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Linda Kezbere, Henri Maurer

Deficit-debt adjustment (DDA) analysis: an analytical tool to assess the consistency of government finance statistics

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Abstract

This statistical paper describes and explains a specific tool enabling statisticians to gain additional insights and assess the consistency of government finance statistics (GFS): analysis of the deficit-debt adjustment (DDA), or stock-flow adjustment (SFA). The DDA reconciles two key government indicators – the government deficit/surplus and government debt. DDA analysis helps to establish whether these statistics are plausible and reliable by exploring the consistency between governments' non-financial accounts (measuring the government deficit/surplus) and financial accounts (measuring government debt at market value). It also takes into account valuation differences between the financial accounts and government debt measured at face value (Maastricht debt). Recent years' GFS for the euro area aggregate and the individual euro area countries (and, where useful, other EU Member States' data) are used to illustrate DDA analysis. The dataset bridging the government deficit and the change in government debt reveals many aspects of a government's economic policies. For instance, the components of the DDA shed light on its equity investments or privatisations, its use of investment in financial reserves, some aspects of its debt management and the accumulation of fiscal or social arrears.

Keywords: data quality, consistency, government finance statistics.

JEL Codes: H62, H63.

Non-technical summary

Government finance statistics (GFS) are politically sensitive in the context of the excessive deficit procedure (EDP). Quality assurance and the improved comparability of these data among EU countries have been at the forefront of Eurostat's statistical work for several years. GFS are also of high importance at the ECB, which closely monitors and contributes to this work.

This statistical paper describes and explains a specific tool enabling statisticians to assess the consistency of GFS in the context of one aspect of quality assessment: analysis of the deficit-debt adjustment (DDA), also referred to as the stock-flow adjustment (SFA). The DDA reconciles two key government indicators – the government deficit/surplus and government debt. DDA analysis is one of the tools that help ascertain that these statistics are plausible and reliable. It explores the consistency between governments' non-financial accounts (measuring the government deficit/surplus) and financial accounts (measuring government debt at market value) and takes into account valuation differences between the financial accounts and government debt measured at face value (Maastricht debt).

The effective use of DDA analysis as a data quality tool for GFS requires detailed methodological knowledge of the concepts of the EDP and GFS, insights into GFS compilation and knowledge of specific institutional frameworks around these statistics. This paper provides a short summary of the data available for DDA analysis purposes and illustrates the institutional arrangements for compiling GFS in the euro area countries that may impact consistency among different GFS datasets compiled by different statistical institutions.

The DDA is, in essence, the difference between the government deficit/surplus in a given year and the change in the stock of government debt over the same year. The three pillars of the DDA are the three groups of factors which can contribute to the DDA – namely, (i) transactions in main financial assets, (ii) valuation effects and other changes in the volume of debt, and (iii) time of recording differences and remaining factors.

This paper explains which detailed data can be used to explore each of the pillars and the risks for GFS quality if there are large items that cannot be explained. Recent years' GFS for the euro area and the euro area countries (and, where useful, other EU Member States' data) are used to illustrate DDA analysis.

That illustration shows that over the period 2011-16 the largest DDA items were related to government transactions undertaken in the context of the financial crisis. In addition, ECB analysis for EU countries over a number of years has shown that the vast majority of the DDA is well explained. However, it is essential to remain vigilant and continue to closely monitor the DDA and its components to ensure that the quality of data remains high.

This paper concludes that the usefulness of DDA analysis depends greatly on the access to and exchange of information on underlying developments in the DDA. In addition, coordination between the different institutions compiling data is very important to ensure consistency between government non-financial and financial accounts and government debt, and thus contribute to the quality of GFS.

1 Introduction

The government deficit and government debt are well-known macroeconomic indicators used in economic analysis and fiscal surveillance, especially in the context of the excessive deficit procedure (EDP) in EU countries. Those data are politically sensitive, as failure to adhere to the reference values laid down in the protocol on the EDP (deficit up to 3% and "Maastricht debt" up to 60% of GDP) leads to corrective measures. Recent experience of the sovereign debt crisis in the euro area and individual large and recurrent revisions in the fiscal data since 2009 have also focused public attention on fiscal data.

In this framework, the reliability and quality of the data used in the EDP are of the utmost importance. The government deficit and government debt are the most prominent statistical outputs of the wider dataset of the government accounts (also known as government finance statistics – GFS), which themselves are part of the economy-wide national accounts data.

GFS aim to be as close as possible to a fair economic representation of government transactions and balance sheets. Nevertheless, due to the broad range of activities undertaken by the numerous entities in all sub-sectors of general government and the multiple data sources, the quality of some elements of fiscal data is open to question.

The extensive quality controls carried out for GFS include monitoring the correct sector classification of government entities, distinguishing non-financial transactions from financial transactions, and checking for internal consistency within the government accounts dataset. For GFS, more than other statistical domains, detailed data controls are performed by Eurostat via EDP dialogue visits to Member States. Moreover, intensive methodological work in the European Statistical System (ESS) and the European System of Central Banks (ESCB) aims to achieve the best possible harmonisation of GFS among the Member States[1].

This statistical paper describes and explains a specific tool enabling GFS statisticians to assess the consistency of GFS in the context of one aspect of quality assessment: analysis of the deficit-debt adjustment (DDA), also referred to as the stock-flow adjustment (SFA). The DDA reconciles the balance of the non-financial accounts (deficit or surplus of general government) with the change in government debt measured at face value (Maastricht debt). Analysis of the DDA assesses whether the observed differences between the deficit/surplus and the change in debt are sound and justified. Consequently, it helps to ascertain whether the government deficit/surplus and government debt are both plausible and reliable. Recent years' GFS for the euro area and the euro area countries (and, where useful, other Member States' data) are used to illustrate DDA analysis.

[1] Both the ESS and the ESCB are responsible for European statistics.

2 Legal and institutional frameworks around DDA data and GFS

The way that government debt (also called "Maastricht debt") is to be measured for the purposes of the excessive deficit procedure (EDP)[2] is defined in Council Regulation (EC) No 479/2009[3]. It represents total consolidated gross debt across the following categories of government liabilities (as defined in ESA 2010[4]): currency and deposits (AF.2), debt securities (AF.3) and loans (AF.4). All of those are measured at nominal value at the end of the period to reflect the amount that general government is contractually committed to repaying to creditors at maturity. This valuation is different from the market price valuation used in the ESA 2010 framework. This means that interest that has accrued but has not yet been paid is not included in government debt, as it is not part of the nominal valuation. Moreover, this definition also excludes some financial liabilities, such as financial derivatives and other accounts payable (which include trade credits). Financial derivatives are excluded from the definition on the basis that nominal values cannot be determined in the way that they can for other financial instruments. Other accounts payable were excluded on the basis that they are considered to be short-term claims and the quality of the relevant data was not satisfactory. In the meantime, there has been some improvement in the quality of those data (at least as regards data relating to trade credits and advances), so other accounts payable may be reconsidered with a view to including them in the definition of Maastricht debt.

Council Regulation (EC) No 479/2009 also defines the government surplus/deficit with reference to ESA 2010, referring to the surplus (+)/deficit (-) of the general government sector as net lending (+)/borrowing (-) (B.9). ESA 2010 also details how government revenue and expenditure are to be compiled. The government surplus/deficit is equal to revenue minus expenditure.

To provide a framework for the compilation and collection of these Maastricht deficit and debt data, the Regulation requires that Member States report EDP-related data to Eurostat twice a year at end-March and end-September. These data are defined in "EDP notification tables". These are designed specifically to provide a consistent

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2 The 1992 Maastricht Treaty organised the conduct of multilateral fiscal surveillance in the EU. The current provisions on the EDP are set out in the 2012 consolidated version of the Treaty on the Functioning of the European Union (TFEU) and Council Regulation (EC) No 1467/97 of 7 July 1997 on speeding up and clarifying the implementation of the excessive deficit procedure (OJ L 209, 2.8.1997, p. 6). The TFEU obliges Member States to comply with budgetary discipline by preventing their deficit-to-GDP and debt-to-GDP ratios from exceeding reference values of 3% and 60% respectively, as defined in the protocol on the EDP annexed to the TFEU.

3 Council Regulation (EC) No 479/2009 of 25 May 2009 on the application of the Protocol on the excessive deficit procedure annexed to the Treaty establishing the European Community (OJ L 145, 10.6.2009, p. 1).

4 Regulation (EU) No 549/2013 of the European Parliament and of the Council of 21 May 2013 on the European system of national and regional accounts in the European Union. The European System of National and Regional Accounts (ESA 2010) comprises binding methodological rules to ensure comparability of national accounts aggregates, as well as a compulsory data transmission programme (ESA 2010 TP).

framework, with a link to national budgetary aggregates and a link between government net lending/net borrowing (B.9) and changes in government debt.

The DDA is a concept that has been developed to check the consistency of the measurement of the government surplus/deficit and government debt. The provision of data on the DDA is not defined in a separate legal act, but is part of several data collections. The EDP notification tables include data on the DDA for the most recent four years covered by the EDP reporting requirement. Following each EDP notification in April and October of each year, Eurostat also publishes a report on stock-flow adjustment (SFA) data[5] – another name for the DDA. The ECB carries out such quality checks for EU countries on a regular basis in cooperation with the national central banks (NCBs) as part of its assessment of the quality of GFS. As part of this assessment, information on the reasons for high DDA values is collected and evaluated for all EU countries on a systematic basis. While this paper includes some of the most relevant examples of these explanations for illustrative purposes, it is not possible to include detailed explanations of all cases. However, the vast majority of the explanations that have been provided in recent years have been plausible and well founded. In a few cases, this exercise has resulted in the revision of some data.

The EDP data are usually based on and consistent with the detailed set of GFS compiled and provided in the context of ESA 2010. These data are both annual and quarterly. NCBs in the euro area are also required to provide the ECB with a set of annual GFS (including data for DDA analysis) on the basis of the requirements in the ECB's GFS Guideline.

GFS relate to general government, which is composed of four sub-sectors: central, regional (or state) where appropriate, local and social security funds. It excludes public (i.e. government-controlled) corporations, which are not classified within the general government sector when they are market producers (i.e. when the sales of the producer cover at least 50% of the production costs).

In an integrated manner, GFS present government non-financial accounts (revenue, expenditure and non-financial balance (deficit or surplus)), government financial accounts (transactions in financial assets and liabilities, other economic flows and financial balance sheets) and government debt as measured at the end of the time period (see, for example, the Annual Fiscal Position report). As such, this presentation is similar to business accounting, where the profit and loss accounts and the balance sheet are presented together.

The table in Annex 1 shows the availability of data under the ESA 2010 TP and the ECB's GFS Guideline for the non-financial and financial government accounts and government debt, showing which particular data from these datasets are necessary to perform DDA analysis.

Although they are separate datasets, the non-financial and financial accounts and government debt are very closely linked. The resulting balances from the non-financial accounts (B.9) and the financial accounts (B.9f) should ideally be equal. However, due

[5] See, for example, the stock-flow adjustment data for October 2017.

to incomplete and varied data sources, there are, in practice, sometimes differences ("statistical discrepancies") between B.9 and B.9f.

The difference between the non-financial and financial accounts lies in the nature of the transactions recorded – financial transactions concern a financial instrument, while non-financial transactions involve a product or a transfer. However, most non-financial transactions have a financial transaction as a counterpart, linking these datasets closely. For example, a government purchase of goods or services is recorded as a non-financial transaction with a financial transaction as a counterpart. The specific financial transaction will depend on the type of payment for the goods and services – a decrease in currency and deposit assets if paid in cash; an increase in other accounts payable liabilities if not paid immediately, but giving rise to a trade credit; or an increase in loan liabilities if financed by taking out a loan from a bank.

Financial transactions are those that involve only financial instruments. For instance, a repayment of a loan decreases loan liabilities and simultaneously decreases currency and deposit assets.

However, there is a range of transactions that are not easily identified as non-financial or financial. For example, governments' capital injections in corporations are normally recorded as an acquisition of equities (financial transaction) by the government in the public corporation when the return on this investment is expected to be comparable with the investment of a private investor. However, they may also be recorded as a non-financial transaction (i.e. expenditure) – a capital transfer from the government to the public corporation – when no return is expected or the government is not expected to get the investment back at all, such as in cases where the public corporation has significant amounts of accumulated losses. Another example may be the granting of a loan – normally a purely financial transaction, but if there is reliable information that the intention is not to repay the loan, it should be recorded as a capital transfer (expenditure impacting the non-financial balance).

2.1 Institutional frameworks

At country level, there may be several institutions (statistical authorities) involved in the compilation and provision of GFS. Usually these are the national statistical institutes (NSIs) and the NCBs. Ministries of finance are often closely involved as main source-data providers, but in a few countries they also have responsibility – shared with the NSI – for compiling the final EDP data or GFS. It is very important in such circumstances to ensure the professional independence of statistical compilers, reinforced by a legislative framework, to avoid political interference in statistical work. Table 1 shows the distribution of institutional responsibilities between different organisations in the euro area countries in terms of the compilation of GFS. While the lead is often taken by the NSIs for the non-financial data, the NCBs are also often active in compiling the financial accounts of the government and/or data on Maastricht debt.

Given the diverse institutional arrangements and the fact that, in addition to different data sources, GFS datasets may be compiled by different compiler institutions, ensuring the consistency of GFS across the different datasets is a challenge. Where discrepancies exist, there is a need to ensure that these are minimised by swift communication and cooperation between the compilers involved.

Table 1

Institutional arrangements for GFS production

	Non-financial accounts	Debt	Financial accounts
Belgium	NCB	NCB	NCB
Germany	NSI	NCB	NCB
Estonia	NSI	NSI	NCB
Ireland	NSI	NSI	NSI
Greece	NSI	NSI	NCB
Spain	NSI	NCB	NCB
France	NSI	NSI	NCB
Italy	NSI	NCB	NCB
Cyprus	NSI	NSI	NSI
Latvia	NSI	NSI	NSI
Lithuania[1)]	NSI/MoF	NSI	NSI
Luxembourg	NSI	NSI	NSI
Malta	NSI	NSI	NSI
Netherlands	NSI	NSI	NSI
Austria	NSI	NSI	NSI
Portugal	NSI	NCB	NCB
Slovenia	NSI	NSI/MoF	NCB
Slovakia	NSI	NSI	NSI
Finland	NSI	NSI	NSI

Notes: NSI = national statistical institute; NCB = national central bank; MoF = ministry of finance.
1) The ministry of finance compiles the EDP deficit data.

3 Definition and decomposition of the DDA

Government deficits and changes in debt are closely related, as we can expect that a deficit during a specific time period will give rise to a corresponding increase in the debt level, as the government will need to borrow to cover its financing needs. By contrast, a government surplus will enable the repayment of government debt and thus decrease the government debt level.

In practice, the change in the debt level in any given period can be larger or smaller than the corresponding deficit or surplus, but we can usually expect the two to be broadly in line with one another.

For example, in 2016 the general government deficit of euro area governments totalled €166 billion (due to expenditure being €5,138 billion and revenue €4,972 billion) and the change in debt was €137 billion (€9,457 billion at the end of 2015 against €9,594 billion at the end of 2016). The difference between the deficit and the change in debt was -€29 billion (= €137 billion – €166 billion). In other words, the change in debt was €29 billion lower than the deficit.

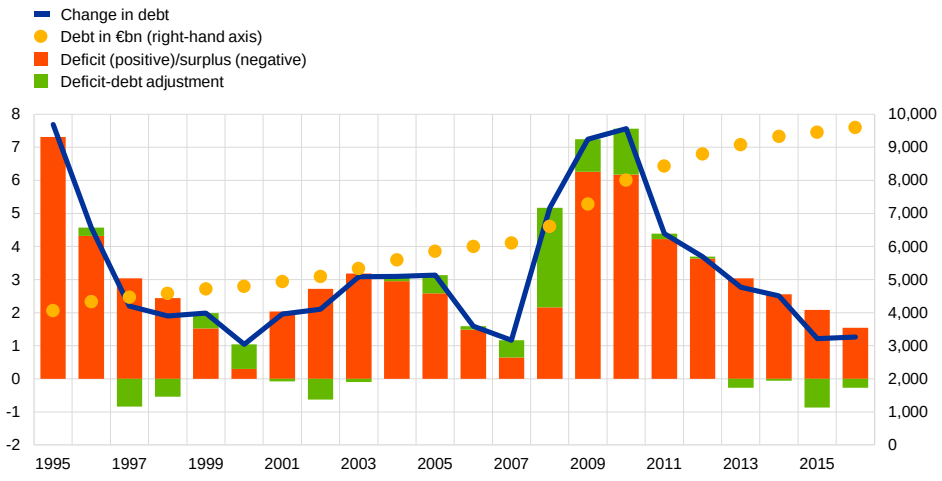
The difference between the change in debt and the deficit is known as the deficit-debt adjustment (DDA) or, more generally, the stock-flow adjustment (SFA).

To illustrate, Chart 1 shows the euro area government deficit, the DDA and the change in debt since 1995. It demonstrates how both the deficit/surplus and the DDA contribute to the change in debt. While the DDA fluctuated between positive and negative up to the mid-2000s, it was large and positive at the height of the financial crisis (2008-10), and it has turned negative in more recent years. The reasons for this variation over the business cycle will be explained further in the following sections.

Chart 1

Euro area government deficit, change in debt and deficit-debt adjustment

(percentage of GDP, unless otherwise indicated)



Source: ECB.

Note that use of the DDA involves two indicators that are methodologically distinct: **a flow** during a time period (deficit/surplus) and **a stock** (debt) at the end of the same time period (hence the name "stock-flow adjustment"). In fact, the deficit (surplus) is a negative (positive) balance in the general government accounts that arises when resources are lower (greater) than usage (in other words, when revenue is lower (higher) than expenditure) and when transactions in financial assets are lower (greater) than transactions in liabilities during a given period, resulting in net borrowing (net lending) (B.9 and B.9f). This means that the deficit/surplus is a flow that covers the creation, transformation, exchange, transfer or extinction of an economic value over a period of time. On the other hand, the change in debt results from a change in a stock that reflects end-of-period positions for two periods. Due to these conceptual differences, reconciliation between Maastricht debt and a deficit/surplus may be a demanding task.

Differences between the deficit/surplus and the change in general government debt are inevitable due to the different methodological approaches and the different data sources used for the compilation. It can be argued, though, that the measurement of debt is more robust and less biased than that of the deficit. Revisions to debt are often driven by reclassification of units. There are at least two statistical reasons that could work in favour of more reliable debt figures: (i) the source data are more concentrated in a limited number of sources, whereby the issuance of debt securities by national debt managers makes up the bulk of it (with around 70% of Maastricht debt in the euro area being composed of debt securities); and (ii) in contrast with data on transactions, the accounting treatment of the outstanding amount of liabilities in face value is more straightforward (in nominal terms, without the problematic "accrual accounting" treatment, which offers some room for interpretation).

DDA analysis seeks to identify the factors that give rise to the DDA in order to assess the plausibility of the general government deficit/surplus and debt data. The reconciliation of the data resulting from those two approaches plays an important role in the assessment of the quality of both crucial fiscal indicators.

There are three reasons why changes in Maastricht debt may differ from the deficit:

- Government debt may change due to financial transactions without impacting the deficit (or surplus). This is the case, for instance, when government entities acquire financial assets financed by debt issuance or dispose of financial assets to redeem debt instruments.
- The value of debt may change relative to its initial measurement in Maastricht debt without any transactions taking place.
- Non-financial transactions may modify the deficit (or surplus) without any equivalent impact on Maastricht debt.

These three distinct reasons form the background to the three DDA pillars, which are described in more detail in the following sections and summarised in Table 2 with examples.

On the basis of accounting identities that should hold for government accounts, we can also derive the algebraic definition and decomposition of the DDA (see Annex 2).

Transactions in main financial assets

The first pillar (and often the most important one in terms of amplitude) consists of transactions by government entities in (main) financial assets. These transactions include the net accumulation of currency and deposits by the ministry of finance or other government units at the NCB and other monetary financial institutions, equities acquired by government in corporations (i.e. investment in equities, excluding privatisations), debt securities held by social security funds, and loans extended by government units. Government financial investment increases the borrowing requirement (the amount that government needs to borrow to finance its activities) and thereby also government debt. Conversely, a disposal of financial assets (for example as a result of privatisation) tends to reduce the borrowing requirement as it generates cash which may be used to redeem debt, while keeping the deficit unchanged.

Valuation effects and other changes in the volume of debt

The second pillar consists of valuation effects and other changes in the volume of debt. Government debt is measured at nominal (face) value even though new borrowing and the repayment of debt may be at prices which differ from the nominal value (issuances and redemptions below or above par). Moreover, as government debt is measured in the national currency (or in euro in the euro area), exchange rate changes modify the value of the debt denominated in foreign currencies without affecting the deficit. Changes in debt that are related to reclassification are recorded as other changes in the volume of debt. These include changes in the statistical classification of units from government to a non-government sector (or the reverse).

Time of recording differences and remaining factors

The third pillar – time of recording differences and remaining factors – refers to the time difference between the accrual recording of expenditure and the related payments, and between the accrual recording of revenue and the related cash flow to government. Accrual recording is one of the most important principles in the compilation of the national accounts, including the government sector accounts. It ensures that non-financial transactions are recorded at the time when they occur and not when the payment takes place, as this could be delayed or advanced. For instance, taxes are recorded as government revenue at the time they are assessed, even though the payments may take place somewhat later. The delayed payment of taxes increases the government borrowing requirement, although the tax assessment decreases the deficit. A large accumulation of delayed tax payments may lead to concerns as to whether tax revenue is overstated owing to amounts that are unlikely ever to be collected. Other time of recording differences may arise on account of

advanced or delayed reimbursement by the EU of funds spent by the government on its behalf, or the gap between the delivery of military equipment (at which time the deficit is affected) and the time of payment.

This third pillar also includes statistical discrepancies between the government deficit as computed in the non-financial accounts and the government deficit as computed in the financial accounts that result from the use of different data sources and compilation methods for those two datasets. Finally, it includes remaining transactions in financial assets that are not included in Pillar 1 and remaining transactions in financial liabilities that are not included in government debt.

Table 2

Examples of the three pillars of the DDA

Reason	Financial transactions (no impact on net lending /borrowing, but impact on debt level)	Change in value of debt without transactions	Non-financial transactions with impact on net lending/borrowing, but no impact on debt
Examples	Government issues debt securities to finance the acquisition of equities.	Debt is measured at face value but its issuance or redemption may be below or above par.	Accrued taxes are recorded as revenue, but some of them remain unpaid (other accounts receivable for government).
	Government disposes of financial assets to redeem debt instruments.	Debt is measured in the national currency, but changes in exchange rates alter the value of debt denominated in foreign currency.	Military aircraft are delivered to the government, but only some of that delivery is paid for (other accounts payable for government not recorded in Maastricht debt).
	The treasury issues debt to invest in the financial portfolios of social security funds.	The reclassification of units to or from the general government sector implies a change in Maastricht debt.	Due to differences in data sources there are statistical discrepancies between non-financial and financial accounts.
Pillar	**Transactions in main financial assets**	**Valuation effects and other changes in volume of debt**	**Time of recording and remaining factors**

4 DDA analysis

DDA analysis is one of several tools that help to confirm the correct measurement of government deficits/surpluses and debt. It identifies large components of the reconciliation items for the differences between the deficit/surplus and the change in Maastricht debt. The identification of large DDA components does not necessarily indicate quality issues in the data, as it usually reflects the recording of government operations or market developments. However, statisticians need to ensure that such large items are well explained in order to be certain that figures are correct.

In addition to ensuring consistency, DDA analysis provides insights into several aspects of governments' economic policies. For instance, the components of the DDA shed some light on governments' equity investments or privatisations, use of investment in financial reserves, some aspects of debt management and the accumulation of fiscal or social arrears.

This analysis is based on cumulative data (as a percentage of GDP) over a period of six years with a view to detecting possible persistent biases. For instance, if net transactions in taxes or social contributions receivable are always positive and accumulate over time, that could signal that tax revenues are overstated. If accrued military expenditures (deliveries) are always less than the respective payments, that could indicate a potential under-recording of expenditure.

The data used for the analysis of the DDA and the three pillars are transmitted by the NCBs within the framework of the GFS Guideline. Figure 1 shows how the data reported under the GFS Guideline can be grouped into the three pillars and used to reconcile the government deficit/surplus data from the non-financial government accounts with the change in Maastricht debt resulting from the financial accounts.

The DDA is calculated from the general government deficit/surplus as defined in ESA 2010 (B.9) and Maastricht debt as defined in Council Regulation (EC) No 479/2009. The data for Pillars 1 and 2 are transmitted under the GFS Guideline, whereas Pillar 3 is calculated as a residual (= DDA – Pillar 1 – Pillar 2).

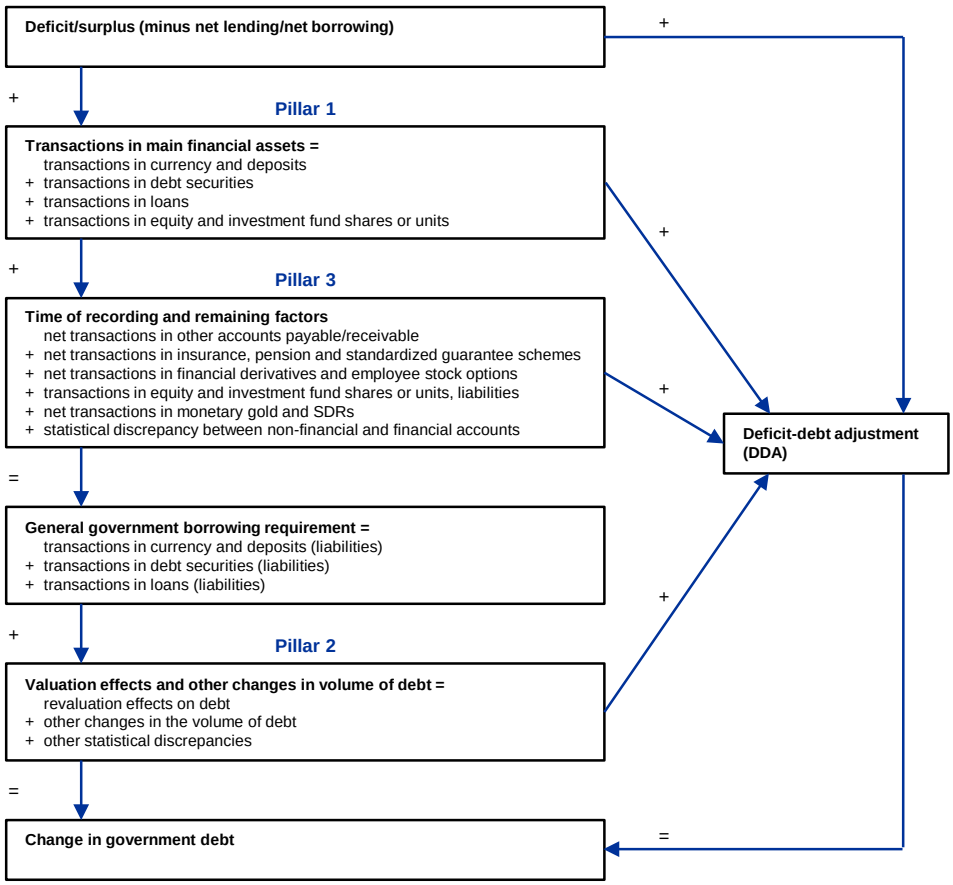
Pillar 2 is, in essence, the difference between the change in (Maastricht) debt and the "general government borrowing requirement" which is reported in the financial accounts. The borrowing requirement is the sum of transactions in the liabilities included in Maastricht debt, namely currency and deposits, debt securities and loans (see Figure 1). From a DDA perspective, the borrowing requirement is the sum of Pillar 1 and Pillar 3, as these include transactions that require borrowing to finance them.

Table 3 shows cumulative figures for the euro area countries for the period 2011-16, broken down into the three pillars. A positive DDA means that the increase in debt exceeds the deficit or that the reduction in debt is lower than the surplus. A negative DDA means that the increase in debt is less than the deficit or that the reduction in debt is greater than the surplus. For example, for Belgium the DDA was 1.6% of GDP,

meaning that debt increased by 1.6% of GDP more than would have been needed to finance the deficit over that time period. That DDA of 1.6% of GDP is the result of transactions in main financial assets totalling 2.4% of GDP, and time of recording differences and remaining factors totalling 1.2% of GDP, which are partly offset by valuation effects and other changes in debt (-2.4% of GDP).

Figure 1

Reconciliation of the government deficit/surplus and government debt



Looking at the DDA and its three pillars for the euro area countries and the euro area as a whole, it can be observed (see Table 3) that the composition of the DDA in the euro area countries varied in 2011-16. For several countries (Cyprus, Luxembourg, Malta, Portugal, Slovenia and Finland) transactions in main financial assets (Pillar 1) have the largest impact on the DDA and the other pillars have only a minor impact. Interestingly, for Ireland both transactions in main financial assets (Pillar 1) and valuation effects and other changes in the volume of debt (Pillar 2) are significant, but with opposite signs, so the total DDA is small. For Greece, the very large negative DDA is mainly due to valuation effects and other changes in the volume of debt (Pillar 2).

In the following sections, the three pillars are explored in more detail, to detect plausible reasons for large DDA components.

There are several groups of transactions or other changes that could significantly impact the three pillars of the DDA, but can be regarded as normal activities of general government. Where available, detailed data can be used to explain the large components of the DDA. When looking at more detailed data, it is also possible to find that, although the total DDA is not significant, some large effects are hidden within the individual pillars, which cancel each other out and deserve to be explained.

Table 3

The DDA and its components in euro area countries

(cumulative annual percentage of GDP for the years 2011-16)

	Deficit-debt adjustment			
		PILLAR 1	PILLAR 2	PILLAR 3
	Total	Transactions in main financial assets	Valuation effects and other changes in the volume of debt	Time of recording differences and remaining factors
Belgium	**1.6**	2.4	-2.0	1.2
Germany	**2.7**	2.5	0.8	-0.5
Estonia	**6.9**	4.2	0.4	2.2
Ireland	**0.6**	-12.0	13.3	-0.7
Greece	**-50.1**	4.8	-57.0	2.1
Spain	**0.6**	-3.5	0.0	4.1
France	**-0.5**	2.6	-1.8	-1.2
Italy	**4.8**	2.8	-0.4	2.4
Cyprus	**19.5**	19.3	1.0	-0.8
Latvia	**-1.6**	-4.6	0.9	2.1
Lithuania	**0.5**	-0.5	-0.3	1.3
Luxembourg	**13.1**	12.0	0.3	0.7
Malta	**6.1**	7.7	-2.6	1.0
Netherlands	**-5.1**	-3.7	-0.3	-1.0
Austria	**3.5**	-0.2	4.9	-1.2
Portugal	**7.4**	5.1	0.9	1.4
Slovenia	**12.9**	13.2	2.1	-2.5
Slovakia	**0.5**	2.7	-1.0	-1.3
Finland	**10.0**	9.3	1.9	-1.2
Euro area	**-1.2**	-0.6	-1.0	0.4

Source: ESCB.
Note: Owing to rounding, the figures may not add up to the total.

4.1 Pillar 1: Transactions in main financial assets

As explained earlier, the acquisition and disposal of financial assets held by government units may have an impact on the level of government debt, as the government may have to borrow more to acquire additional financial assets or may use the proceeds from the sale of financial assets to redeem some of its outstanding debt. Thus, the level of debt may change without having an impact on the government deficit/surplus. These net transactions in the main financial assets of general government constitute Pillar 1 of the DDA and are the sum of annual (net) transactions

in four main types of general government asset: currency and deposits (F.2), debt securities (F.3), loans (F.4) and equities and investment fund shares or units (F.5). As it is recommended that the interest accrued is recorded under the relevant financial instrument, the acquisition of main financial assets should also include the interest accrued on those assets. Table 4 shows Pillar 1 data and the relationship between its components for euro area countries and the euro area aggregate in the period 2011-16.

Some of the large transactions in main assets can be explained by regular general government activities, such as investment by social security funds, or special government activities, such as governmental financial support related to the financial crisis.

However, large accumulations of transactions in main financial assets may highlight some risks to the quality of the government accounts. For example, an accumulation of equity through capital injections could in some cases hide capital transfers to corporations that should instead be booked as deficit-increasing transactions (expenditure). The accumulation of loans (to corporations) could in some cases hide financial support for corporations in difficulty, which should also be booked as deficit-increasing transactions (expenditure).

In addition, it is advisable to look at more detailed data to identify large transactions. For example, distinguishing between privatisations and other transactions in equity may be helpful, as they may cancel each other out. Therefore, the accumulation of capital injections cannot easily be interpreted on the basis of more aggregated data without further analysis. Similarly, privatisation is the sale to third parties of government-owned shares in public corporations so that the government cedes control of the corporation to the private sector. However, not all sales of shares in public corporations are to be recorded as privatisations. For example, the sale by a social security fund of shares initially bought by it for investment purposes would not be a privatisation. Privatisations would normally be recorded as a sale of equity.

As Table 4 shows, in Belgium, Greece and Portugal, privatisations were significant during this period. In Greece and Belgium, those privatisation transactions (partly) offset the governments' other equity acquisitions (see Table 4, columns 5 and 6), which were especially large in Greece due to government intervention to support and stabilise the financial sector (see Table 4, column 9).

The transactions in equities and investment fund shares also include capital paid to the European Stability Mechanism (ESM) – about €80 billion paid, mainly in 2014, by all euro area governments as shareholders of the organisation. The amount of capital to be paid by each individual country is determined by a capital key based on the population and GDP of the country.

Table 4

Transactions in main financial assets (Pillar 1)

(cumulative annual percentage of GDP for the years 2011-16)

	Total	By instrument							Memo item
		Currency and deposits	Debt securities	Equities and investment fund shares or units			Loans		Government support to financial sector[2]
				Total	By purpose		Total	Excluding EFSF and bilateral loans[1]	
					Privati-sations (-)	Equity injections and other investments in shares (+)			
	1 = 2+3+4+7	2	3	4 = 5+6	5	6	7	8	9
Belgium	**2.4**	0.3	-0.3	-1.4	-4.5	3.1	3.8	1.7	-2.6
Germany[3]	**2.5**	2.4	-1.6	0.9	-0.7	1.6	0.7	-1.4	-3.0
Estonia	**4.2**	1.4	-1.6	2.2	0.2	2.0	2.3	0.1	0.0
Ireland	**-12.0**	-2.2	-3.6	2.4	-1.2	3.6	-8.5	-8.6	2.4
Greece	**4.8**	1.2	-2.1	9.2	-4.5	13.8	-3.4	-3.4	11.0
Spain	**-3.5**	-2.6	-3.7	0.8	-0.3	1.1	2.0	-0.6	-2.1
France	**2.6**	0.3	-0.2	0.9	-0.5	1.4	1.5	-0.7	-0.1
Italy	**2.8**	-0.4	0.4	0.3	-1.4	1.7	2.4	-0.2	-0.2
Cyprus	**19.3**	6.3	-0.3	10.1	0.0	10.1	3.1	0.8	9.7
Latvia	**-4.6**	-1.9	-0.3	0.2	-1.2	1.4	-2.6	-2.6	-2.3
Lithuania	**-0.5**	0.3	-0.4	0.1	-0.3	0.4	-0.5	-0.5	0.6
Luxembourg	**12.0**	1.9	4.8	4.9	-	-	0.4	-0.7	0.9
Malta	**7.7**	3.6	0.0	1.1	-0.1	1.2	2.9	0.7	0.0
Netherlands	**-3.7**	-0.5	-2.4	-2.0	-	-	1.2	-0.8	-4.8
Austria	**-0.2**	2.9	-3.2	-1.1	-	-	1.2	-0.7	-
Portugal	**5.1**	8.1	0.4	-4.5	-3.7	-0.8	1.1	0.4	2.3
Slovenia	**13.2**	7.3	0.0	0.4	-1.2	1.7	5.5	2.7	-0.5
Slovakia	**2.7**	1.7	-0.1	-2.0	-1.0	-1.0	3.1	0.8	0.0
Finland	**9.3**	0.8	-0.1	8.1	-1.8	9.9	0.6	-1.4	0.0
Euro area	**-0.6**	0.7	-1.2	0.7	-1.0	1.7	-0.9	-2.5	-1.3

Source: ESCB.
Note: Owing to rounding, the figures may not add up to the total.
Transactions in currency and deposits: These are deposits held by the finance ministry or other government units at the central bank or commercial banks. Transactions in equities and investment fund shares or units: This represents equities acquired by government in corporations minus the sale of shares. Transactions in loans: Net increase in loans from government to mainly public corporations. A positive sign means net acquisitions of financial assets; a negative sign means net sales of financial assets.
Footnotes:
1) EFSF loans to Greece, Ireland and Portugal and bilateral loans to Greece.
2) General government transactions in main financial assets related to support to financial sector in context of financial crisis.
3) For Germany, the data on equity breakdown between privatisations and equity injections and other investments in shares are estimations by the Deutsche Bundesbank.

Transactions of social security funds

Financial investment in deposits, debt securities, equities and investment fund shares can result from deliberate economic decisions taken by government (including social security funds), for instance in order to build up assets for future pension liabilities. In some euro area countries (e.g. Luxembourg and Finland), financial investment by social security funds is a major driver of general government financial investment (see

Chart 2). This explains the high transactions in debt securities and/or equities and investment fund shares in these countries (see Table 4, columns 3 and 4).

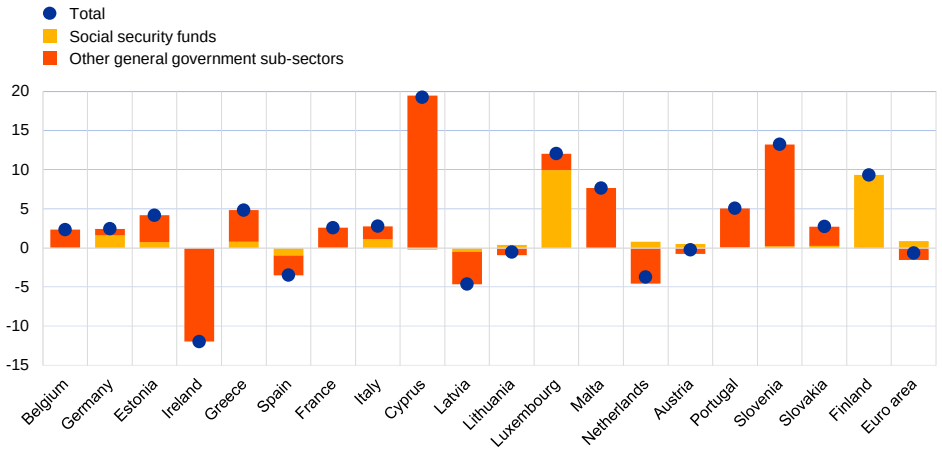
Data on the financial transactions of social security funds and the counterpart sectors are available on a quarterly basis from Table 27 of the ESA 2010 TP (quarterly financial accounts of general government). These data, combined with annual data on transactions in main financial assets, give additional insight and explain large amounts of transactions in Pillar 1 that are part of the usual activity of the general government sector, in particular social security funds.

Other countries report large amounts for transactions in main financial assets undertaken by government sub-sectors other than social security funds (e.g. Ireland, Greece, Cyprus, Malta, the Netherlands, Portugal and Slovenia). In some of these countries, the reasons for those large amounts are related to the government's response to the financial crisis, as explained in the following sections. In others, especially where large amounts of currency and deposits have been accumulated, it is related to the government's establishment of reserves to cover future expenditure and financing needs.

Chart 2

Transactions in main financial assets by social security funds and other general government sub-sectors

(cumulative annual percentage of GDP for the years 2011-16)



Sources: Eurostat and authors' calculations.

Government support for the financial sector during the financial crisis

As shown earlier in Chart 1, there were significant increases in the DDA in the euro area countries from 2008 to 2010, which were, in large part, related to the financial support that euro area governments provided to the financial sector during the financial crisis. That support included the purchase by governments of financial assets (equities, unquoted shares, etc.), the granting of loans, the assuming of debt and the provision of guarantees to alleviate the strain on the banking system and restore

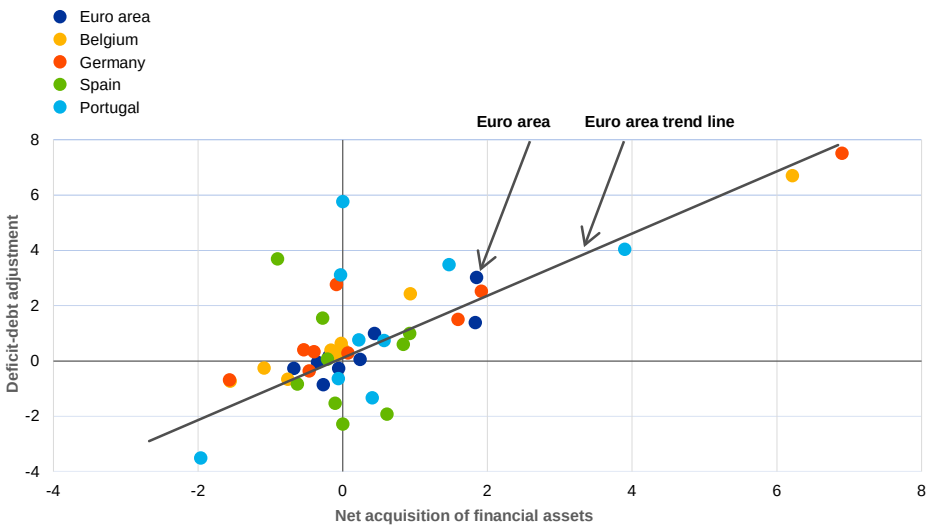
confidence. These transactions often increased government debt levels, since purchases of financial assets were often financed by the issuance of government bonds, while not impacting government deficits[6].

Chart 3 shows the relationship between government support for the financial sector in terms of financial asset acquisitions between 2008 and 2016 and the DDA in the respective years in the euro area and selected euro area countries. This relationship is positive – the higher the support for the financial sector, the larger the DDA. The opposite effect can also be observed – when net transactions related to financial support for the financial sector are negative (unwinding of support), the DDA also becomes negative in several cases.

Chart 3

The DDA and government net acquisition of financial assets in support of the financial sector in the euro area and selected euro area countries

((2008-16; percentage of GDP)



Source: ECB.

Table 4, column 9, shows the data on government support for the financial sector in 2011-16 in the form of net financial asset acquisitions. These data are collected by the ECB using a special data collection on government financing needs in relation to support for the financial sector during the financial crisis[7]. During that period Greece and Cyprus acquired significant amounts of financial assets, especially equities and investment fund shares (see Table 4, column 4), in order to support the financial sector, which was also reflected in the DDA. On the other hand, in several countries (e.g. Belgium, Germany, Spain, Latvia and the Netherlands) the negative values in

6 Some of the transactions also impacted the government deficit for their full amount or partly, in particular where the price paid for the assets acquired by the governments was above market price or there was evidence that the financial investments could not be repaid or recovered in the future or in cases of debt assumptions.

7 For more information on these data, see Maurer, H. and Grussenmeyer, P. (2015), "Financial assistance measures in the euro area from 2008 to 2013: statistical framework and fiscal impact", *Statistics Paper Series*, No 7, ECB.

2011-16 denote that they were net sellers of assets that were previously acquired to help the financial sector.

In addition, in the course of their efforts to stabilise the financial sector in the financial crisis, some countries set up defeasance structures that bought or received transfers of impaired assets (mainly loan portfolios) to alleviate the balance sheets of commercial banks. Depending on the level of government involvement in the process, several of these "bad banks" were classified or reclassified into the government sector, with their assets recorded as assets of general government. While the statistical reclassification itself is not regarded as a transaction (instead being included in other changes in the volume of debt (Pillar 2)), transactions (sales and acquisitions) in the assets of these entities also impact Pillar 1. Table 4 illustrates the case of Ireland, where the large negative amounts of transactions in loans represent the sale of a loan portfolio held by a defeasance structure classified in the government sector (see Table 4, column 8).

Financial support for governments during the sovereign debt crisis

During the sovereign debt crisis that began in 2010, several euro area governments were either unable to access financial markets or market conditions changed so drastically that those governments were unable to finance themselves through the financial markets. The Greek Loan Facility, the first financial support programme for Greece, was agreed in May 2010 and consisted of bilateral loans from euro area countries totalling €52.9 billion and a €20.1 billion loan from the IMF.

For the euro area governments that granted those loans to Greece, transactions in loan assets and liabilities increased considerably (mainly for 2010 and 2011).

Similarly, the loans that the European Financial Stability Facility (EFSF) granted to Greece, Ireland and Portugal between 2010 and 2014 (€175.5 billion in total) were rerouted through the government accounts of the euro area countries that guaranteed the borrowing of the EFSF, which was not considered to be a separate institutional unit in the national accounts. This rerouting increased transactions in both liabilities and assets for the euro area guarantor governments during this period and, consequently, also had an impact on the DDA. Thus, a large part of the transactions in loan assets may be explained by the loans provided bilaterally or via the EFSF to euro area countries in need. When those loans extended by the EFSF and the bilateral loans to Greece are excluded, loan transactions are reduced significantly for most euro area countries (see Table 4, column 8, for transactions in loan assets excluding EFSF loans and bilateral loans to Greece), except for Latvia and Lithuania, which were not euro area members at the time when the loans were provided. On the other hand, for the borrowing countries (Greece, Ireland and Portugal) the loans may have an impact on deposit assets due to the accumulation of funds from the loans received under the financial support, if the amounts received have not yet been spent, which was the case in Portugal (see Table 4, column 2).

4.2 Pillar 2: Valuation effects and other changes in the volume of debt

Changes in the level of debt that are not attributed to transactions, but rather to events that change the valuation or volume of the debt, are grouped in Pillar 2. There are two sub-groups of components of Pillar 2 – one related to valuation effects on debt and the other related to other changes in the volume of debt.

Table 5 shows the components of Pillar 2 for euro area countries and the euro area as a whole, showing that in 2011-16 Greece and Ireland had large valuation effects and changes in the volume of debt. It is also possible to see that for Greece this was due to large market-to-face-value adjustments (see Table 5, column 4, and the explanation on page 25) and for Ireland it was due to the reclassification of units or instruments (see Table 5, column 7). The following sections describe the components of Pillar 2 and how they contribute to the DDA.

Table 5

Valuation effects and other changes in the volume of debt (Pillar 2)

(cumulative annual percentage of GDP for the years 2011-16)

	Valuation effects and other changes in the volume of debt						
		Valuation effects on debt				Other changes in volume of debt	
				Market-to-face-value adjustments		Total	
	Total	Total	Foreign exchange holding gains and losses[1)]	Issuances/ redemptions, repurchase above/below nominal value	Interest accrued vs. paid[2)]		of which: Reclassification of units
	1	2 = 3+4+5	3	4	5	6 = 1-2	7
Belgium	**-2.0**	-2.1	0.4	-3.6	1.2	0.1	0.3
Germany	**0.8**	0.4	0.4	0.4	-0.4	0.4	0.0
Estonia	**0.4**	0.0	0.0	0.0	0.0	0.4	0.4
Ireland	**13.3**	2.0	0.5	1.4	0.1	11.3	11.3
Greece	**-57.0**	-60.0	1.0	-59.7	-1.3	3.0	3.0
Spain	**0.0**	-2.4	0.1	-2.5	0.0	2.4	2.4
France	**-1.8**	-2.0	0.0	-2.9	0.9	0.2	0.0
Italy	**-0.4**	-0.5	0.0	0.4	-1.0	0.1	0.1
Cyprus	**1.0**	0.8	1.0	0.6	-0.8	0.2	0.0
Latvia	**0.9**	0.7	0.4	0.3	-0.1	0.2	0.2
Lithuania	**-0.3**	-0.3	0.0	-0.6	0.3	0.0	0.0
Luxembourg	**0.3**	0.3	0.0	0.0	0.2	0.0	0.0
Malta	**-2.6**	-0.1	0.1	-0.5	0.4	-2.5	-2.8
Netherlands	**-0.3**	-0.7	0.0	-1.3	0.6	0.4	0.4
Austria	**4.9**	-0.8	0.4	-	-	5.8	6.8
Portugal	**0.9**	0.7	0.8	0.3	-0.4	0.2	0.2
Slovenia	**2.1**	1.3	0.9	1.7	-1.3	0.8	0.7
Slovakia	**-1.0**	-2.4	0.6	-1.9	-1.1	1.4	1.1
Finland	**1.9**	0.2	0.4	-0.2	-0.1	1.7	0.6
Euro area	**-1.0**	-1.9	0.2	-2.1	0.0	0.9	0.8

Source: ESCB.
Note: Owing to rounding, the figures may not add up to the total.
1) Also includes impact of derivative contracts that change the effective currency of the debt.
2) A negative adjustment means that interest accrued exceeds the interest paid. A positive adjustment means that interest paid exceeds interest accrued.

4.2.1 Valuation effects on debt

Valuation effects on (Maastricht) debt include adjustments to be made due to the fact that part of the debt can be denominated in foreign currency, but is reported in the domestic currency, and the fact that Maastricht debt and the change in debt are recorded at nominal (face) value while the underlying financial transactions are recorded at market value including accrued interest. Thus, the two main components of valuation effects are foreign exchange holding gains and losses and market-to-face-value adjustments.

Foreign exchange holding gains and losses reflect changes in the value of Maastricht debt due to exchange rate movements. This includes both the impact of exchange rate

movements on debt denominated in foreign currencies and the impact of derivative contracts changing the effective currency of the debt.

If the government debt is denominated in foreign currencies, it is valued at current exchange rates on the balance sheet date, for example at the end of the year (i.e. on the last working day). The amount of outstanding debt may therefore vary without any counterpart in the general government deficit, or any transactions in foreign currency debt since the date of the previous balance sheet, simply due to changes in exchange rates.

However, when foreign exchange risk is changed through contractual agreements, the rate agreed in those contracts should be used. Entering into such a contract can affect government debt since the exchange rate agreed in the contract may differ from the exchange rate prevailing on the last working day of the period. These contractual arrangements can include various hedging instruments such as currency swaps, foreign exchange swaps, foreign exchange forwards, futures and potentially options.

Table 6 shows the three DDA pillars for EU Member States outside the euro area and foreign exchange holding gains and losses. By contrast with the euro area countries, where foreign exchange holding gains and losses do not exceed 1% of GDP on a cumulative basis over the period 2011-16, the effects on the value of debt are more noticeable in Croatia, Hungary, Poland, Romania and Sweden. This effect can be exacerbated when a large proportion of the debt is denominated in foreign currencies. On average, foreign currency-denominated debt has, as a percentage of total debt, tended to be higher in non-euro area countries than it has in euro area countries in recent years, with the exception of Denmark and the United Kingdom.

Table 6

The DDA and its components in non-euro area EU countries

(cumulative annual percentage of GDP for the years 2011-16)

	Deficit-debt adjustment				
		PILLAR 1	PILLAR 2		PILLAR 3
			Valuation effects and other changes in the volume of debt		
	Total	Transactions in main financial assets		of which: foreign exchange holding gains and losses	Time of recording differences and remaining factors
Bulgaria	**8.7**	6.3	-1.0	0.2	3.3
Czech Republic	**-2.7**	0.0	-0.7	0.3	-2.0
Denmark	**-7.3**	-3.0	0.4	0.3	-4.7
Croatia	**1.8**	-0.1	1.4	1.6	0.5
Hungary	**-3.2**	4.7	4.6	4.8	-12.4
Poland	**-7.4**	-2.9	3.5	2.6	-7.9
Romania	**3.8**	6.2	-0.2	1.3	-2.2
Sweden	**10.0**	8.7	3.7	2.1	-2.3
United Kingdom	**-3.2**	1.4	-2.4	0.1	-2.2

Source: ESCB.
Note: Owing to rounding, the figures may not add up to the total.

Market-to-face-value adjustments

Government debt (and therefore the change in debt) is recorded at face value, whereas financial transactions in assets and liabilities in ESA 2010 are recorded at market value including accrued interest. This difference in valuation is reflected in the market-to-face-value adjustment in the DDA and can be split into two effects: issuance, redemption and repurchase above/below the nominal value (see Table 5, column 4); and interest accrued but not yet paid (see Table 5, column 5).

The first effect applies to new borrowing and repayments or buybacks of debt at prices which differ from the nominal value (issuances and redemptions below or above par). For example, a bond issued at a discount will increase the liabilities in financial accounts by the discounted price (since that is the market price), but will increase government debt by the full price because Maastricht debt is measured at face value. In this case, the market-to-face-value adjustment is equal to face value minus the market price.

Differences between market and face value may be observed both at the time of the issuance of the debt and at the time of the redemption of the debt, as well as on exchange of the debt (early redemption of old debt and issuance of new debt with equivalent market value).

For debt issued at a discount or premium, there will be a difference between the market value and the face value at issuance. The treatment is similar for all bonds not issued at face value. For bonds issued at a premium, the market-to-face-value adjustment will be negative.

In general, redemption at maturity is, by definition, at face value, so no adjustment is needed. However, if there is an early redemption the market-to-face-value adjustment equals the price paid to redeem the securities before the maturity date (the financial transaction recorded according to ESA 2010) minus the face value.

A prominent example of an early redemption and exchange of debt is the private sector involvement (PSI) in Greece in 2012. At the beginning of March 2012, the private investors (mainly banks) that held Greek government bonds participated on a voluntary basis in an exchange, with a discount, of existing Greek government bonds (maturing in the next few years) against new Greek government bonds with a longer maturity (from 11 to 30 years). The reduction in nominal value was equal to 53.5%. This PSI exchange was recorded in national accounts as a buyback by an issuer of bonds on the market and an issuance of new bonds with a lower nominal value[8]. Thus, as reflected in Table 5, column 4, there was a large adjustment of Greek government debt measured in nominal value as a result of this operation. As a result, the DDA Pillar 2 for Greece is exceptionally large for the period 2011-16.

Another difference between the market and face value of debt may be caused by the accrual of unpaid interest. Maastricht debt is recorded at face value, so accrued

[8] See Eurostat note entitled "The impact on EU governments' deficit and debt of the decisions taken in the 2011-2012 European summits", 12 April 2012.

interest on Maastricht debt instruments is not included in debt, except for deposits, which also include accrued interest.

The accrual recording of interest applied in ESA 2010 means that the interest expenditure and income of the government that accrues in each period is recorded in the government deficit/surplus and, if it is not paid, is viewed as being reinvested in the instrument generating the interest through an entry in the financial account[9].

In the financial accounts, the accruing of interest does not create difficulties in reconciling transactions and balance sheet stocks because the market value of the instrument increases with the accruing of interest. By contrast, because government debt is recorded at face value (excluding the stock of accrued interest), an adjustment is needed as Maastricht debt is not influenced by the accrual of interest (except for index-linked bonds).

As reflected in Table 5, column 5, this adjustment can be positive or negative. A negative adjustment means that interest accrued exceeds the interest paid and a positive adjustment means that interest paid exceeds interest accrued.

For example, if the accrued interest on a bond is 100, this will be included in the government balance as expenditure. However, if only 80 of the accrued interest has to be paid in that period, the government will only need to borrow 80 to pay the interest and not the full amount reflected in the government balance. Thus, the adjustment of -20 is recorded to achieve the correct change in government debt.

Positive values may reflect the accrual impact of large amounts of bonds issued at a premium. On the other hand, negative values can also reflect deferrals of interest payments, as experienced in the case of Greece when the interest payments on EFSF loans granted were deferred for ten years in 2012.

4.2.2 Other changes in the volume of debt

The second main sub-component of Pillar 2 (other changes in the volume of debt) includes events which change the volume of the government's Maastricht liabilities without any corresponding transactions. These are mainly composed of other flows as defined in ESA 2010, such as the destruction of liabilities due to catastrophic losses (e.g. natural disasters, wars or technological accidents (K.3), or uncompensated seizures (K.4)), other changes in volume not classified elsewhere (e.g. fire damage or theft, or unilateral write-offs of liabilities (K.5) or changes in the sector classification of units (K.61)) and the reclassification of instruments from Maastricht debt instruments to non-Maastricht debt instruments (K.62), which have an impact on the debt level (see Table 5, column 6).

As reflected in Table 5, in most euro area countries other changes in volume mainly consist of the reclassification of units from financial or other non-financial sectors to

[9] ESA 2010 recommends recording accrued unpaid interest under the instrument that generates the interest, rather than under other accounts receivable/payable.

the government sector (see Table 5, column 7). In the event of a unit being classified or reclassified as part of the government sector, the Maastricht financial liabilities of the unit at face value are added to Maastricht debt and the deficit/surplus of the unit is added to the government deficit/surplus. Thus, reclassification to the government sector has a positive effect on adjustments in other volume changes and the reclassification of units from the government sector to other sectors of the economy has a negative effect on adjustments. In Table 5, column 7, Ireland and Austria report large amounts of changes in debt due to sector reclassifications. This reflects the reclassification of financial defeasance entities to the government sector with a significant impact on Maastricht debt levels.

Remaining residuals for other changes in the volume of debt need to be looked at carefully to ensure that there are no mistakes in the compilation of data. However, this residual may also include some statistical discrepancies (excluding the statistical discrepancy between financial and non-financial accounts, which is part of Pillar 3).

4.3 Pillar 3: Time of recording differences and remaining factors

Pillar 3 covers time of recording differences and remaining factors that are not part of the other pillars. It is composed of transactions in remaining assets that are not included in the main financial assets in Pillar 1, transactions in remaining liabilities that are not part of Maastricht debt and the statistical discrepancy between the non-financial and financial accounts. Pillar 3 is calculated as a residual using the total DDA and the two other pillars, for which direct data are usually available.

Table 7 shows a list of financial assets and liabilities and their association with the respective DDA pillar or Maastricht debt. Net transactions in assets and liabilities in monetary gold and special drawing rights (F.1), insurance, pension and standardised guarantee schemes (F.6), financial derivatives and employee stock options (F.7), other accounts receivable/payable (F.8) and net transactions in liabilities in equity and investment fund shares or units (F.5) are grouped together under Pillar 3. This is done because governments' transactions in these financial instruments are usually small – except for other accounts payable/receivable that represent time of recording differences and transactions in financial derivatives, which are shown separately.

Table 7

Distribution of net transactions in financial assets and liabilities between DDA pillars

	Net transactions in assets	Net transactions in liabilities
AF. 1 Monetary gold and special drawing rights (SDR)	Pillar 3	Pillar 3
AF. 2 Currency and deposits	Pillar 1	Maastricht debt
AF. 3 Debt securities	Pillar 1	Maastricht debt
AF. 4 Loans	Pillar 1	Maastricht debt
AF. 5 Equity and investment fund shares or units	Pillar 1	Pillar 3
AF. 6 Insurance, pension and standardised guarantee schemes	Pillar 3	Pillar 3
AF. 7 Financial derivatives and employee stock options	Pillar 3	Pillar 3
AF. 8 Other accounts receivable/payable	Pillar 3	Pillar 3

Table 8 shows the components of Pillar 3 – time of recording differences and remaining factors, including statistical discrepancies for euro area countries and the euro area. It shows that the contribution that this pillar makes to the DDA is fairly limited for all euro area countries. Only in Spain does Pillar 3 exceed 3% of GDP in 2011-16, due to transactions in other accounts payable/receivable. Also, the cumulative statistical discrepancies between the financial and non-financial accounts are not significant for any of the euro area countries over this period (see Table 8, column 6).

Table 8

Time of recording differences and remaining factors (Pillar 3)

(cumulative annual percentage of GDP for the years 2011-16)

	Time of recording differences and remaining factors					
		Net transactions in other accounts payable/receivable[1)]		Remaining factors		
	Total		of which: Taxes and social contributions receivable		of which: Net transactions in financial derivatives	of which: Statistical discrepancy (B.9 – B.9f)
	1	2	3	4 = 1-2	5	6
Belgium	**1.2**	1.4	1.1	-0.2	0.5	-0.7
Germany	**-0.5**	-0.6	0.3	0.1	0.1	0.0
Estonia	**2.2**	2.3	1.0	0.0	0.0	0.1
Ireland	**-0.7**	0.2	0.6	-0.9	-0.3	-0.6
Greece	**2.1**	2.9	-0.6	-0.8	-0.7	-0.1
Spain	**4.1**	4.1	-	0.0	0.0	0.0
France	**-1.2**	-0.8	0.1	-0.4	0.0	-0.3
Italy	**2.4**	1.1	0.5	1.3	1.9	-0.4
Cyprus	**-0.8**	-0.6	0.4	-0.2	0.0	0.0
Latvia	**2.1**	2.1	0.4	0.1	0.0	0.0
Lithuania	**1.3**	2.9	0.7	-1.5	-1.4	-0.1
Luxembourg	**0.7**	0.5	0.7	0.3	0.5	-0.2
Malta	**1.0**	1.2	2.5	-0.2	0.0	-0.2
Netherlands	**-1.0**	0.4	0.6	-1.5	-1.6	0.1
Austria	**-1.2**	-1.9	0.6	0.7	0.8	-0.1
Portugal	**1.4**	2.0	-0.1	-0.6	-0.6	0.0
Slovenia	**-2.5**	-1.1	0.4	-1.4	-1.2	0.1
Slovakia	**-1.3**	-1.4	1.0	0.1	0.0	0.1
Finland	**-1.2**	-0.8	0.4	-0.5	0.4	-0.2
Euro area	**0.4**	0.4	0.3	0.0	0.3	-0.2

Source: ESCB.
Note: Owing to rounding, the figures may not add up to the total.
1) For Ireland, Greece, Luxembourg and the euro area, the data also include transactions in monetary gold and SDRs and transactions in liabilities in equity and investment fund shares or units.

4.3.1 Time of recording differences

The main component of Pillar 3 is time of recording differences. These transactions are recorded in other accounts payable/receivable in the financial accounts (ESA 2010 F.8). Time of recording differences result from the lags which exist between the recording of expenditure and the related cash payments and, conversely, between the recording of revenue and the related cash receipts.

In the DDA, these transactions are reported on a net basis – i.e. net transactions in assets (other accounts receivable) minus net transactions in liabilities (other accounts payable) (see Table 8, column 2). For time of recording differences, it is useful to use cumulative values over several years. The nature of the accounting process means that time of recording differences are expected to cancel each other out over time

(e.g. because other accounts payable will increase at the time of the accrual of the expenditure, but decrease at the time of the future cash payment).

According to the accrual principle, expenditure is recorded in government accounts on delivery of supplies or consumption of services, while the actual cash payment may be delayed (e.g. due to contractual clauses). In this case, the deficit would immediately be impacted by the transaction (as well as a counterpart "other accounts payable" transaction in the financial accounts), but the government borrowing requirement and debt will remain unchanged, as other accounts payable are not part of Maastricht debt.

Similarly, taxes and social contributions are recorded as revenue (therefore reducing the deficit) at the time they are assessed, even though the payment may be received some time later. It is especially important to monitor the accumulation of tax and social contribution receivables to see if unpaid amounts are really collected by the government later on and check that government revenues are not structurally overstated. The overstatement of revenues would lead to the understatement of government deficits. According to ESA 2010, taxes and social contributions which are unlikely to be collected should be excluded from other accounts receivable and the uncollected revenues of the government. Thus, when such overstatement is identified, both government revenue data and other accounts receivable need to be corrected.

As Table 8 shows, none of the euro area countries accumulated large amounts of tax and social contribution receivables over the six years from 2011 to 2016, while Malta accumulated only limited amounts (2.5% of GDP) thanks to its good economic performance and rising tax receipts in that period. The time-adjusted-cash method used for tax recording in most euro area countries may lead to some increases in tax receivables in periods with continuous strong growth in tax revenues.

Other accounts payable and receivable also include trade credits and advances (ESA 2010 F.81) – for example, when goods and services are bought and the related payment is made later. When governments face difficult times, they tend to delay the payment of invoices, thus accumulating trade credits. At the moment, DDA analysis does not include a breakdown providing separate data for trade credits and advances and other remaining accounts payable, which would be beneficial in order to look more closely at data on trade credits and advances. That breakdown would highlight the fiscal risk associated with the delayed payment of trade credit, as well as allowing more detailed analysis of other remaining accounts payable/receivable (F.8 – F.81) in the event of exceptional developments.

Other accounts payable may sometimes include large amounts related to the accrual recording of military expenditure. The time of recording for the transfer of assets should be the point at which the military assets are actually delivered, not the time of the cash payment. In addition, time of recording differences also arise on account of EU funds being reimbursed to governments early or late.

Another reason to monitor any unexplained residual amounts in time of recording differences is the fact that, due to compilation practices in some countries, these may also include statistical discrepancies between the non-financial and financial accounts. It is recommended that countries do not include those statistical

discrepancies in other accounts payable and receivable, and instead report them as a separate item, so as to be able to check the consistency of the non-financial and financial accounts.

4.3.2 Remaining factors

Remaining factors are composed of transactions in assets and liabilities for financial instruments that are not included in Pillar 1, excluding time of recording differences (other accounts payable and receivable) and statistical discrepancies between financial and non-financial accounts.

The largest of these items are usually net transactions in financial derivatives and statistical discrepancies. According to Council Regulation (EC) No 479/2009, liabilities in financial derivatives are not included in Maastricht debt instruments, so they would not be reflected in the change in Maastricht debt. However, a government may need to borrow to finance the settlement of financial derivatives or may be able to repay some of its liabilities if settlements in financial derivatives are in its favour. Net transactions in financial derivatives are compiled as net transactions in assets minus net transactions in liabilities for the financial derivatives and employee stock options (ESA 2010 F.7) financial instrument (see Table 8, column 5).

A statistical discrepancy between the non-financial and financial accounts is always expected because the data sources and methods used in the compilation of the non-financial and financial accounts differ and the data sources may not be exhaustive. However, a large statistical discrepancy may signal that there is a more profound problem in the compilation of either the non-financial or financial accounts that may impact the accuracy of the government deficit and/or government debt.

As Table 6 shows, none of the euro area countries report large statistical discrepancies over the period 2011-16, while Germany, Spain and Portugal include all or part of the statistical discrepancy in other accounts payable/receivable.

The other remaining factors, which can be calculated as a residual, should contain the remaining financial transactions that are not part of Maastricht debt, such as monetary gold and special drawing rights (ESA 2010 F.1), or net liabilities in equity and investment fund shares or units (ESA 2010 F.5) (note that net transactions in F.5 assets are reflected in Pillar 1). These transactions are usually negligible or very small. However, if the residual is significant, it should be analysed carefully to confirm that there is no mistake or misrepresentation in the data.

5 Other aspects of the DDA and its analysis

This chapter provides details of a few other areas where measurement of the DDA or DDA analysis is used for analytical purposes.

Section 5.1 illustrates that DDA analysis can also be used as a tool for quarterly fiscal analysis, as long as the volatility of its components is well understood.
Section 5.2 illustrates that, when combined with revision analysis of fiscal data, the DDA analysis framework may spot the more fragile datasets which bridge the deficit and the change in debt. Finally, Section 5.3 shows that the DDA can be used to assess the fiscal sustainability of debt.

5.1 Quarterly DDA

The government accounts data in the ESA 2010 TP are available on a quarterly basis, allowing developments to be monitored in a timely manner, allowing early investigation of any extraordinary amounts, and allowing any necessary corrections to be made to the data in order to ensure high-quality output.

The non-financial balance can be taken from Table 801, financial transactions can be taken from Table 27 and government debt can be taken from Table 28. Pillar 1 data can be taken from the Table 27 transactions, which are at market value. In addition, Pillar 3 can be calculated from the net transactions in other accounts payable/receivable and the statistical discrepancy between the non-financial and financial accounts. There is no reporting of the other flows, such as revaluations of debt and changes in volume, but Pillar 2 data can be calculated as a residual. Therefore, detailed analysis of Pillar 2 is not possible using the quarterly GFS.

Another aspect to be taken into account when analysing the quarterly DDA is the fact that some quarterly series may display seasonality, so the data may be more volatile than annual data. Smoothing of the series may be achieved by using rolling four-quarter sums, for example. This annualises the data, but also allows the signal from the quarterly data to be reflected. With this method, the data in Q4 of each year should coincide with the annual data for that year.

Table 9 shows annualised quarterly data for the euro area as a percentage of annualised quarterly GDP. It should be noted, however, that these figures cannot be directly compared with the data presented above, which are cumulative figures for a six-year period (whereas each figure in Table 9 relates to a single year).

Table 9

Quarterly DDA for the euro area

(percentage of GDP; flows during one-year period)

	Deficit-debt adjustment							
		PILLAR 1					PILLAR 2	PILLAR 3
		Transactions in main financial assets					Valuation effects and other changes in the volume of debt	Time of recording differences and remaining factors
	Total		Currency and deposits	Debt securities	Loans	Equity and investment fund shares		
2015 Q3	-0.6	-0.3	0.3	-0.2	-0.3	-0.2	0.1	-0.3
2015 Q4	-0.9	-0.6	0.2	-0.3	-0.3	-0.1	0.0	-0.3
2016 Q1	-0.6	-0.1	0.3	-0.3	-0.2	0.0	0.0	-0.5
2016 Q2	0.1	0.4	0.8	-0.2	-0.1	0.0	-0.1	-0.2
2016 Q3	-0.5	-0.2	0.2	-0.3	-0.1	0.0	-0.2	-0.1
2016 Q4	-0.3	0.3	0.3	0.0	-0.1	0.1	-0.3	-0.3
2017 Q1	-0.5	-0.1	-0.1	0.0	-0.1	0.2	-0.3	-0.2
2017 Q2	-0.7	-0.3	-0.2	-0.1	-0.1	0.1	-0.2	-0.1

Sources: Eurostat and authors' calculations.
Note: Owing to rounding, the figures may not add up to the total.

5.2 Historical revisions of the DDA and its pillars

Revision analysis is another tool that can be used to assess data quality. Analysing revisions in the DDA and its pillars can show which pillars are revised more and have the greatest impact in terms of the revision of the total DDA. This may, therefore, also show which data are less reliable due to weaknesses in data sources or uncertainties in the recording process. An ECB study in 2017[10] explored revisions in the main GFS, including DDA revisions since the introduction of the euro.

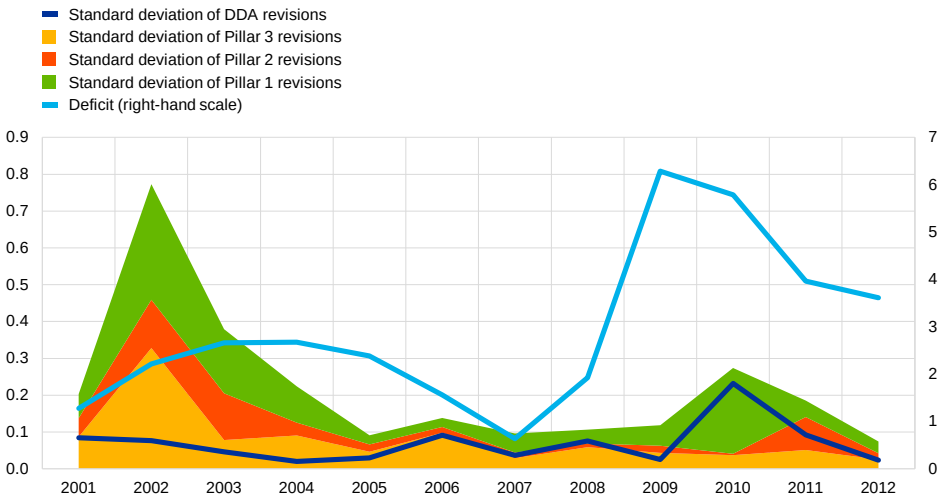
Chart 4 compares the standard deviation of total DDA revisions with the standard deviation of its pillars. This analysis demonstrates that, from 2001 to 2012, the volatility of total DDA revisions did not change significantly, with the exception of the financial crisis years 2010 and 2011. However, the volatility of the revisions of the three pillars has declined over time. It also shows that Pillar 3 had the highest volatility in the first period (2001-06), while Pillar 1 had the highest volatility in the second period (2007-12). This may be explained by the uncertainty surrounding the recording of some government transactions in the context of the financial crisis. At the time, detailed analysis had to be carried out to establish whether transactions were to be recorded as acquisitions of financial assets or whether they were in fact non-financial transactions, such as capital transfers (government expenditure).

[10] See Maurer, H. and Keweloh, S. (2017), "Quality enhancements in Government Finance Statistics since the introduction of the euro: econometric evidence", *Statistics Paper Series*, No 26, ECB.

Chart 4

Standard deviation of revisions in the DDA and its pillars in the euro area (2001-12)

(y-axis (left-hand scale) standard deviation of revision; y-axis (right-hand scale) deficit (% of GDP))



Source: ECB calculations.
Note: The standard deviation is calculated from the single revisions observed in each reference year. Since the DDA is the sum of the three pillars, a difference between the sum of the standard deviations of the pillars and the standard deviation of the total DDA indicates a negative covariance between the revisions of the pillars (i.e. the revisions for the individual pillars partly offset each other).

Chart 4 also shows that the first period was characterised by high volatility in revisions for the DDA pillars without any effect on the volatility of the overall DDA revisions. The high number of revisions within the DDA can be explained by the large difference in the first period (2001-06) between the sum of the standard deviations for the DDA pillars and the standard deviation for the DDA itself. In the second period (2007-12), the difference declined, which indicates fewer revisions for the DDA pillars, in spite of the fact that those data were recorded during the volatile economic period of the financial crisis. This development suggests a significant improvement in the robustness of fiscal data in the euro area. In absolute terms, the average revision of the DDA was -0.16% of GDP in the first period and -0.10% of GDP in the second period.

5.3 Fiscal sustainability analysis and the link to the DDA

The DDA also plays a role in the analysis of long-term fiscal sustainability. Fiscal sustainability is a central tenet of the Maastricht Treaty and the fiscal rules laid down in the Stability and Growth Pact.

Starting with the basic accounting identities of government debt, it is possible to break the change in government debt expressed as a percentage of GDP down into its constituent components: the interest-growth differential, the primary deficit/surplus and the DDA (see algebraic decomposition in Annex 3).

This decomposition of debt highlights the degree of fiscal sustainability using a simple equation which links together the growth of the economy, the interest rate on debt and the budgetary constraints of government. It is clear from this analysis that the

differential between the interest rate paid to service government debt and the growth rate of the economy is a key concept in assessing fiscal sustainability.

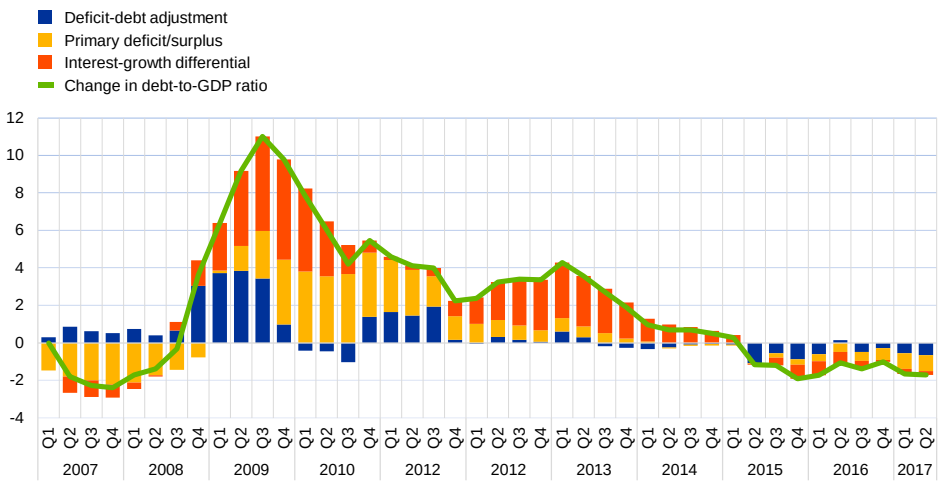
Assuming that the DDA is zero, we can see that debt sustainability depends on the differential between the growth and interest rates (the “interest-growth differential”, also known as the “snowball effect”). If the interest rate is higher than the nominal GDP growth rate, a positive primary balance is required to keep the debt-to-GDP ratio constant. Similarly, when GDP growth exceeds the interest rate, even a primary balance of zero will lead to a reduction in the debt-to-GDP ratio.

Chart 5 shows quarterly changes in the euro area’s debt-to-GDP ratio and its components. From the start of the financial crisis right up to the beginning of 2015, the interest-growth differential was positive, meaning that it contributed to increases in the debt-to-GDP ratio.

Chart 5

Changes in euro area debt-to-GDP ratio and its components

(percent of GDP)



Sources: Eurostat and ECB calculations.

The assumption of zero DDA is reasonable in the long run, while large values may be recorded in the short term, mainly driven by fluctuations in government transactions in main financial assets (for example through privatisations or financial investments), which depend on policy choices. In addition, DDA items that are related to time of recording differences are expected to cancel each other out eventually (and thus tend to be zero in the medium term). However, there could also be some impacts on the DDA that do not total zero over longer time periods. For instance, the acquisition of financial assets by social security funds may impact debt sustainability, as these surpluses are invested in financial assets (see, for instance, the relevant ratio in Finland and Luxembourg). In such cases, the fiscal surplus is not used to reduce general government debt, but rather to establish financial reserves for specific policies.

6 Conclusions

DDA analysis is a useful tool that allows the reconciliation of the non-financial and financial parts of the government accounts and is linked to the commonly used concept of government debt (Maastricht debt). It allows us to identify large values that may influence the reliability of the government deficit/surplus and/or government debt if they cannot be explained by transactions undertaken by government, valuation effects on government debt, issues related to compilation practices (such as sound accrual treatment of data) or methodological changes. It is useful to group the various components together into DDA "pillars", enabling focused analysis, comparison with detailed data on similar impacts and optimum use of the arithmetical properties of each pillar.

In addition to ensuring consistency, DDA analysis provides insights into several aspects of governments' economic policies. For instance, the components of the DDA shed light on governments' equity investments or privatisations, use of investment in financial reserves, some aspects of debt management and the accumulation of fiscal or social arrears.

Use of the DDA requires extensive knowledge of the concepts and methods used in the compilation of GFS, as well as information on underlying developments – be it government transactions or impacts on valuation or methodological changes.

Some of the DDA items can be explained by regular government activities, such as investments in financial assets by social security funds, whereas other transactions may be exceptional, such as governments' acquisition of large amounts of financial assets to support the financial sector at the height of the financial crisis. In addition, governments with large proportions of government debt in foreign currencies may be more exposed to changes in the value of government debt due to exchange rate volatility. Debt may also change due to the reclassification of entities to and from the government sector, which dictates whether their liabilities are included in or excluded from government debt. In order to analyse such and other specific cases in individual countries that may have an impact on the DDA, it is important that such information is collected and exchanged among data compilers.

This paper uses data for the euro area and EU countries to illustrate its analysis. That illustration shows that over the period 2011-16 the largest DDA items were related to government transactions undertaken in the context of the financial crisis. ECB analysis for EU countries over a number of years has shown that the vast majority of the DDA is well explained. However, it is essential to remain vigilant and continue to closely monitor the DDA and its components to ensure that the quality of GFS remains high. This continuous monitoring may, in a few cases, trigger appropriate revisions to some data.

In contrast with DDA analysis, which involves data at a relatively high level of aggregation, the work carried out by Eurostat in the context of the EDP data quality assurance framework generally focuses on more detailed and sometimes even

granular data assessment, such as reviewing governments' lists of other accounts payable or inspecting the sector classification of individual public units.

At a methodological level, we recommend further enhancing the analytical framework of the DDA by adding an additional breakdown to the third pillar (time of recording differences and remaining factors). This breakdown would identify trade credits and advances (F.81 in ESA 2010) within other accounts payable/receivable (F.8). Indeed, when governments face tough times, they tend to delay the payment of invoices. This breakdown would highlight the fiscal risk associated with the delayed payment of trade credit and, at the same time, more detailed explanations regarding the remaining accounts payable/receivable (F.8 – F.81) in the event of exceptional developments would be provided.

Given that, in the EU, responsibility for GFS compilation is frequently shared between different institutions (e.g. NSIs and NCBs), coordination between those institutions is important and necessary to ensure the consistent recording of data for non-financial and financial accounts and government debt.

Monitoring of the reliability and plausibility of fiscal data can benefit from the fact that those data are multi-sourced and compiled by different institutions, as this allows the comparison of datasets with a view to assessing consistency. This is true as long as the aggregation of figures to establish final financial and non-financial fiscal data is carried out using suitable data processing which views data discrepancies as a welcome signal prompting the fine-tuning of data output.

In combination, these efforts, in close cooperation with data compilers, should ensure that GFS continue to be of high quality.

Annexes

Annex 1: Availability of GFS for DDA analysis

Note: referenced in Chapter 2 ("Legal and institutional frameworks around DDA data and GFS"), page 6.

Table A.1
Availability of GFS for DDA analysis

	Non-financial accounts	Financial accounts	Debt
Data availability	ESA TP Table 2 (Annual) and Table 801 (Quarterly) ECB GFS Guideline Table 1A (Annual)	ESA TP Table 27 (Quarterly) ECB GFS Guideline Table 2A (Annual)	ESA TP Table 28 (Quarterly) ECB GFS Guideline Table 3A (Annual)
Relevant data for DDA analyses	Government balance (B.9)	Transactions in financial assets and liabilities Other economic flows	Stock of government debt at face value

Notes: ESA TP Table 27 includes the stock of government liabilities at market value. When combined with the stock of government liabilities at face value, which can be taken from Table 28, this allows the calculation of economic flows for all government liabilities.

Annex 2: Algebraic decomposition of the DDA

Note: referenced in Chapter 3 ("Definition and decomposition of the DDA"), page 12.

The formula for the DDA is as follows:

$$DDA_t = (D_t - D_{t-1}) - d_t \tag{1}$$

where D_t means debt at the end of period t, and d_t means net government borrowing for the year t (negative B.9).

Within the framework of the government accounts based on ESA 2010 and the data reported in the EDP, the government deficit (or surplus) is net lending or net borrowing as derived from the non-financial accounts (B.9 = expenditure minus revenue). A deficit is negative B.9 and a surplus is positive B.9. Based on an accounting identity, this balance should be equal to the balance calculated in the financial accounts (B.9f = transactions in liabilities – transactions in assets). The possible difference in the recording of these two balances is the statistical discrepancy between financial and non-financial accounts, which can occur, for example, due to incomplete coverage by data sources or the use of different data sources for the compilation of financial and non-financial accounts.

In algebraic terms, we can formulate this as follows:

$$d_t = df_t + SD_t \tag{2}$$

$$d_t = TL_t - TA_t + SD_t \tag{3}$$

where df is net borrowing as calculated from the financial accounts, TL is transactions in liabilities, TA is transactions in assets and SD denotes the statistical discrepancy between non-financial and financial accounts.

By replacing d in equation (1) with its equivalent in financial transactions (3), we obtain the following relationship (4):

$$DDA_t = (D_t - D_{t-1}) - (TL_t - TA_t + SD_t) \quad (4)$$

The change in debt does not equal (net) transactions in all liabilities because of the following:

(i) Some transactions in liabilities are not included in the definition of government debt used for the DDA (Maastricht debt) – e.g. transactions in financial derivatives and other accounts payable.

$$TL_t = TLD_t + TLND_t \quad (5)$$

where TLD means transactions in Maastricht debt liabilities and TLND means transactions in liabilities that are not included in (Maastricht) debt.

(ii) Debt does not only change because of transactions in Maastricht debt liabilities, but also due to valuation effects and other changes in the volume of debt. These two adjustments may be formalised as follows:

$$(D_t - D_{t-1}) = TLD_t + OC_t \quad (6)$$

where OC is valuation effects and other changes in the volume of debt.

By replacing ($D_t - D_{t-1}$) in equation (4) with its equivalent in (6) and TL_t with its equivalent in (5), we obtain the following new relationship:

$$DDA_t = TLD_t + OC_t - (TLD_t + TLND_t - TA_t + SD_t) \quad (7)$$

Equation (7) can be simplified as:

$$DDA_t = TA_t + OC_t - (TLND_t + SD_t) \quad (8)$$

Equation (8) forms the basis for the analysis of the three pillars of the DDA.

For financial derivatives and other accounts payable/receivable, transactions in assets for the respective instruments may be netted out with transactions in liabilities for the same instruments.

Algebraically, this may be developed further as follows:

$$TA_t = TMA_t + TOA_t \quad (9)$$

where TMA denotes transactions in “main financial assets” (currency and deposits, debt securities, loans, and equities and investment fund shares or units) and TOA is mainly financial derivatives and other accounts receivable.

By replacing TA_t in equation (8) with its equivalent in (9), we obtain:

$$DDA_t = TMA_t + TOA_t + OC_t - (TLND_t + SD_t) \quad (10)$$

By regrouping TOA_t and $TLND_t$, we obtain:

$$DDA_t = TMA_t + OC_t + (TOA_t - TLND_t) - SD_t \quad (11)$$

Equation (11) divides the DDA into three main pillars: transactions in main financial assets (TMA) are Pillar 1; valuation effects and other changes in the volume of debt (OC) represent Pillar 2; and time of recording differences and remaining factors ((TOA – TLND) – SD) represent Pillar 3. These are the three pillars used in DDA analysis at the ECB.

Annex 3: Equations related to the DDA and debt sustainability

Note: referenced in Chapter 5 ("Other aspects of the DDA and its analysis"), page 34.

Basic relationship between current debt and past debt

The relationship between debt at the end of year t and debt at the end of the previous year (t-1) can be defined as follows:

Debt at the end of year t (Dt) is equal to:

- debt at the end of year t-1 (Dt_{-1}); plus
- interest expenditure in year t, calculated as the average interest rate (**i**) on debt at the end of year t-1; plus
- the primary deficit in year t (Pd_t), which is equal to the government deficit in year t (d_t) minus interest expenditure (already identified separately); plus
- the deficit-debt adjustment in year t (DDA_t).

This relationship can be summarised in the following algebraic formula:

$$D_t = (D_{t-1}) + (i\, D_{t-1}) + Pd_t + DDA_{t-}\text{[11]} \quad (1)$$

Formula (1) can be rewritten as follows:

$$D_t = (D_{t-1})\,(1 + i) + Pd_t + DDA_t \quad (2)$$

If deficit d_t is replaced by Pd_t + i (D_{t-1}), formula (2) can be rewritten as:

$$DDA_t = (D_t - D_{t-1}) - d_t \quad (3)$$

[11] Pd_t is positive if the government is running a (primary) deficit and negative if it is running a surplus.

Thus, the DDA equals the difference between the change in debt and the deficit.

Derived fiscal ratio related to current debt

Fiscal data are usually expressed as a percentage of GDP at current market prices (Y_t). GDP in year t is equal to GDP in year t-1 plus nominal growth in GDP in year t:

$$Y_t = Y_{t-1}(1+g) \tag{4}$$

where g is the nominal GDP growth rate in year t.

If formula (2) is divided by GDP in year t, the following formula can be derived:

$$\frac{D_t}{Y_t} = \frac{D_{t-1}(1+i)}{Y_{t-1}(1+g)} + \frac{Pd_t}{Y_t} + \frac{DDA_t}{Y_t} \tag{5}$$

By subtracting the debt ratio in the previous period from both sides of the equation and having the change in the debt ratio on the left-hand side, we obtain:

$$\frac{D_t}{Y_t} - \frac{D_{t-1}}{Y_{t-1}} = \frac{D_{t-1}(1+i)}{Y_{t-1}(1+g)} - \frac{D_{t-1}}{Y_{t-1}} + \frac{Pd_t}{Y_t} + \frac{DDA_t}{Y_t} \tag{6}$$

$$\frac{D_t}{Y_t} - \frac{D_{t-1}}{Y_{t-1}} = \frac{D_{t-1}}{Y_{t-1}}\left[\left(\frac{1+i}{1+g}\right) - 1\right] + \frac{Pd_t}{Y_t} + \frac{DDA_t}{Y_t} \tag{7}$$

By expressing the first part of the right-hand side of equation (7) using the same denominator (1 + g), we obtain:

$$\frac{D_t}{Y_t} - \frac{D_{t-1}}{Y_{t-1}} = \frac{D_{t-1}}{Y_{t-1}}\left(\frac{1+i-1-g}{1+g}\right) + \frac{Pd_t}{Y_t} + \frac{DDA_t}{Y_t} \tag{8}$$

This can be simplified to the following **key formula for public finance**, which identifies the **three components** of the change in the debt-to-GDP ratio:

$$\frac{D_t}{Y_t} - \frac{D_{t-1}}{Y_{t-1}} = \frac{D_{t-1}}{Y_{t-1}}\left(\frac{i-g}{1+g}\right) + \frac{Pd_t}{Y_t} + \frac{DDA_t}{Y_t} \tag{9}$$

The change in the debt-to-GDP ratio:	The interest-growth differential or "snowball effect" on the debt-to-GDP ratio represents the impact on the debt-to-GDP ratio of the spread between the interest rate on public debt and the nominal growth of GDP:	The primary deficit (+) or surplus(-) as a percentage of GDP:	The DDA as a percentage of GDP:
$\frac{D_t}{Y_t} = \frac{D_{t-1}}{Y_{t-1}}$	$\frac{D_{t-1}}{Y_{t-1}}\left(\frac{i-g}{1+g}\right)$	$\frac{Pd_t}{Y_t}$	$\frac{DDA_t}{Y_t}$

The sustainability constraints of public debt

The above key equation (9) can be used in a simple model to better highlight the different factors at play in the sustainability of government debt.

If we assume that the DDA is zero, it can be shown that debt sustainability depends on the differential between the growth and interest rates.

If a country wants to keep its debt-to-GDP ratio constant, the following relationship needs to hold, as derived from equation (9):

$$\frac{D_{t-1}}{Y_{t-1}}\left(\frac{i-g}{1+g}\right)+\frac{Pd_t}{Y_t}=0 \tag{10}$$

By reducing the two terms of the equation by $(Pd_t)/Y_t$ and changing the sign of both sides of the equation, we obtain:

$$\frac{Pd_t}{Y_t}=\frac{D_{t-1}}{Y_{t-1}}\left(\frac{g-i}{1+g}\right) \tag{11}$$

This becomes equation (12) by multiplying by $(Y_{t-1})/(D_{t-1})$:

$$\frac{Pd_t}{Y_t}\frac{Y_{t-1}}{D_{t-1}}=\left(\frac{g-i}{1+g}\right) \tag{12}$$

This may be expressed as follows:

$$\frac{Pd_t}{Y_{t-1}(1+g)}\frac{Y_{t-1}}{D_{t-1}}=\left(\frac{g-i}{1+g}\right) \tag{13}$$

Finally, by multiplying both sides of the equation by (1 + g), the following sustainability constraint (under which the debt-to-GDP ratio is stable) ensues:

$$\frac{Pd_t}{D_{t-1}}=g-i \tag{14}$$

Therefore, high nominal GDP growth and low (average) interest rates on sovereign debt allow a country to have a larger primary deficit (ratio) without increasing the government debt ratio. On the other hand, a country with a nominal GDP growth rate that is lower than the interest rate will have to run primary surpluses in order to keep the debt-to-GDP ratio steady.

Another way to express the consequences of the sustainability constraint (equation (14)) is to distinguish between the three possible options in the dynamic relationship between g and i:

(i) g = i (nominal GDP growth rate equals nominal (average) interest rate). In this case, a primary balance of zero ensures a constant government debt-to-GDP ratio.

(ii) i > g (the interest rate is higher than the nominal GDP growth rate). In this case, the primary balance should be positive (in equation (14), PD_t is then negative) in order to keep the debt-to-GDP ratio constant. If the primary balance is zero, the debt-to-GDP ratio will increase (in proportion to the difference between i and g). This growth in debt when the primary government balance equals zero is the manifestation of the interest-growth differential or “snowball effect” described in Section 5.3.

(iii) $g > i$ (the interest rate is lower than the nominal GDP growth rate). In this case, the debt-to-GDP ratio may fall despite the presence of a primary deficit (until the equalisation of the two terms of the sustainability constraint in equation (14)). If the primary balance is zero, the debt-to-GDP ratio decreases.

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Linda Kezbere
European Central Bank, Frankfurt am Main, Germany; email: linda.kezbere@ecb.europa.eu

Henri Maurer
European Central Bank, Frankfurt am Main, Germany; email: henri.maurer@ecb.europa.eu

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Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

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