid of cross-subsidisation?" ECB Occasional Paper Series No. 208.

Chen, Yehning (1999). "Banking Panics: The Role of the First-Come, First-Served Rule and Information Externalities ." *Journal of Political Economy*, 107(5), 946–968.

Cifuentes, Rodrigo, Gianluigi Ferrucci, and Hyun Song Shin (2005). "Liquidity risk and contagion." *Journal of the European Economic Association*, 3(2-3), 556–566.

Constâncio, Vitor (2012). "Contagion and the European debt crisis." In *Financial Stability Review*, vol. 16, pp. 109–121. Banque de France.

Craig, Ben, Margherita Giuzio, and Sandra Paterlini (2019). "The effect of possible EU diversification requirements on the risk of banks' sovereign bond portfolios." ESRB Working Paper Series No. 89.

Dasgupta, Amil (2004). "Financial Contagion through Capital Connections: A Model of the Origin and Spread of Bank Panics." *Journal of the European Economic Association*, 2(6), 1059–1084.

De Santis, Roberto A. (2018). "Redenomination Risk." *Journal of Money, Credit and Banking*, forthcoming.

Demirguc-Kunt, Asli and Enrica Detragiache (2002). "Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation." *Journal of Monetary Economics*, 49(7), 1373–1406.

Demirguc-Kunt, Asli, Edward Kane, and Luc Laeven (2015). "Deposit insurance around the world: A comprehensive analysis and database." *Journal of Financial Stability*, 20, 155–183.

Diamond, Douglas W. (1984). "Financial Intermediation and Delegated Monitoring." *Review of Economic Studies*, 51(3), 393–414.

Diamond, Douglas W. and Philip H. Dybvig (1983). "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy*, 91(3), 401–419.

Diamond, Douglas W. and Raghuram R. Rajan (2005). "Liquidity Shortages and Banking Crises." *Journal of Finance*, 60(2), 615–647.

Drehmann, Mathias and Nikola Tarashev (2013). "Measuring the systemic importance of interconnected banks." *Journal of Financial Intermediation*, 22(4), 586 – 607.

Ennis, Huberto M. and Todd Keister (2009). "Bank Runs and Institutions: The Perils of Intervention." *American Economic Review*, 99(4), 1588–1607.

European Central Bank (2017). "Financial integration in Europe." Tech. rep., European Central Bank.

European Commission (2015). "Towards the completion of the Banking Union." Tech. rep., European Commission.

European Commission (2017). "On Completing the Banking Union." Tech. rep., European Commission.

European Commission (2019). "Capital Markets Union: progress on building a Single Market for capital for a strong Economic and Monetary Union." Tech. rep., European Commission.

European Parliament (2018). "Report on Banking Union - Annual Report 2018 (2018/2100(INI))." Committee on Economic and Monetary Affairs.

Farhi, Emmanuel and Jean Tirole (2017). "Deadly Embrace: Sovereign and Financial Balance Sheets Doom Loops." *Review of Economic Studies*, 85(3), 1781–1823.

Freixas, Xavier (2003). "Crisis Management in Europe." In *Financial Supervision in Europe*, edited by J. Kremers, Dirk Schoenmaker, and P. Wierts, pp. 102–119. Edward Elgar.

Freixas, Xavier, Bruno Parigi, and Jean-Charles Rochet (2000). "Systemic risk, interbank relations, and liquidity provision by the central bank." *Journal of Money, Credit and Banking*, 32(3), 611–638.

Goldstein, Itay and Ady Pauzner (2004). "Contagion of self-fulfilling financial crises due to diversification of investment portfolios." *Journal of Economic Theory*, 119(1), 151–183.

Goodhart, Charles A.E. (1987). "Why Do Banks Need a Central Bank?" *Oxford Economic Papers*, 39(1), 75–89.

Gorton, Gary B. (2019). "The Regulation of Private Money." NBER Working Paper No. 25891.

Gorton, Gary B. and Andrew Metrick (2012). "Getting up to Speed on the Financial Crisis: A One-Weekend-Reader's Guide." *Journal of Economic Literature*, 50(1), 128–150.

Gros, Daniel (2013). "Principles of a Two-Tier European Deposit (Re-)Insurance System." CEPS Working Document No. 287.

Gros, Daniel (2015). "Completing the Banking Union: Deposit Insurance." CEPS Working Document No. 335.

Gros, Daniel and Dirk Schoenmaker (2014). "European Deposit Insurance and Resolution in the Banking Union." *Journal of Common Market Studies*, 52(3), 529–546.

Grubel, Herbert G. (1979). "A Proposal for the Establishment of an International Deposit Insurance Corporation." Essays in International

Finance No. 133.

Holmstrom, Bengt and Jean Tirole (1998). "Private and Public Supply of Liquidity." *Journal of Political Economy*, 106(1), 1–40.

Horvath, Balint, Harry Huizinga, and Vasso Ioannidou (2015). "Determinants and Valuation Effects of the Home Bias in European Banks' Sovereign Debt Portfolios." CEPR Discussion Paper No. 10661.

Jokivuolle, Esa and George G. Pennacchi (2019). "Designing a Multinational Deposit-Insurance System: Implications for the European Deposit Insurance Scheme." *ifo DICE Report*, 17(1), 21–25.

Juncker, Jean-Claude, Donald Tusk, Jeroen Dijsselbloem, Mario Draghi, and Martin Schulz (2015). "Completing Europe's Economic and Monetary Union." Tech. rep., European Commission.

Kareken, John and Neil Wallace (1978). "Deposit Insurance and Bank Regulation: A Partial-Equilibrium Exposition." *Quarterly Journal of Economics*, 69(2), 207–222.

Lagunoff, Roger and Stacey L. Schreft (2001). "A Model of Financial Fragility." *Journal of Economic Theory*, 99(1-2), 220–264.

Leonello, Agnese (2018). "Government Guarantees and the Two-Way Feedback between Banking and Sovereign Debt Crises." *Journal of Financial Economics*, 130(3), 592–619.

Nouy, Danièle (2017). "Everything is connected - The international dimension of banking regulation and supervision." Speech at King's College, London (UK).

Ratnovski, Lev (2009). "Bank liquidity regulation and the lender of last resort." *Journal of Financial Intermediation*, 18(4), 541–558.

Repullo, Rafael (2018). "Hierarchical bank supervision." *SERIEs*, 9(1), 1–26.

Repullo, Raphael (2005). "Liquidity, Risk Taking and the Lender of Last Resort." *International Journal of Central Banking*, 1(2), 47–81.

Rochet, Jean-Charles and Jean Tirole (1996). "Interbank Lending and Systemic Risk." *Journal of Money, Credit and Banking*, 8(4), 733–762.

Schoenmaker, Dirk (2018). "Resolution of International Banks: Can Smaller Countries Cope." *International Finance*.

Tucker, Paul (2015). "How Can Central Banks Deliver Credible Commitment and Be "Emergency Institutions"?" In *Central Bank Governance And Oversight Reform*, edited by John H. Cochrane and John B. Taylor, pp. 1–30, Stanford University, Hoover Institute, Hoover Press.

Valle-e-Azevedo, João and Diana Bonfim (2019). "Deposit Insurance and Cross-Border Banks." *ifo DICE Report*, 17, 14–20.

Van Rompuy, H., J.M. Barroso, Jean-Claude Juncker, and Mario Draghi (2012). "Towards a Genuine Economic and Monetary Union." Tech. rep., European Commission.

Wallace, Neil (1996). "Narrow Banking Meets the Diamond-Dybvig Model." *Federal Reserve Bank of Minneapolis Quarterly Review*, 20(1), 3–13.

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