



EUROPEAN CENTRAL BANK

EUROSYSTEM

Statistics Paper Series

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Leverage interactions:
a national accounts approach

No 19 / January 2017

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Abstract

The policy focus on excessive leverage in the euro area has raised interest in developing comprehensive analytical approaches to better understand the interrelationship between leverage and deleveraging processes across economic agents. In particular, the interplay between government debt and private leverage is attracting increasing attention in the current context of simultaneous deleveraging adjustments. However, analyses of the subject are generally partial in that they fail to take into account feedback effects on balance sheet positions across economic agents. This paper attempts to clarify these cross-agent interlinkages by examining concepts, relationships and restrictions taken from the national accounts framework. Hence, the paper presents a mechanism that captures how increased leverage in certain agents contributes, *ceteris paribus*, to a reduction in leverage in the rest of the economy. The novelty of the underlying framework for leverage behaviour is that it takes the financial assets held by agents into consideration.

JEL classification: E01, E62, H3, H6.

Keywords: indebtedness, leverage, national accounts, balance sheet approach.

Non-technical summary

The current economic situation in the euro area presents macroeconomic imbalances in several euro area countries, as communicated by the European Commission on March 2016 under the Macroeconomic Imbalance Procedure.¹ A particular source of macroeconomic imbalances is when the private sector consolidated debt threshold of 133% of GDP, or the general government sector debt-to-GDP ratio of 60% of GDP, is exceeded.

Notwithstanding the direct adverse effects that high sector indebtedness has per se, it is clear that there are cross-sector implications of indebtedness that should also be taken into account. These stem from the simple fact that economic agents present interlinked balance sheets, since “every liability is an asset”. While this is a basic accounting relationship, it has consequences that are not fully captured by the mainstream indebtedness indicators. For instance, debt-to-income or debt-to-GDP ratios ignore this and do not capture how sector debt developments relate to developments in the overall balance sheet structure by sector.

In this paper we use a leverage ratio to understand leverage interactions. In particular, we postulate the “leverage multiplier”, which consists in the ratio of net assets to debt. Net assets are defined as the difference between assets – financial and non-financial – and debt.

The use of net assets in the leverage definition allows the use of the national accounts linear restrictions to impose constraints on leverage, a framework that does not require the establishment of any kind of assumption at the microeconomic level. In particular, we derive a basic cross-agent accounting restriction by virtue of which the sum of net assets across the economy is equal to the sum of non-financial assets and equity assets.

As a consequence of that restriction, debt increases by an agent to finance the acquisitions of new non-financial assets or equity, and debt increases impacting (negatively) the net assets of that agent, both have a positive effect on the net assets of the rest of the economy. Accordingly, decreases in the leverage multiplier caused by debt increases would translate into increases in the multiplier(s) of other agents.

These inter-agent bounds suggest the possibility of “crowding-in” effects of debt: ceteris paribus, debt increases by one agent have the effect of increasing the leverage multiplier of, say, at least one other agent. In other words, that second agent can now increase its own debt while keeping its leverage multiplier unchanged. The debt increase has then created room for further debt increases by

¹ Regarding euro area countries, “excessive imbalances” are found in Cyprus, France, Italy and Portugal; while “imbalances” are found in Germany, Ireland, Spain, the Netherlands, Slovenia and Finland. Note that Greece is under surveillance in the context of the EU/IMF macroeconomic adjustment programme.

(an)other agent(s) (room understood as more debt for the same multiplier).
Conversely, debt decreases reduce the debt capacity of other agents.

In this paper we explore in detail these interlinkages when driven by transactions in assets and debt, but the underlying mechanism is also at work when the changes in the multiplier are caused by asset price developments. The specific interplay between government debt and private leverage is discussed, reiterating the possible crowding-in effect of government debt on private debt. This effect must be considered together with the classical counter “crowding-out” effect that government debt might entail through its impact on the cost of finance and access to financing markets. The specific macroeconomic conditions might have implications for which effect is dominant: in situations of high interest rates crowding-out effects might play the most prominent role, whereas in situations of close-to-zero interest rates the crowding-in effects derived from the impact of debt on net assets might more than offset the negative impact that additional debt has on the cost of finance.

1 Introduction

Since 2008 the economic and financial crisis has progressively reaffirmed concerns about the economic imbalances across euro area countries and the imperative need to understand country divergences and the interrelationship between the various imbalances in greater depth. The facts are that, although the euro area – at the aggregated level – was relatively balanced in terms of current account up to 2012, the situation masked large imbalances in a number of euro area countries and sectors (ECB, 2012).² This has been explained as the consequence of the prolonged period of credit expansion prior to the crisis related to deeper financial market integration, convergence to low nominal interest rates and misalignments in asset prices. These sustained current account imbalances have resulted in large debt accumulation in the countries presenting external deficits.

The current debate acknowledges the need for rebalancing within the euro area (sometimes referred to as the “great rebalancing”), which implies a deleveraging or reduction in the stock of gross debt held on non-financial private sector (households and non-financial corporations) balance sheets, but also in the financial sector and general government depending on the country-specific situation.

Debt-to-GDP or income ratios are traditionally taken as the relevant economic variables in this context, while other measures of indebtedness – particularly debt-to-assets – tend to be ignored. In fact, the term “leverage” is often used to denote simply debt (if any, deflated by GDP or income), ignoring other measures linked to the balance sheet structure. Thus, relevant empirical research on the linkages between debt and growth (as in Reinhart and Rogoff (2010), Checherita and Rother (2010) and Cecchetti et al. (2011)) consider debt (deflated) as the variable of interest.³

² Although the accumulation of country-specific and sector-specific imbalances and the associated monitoring (e.g. the European Union’s Broad Economic Policy Guidelines – BEPG – and the Stability and Growth Pact – SGP) are previous to the crisis, there were not enough binding mechanisms in place, and those available – mainly for fiscal imbalances – were not activated where necessary. Against this background, the European Commission in 2011 put in place a reinforced surveillance and enforcement mechanism – the EU’s Macroeconomic Imbalance Procedure (MIP). The MIP is based on assessment by the application of the alert mechanism (preventive arm), which helps to identify and correct short-term deteriorations and long-term build-ups of imbalances on the basis of alert thresholds. In the case of serious imbalances, an Excessive Imbalance Procedure (EIP) could be opened against an EU country (corrective arm). The basic indicators relate to external imbalances (current account balance, net international investment position, real effective exchange rate, export market shares and nominal unit labour cost) and internal imbalances (deflated house prices, private sector credit flow, private sector debt and general government debt, and the unemployment rate).

³ There is some debate about thresholds for debt-to-GDP ratios. For government debt, the maximum ratio ranges from 85% of GDP (e.g. Cecchetti, Mohanty and Zampolli, 2011) to a ratio of about 90-100% of GDP (e.g. Checherita and Rother, 2010). For the Excessive Deficit Procedure (EDP) administrative purposes in the European Union, the threshold set for the general government sector is 60% of GDP. The literature refers to a ratio of around 90% of GDP for non-financial corporations, and of around 85% of GDP for households (Cecchetti et al., 2011). A novelty in the European context (MIP) is the inclusion of private sector debt (consolidated) as a percentage of GDP, with a threshold of 133%. At the same time, recent theoretical research on a small open economy shows that debt-level targeting rules might work better as a (debt and output) stabilisation tool when GDP is not taken in the denominator (Boeing-Reicher, 2016).

Although the design of the Macroeconomic Imbalance Procedure (MIP – see footnote 2) in the European context⁴ is a step in the right direction for preventing and correcting macroeconomic imbalances, the focus is – as in the research on leverage mentioned above – based on deflated debt only. Furthermore, no attention is paid in the MIP context to possible interactions of indicators and, in particular, between the debts of the various sectors. This scenario resembles the situation before 2008, when the analytical focus was on the measurement of general government debt, ignoring its possible relation to mounting private debt, which was seen as irrelevant in a sort of Lawson doctrine bias (according to the “Lawson doctrine”, current account deficits due to private sector behaviour are not a concern and should not be subject to public intervention – see Corden (1977)).⁵

The underlying line of reasoning throughout this paper is that mainstream debt analysis, focusing on GDP ratios, overlooks the asset dimension of debt and fails to capture a basic economic relationship and its implications: that every liability of an agent is also the asset of another agent in the economy.⁶ We believe that this aspect is becoming more central to understanding the dynamics of debt and its macroeconomic implications.

Our methodological contribution consists in examining cross-balance sheet interactions⁷ by considering the impact of debt on the asset side of the agents holding it. In this way, we circumvent the two most important shortcomings of the conventional sector debt analysis: (i) that it focuses only on individual (sector) debt, ignoring that it is the counterpart of assets of other agents, and (ii) that it also focuses only on one side of the balance sheet, the liability side, abstracting from the collateral role played by the asset side. To address the second shortcoming, we depart from the traditional way debt is measured, i.e. against an income measure, typically GDP, and we refer debt to the asset side of the balance sheet through a “leverage multiplier”. In addressing the first shortcoming, debt interactions are formulated in terms of leverage multiplier interactions. This allows us to shed new light on related questions, such as the implications of simultaneous debt reductions across the board, or whether debt may have crowding-in effects on the debt of other agents.

Accordingly, this paper describes the accounting identities that link developments in assets and debt within and across agents, making use of the national accounts methodological framework. The “national accounts” are a complete, comprehensive

⁴ Regulation (EU) No 1176/2011 of the European Parliament and of the Council of 16 November 2011 on the prevention and correction of macroeconomic imbalances and Regulation (EU) No 1174/2011 of the European Parliament and of the Council of 16 November 2011 on enforcement measures to correct excessive macroeconomic imbalances in the euro area.

⁵ For a recent paper emphasising the need to focus on total debt, as opposed to government debt only, and balance of payments issues, see van Nieuwenhuyze (2013).

⁶ Notable exceptions exist in the literature where links between liabilities and assets are explicitly taken into account. Particularly relevant is the literature on stock-flow consistent (SFC) models (see Godley and Lavoie, 2007, for a reference and Caverzasi and Godin, 2013, for a review), rooted in the work on flows of funds by Copeland (1949) and the multi-asset model approach of Tobin (see his Nobel Prize Lecture, 1982), and heir to the “Saldenmechanik” of Stützel (1958).

⁷ Our work focuses on balance sheets and is therefore in line with the so-called “balance sheet approaches” to macroeconomic analysis (IMF, 2009; Allen et al., 2002).

analytical system that, first and foremost, enables the interaction of debt across economic agents to be formalised as accounting identities.⁸ These inter-agent leverage restrictions are “low-level” micro relationships that stem from the intrinsic nature of assets and liabilities and require no assumption regarding the agent’s microeconomic behaviour.

The paper proceeds as follows. Section 2 presents the structure of a balance sheet, as seen in the national accounts conceptual framework, and the resulting accounting restrictions across agents. Section 3 focuses on the leverage multiplier and explains the basic mechanism at play in cross-agent balance sheet interactions through leverage. Section 4 discusses debt crowding-in effects and debt rebalancing opportunities that could result from leverage interactions. Section 5 concludes.

⁸ Although it is usual to exploit national accounts identities to understand sector interplays in the flow-of-funds analysis based on transactions, a similar use of national accounts identities for stock analysis and individual agent interlinkages is not common. Our paper contributes to clarify inter-sector and inter-agent links on the basis of these national accounts identities.

2 A conceptual framework for cross-agent sectoral balance sheet interactions

Table 1 shows what a stylised balance sheet for a given sector or institutional unit (hereafter “agent”) would look like using the national accounts framework, although using non-standard asset groupings, such as “broad debt” and “equity” (term used in a slightly different way from that in the national accounts manuals).

In our characterisation, the asset side, denoted as \bar{A}_i for agent/sector i , comprises financial assets that represent claims against other agents – in the form of (broad) debt instruments, D^i , and equity instruments, E^i , as defined below for liabilities– and non-financial assets, A_i .

The liabilities are divided into broad debt (D_i), here understood as pre-established payment obligations (of principal and/or interest) at some point(s) in the future incurred by the debtor agent/sector i vis-à-vis the creditor agent/sector, and equity (E_i), here including all other kinds of payment obligations, in particular those whose amounts are linked to the performance of the asset side of the issuer’s balance-sheet. Broad debt and equity are alternative ways of financing the build-up of assets.

Although it is not a standard national accounts concept, our analysis relies on this “broad debt” concept (also referred to simply as “debt” in the rest of the paper) and the related concept of “net assets” (NA_i), for the definition of leverage. Net assets correspond to the arithmetical difference between assets and broad debt liabilities. It can be broken down into equity and net worth (NW_i). These can also be defined, respectively, as the parts of the net assets that are materialised in financial claims (equity) and of those that are not materialised in financial claims (net worth). As indicated, equity and broad debt claims are differentiated by the fact that the former embody variable payment obligations related to developments in net assets, while the latter represent pre-established payment obligations.

Additionally, agents face claims and obligations that are not realised on the balance sheet because of their contingent or implicit nature. **Table 1** places these elements among the “off-balance-sheet items” and, although they are not the focus of our paper, they are given due consideration.

Table 1
Stylised agent/sector balance sheet⁹

		Total assets	Total liabilities
Balance sheet items (ESA 2010)	ESA 2010 code	Broad debt instruments held (D^i)	Broad debt instruments issued (D_i)
	AF.2	Currency and deposits held	Currency and deposits
	AF.3	Debt securities held	Debt securities issued
	AF.4	Loans granted	Loans received
	AF.52	Investment fund shares or units (money market and non-market shares/units), held	Investment fund shares or units (money market and non-market shares/units)
	AF.6	Claims on insurance, pension and standardised guarantee schemes	Insurance, pension and standardised guarantee schemes
	AF.7	Claims arising from financial derivatives and employee stock options	Obligations arising from financial derivatives and employee stock options
	AF.8	Other accounts receivable	Other accounts payable
		Equity held (E^i)	Equity issued (E_i)
	AF.511 + AF.512	Equity (listed and not listed shares) held	Equity (listed and not listed shares)
	AF.519	Other equity held	Other equity
		Non-financial assets (A_i)	Net worth (NW_i)
	AN.1	Produced assets	
	AN.2	Non-produced assets	
Off-balance-sheet items	N/A	Contingent assets	Contingent liabilities
	N/A	Implicit assets	Implicit liabilities

Source: Authors, based on Hartwig Lojisch, Rodríguez-Vives and Slavík (2011).

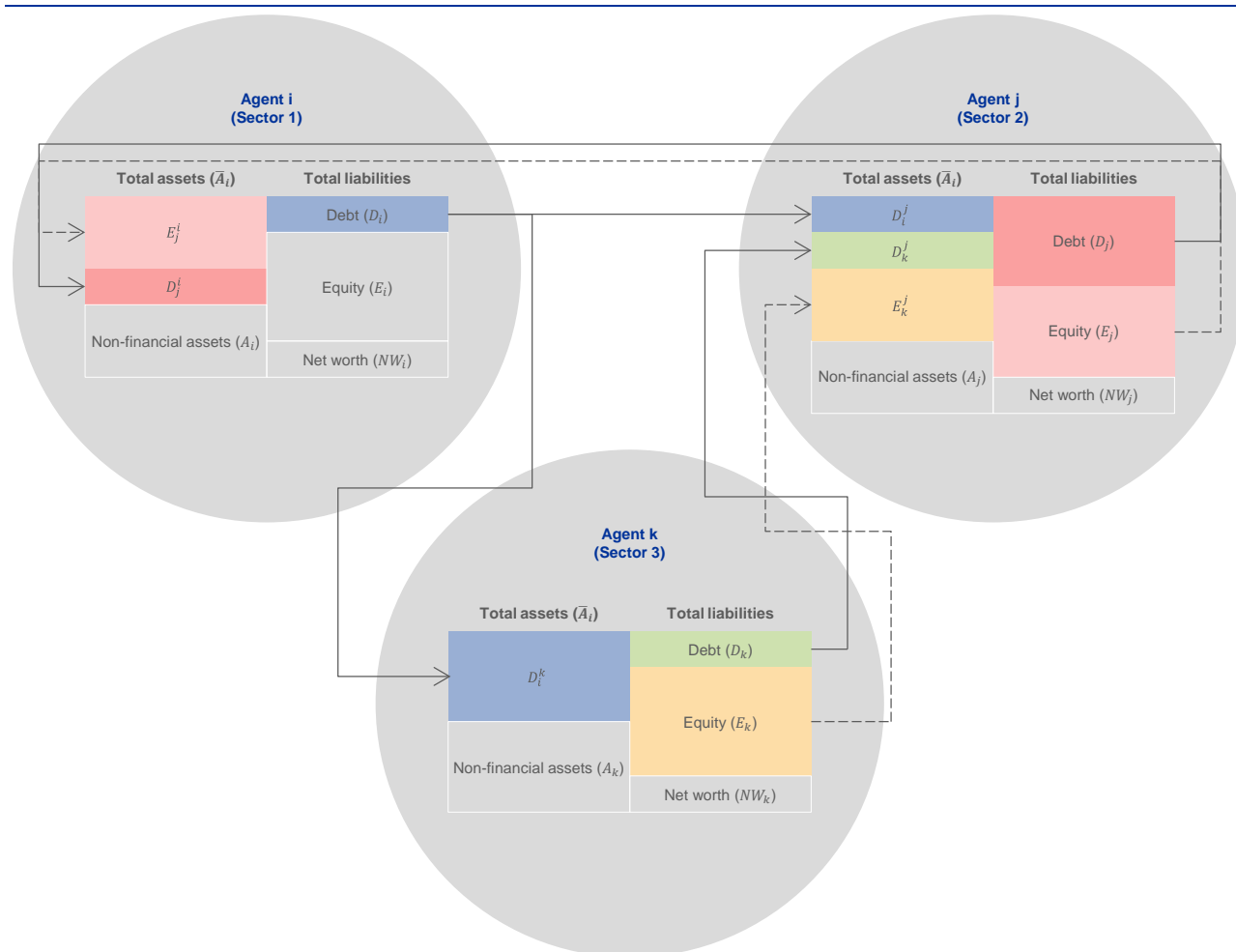
Stating the obvious, debt liabilities are financial assets from the perspective of the agents that hold them. Debt, like equity, reflects funds that are raised by certain agents in the economy to meet imbalances between income, current expenditure and investment. At the same time, they materialise the financial investment of other agents, i.e. the allocation of an excess of income and financing over current and capital expenditure.

Figure 1 illustrates a simple interplay of debt (as well as equity) liabilities and the corresponding holdings for three agents (i, j and k) belonging to three different sectors (1, 2 and 3). The solid arrows represent the debt links between issuers and holders.

⁹ Under our definition of broad debt and equity, items AF.52 (investment fund shares), F.6 (insurance technical reserves) and F.7 (financial derivatives) are not easy to classify as the associated cash flows might or not be seen as belonging to the category of pre-established payments. A more granular breakdown of these instruments would help in deciding the classification under one category or the other. In the case of financial derivatives whose payments are not pre-established *sensu stricto*, they are, at the same time, in almost all cases not linked to the asset side of the agent for which the derivative is a liability (moreover, its nature as a liability or asset might even change during its life). For the sake of simplicity, **Figure 1** puts them all under broad debt.

As examples of off-balance-sheet items, contingent assets for the financial sector comprise, for instance, the collateral recorded in banks against loans to households or financial corporations. Contingent liabilities can be the explicit one-off guarantees provided by the general government sector to financial corporations. Implicit assets for the general government sector are, for instance, additional revenue stemming from future taxes, while implicit liabilities on the general government sector's balance sheet would include, for instance, the net obligations for future social security benefits.

Figure 1
Sector balance sheet and an example of cross-sectoral debt holdings



Source: Authors.

The links between assets and debt have strong consequences for cross-agent net assets. *Ceteris paribus*,¹⁰ an increase in the debt of one agent deteriorates the net asset position of that agent but improves the net asset positions of other agents – those that hold the new debt – thus leaving the overall net asset position in the economy unchanged.

Algebraically, this can be derived starting from expression (1-a), which formally defines the net assets of an agent, where the subscripts are to be understood as referring to an individual agent:

¹⁰ In national accounts, the expression “*ceteris paribus*” often lacks meaning as the analytical system is comprehensive and complete. In this context we refer to the absence of any other change on the balance sheet of the sector, except net worth: indeed, a change in debt, accompanied by all other elements on the balance sheet remaining constant, implies an increase in expenditure over income and a reduction in net worth. Alternatively, an increase in debt might be accompanied by acquisitions of assets. The implications of that case are discussed in relation to restriction (3).

$$NA_i = \bar{A}_i - D_i = (A_i + E^i + D^i) - D_i \quad (1-a)$$

As discussed above, debt issued by one agent is also debt held by (an) other(s). The **cross-agent restriction** that ties debt, assets and net worth developments is then given by:

$$\sum_i D_i = \sum_i D^i \quad (2)$$

As a result of (1-a) and restriction (2), the total net assets of all agents in an economy are equal to the sum of the non-financial assets and equity:

$$\sum_i NA_i = \sum_i A_i + \sum_i E^i \quad (3-a)$$

Or, applying differences:

$$\sum_i \Delta NA_i = \sum_i \Delta A_i + \sum_i \Delta E^i \quad (3-b)$$

Restriction (3-b) is key to our framework, leading to the following statement: changes in the debt of an agent that finance the acquisition of newly produced non-financial assets or equity issuance, or that reduce the net assets of the agent, result in increases in the net assets of other agents.

Of the three cases mentioned, the first two entail no change in the net assets of the agent issuing debt, namely the acquisition of non-financial assets and equity. However, the right-hand side of restrictions (3) would increase in such cases by the increase in non-financial assets or equity, requiring the "emergence" of net assets for some (an) other agent(s). In the case of a reduction in the agent's net assets, the fact that the right-hand side of (3) has to remain unchanged (the reduction in the agent's net assets implies that the increase in debt is not accompanied by the acquisition of any asset) makes increases in the net assets of other agents essential so that (3) holds. The only case where an increase in the debt of a given agent does not bring about net asset increases for other agents is when such an increase in debt is used to acquire more debt (of other agents) or pre-existing non-financial assets and equity.

The restriction (3) corresponds to a classical national accounts one operating for economic transactions, as opposed to stocks or changes in stocks. Applying the difference operator to (1-a), we obtain a relationship for changes in net assets, assets and debt. These can, in turn, be broken down into transactions in assets and

debt and other flows of assets and debt, including price changes.¹¹ However, by focusing only on **transactions**, we obtain:

$$na_i = a_i + e_i + B\theta_i \quad (1-b)$$

where lower letters stand for changes due to transactions and $B\theta_i$ denotes the net change in debt and equity held and issued ($B\theta_i = (e^i + d^i - e_i - d_i)$), which is known in national accounting as net lending (+) / net borrowing (-).

Cross-agent restrictions similar to (2) apply for transactions in debt and equity,¹² leading to $\sum_i B\theta_i = 0$ and to:

$$\sum_i na_i = \sum_i a_i + \sum_i e^i \quad (3-c)$$

i.e. the total increase in net assets is equal to the sum of total transactions in non-financial assets (gross capital formation (investment) using national accounts terminology) and the total issuance of equity.

Alternatively, calculations on the basis of net worth, as opposed to net assets, can be undertaken. As net worth is defined as $NW_i = \bar{A}_i - D_i - E_i$ the cross-agent restriction is then $\sum_i NW_i = \sum_i A_i$. Transactions in net worth (also called savings, S_i in national accounts) are $nw_i = S_i = a_i + B\theta_i$ and $\sum_i S_i = \sum_i a_i$.¹³

¹¹ Together with assets and debt price changes, other flows include other balance sheet changes, such as write-offs and bilateral debt cancelations.

¹² Note also that $\sum_i E_i = \sum_i E^i$.

¹³ This is the accounting identity between savings and (real) investment in a closed economy. An open economy can be modelled by the presence of an auxiliary, dummy agent, which would encompass all debt and equity counterparts outside the economy of the agents in the economy. The sector "Rest of the World" in national accounts is this dummy agent.

3 The rationale of the proposed leverage multiplier

This section describes the proposed measurement of leverage, the leverage multiplier, by referring to its arithmetics and by illustrating, by means of a numerical example, the interactions of the multiplier in an economy of three agents.

3.1 The arithmetics of leverage interactions

Leverage ratios capture, in a single number, the balance between debt and equity on an agent's balance sheet, thus distinguishing, as explained above, between commitments of fixed future payment streams (debt) and future payments streams that are not fixed but linked to future cash inflows stemming from the agent's assets (equity). In that respect, a leverage ratio is an indicator of debt sustainability, as it indicates the agent's ability to liquidate debt through the disposal of assets.

From a macroeconomic point of view, leverage ratios also convey information on the ability and cost of incurring additional debt, as they measure assets not linked to current debt, or "excess" assets which can be used as collateral for further debt incurrence. In other words, a leverage metrics gives a measure of excess capacity for debt incurrence or a debt sustainability margin or leeway.¹⁴ It can be used in conjunction with the more traditional debt-to-income ratios (generally GDP) to analyse the macroeconomic effects of debt.

Of the various ways to measure leverage, in this paper we use a "leverage multiplier",¹⁵ defined as the ratio of net assets to debt (see, for example, Cour-Thimann and Winkler, 2013):

$$m_i = \frac{NA_i}{D_i} = \frac{\bar{A}_i - D_i}{D_i} \quad (4)$$

Leverage decreases when the ratio increases, indicating that there is a higher excess of assets over debt (a higher capacity for further debt incurrence).¹⁶ Box 1

¹⁴ The role of collateral in macroeconomic fluctuations was popularised after the introduction of the concept of the financial accelerator (see, for instance, Bernanke and Gertler, 1989). The prominent role of the balance sheet was, however, already present in influential papers like Mishkin (1978) and can be traced back to Fisher (1933).

¹⁵ In spite of the use of the term "multiplier", (5) is really a balance sheet ratio and it is not the authors' intention to use it as a multiplier in the same sense as the "money multiplier". However, that use would also be appropriate provided that the necessary assumptions on balance sheet stability are made. Note that the money multiplier is also a balance sheet ratio, turned into a multiplier on the basis of assumptions regarding balance sheet stability.

¹⁶ This specific analytic expression for leverage is chosen for the sake of clarity in the discussion below, in particular to use restriction (3), although a number of other fully equivalent expressions could also have been used. A popular definition of leverage is given by the *leverage ratio* $l_i = D_i/A_i$, which directly relates debt to assets. Note that $l_i = 1/(m_i + 1)$ and that increases in m_i imply reductions in l_i and in leverage.

illustrates the evolution of the leverage in the private sector at the euro area level for the last 15 years.

The particular choice for the leverage multiplier, as defined above, is justified by the fact that it can be easily expressed in terms of national accounts restrictions (1) to (3). Moreover, for analytical purposes changes in leverage can be decomposed into those caused by changes in net assets (i.e. operating through the numerator of the ratio in (4) and those leaving the net assets unchanged (and therefore operating only through the denominator of the ratio, i.e. changes caused by equal increases in assets and debt). On those operating through the numerator, we can distinguish between the changes caused by asset price variation affecting \bar{A}_i , and the transaction-based changes in net assets, which are governed by equation (1-b).

Following the cross-agent relationships in (3), a cross-agent expression for a weighted leverage multiplier can be constructed as follows:

$$m = \frac{\sum_i NA_i}{\sum_i D_i} = \frac{\sum_i (\bar{A}_i - D_i)}{\sum_i D_i} = \frac{\sum_i (A_i + E^i)}{\sum_i D_i} \quad (5)^{17}$$

We turn now in more detail to the interaction between assets and debt and the implication for leverage across agents. In particular, we ask what the impact is of an increase in the debt of one agent on overall leverage, *ceteris paribus*. First, the leverage of the agent will obviously increase (leverage multiplier decrease) but, second, the leverage multipliers of the agents holding the new debt issued will also increase if they experience an increase in their net asset positions by virtue of restriction (3).

This second effect can be captured in the case of transactions by means of the following expression, which describes how the leverage of agent *j* is affected by an increase in the debt of agent *i*:

$$\Delta^i m_j = \frac{1}{D_j} d_i^j \quad (6)$$

where $\Delta^i m_j$ stands for the change in the leverage multiplier of agent *j* when the debt of agent *i* changes via transactions and d_i^j is the acquisitions of debt of *i* by *j*.¹⁸

¹⁷ As indicated above, leverage can also be defined in terms of net worth, rather than net assets. In such a case, expression (5) would be $m^c = \sum_i A_i / \sum_i D_i$, which is the ratio of non-financial assets to total debt. Moreover, the ratio for a group of agents can be defined in a consolidated manner excluding cross-agent debt: $m_S^c = \sum_{i \in S} A_i / \sum_{i \in S, j \in S} D_i^j$ for the net worth option, where *S* is the set of agents in the grouping, \bar{S} is the set of other agents and D_i^j is the debt issued by *i* and held by *j*. Note that $\sum_{i \in S, j \in S} D_i^j = \sum_{i \in S} D_i - \sum_{i, j \in \bar{S}} D_i^j$. Note also that it is not possible to calculate a consolidated ratio for the total economy as in (6) as $S = \forall i$ and then $\sum_{i \in S} D_i = \sum_{i, j \in S} D_i^j$.

¹⁸ For the sake of simplicity we assume that the impact on net assets of agent *j* travels via direct holdings of debt issued by *i*. The effect on net assets of agent *j* might also be the result of a more complicated chain of asset holdings involving agents other than *i* and *j*.

Note that, in the particular case of debt issued to finance mismatches between income and expenditure (and therefore reducing issuing agent's net assets), $d_i^j = B9_j$, and since $\sum_{j \neq i} B9_j = -B9_i$, we then obtain expression (7-a), where $m_{\{\forall j, j \neq i\}}$ is the weighted leverage ratio for the set of all agents other than agent i:

$$\Delta m_{\{j, j \neq i\}} = \frac{-B9_i}{\sum_{j \neq i} D_j} \tag{7-a}$$

3.2 A numerical example of leverage multiplier interactions in a three-agent economy

Figure 2 provides an illustrative example of the impact of debt on the leverage multiplier of the various agents. In our simplified economy there are three agents and, for the sake of simplicity in the calculations, equity does not exist.¹⁹

Moreover, the increase in debt in the example is not accompanied by an increase in assets, and therefore corresponds to the financing of an imbalance between revenue and expenditure and a decrease in net assets. Similar cross-agent results would be obtained with increases in debt that are net asset neutral, i.e. when debt is issued to finance the acquisition of assets, as that would still have a potential impact on the net assets of other agents (see Section 2, expressions (1) to (3)). The changes are all assumed to correspond to transactions.

Figure 2
Leverage in a three-agent economy

Moment t		Moment t+1		Changes from t to t+1	
	total debt (D)		total debt (D)		total debt (D)
	Holding agent		Holding agent		Holding agent
	a b c		a b c		a b c
Issuing agent	a	a	a	a	a
	b	b	b	b	b
	c	c	c	c	c
Total Debt (D ⁱ)	7 5 3	8 5 4	1 0 1	1 0 1	1 0 1
Assets (A _i)	13 14 12	13 14 12	0 0 0	0 0 0	0 0 0
D ⁱ -D _i	1 -1 0	2 -3 1	1 -2 1	1 -2 1	1 -2 1
Net assets (NA _i =A _i +D ⁱ -D _i)	14 13 12	15 11 13	1 -2 1	1 -2 1	1 -2 1
leverage (m _i)	2.33 2.17 4.00	2.50 1.38 4.33	0.17 -0.79 0.33	0.17 -0.79 0.33	0.17 -0.79 0.33

In moment t, agent a holds non-financial assets totalling 13 monetary units and financial assets (debt held) totalling 7 (5 vis-à-vis agent b and 2 vis-à-vis agent c),

¹⁹ We do not allow intra-player debt, i.e. $D_i^j = 0$, as results from our players being agents or institutional units. A representation of institutional sectors, as opposed to agents, would in general allow for intra-player debt. However, we allow for cross-player, across-balance-sheet simultaneous positions, i.e. $D_i^j \neq 0$ and $D_j^i \neq 0$ are possible at the same time. This is, in general, possible for individual units but probably circumscribed to specific kind of agents: financial intermediaries or non-financial corporations belonging to the same corporate grouping. In any case, a matrix representation of real economic agents, as in Figure 2, would probably be much sparser. We provide here a dense matrix for the sake of example.

and is indebted by an amount of 6 monetary units (4 vis-à-vis agent b and 2 vis-à-vis agent c), which leads to net assets of 14 and a leverage multiplier of 2.33. Agent b is more leveraged, with a multiplier of 2.17, while agent c is less leveraged (multiplier of 4). The overall aggregated weighted leverage multiplier is 2.6.

In moment t+1, agent b incurs additional debt of 2, which is acquired by agent a (1 unit) and agent c (also 1 unit). As a result, its leverage multiplier decreases to 1.38. At the same time, this reduction in agent b's net assets translates into increases in the net assets of the other two agents and in the corresponding leverage multipliers (by 0.17 and 0.33). For the grouping composed of agents a and c, the multiplier increases by 0.22, as given by expression (7-a), with $B\theta_b = -2$, while the overall leverage multiplier decreases by 0.39.

The additional debt incurred by agent b improves the balance sheet position of the other agents and increases their capacity to incur further debt. This results from the increase in their net assets – collateral against which they can raise debt (greater debt is now consistent with the same multiplier). **Figure 3** shows this by assuming that agent c follows a strategy of keeping its leverage multiplier constant, issuing debt against any increase in its net assets; this can be referred to as “leverage targeting” (see, for instance, Adrian and Shin, 2010).

Figure 3
Leverage in a three-agent economy. Agent c undertaking leverage targeting

Moment t	Moment t+1	Changes from t to t+1																																																																																																																																																
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Agent c now tries to keep its multiplier unchanged at 4 by incurring additional debt amounting to 0.2, fully subscribed by agent a. The initial increase in the debt of one agent then has an additional “crowding-in” effect on the debt of the other agents. It is relevant to note that such a crowding-in effect occurs without damaging the balance sheet position of the agents affected (see agent c in **Figure 3**), which keep their leverage multipliers unchanged. It can then be argued that the additional increase in debt comes with all its benefits (allegedly economic growth) and none of its possible drawbacks (balance sheet vulnerabilities linked to increased leverage).

This mechanism intuitively suggests a potential for leverage rebalancing in certain economies. Agents with a sound leverage position could engage in additional leverage without exposing themselves to severe balance sheet risks. This would result in increases in net assets of the other agents, who could take on further debt without increasing their leverage. Similarly, agents facing a need to deleverage –

agents presenting a low leverage multiplier – could follow a smoother adjustment path with less sharp debt reductions if, at the same time, other better-positioned agents increased their debt and reduced their leverage multipliers.²⁰

Box 1

Leverage in the non-financial private sector

This box aims to show the evolution of non-financial private sector leverage (non-financial corporations, households and non-profit institutions serving households, including public market producers – see Table 1.1 of ESA 2010) in the euro area in conjunction with government indebtedness (general government sector, S.13). Here we use a debt-to-asset ratio, as opposed to the leverage multiplier explained in Section 3. This different choice is justified by the fact that the debt-to-asset ratio provides a more direct measure of indebtedness (conversely, the leverage multiplier is better suited to reveal the connections between leverage and the standard national accounts concepts, as pursued in the main text of this paper). At the same time, the leverage ratio (l_i) and leverage multiplier (m_i) are linked by the relationship $l_i = 1/(m_i + 1)$ (see footnote 16), which means that the evolution of the debt-to-asset ratios shown in this box are roughly the inverse of the evolution of the leverage multipliers.²¹

As illustrated in **Chart 1**, since the end of 2008 the overall deleveraging trend of the non-financial private sector has clearly been compensated for by a steady increase in government indebtedness. The government debt measure at aggregated level has increased by almost 40 percentage points of GDP since 2008, i.e. from a ratio of 67% in 2008 to 106% in 2015. It is worth mentioning that this metric of government indebtedness is derived from national accounts valuation, consolidation and definition criteria, and is a different concept from the standard Excessive Deficit Procedure (EDP) debt definition used for administrative purposes in the European Union (which is measured in nominal terms, consolidated, and includes only a sub-set of total government liabilities). EDP government debt stood at 90% of GDP by the end of 2015.

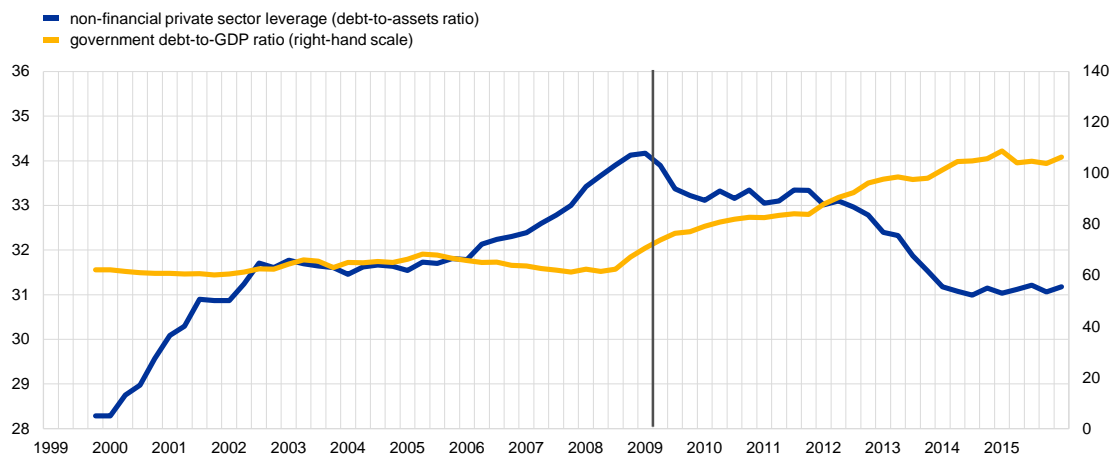
²⁰ The examples in Figures 2 and 3 are based on increases in debt which are not accompanied by increases in non-financial assets, i.e. debt that finances consumption or other current expenditures. Similar results would be obtained if the examples were complicated by introducing increases in non-financial assets, i.e. debt-financing investment.

²¹ We exclude the financial sector from this analysis as the leverage ratio plays a different function there. The nature of the financial sector is precisely engage in leverage as intermediary; it can be said that its activity consist in providing leverage to the economy.

Chart 1

Non-financial private leverage and government indebtedness

(percentages)



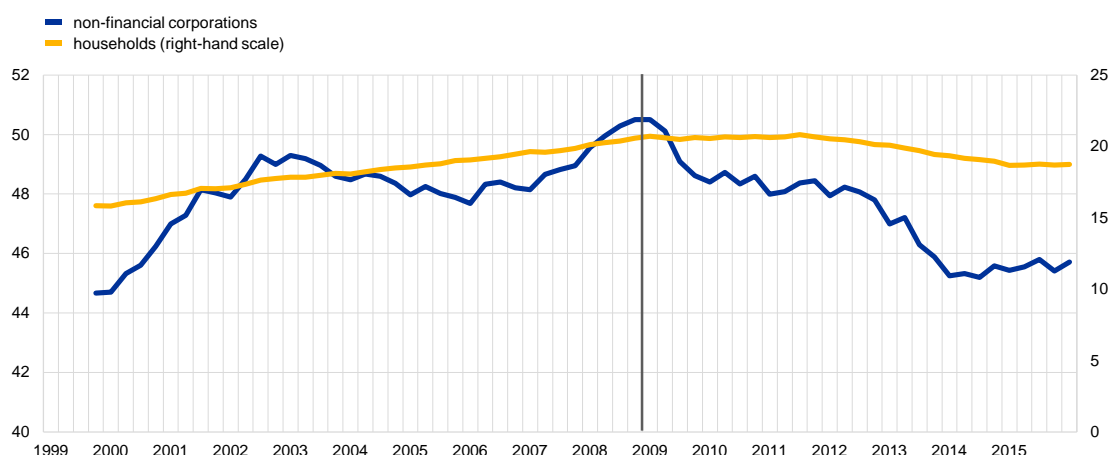
Source: Author's calculations based on national accounts data (market value).

Overall, the non-financial private leverage ratio fell from 34% in the fourth quarter of 2008 to a rate of 31% in the first quarter of 2016. In particular, the non-financial private sector deleveraging pattern since 2008 has been driven mainly by deleveraging in the non-financial corporation sector, which has fallen by around 5 percentage points (from 51% in 2008 to 46% in the first quarter of 2016), as can be seen in **Chart 2**. While deleveraging among non-financial corporations started immediately after the onset of the crisis, deleveraging among households gained momentum only later, around mid-2011. The drop was also less significant, amounting to roughly 2 percentage points (from 21% in 2011 to 19% in the first quarter of 2016), and smoother. The household sector is currently fairly close to its pre-crisis leverage ratio, while the non-financial corporations sector has a considerably lower ratio.

Chart 2

Non-financial private leverage

(percentages)



Source: Author's calculations based on national accounts data (market value).

Looking ahead, a continuation of the recent deleveraging trend is foreseen, although a degree of deceleration has been observed in recent quarters, likely linked to the latest non-standard monetary policy measures adopted by the ECB.²²

At the same time, although it is clear that the adjustment is taking place in the euro area private sector as a whole, the aggregated results hide a large cross-country heterogeneity that deserves further analysis.

Before concluding Section 3, two additional remarks refer to the role of financial intermediaries, which could also be integrated in this very simplified framework (see Girón and Rodríguez-Vives, 2017). In real economies, interactions between agents, as described here, usually take place via agents that take and issue debt simultaneously against those agents that are ultimately changing their net asset positions. These distinct agents are what we denominate “financial intermediaries”. Financial intermediaries can be subject to conditions of leverage pressure or relative relief like any other agent, although the levels are usually higher than those of normal agents owing to their particular role as intermediaries. For crowding-in effects to manifest themselves and leverage rebalancing to be at work, these financial intermediaries should present leverage multipliers above a certain threshold, such that they can engage in debt without exposing themselves to unsustainable balance sheet vulnerabilities, i.e. without their leverage multiplier decreasing too much.

²² See Girón and Rodríguez-Vives (2017) on the impact of central bank leverage on other sectors' leverage.

4 The “crowding-in” effect of debt

The framework outlined in the previous sections provides a balance sheet perspective of the impact of the debt of one agent on the debt of other agents. Similarly, it can serve as an accounting framework for the impact of institutional sector debt on the debt of the rest of the sectors. For instance, the impact of government debt on private debt can be followed via equation (7-a), which would indicate that the leverage multiplier of the private sector increases as the general government deficit increases ($B9_{S13}$ refers to government deficit in this equation), *ceteris paribus*:

$$\Delta m_{\{j,j \neq i\}} = \frac{-B9_{S13}}{\sum_{j \neq i} D_j} \quad (7-b)$$

This is due to the increase in the net assets of the private agents that results from the issuance of government debt, i.e. it results from the private net lending that accommodates the net borrowing of the government. Such increases in private net assets and the corresponding improvement in balance sheet positions might lead some agents to increase their indebtedness. More private debt would then be consistent with the same or lower levels of private leverage through the mechanism explained in Section 3. We can call this a crowding-in effect of debt, in this case general government debt, but this analysis could be applied to other institutional sectors as well.

This result is at odds with traditional crowding-out effects, where the issuance activity of government would rather exert dominant pressure on private debt, pushing prices down and yields up, as additional supply of debt competes with investors' demand for debt (see, for instance, Carlson and Spencer, 1975). Higher fiscal deficits would lead to reduced amounts of funds being available to other borrowers.

The crowding-in effect that we describe above results from channels not fully taken into consideration by the literature. Here, we consider balance sheet effects on the side of the debt holders, which result from increases in net assets, associated decreases in leverage and increases in the collateral capacity to raise more debt. Furthermore, traditional crowding-out results from keeping the demand for assets constant against increasing supply in a traditional Walrasian equilibrium framework. By contrast, in the framework proposed above, the amount of funds borrowed/lent result from the interaction between heterogeneous multiple economic agents in response to changes in their idiosyncratic leverage multiplier.

At the same time, the presence of multiple agents not behaving the same way is also essential to understand the differences in outcomes from a sector imbalance perspective. In a traditional crowding-out approach, an increase in net borrowing of, for instance, the general government sector is immediately translated into an increase in net lending of the private sector (assuming a balanced external sector). This is linked to the Ricardian equivalence proposition, as the Ricardian consumer-

type will offset today increases in government deficits by higher private saving in the anticipation of future consolidation, thereby smoothening private consumption. The impact of government deficits on private surpluses is, of course, still true in the presence of balance sheet effects of the kind described in this paper for the whole of the sector – it could not be otherwise by virtue of the binding accounting restriction. However, the key outcome here is that such increases in private net lending at the aggregated level should be accompanied by some agents increasing their net borrowing position and others increasing their net lending position by more than what is directly triggered by the government net borrowing position. The increase in the total net lending of the private sector is therefore consistent with increasing private debt. This results from heterogeneous agents that present different leverage positions and different ways of reacting to changes in their leverage.

It is important to note that, as opposed to the strong relationship between the sector's net lending/net borrowing at macroeconomic level, the impact on individual agents' net lending/net borrowing via the leverage multiplier does not need to take place in any particular way. The crowding-out and crowding-in results are not in contradiction with each other. In the case of the general government sector, given its weight in the economy, its debt issuing activity will constitute a high competition for other agents seeking to place their debt and, therefore, exert a remarkable crowding-out effect. At the same time, also because of its size, the effect on the net assets of the other sectors is considerable, increasing their collateral and their ability to take on further debt.

Crowding-out balance sheet effects – in addition to the crowding-in balance sheet effects and the crowding-out transaction equilibrium effects – can also be derived from the framework described above if the effects of changes in asset prices are considered. Higher levels of government debt could have a negative impact on the value of the stock of government debt and, therefore, an upside effect on private leverage, limiting their ability to issue further debt. This effect might be particularly substantial if financial intermediaries are holding relatively high levels of government debt. The damage on the leverage position of the intermediaries caused by a fall in debt prices might then have a sizeable effect on the ability of private agents to increase indebtedness, as the intermediaries would find it difficult themselves to take on debt to intermediate.

Additionally, the prices of all types of assets, not only of government debt, might fall if there is an overall reduction in confidence as a result of increasing government debt. A general fall in asset prices would then have an additional negative effect on the leverage multipliers of the private agents and result in private debt “expulsions” to restore the multipliers.

Similarly, crowding-out results can be derived in the accounting framework provided here if implicit assets and liabilities are also considered (see [Table 1](#)). It can then be argued that a government deficit is neutral on private net assets because even though it increases bond holders' wealth it reduces that of tax payers (because bonds represent implicit liabilities; see Barro, 1974).

At the same time, it can be argued that certain economic conditions are more prone to government crowding-out effects, while others would rather favour crowding-in effects. Thus, in environments with very low interest rates and cost of finance, the rate rises caused by increasing government debt supply would not constitute a serious problem for accessing financing, especially if the rates are close to the zero bound. However, the increases in debt supply could have, in the same environment, substantial crowding-in effects via the mechanism explained in this paper, derived from increases in net assets and available collateral for other sectors. This is particularly true if government bonds are seen as “safe assets” and there is a shortage of eligible collateral.²³

²³ The possibility that crowding-in effects could dominate when interest rates are close to the zero bound would also underpin the choice of non-standard monetary policy measures that are more geared towards sustaining the level of global leverage or towards avoiding disorderly deleveraging chains (see Girón and Rodríguez-Vives, 2017).

5 Conclusions

This paper examines cross-agent leverage interactions (or balance sheet interactions). Such interactions derive from the fact that “every liability (of an agent) is an asset (of another agent)”, which links balance-sheets developments across economic agents. This is indeed a simple, obvious statement but its consequences, for example that debt accumulation is strongly linked to asset accumulation, seem not to be fully taken into account.

Mainstream indicators, such as debt-to-income or debt-to-GDP ratios, ignore how debt developments relate to developments in the overall balance sheet structure. More comprehensive indicators are therefore necessary to fill in this gap and complement the standard analysis. A first step in this direction could consist in using a debt-to-asset ratio or in combining an asset-to-GDP ratio with information on how these assets are financed by debt or equity (i.e. combined with an analysis of the implicit leverage behaviour).

An implication of the inter agent balance-sheet links is that the leverage developments for a given economic agent have repercussions on other agents' leverage developments. Inter-agent leverage links or even inter-sector leverage links are, however, not the focus in traditional debt monitoring. The case for leverage rebalancing is made in our paper by illustrating the relevance of heterogeneity in leverage at the microeconomic level. The study of leverage has to take place in an analytical framework that clearly allows for such inter-agent interactions. The efforts to introduce agent heterogeneity in mainstream general equilibrium models are only starting and the heterogeneity in leverage is still absent in the current debate.

This paper sheds light on the points above by making use of national accounts linear restrictions, a framework that does not pre-establish any kind of assumptions on behaviour at the microeconomic level. The derived leverage interlinkages respond to pure accounting relationships, and do not follow from heroic theoretical assumptions, for instance, on complete and efficient markets, which are usual in traditional general equilibrium frameworks. The relationships are, therefore, valid under any kind of theoretical settings, no matter how exotic.

Further research avenues could take advantage of the simple leverage interactions framework presented in this paper. For instance, a straightforward accounting relationship can be used to illustrate how governments could contribute to certain objectives of private sector deleveraging by fixing a private sector deleveraging path and examining the volume of private debt consistent with such a path and different fiscal policy scenarios. In a similar set-up we can better understand the pressure that ambitious government debt reduction plans may have on private leverage and debt. We can also see how changes in debt prices for a given sector, be it government or another, affect through leverage the possibilities of indebtedness of other sectors. Moreover, the analysis of the government's role could be extended to the analysis of the interactions with the central bank.

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Acknowledgements

The authors would especially like to thank the organisers of and participants in the Eurosystem Directorate General Economics Seminar “Sectoral Debt Sustainability in Individual Euro Area Countries” (June 2011) for their useful comments and suggestions to our preliminary work, from which this paper derives, and in particular to our discussant Angel Gavilán. We also thank the ECB’s Fiscal Policies Division and the Flow-of-Funds team for organising research forums during 2012 to discuss our key findings. Likewise, we wish to thank Henning Ahnert for his useful comments and the working groups of the ESCB Statistics Committee on Government Finance Statistics and Financial Accounts for their support with the data.

This work has benefited from the feedback of the Editorial Board of the Statistics Paper Series (ECB).

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ISSN	2314-9248 (pdf)	DOI	10.2866/127510 (pdf)
ISBN	978-92-899-2833-5 (pdf)	EU catalogue No	QB-BF-17-001-EN-N (pdf)