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Global Economics View

Looking into the Deep Pockets of the ECB

- The total non-inflationary loss absorption capacity (NILAC) of the ECB is very large – we provide estimates that put it at €3.4trn.
- The NILAC includes the conventional loss absorption capacity of the Eurosystem (ECB plus the 17 national central banks (NCBs) in the euro area): around €80bn of capital and reserves, revaluation accounts (around €400bn), and provisions (€6.4bn for the ECB alone).
- But the largest components of the total NILAC are not on the ECB's or the Eurosystem's balance sheet: the present value of future seigniorage (measured conservatively by future net currency issuance), and the outstanding stock of euro currency (€850bn). We estimate the value of the former to be at least €2trn. The ECB's loss absorption capacity in euros, unconstrained by an inflation limit, is infinite.
- The size of the ECB/Eurosystem balance sheet and its risk exposure have risen strongly over the past four years, but remain manageable relative to its NILAC. The largest items on the Eurosystem's books are collateralized lending operations in euro and USD to EA banks (around €900bn), around €670bn of gold, foreign exchange and other investment holdings, €220bn for its outright holdings of EA sovereign debt through the Securities Markets Programme and €65bn through the Covered Bonds Purchase Programmes. Emergency liquidity assistance (ELA) is provided by NCBs without loss-pooling with the rest of the Eurosystem, but is likely to be an exposure of the Eurosystem if the NCB and its sovereign are insolvent. ELA in the euro area currently likely stands at around €120-130bn.
- We do not consider ECB default and hyperinflation in the euro area to be material risks. 'Roublezonefication', balkanization of the EA monetary and financial system, and banking systems with too many insolvent but liquid zombie banks are material risks, in our view.

Willem Buiter
+44-20-7986-5944
willem.buiter@citi.com

Ebrahim Rahbari
+44-20-7986-6522
ebrahim.rahbari@citi.com

With thanks to
Juergen Michels and Antonio Montilla

See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

Contents

Looking into the Deep Pockets of the ECB **3**
1. Introduction **3**
2. The conventional loss absorption capacity of the ECB/Eurosystem **6**
2.1. Regulatory capital of the ECB 6
2.2. Revaluation accounts 7
2.3. ECB Provisions 8
2.4. The Eurosystem 8
3. The ECB/Eurosystem's off-balance-sheet assets: the present value of current and future seigniorage **11**
4. ECB/Eurosystem balance sheet size and exposure **16**
4.1. The Securities Markets Programme and the Covered Bonds Purchase Programmes 18
4.2. Exposure through Eurosystem euro and foreign currency funding operations 22
4.3. Collateral 26
4.4. Emergency liquidity assistance (ELA) 30
5. Will it all end in tears? **32**
5.1. What happens if the ECB makes a loss? Would it default? 32
5.2. Does expanding the ECB/Eurosystem balance sheet or using the NILAC imply printing 'money'? 34
5.3. Could a €2trn SMP be sterilized? 34
5.4. Would a €2trn SMP cause inflation? 35
7. Appendix **38**
7.1. The Full ECB and Eurosystem Balance Sheets 38
7.2. The ECB Profit and Loss Account 39
7.3. ECB Open Market Operations 40
7.4. Seigniorage 40
7.5. Estimating currency and money demand 42
7.6. Estimates of the PDV of Seigniorage 44
7.7. NCB details on changed collateral standards 46
References **50**
Appendix A-1 **52**

Looking into the Deep Pockets of the ECB

1. Introduction

In this report, we study three key aspects of the financial strength of the Eurosystem.

The conventional loss absorption capacity (CLAC) of the ECB and the Eurosystem is around €500bn (€80bn Eurosystem capital and reserves, €394bn revaluation accounts, plus provisions which are €5.2bn for the ECB alone).

First, we document in detail the conventional loss absorption capacity (CLAC) of the ECB and the Eurosystem (the ECB and the 17 national central banks (NCBs) in the euro area). The CLAC amounts to around €500bn and consists of the capital and reserves of the Eurosystem (around €80bn, of which the ECB accounts for €6.4bn), its provisions (€5.2bn for the ECB alone) and its revaluation accounts (unrealized gains on the Eurosystem's holdings of gold, foreign exchange and other investments, which currently stand at €394bn, of which the ECB accounts for EU20bn).

The non-inflationary loss absorption capacity (NILAC) of the Eurosystem is much larger - we estimate it at around €3.4trn, which includes the present value of future seigniorage (estimated at €2.1trn) and the currently outstanding currency stock (€850bn).

Second, we present estimates of the – much larger – total non-inflationary loss absorption capacity (NILAC) of the Eurosystem. The NILAC includes – in addition to the CLAC – the outstanding stock of currency (around €875bn for the euro area currently) and the present value of future seigniorage. We conservatively estimate the latter to be around €2trn, which implies that the NILAC of the ECB is at least €3.4trn. The ECB's loss absorption capacity in euros, unconstrained by an inflation limit, is of course infinite.

Figure 1. ECB – Balance Sheet as of December 31, 2010

Assets (€ millions)		Liabilities (€ millions)	
Gold & forex reserves	62,856	Banknotes in circulation	67,176
Claims on EA credit institutions	33	Liabilities to EA credit institutions	33
Debt held outright	17,926	Debt Certificate Issued	0
Intra-Eurosystem claims	67,176	Non-monetary liabilities	4,735
Other assets	15,532	Intra-Eurosystem liabilities	61,430
		Provisions	5,217
		Revaluation accounts	19,627
		Financial net worth	5,306
Total assets	163,523	Total liabilities	163,523

Note: Gold & forex reserves includes gold and gold receivables, claims on non-euro area residents denominated both in foreign currency and Euros, and claims on euro area residents denominated in foreign currency. Debt held outright includes securities held for monetary policy purposes. Intra-Eurosystem claims related to the allocation of euro banknotes within the Eurosystem. Non-monetary liabilities includes liabilities to other euro area residents denominated in Euros, liabilities to non-euro area residents both in foreign currency and Euros, other liabilities and profit of the year. Financial Net Worth corresponds to Capital and Reserves.

Sources: ECB and Citi Investment Research and Analysis

The ECB's main exposures relate to the Eurosystem's collateralized lending operations in euros and USD (currently around €900bn pre-LTRO2), its gold, forex and investment portfolio (€670bn), and its outright purchases of EA sovereign bonds (€220bn) and covered bonds (€65bn).

Emergency liquidity assistance, technically an exposure for the granting NCB alone, is likely to become an exposure of the Eurosystem if the NCB and its sovereign are insolvent.

Third, we analyse the asset side of the ECB and Eurosystem balance sheet and its resulting exposures. These include the Eurosystem's collateralized lending operations to EA banks in euros and foreign currency, which currently stand at around €900bn and are set to rise by another couple of hundred billion as a result of the upcoming 3-year long-term refinancing operation (LTRO). These exposures also include the outright holdings of Greek, Irish, Italian, Portuguese, and Spanish sovereign debt in the ECB's Securities Markets Programme (SMP) which currently amount to €219.5bn at carrying value on the Eurosystem balance sheet and to around €240bn (our estimate) at face value. Other securities held outright for monetary policy purposes include euro area (EA) covered bonds bought through the two Covered Bonds Purchasing Programmes (CBPP and CBPP2), with outstanding values of €57bn for the original CBPP and €7bn for CBPP2 (at purchase prices). Other exposures include the Eurosystem's holdings of gold, foreign exchange and other investments (valued at around €670bn currently. Finally, there is the exposure of the Eurosystem implied by emergency liquidity assistance (ELA) provided by national central banks (NCBs). While this exposure is officially for the balance sheet of the ELA-granting NCB only, and explicitly guaranteed by its sovereign, the

ECB/Eurosystem would likely be exposed if the NCB and its sovereign were insolvent. This risk is most obvious in the case of Greece, where ELA exposures have been rising fast. Data on ELA are scarce, but the available information indicate that around €120-130bn is currently outstanding in Belgium, Cyprus, Greece and Ireland, with the latter two accounting for just over €100bn of the total.

The Eurosystem's exposures have been rising quickly, but should be compared to the ECB's NILAC rather than its CLAC. The CLAC should not be used to argue against the ECB's lender of last resort role for EA sovereigns and banks.

This exposure of ECB/Eurosystem is large and has been rising quickly – between June 2007 and December 2011, the Eurosystem balance sheet increased by 126% (in current euros). The increase has been smaller than in the case of the Bank of England or the Fed, whose balance sheets grew by 264% and 237%, respectively over the same period (in current sterling and dollar terms, respectively), but has been similar relative to GDP.[1] But both the increase in and the total size of the exposures seem less threatening relative to the total NILAC than relative to most of the much narrower conventional measures of the loss absorption capacity of the ECB/Eurosystem. These conventional loss absorption measures are often used and abused –- typically by comparing them to the size of the ECB's and the Eurosystem's balance sheets – to draw fearful but misleading implications about the consequences of this risk exposure for ECB insolvency risk or inflation. We show that the conventional loss absorption capacity measures should not be used to argue against the ECB providing lender of last resort support to EA sovereigns and banks (see also Global Economics View - Why Does The ECB Not Put Its Mouth Where Its Money Is? The ECB As Lender Of Last Resort For Euro Area Sovereigns And Banks).

The ECB is exempt from regulatory capital requirements and from complying with externally set accounting rules. It could run on negative equity or 'evergreen' its exposures indefinitely.

We also address a number of other common misperceptions. First, we highlight that the ECB is – in our view for excellent economic reasons – exempt from capital requirements (such as the capital requirements directive in the European Union) and that it is also not obliged to comply with externally set accounting conventions. When faced with very large losses on its exposures, the ECB could therefore choose to either realise the loss and continue its only slightly less happy existence with negative equity, or it could 'evergreen' the respective exposure in perpetuity. Since the overwhelming majority of the ECB's obligations are in euros, the ECB is also not at risk of payments default.

The ECB can increase its balance sheet by issuing monetary or non-monetary liabilities – a much bigger SMP does not mean 'printing money' (even electronically). They are currently unlikely to lead to inflation, and could be sterilized.

A further substantial expansion of the ECB's balance sheet, e.g. to ramp up outright purchases of public and private securities, would not necessarily imply a large increase in the ECB's monetary liabilities – it always has the option to 'sterilise' such purchases by issuing non-monetary liabilities, such as fixed-term deposits or ECB bills and bonds, and varying their terms to make them attractive enough for banks to hold. The fact that, on two occasions, the ECB did not generate enough interest from EA banks to sterilize its weekly SMP purchases was because the ECB did not try very hard – so far, the ECB has stuck to its self-imposed rule of only issuing fixed-term one week deposits at a maximum of the refi rate to absorb SMP liquidity.

Risks arising from increases in the Eurosystem balance sheet are a gradual 'Roublezoneification', a 'Balkanization' of EA financial systems or a zombie banking system.

There are risks associated with the balance sheet expansion of the ECB/Eurosystem. The ELAs permit NCBs, which could be at risk of 'going native' to provide credit to their national counterparty commercial banks on terms that cannot be effectively monitored by the rest of the Eurosystem or by the ECB. The Governing Council of the ECB does retain the right to limit the overall size of national ELAs, however, so the risk of multiple independent centres of central bank credit expansion – what we have called 'Roublezoneification' – is in principle controllable as far as the ELAs are concerned. The same is not true for the further relaxation of collateral standards permitted to seven national central banks. This

[1] The Eurosystem balance sheet grew by 15.2% of EA GDP between June 2007 and end-December 2011, while the increase for the BoE and the Fed were 13% of GDP.

applies to the Eurosystem operations of these seven NCBs, including the two 3-year LTROs. With the magnitude of the central bank credit extended demand determined under the current full allotment allocation system, and with no effective quality control by the centre (the ECB and the Eurosystem as a whole) over the collateral the seven NCBs are willing to accept as part of their new 'tier two' national collateral, the risk of uncontrolled overall credit expansion and Roublezoneification is real.

To limit these risks, the ECB appears to have decided that any losses incurred as a result of credit expansion by the seven NCBs against the new lower-grade national collateral will not be shared by the Eurosystem as a whole but will be for the account of the national central bank in question. This indeed mitigates the risk of reckless credit expansion by these seven NCBs, if the decision not to pool and share these losses is indeed credible. The fact remains that we have had no formal announcement by the ECB of such a decision, only a not completely unambiguous statement by President Draghi during the Q&A following the ECB's Governing Council meeting on February 9, 2012: *"Therefore, we want to keep the risk related to these assessments with national central banks so they bear the full risk of their choices".* Although absence of loss pooling and sharing reduces the risk that NCBs will lend recklessly, it Balkanizes euro area monetary policy. In recognition of that, the ECB had eliminated the 'tier two collateral' list as recently as January 1, 2007. Even more seriously, it means that different NCBs in the euro area will potentially be characterized by larger differences in credit risk or default risk between themselves than was the case in the past, especially when a barely solvent NCB is 'backed' by a barely solvent or even an insolvent sovereign.

Finally, pouring liquidity on demand into the banking system, at deeply subsidized rates and against potentially very poor collateral keeps the banks alive but reduces the banks' incentives to clean up their balance sheets, recapitalize, restructure and consolidate. We are at risk of importing into the euro area an undesirable feature of the early post-Soviet Union collapse Russian state-owned banking system – where the banks were insolvent but highly liquid. Weaning the addicted zombie banks off cheap central bank liquidity will not be a simple task.

We hope and expect that the ECB/Eurosystem will manage these challenges and address these risks effectively during the years to come. Provided they do, even a big increase in the ECB's balance sheet, be it through ramping up outright purchases or through further large increases in its collateralized lending operations, is unlikely to lead to high inflation anytime soon, or indeed ever. This is not because the ECB could choose to issue very short-term non-monetary liabilities rather than 'central bank money', that is, base money or high-powered money to fund these – this type of 'sterilisation' is largely semantic and the inflation implications would be very similar to those resulting from classic monetization of central bank balance sheet expansion.

Rather, there is no direct mapping between narrow or even broader measures of the money supply and inflation. In the environment that the euro area faces today, with weak demand and large output gaps in most countries, inflation is unlikely to rise strongly. Even as base money has exploded in the euro area over the past 5 years, broader measures of the money supply, such as M1, M2 or M3, have risen much less quickly. Both the demand for and supply of bank credit remain very weak. Under such circumstances, the most the ECB can do is likely to prevent deflation or inflation from falling too strongly. And even if EA banks rediscovered their 'mojo' and started lending out their funds to EA corporates and households, the ECB has the tools at its disposal to make sure inflation remains within its pre-ordained bounds.

Nothing the ECB has done so far, or is indeed likely to do, has shaken our belief that it remains fully committed to the primacy of its price stability mandate.

After the liquidity-fuelled rally in many asset markets, the risk-on trade may be back, but the fundamental risks in euro area economies and financial markets have not disappeared. These risks include the risk of a full market melt-down of the EU and global financial system after the default of a systemically important bank or sovereign and/or the risk of a deep and prolonged recession. Those risks are real, unlike the risk that the ECB will default or cause hyperinflation anytime soon.

2. The conventional loss absorption capacity of the ECB/Eurosystem

2.1. Regulatory capital of the ECB

ECB paid-up capital is €6.5bn currently, and set to rise to €7.6bn at end-2012.

As of end-December 2011, the subscribed capital of the ECB stood at €10.8bn. Paid-in capital was €6.5bn, up from €5.3bn the year before and €4.0bn at end-2009, following an ECB Governing Council decision to increase its capital base in December 2010 (Figure 2). The total subscribed capital increase was €5bn (from €5.8bn to €10.8bn), of which €3.5bn is supposed to be paid up in three annual installments by the euro area (EA) National Central Banks (NCBs) according to their capital shares. After the installments at the end of 2010 and 2011, the final installment is due at the end of 2012. Non-euro area members of the European System of Central Banks (ESCB), such as the Bank of England or the Sveriges Riksbank, account for just over 30% of the total subscribed capital of the ECB, but only a very low share of the paid-in capital (EA NCBs account for €6.4bn of the total €6.5bn in paid-up capital). The non-EA NCBs are not entitled to receive any share of the distributable profits of the ECB nor are they liable to fund any loss of the ECB, so we will mostly ignore them for the purposes of this study.[2] The total balance sheet size of the ECB was €164bn at the end of 2010, implying a ratio of paid-in capital (as of end-2010) to total assets of 3.2% or a 'leverage ratio' (debt/equity) of 30.

We will argue below that both the on-balance sheet capital and reserves of the ECB and the leverage ratio are near-irrelevant (as a measure of the loss absorption capacity and riskiness of the ECB/Euroystem's balance sheet) and are used in an often misleading and usually misinformed way.

But first, we turn our attention to two other items on the ECB's balance sheet which are loss-absorbing (revaluation accounts and provisions), and then we consider the equivalent items on the Eurosystem's balance sheet.

[2] Non-EA NCBs are, however, required to contribute a percentage of 3.75% of their subscribed capital (7% before the recent capital increase) to the operational costs of the ECB.

Figure 2. ECB – Capital and Capital Shares, 2010 and 2011

National Central Bank	Country	Capital key since 1 January 2009 %.	Subscribed capital since 29 December 2010 (MIL €)	Paid-up capital on 28 December 2011 (MIL €)	Paid-up capital on 29 December 2010 (MIL €)	Adjusted capital share %
Nationale Bank van België	Belgium	2.43	261	220.6	180	3.47
Deutsche Bundesbank	Germany	18.94	2,038	1,722	1,407	27.07
Eesti Pank	Estonia	0.18	19	16.278	1	0.26
Central Bank of Ireland	Ireland	1.11	120	101	82	1.59
Bank of Greece	Greece	1.96	211	178.687	146	2.81
Banco de España	Spain	8.3	894	755.164	617	11.87
Banque de France	France	14.22	1,530	1,293	1,056	20.32
Banca d'Italia	Italy	12.5	1,345	1136.43	928	17.86
Central Bank of Cyprus	Cyprus	0.14	15	12.45	10	0.20
Banque centrale du Luxembourg	Luxembourg	0.17	19	15.887	13	0.25
Central Bank of Malta	Malta	0.06	7	5.747	5	0.09
De Nederlandsche Bank	Netherlands	3.99	429	362.686	296	5.70
Oesterreichische Nationalbank	Austria	1.94	209	176.577	144	2.78
Banco de Portugal	Portugal	1.75	188	159.181	130	2.50
Banka Slovenije	Slovakia	0.33	35	29.901	24	0.47
Národná banka Slovenska	Slovenia	0.69	75	63.057	52	0.99
Suomen Pankki - Finlands Bank	Finland	1.25	135	114.029	93	1.79
Subtotal for euro area NCBs		**69.97**	**7,510**	**6,363**	**5,197**	**100.00**
Bulgarian National Bank	Bulgaria	0.87	93	3.505	4	
Česká národní banka	Czech Republic	1.45	156	5.839	6	
Danmarks Nationalbank	Denmark	1.48	160	5.986	6	
Latvijas Banka	Latvia	0.28	31	1.144	1	
Lietuvos bankas	Lithuania	0.43	46	1.717	2	
Magyar Nemzeti Bank	Hungary	1.39	149	5.591	6	
Narodowy Bank Polski	Poland	4.9	527	19.754	20	
Banca Naţională a României	Romania	2.46	265	9.944	10	
Sveriges Riksbank	Serbia	2.26	243	9.112	9	
Bank of England	UK	14.52	1,562	58.58	59	
Subtotal for non-euro area NCBs		**30.03**	**3,251**	**121**	**121**	
Total		**100**	**10,761**	**6,484**	**5,306**	

Note: The adjusted capital share is computed such that the capital shares of the EA NCBs sum to 100%.

Source: ECB and Citi Investment Research and Analysis

2.2. Revaluation accounts

ECB revaluation accounts stood at €20bn at end-2010.

Revaluation accounts on the ECB's balance sheet represent balances arising from unrealised gains on assets and liabilities, including gold, foreign currency, securities and other instruments. These gains stood at €19.6bn at the end of 2010. Figure 3 shows that gold accounts for the bulk of the revaluation accounts (almost exactly two thirds of the total in 2010).[3] ECB/Eurosystem accounting conventions imply that reductions in the value of securities, foreign exchange holdings and gold (except securities held for monetary policy purposes which include the Securities Markets Programme purchases) are marked to market at the end of each quarter. Unrealised gains arising from the quarterly revaluation are not recognised as income, but credited to the revaluation account, while unrealised losses *are* taken to the profit and loss account at the end of the year if they exceed previous revaluation gains *for the same class of securities.* These revaluation gains are registered on the liability side of the balance sheet in the revaluation accounts. The balance on the revaluation account is therefore clearly potentially loss-absorbing. A mere plausible change of the accounting convention used could see the revaluation gains included in the capital entry (effectively treating increases and decreases in market value

[3] The ECB holds 16m ounces of gold, and total Eurosystem gold holdings are 347m ounces. The likely current value of the revaluation accounts is higher than at the end of 2010, as we are not aware of any sales of gold and the (dollar) price of gold increased by 18% in 2011. For the ECB the increase in value of gold holdings was around €2.5bn, while the value of Eurosystem gold holdings increased by €55bn.

symmetrically). At most, what it would take for the revaluation gains to be treated as fully loss-absorbing would be to sell and immediately repurchase some of these assets, with the gain being realised as profit and added to the capital balance on the liability side, with the repurchased assets accounting for the matching increase in the value of the assets.[4]

Figure 3. ECB – Revaluation Accounts (millions €), 2009 – 2010

	2010	2009	Change
Gold	13,079	8,418	4,660
Foreign currency	6,271	2,070	4,201
Securities and other instruments	277	427	-150
Total	19,627	10,915	8,711

Source: ECB Annual Reports and Citi Investment Research and Analysis

2.3. ECB Provisions

ECB provisions were €5.3bn in 2010.

According to the ECB's Annual Report for 2010, the ECB's risk provision stood at just over €5.3bn. The provision covers a range of activities, including those related to relocation of the ECB's headquarters, its gold and foreign exchange reserves and other investments, but the provision is also explicitly aimed at covering credit risk arising from both Covered Bond purchase programmes. It would hardly constitute a stretch of imagination for the provision to also cover credit risk arising from sovereign bond exposure.

The ECB's Statute determines that the combination of the ECB's provision and its general reserve cannot exceed the level of paid-up capital, but it was brought up to the increased level of paid-up capital at the end of 2010. The increase of €1.16bn in the provision was funded out of the ECB's monetary and non-monetary income and correspondingly reduced its distributable profit (its dividends to the NCBs).

2.4. The Eurosystem

Eurosystem capital and reserves are just under €80bn and revaluation accounts just over €390bn currently.

The Eurosystem is the ECB and the NCBs of countries that are part of the EMU. The ECB Statute states that the Governing Council can increase the ECB's capital, and with the NCBs the only shareholders of the ECB, the implication is that such a capital increase would be provided by the NCBs – which also receive the distributable profits of the ECB. The Eurosystem is not a legal person (unlike the ECB and the NCBs) and very little detailed information is provided about the composition of the Eurosystem assets and liabilities besides a weekly financial consolidated financial statement for the Eurosystem provided by the ECB. As of the latest such statement, the Eurosystem's capital and reserves were €81.7bn on 17 February 2012, while the revaluation accounts stood at €394bn (Figure 4).[5,6] Data on the level of provisions at the level of the Eurosystem were not available.

[4] The ECB is signatory to international agreements between central banks that limit the amount of gold sales, but may not apply to such spurious transactions simply carried out to transform unrealized gains into realized gains. See http://www.ecb.int/press/pr/date/2009/html/pr090401.en.html and http://www.ecb.int/pub/pdf/other/pp51_57_mb200001en.pdf.

[5] Eurosystem Capital and Reserves include i) the paid-up capital and the reserves of the individual NCBs (€79.5bn for Dec-2010), ii) the paid-up shares in the ECB's capital of the non-euro area NCBs (€0.12bn), and iii) the ECB's reserves (€0).

[6] Revaluation accounts include i) the revaluation accounts of the individual NCBs (€312.0bn for Dec-2010), and ii) the ECB's revaluation accounts (€19.6bn).

Figure 4. Eurosystem – Consolidated Balance Sheet, as of Feb 17, 2012 and Dec 30, 2010

Assets (€ millions)			Liabilities (€ millions)		
	17-Feb-12	30-Dec-10		17-Feb-12	30-Dec-10
Gold & forex reserves	792,391	640,946	Banknotes in circulation	869,355	839,702
Collateralised loans to banks	865,529	592,402	Bank reserves	807,200	378,008
Debt held outright	655,855	492,369	Debt Certificate Issued	0	0
Other assets	349,488	276,493	Non-monetary liabilities	511,020	373,512
			Financial net worth	81,657	79,479
			Revaluation accounts	394,029	331,510
Total assets	2,663,261	2,002,210	Total liabilities	2,663,261	2,002,210

Note: Gold & forex reserves includes gold and gold receivables, claims on non-euro area residents denominated both in foreign currency and Euros, and claims on euro area residents denominated in foreign currency. Colllateralised loans to banks include lending facilities to EA credit institutions and other claims on EA credit institutions. Debt held outright includes holdings of public and private debt securities, including those held for monetary policy purposes which in turn include purchases under the Covered Bonds programme and the Securities Markets Programme. It also includes a small amount of EA sovereign debt securities held not for monetary policy purposes. Bank Reserves corresponds to liabilities to euro area credit institutions related to monetary policy operations. Non-monetary liabilities includes other liabilities to euro area credit institutions, liabilities to other euro area residents denominated in Euros, liabilities to non-euro area residents both in foreign currency and Euros, counterpart of special drawing rights allocated by the IMF, and other liabilities. Financial Net Worth corresponds to Capital and Reserves. Totals/sub-totals may not add up, due to rounding.

Sources: ECB and Citi Investment Research and Analysis

But Eurosystem capital is not distributed evenly across the 17NCBs – potentially limiting their ability to respond to ECB capital calls.

Disregarding for the time being that provisions are not reflected on the Eurosystem balance sheet, the combination of Eurosystem capital and reserves and revaluation accounts presents an upper bound on the loss absorption capacity of the ECB that is currently recorded on its balance sheet.[7] That is because the composition by country of the capital and reserves of the NCBs in the Eurosystem is not exactly equal to the composition by country of ECB capital. It is therefore possible that a capital call by the ECB could not be answered by some of the NCBs unless these (relatively poorly capitalized) NCBs were recapitalized themselves, presumably by their sovereigns. In the case of an insolvent national sovereign, such an NCB recapitalization may not be forthcoming.

The ECB does not publish a breakdown of the composition of the Eurosystem's consolidated capital and reserves, nor does it provide any notes with further colour on the subject in its weekly financial statements. Individual NCBs publish their levels of capital and reserves in their own annual reports, and sometimes in monthly accounts. The definition of capital, and balance sheet items in general, differs somewhat between the monthly and the annual accounts. Based on available data it is only possible to reconcile the annual data of the individual NCBs with those of the Eurosystem, so the latest date for which we can estimate the composition of Eurosystem capital and reserves by NCBs is at the end of 2010. Since capital and reserves stood at €79.5bn at end-2010 (not including Estonia which had capital and reserves of €343mn at end-2010), while capital and reserves were €81.7bn as of the latest weekly Eurosystem financial statement (17 February 2012, including Estonia), we regard the discrepancy between the end-2010 and the current data as likely immaterial.

Relative to the capital implied by applying NCB capital shares to total Eurosystem capital, the central banks of Germany, Greece and Spain are undercapitalised.

If we compare actual reserves with those predicted by applying the ECB capital share of an NCB to the consolidated Eurosystem capital and reserves figure provided by the ECB (adjusted such that they sum to 100%), the differences can be quite large (Figure 5). In the case of the Central Bank of Austria, the actual capital and reserves are almost twice as large as those implied by its capital share (€4.2bn vs €2.2bn), and similarly for France (€28.6bn actual vs €16.2bn implied). For Belgium, Ireland, Italy and the Netherlands, the implied capital shares also

[7] If we assume that the Eurosystem carries proportionally as much in provisions relative to the size of its balance sheet as the ECB, provisions could be around €74bn.

substantially underestimate the actual shares of these NCBs' capital and reserves in those of the Eurosystem. By contrast, for Germany, Greece, and Spain the capital implied by multiplying the NCB's capital share in the ECB by consolidated Eurosystem capital and reserves overestimates actual capital; by almost a factor of three in the case of Greece, and by almost a factor of five in the case of the Bank of Spain and the Bundesbank.

Figure 5. EA Countries – Capital and Reserves, as of 31 December 2010 (mn €)

Country	Capital and Reserves	Adjusted capital share (%)	Implied capital and reserves	Ratio of implied and actual capital	Capital as % of NCB assets
Austria	4,166.3	2.8	2,211.2	0.5	6.6
Belgium	3,537.0	3.5	2,762.2	0.8	3.0
Cyprus	116.7	0.2	155.9	1.3	0.7
Finland	2,175.0	1.8	1,427.9	0.7	2.5
France	28,611.0	20.4	16,194.8	0.6	4.0
Germany	5,000.0	27.1	21,565.5	4.3	0.6
Greece	815.4	2.8	2,237.6	2.7	0.5
Ireland	1,723.0	1.6	1,264.8	0.7	1.1
Italy	21,149.4	17.9	14,230.9	0.7	3.9
Luxembourg	182.0	0.3	198.9	1.1	0.1
Malta	266.5	0.1	72.0	0.3	7.4
Netherlands	7,244.0	5.7	4,541.7	0.6	2.7
Portugal	1,380.6	2.5	1,993.3	1.4	1.5
Slovakia	358.3	0.5	374.4	1.0	1.7
Slovenia	802.0	1.0	789.6	1.0	7.8
Spain	1,950.0	11.9	9,456.4	4.8	0.5
Total	**79,477.3**	**100.0**	**79,477.3**	**1.0**	**3.0**

Figure 6. EA Countries – Revaluation Accounts, as of 31 December 2010 (mn €)

Country	Revaluation Accounts	Adjusted capital share (%)	Implied revaluation accounts	Ratio of implied and actual revaluation accounts	Revaluation accounts as % NCB assets
Austria	8,690.2	2.8	8,681.1	1.0	13.9
Belgium	7,690.0	3.5	10,844.6	1.4	6.5
Cyprus	478.1	0.2	612.1	1.3	3.0
Finland	2,274.0	1.8	5,606.1	2.5	2.6
France	67,961.0	20.4	63,581.5	0.9	9.5
Germany	110,500.0	27.1	84,666.7	0.8	12.8
Greece	3,263.7	2.8	8,784.9	2.7	1.9
Ireland	230.3	1.6	4,965.8	21.6	0.1
Italy	70,206.2	17.9	55,871.0	0.8	13.0
Luxembourg	298.0	0.3	781.1	2.6	0.2
Malta	12.3	0.1	282.6	23.0	0.3
Netherlands	20,365.0	5.7	17,830.8	0.9	7.6
Portugal	10,054.6	2.5	7,825.9	0.8	11.3
Slovakia	544.5	0.5	1,470.0	2.7	2.5
Slovenia	188.1	1.0	3,100.1	16.5	1.8
Spain	9,274.6	11.9	37,126.3	4.0	2.6
Total	**312,030.4**	**100.0**	**312,030.4**	**1.0**	**11.6**

Note: Capital and reserve value for France correspond to the sum of Funds for general risks and accelerated tax depreciation, Revaluation reserve of State gold reserves, Revaluation reserve of State foreign exchange reserves, and Capital, reserves and retained earnings. Adjusted capital share correspond to implied capital share excluding Estonia. Implied capital and reserves (implied revaluation accounts) is the product of Eurosystem capital and reserves (revaluation accounts) and adjusted capital share. Balance sheet size ratios are based on total size of NCBs balance sheet as 31 January 2012

Source: National Central Banks Annual Reports, ECB and Citi Investment Research and Analysis

Once we taken revaluation gains into account, it is the Greek, Irish and Spanish central banks are relatively short of conventional loss absorption capacity.

Once we include revaluation accounts of the Eurosystem, the picture changes (Figure 6). Balances on the revaluation accounts of the Bundesbank, the Bank of Italy and the Bank of Portugal are substantially larger than implied by their capital shares, while those of the NCBs in Finland, Greece, Ireland, Luxembourg, Malta, Slovakia, Slovenia and Spain are much smaller relative to the implied values (Figure 6). If we combine capital and reserves and revaluation account balances, the loss-absorption capacity of the Bundesbank is just slightly above that implied by its ECB capital share, while that of the central banks of Austria, France, Italy, Netherlands, and Portugal is larger, and that of Belgium, Cyprus, Finland, Greece, Ireland, Luxembourg, Malta, Slovakia, Slovenia, and Spain below the implied levels (Figure 7).

Relative to total NCB assets, the sum of capital and revaluation accounts varies from 0.4% in Luxembourg to 20.5% in Austria.

Relative to GDP, the range is from 1.0% in Spain to 6.7% in Portugal.

Relative to the size of the ECB balance sheet or GDP, the conventional or on-balance sheet loss absorption capacity (CLAC) of the NCBs also varies widely (Figure 7). Relative to NCB assets, the cross-country dispersion is particularly striking. For the Eurosystem as a whole, the sum of capital and reserves and revaluation accounts sum to just under 15% of total assets, but in countries that either have a very large financial sector relative to the size of the economy (Luxembourg), or a banking sector with a high reliance on the Eurosystem for funding (Greece), or both (e.g. Ireland), the ratio of on-balance sheet loss absorption capacity and total assets can be much smaller (0.4% in Luxembourg, 1.2% in Ireland, 2.4% in Greece and 3.1% in Spain).

Figure 7. EA Countries – Capital and Reserves plus Revaluation Accounts, as of 31 December 2010

Country	Capital and Reserves + Revaluation Accounts		
	€ millions	% of assets	% of GDP
Austria	12,856	20.5	4.3
Belgium	11,227	9.5	3.0
Cyprus	595	3.8	3.3
Finland	4,449	5.2	2.3
France	96,572	13.5	4.9
Germany	115,500	13.4	4.5
Greece	4,079	2.4	1.9
Ireland	1,953	1.2	1.3
Italy	91,356	16.9	5.8
Luxembourg	480	0.4	1.1
Malta	279	7.7	4.3
Netherlands	27,609	10.3	4.5
Portugal	11,435	12.8	6.7
Slovakia	903	4.2	1.3
Slovenia	990	9.6	2.8
Spain	11,225	3.1	1.0
Total	**391,508**	**14.6**	**4.2**

Note: values relative to total balance sheet size are based on total size of NCB balance sheet as 31 January 2012

Source: ECB, Eurostat, and Citi Investment Research and Analysis

Relative to GDP, the cross-country differences are much less striking, but still large. At the lower end of the scale, the sum of capital and revaluation gains is 1% of GDP in Spain, 1.1% in Luxembourg, 1.3% in Slovakia and Ireland and 1.9% in Greece, while it is 4.2% for the EA as a whole, with not only France and Germany, but also Austria, Italy and Portugal above the EA average.

3. The ECB/Eurosystem's off-balance-sheet assets: the present value of current and future seigniorage

The main asset of the ECB/Eurosystem is not recorded on its balance sheet – it is the present value of current and future seigniorage.

The total on-balance-sheet loss absorption capacity of the Eurosystem, as discussed in the last section, is likely up to around €500bn. But the main asset of the ECB/Eurosystem is not recorded on its balance sheet, so this number substantially understates the loss absorption capacity of the Eurosystem. This asset is the monopoly the Eurosystem has on creating euro banknotes and the other components of the EA's monetary base. Euro banknotes are the only vehicle to carry the status of legal tender in the euro area.[8] The other two components of the monetary base – coins and short-term deposits of EA credit institutions with the ECB/Eurosystem – do not enjoy the status of legal tender, but still offer the potential to earn revenue, as they can be remunerated at a level below the going market interest rate or the interest rate earned on the Eurosystem's assets.[9] In this section, we estimate, under conservative assumptions including that inflation remains at 2% a year on average, the value of this monopoly of current and future money issuance for the Eurosystem, which is very large – at least €2trn. This number and the

[8] ECB Statute Article 16: "Banknotes

In accordance with Article 128(1) of the Treaty on the Functioning of the European Union, the Governing Council shall have the exclusive right to authorise the issue of euro banknotes within the Union. The ECB and the national central banks may issue such notes. The banknotes issued by the ECB and the national central banks shall be the only such notes to have the status of legal tender within the Union."

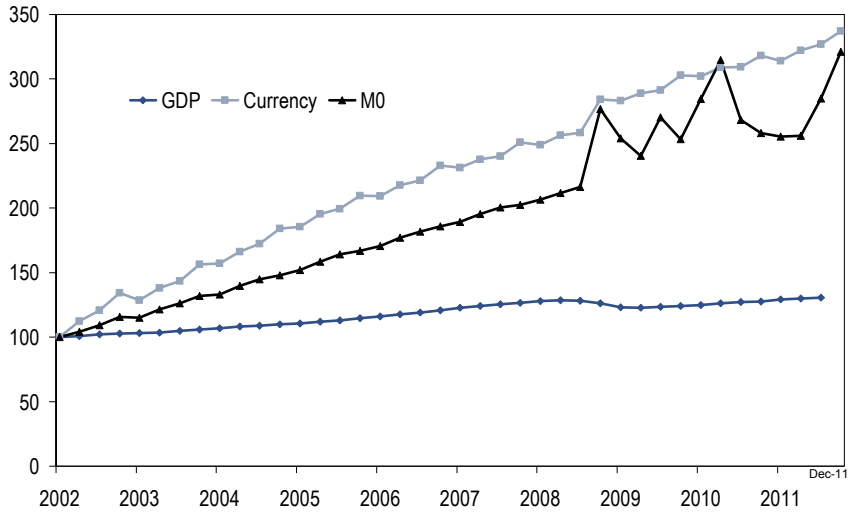
[9] In the case of coins, of course, remuneration is generally zero.

currently outstanding stock of currency in the euro area (around €850bn currently) need to be added to the conventional loss absorption capacity (CLAC) to arrive at the non-inflationary loss absorption capacity (NILAC) of the Eurosystem.

We focus on currency only. Currency grew faster than GDP over the last decade in the EA, UK, US, and Japan and this trend shows little sign of disappearing.

We will focus mostly on the Eurosystem's monopoly for issuing currency. The ascent of electronic payments has sometimes led to the assumption that average currency balances would decrease substantially over time, if not in nominal terms, then at least in real terms or relative to levels of transactions or income. Goodhart (2010) presents some arguments why any tendency for electronic money to displace currency may at least be much attenuated.[10] To date, there is also very little empirical support for the prediction of a demise of currency holdings. Figure 8 charts the evolution of a narrow measure of the money supply (M0, which includes short-term bank deposits of credit institutions with the Eurosystem in addition to banknotes, but excludes coins) and currency holdings (excluding coins) since the introduction of euro currency on January 1, 2002, as well as nominal GDP. As is clear from the chart, both types of money balances have grown faster than nominal GDP. In fact, currency balances (excluding coins) have almost tripled in the 9 years since euro currency was introduced, while nominal GDP has only grown by around 30%. Other measures of the narrow money supply, including M0, have also grown faster than GDP.

Figure 8. Euro Area – Money Supply (Jan 2002 = 100), 2002 – 2011



Note: M0 includes currency in circulation plus the minimum reserves credit institutions are required to hold with the Eurosystem and any excess reserves they may voluntarily hold.

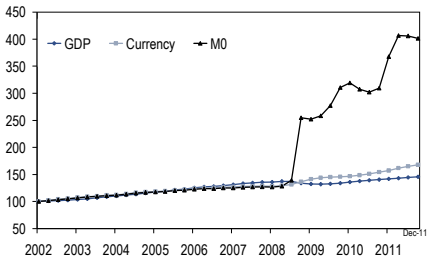
Source: ECB, Eurostat, and Citi Investment Research and Analysis

The recent experience in Europe may be somewhat extreme, as the introduction of euro currency on January 1, 2002, was a huge structural break. Not only were national currencies abolished in the (then 12, not 17) member countries, but a new truly international vehicle and reserve currency was created, quite plausibly

[10] Among the reasons given are that currency exchange is completely anonymous, while electronic payments always at least leave the possibility of tracking the transactions, that the reliance on electronic equipment creates risks of malfunctions, that electronic transactions can be hacked. Of course, currency is subject to both theft and forgery, somewhat weakening the second and third arguments. The first – the fact that currency is anonymous – may in fact be sometimes an undesirable feature of currency, particularly for high-denomination notes which enjoy widespread popularity in those parts of the official and unofficial parts of the economy that engage in what Goodhart summarily calls 'bad behaviour'.

boosting demand for euro currency and other euro-denominated instruments (including those classified as 'money'). The deep recession of '08/'09, which was followed by only a slow and timid recovery before recently submerging into recessionary territory again, implies that nominal GDP growth was unusually weak. However, as Figure 9 - Figure 11 show, currency and narrow money (M0) demand have also broadly at least kept up with nominal GDP growth in Japan, the US and the UK over the same time period. Longer time series (not reported here) show a similar picture.[11]

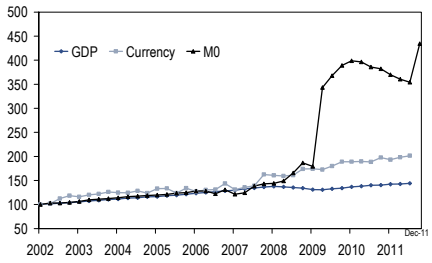
Figure 9. US – Money Supply and Nominal GDP (2002Q1 = 100), 2002 – 2011



Note: M0 includes total reserves, the currency component of the money stock, and other deposits and vault cash.

Source: Bureau of Economic Analysis, Federal Reserve, and Citi Investment Research and Analysis.

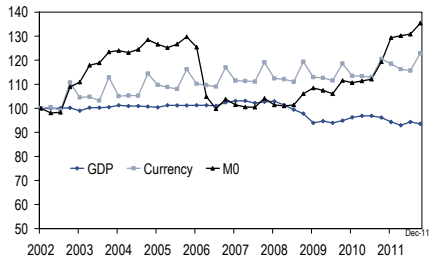
Figure 10. UK – Money Supply and Nominal GDP (2002Q1 = 100), 2002 – 2011



Note: M0 until 2006, monetary base after 2006. Since these two measures are not wholly comparable, we use growth rates for M0 until 2006 and growth rates for monetary base from 2006.

Source: Bank of England, IMF, Office for National Statistics, and Citi Investment Research and Analysis

Figure 11. Japan – Money Supply and Nominal GDP (2002Q1 = 100), 2002 – 2011



Note: M0 includes notes and coins in circulation and the required reserves financial institutions held in the central bank.

Source: Bank of Japan, Cabinet Office, and Citi Investment Research and Analysis

We estimate the relationship between currency demand and output and between currency demand and a short-term risk-free interest rate (its opportunity cost).

Based on the recent and basic evidence, we can thus see that narrow money demand and currency show very little sign of disappearing. But we do not stop at this casual observation. Instead, we estimate the value of the monopoly of issuing currency for the Eurosystem in two steps.

First, we estimate the relationship between currency demand and its main drivers in the euro area. The old and venerable academic literature on the topic (see for example Friedman (1956), Tobin (1956), and Friedman and Schwartz (1963)) stresses that currency demand and money demand more generally depend positively on the value of transactions in the economy (proxied here by nominal GDP, as is common in the literature) and negatively on the opportunity cost of holding money, given by the difference between the interest rate that can be earned on a close alternative to currency and the interest rate paid on currency (which we set to zero). We estimate the strength of the relationship between real currency demand and nominal interest rates and between real currency demand and real output statistically, taking into account nonstationarity, common trends and structural breaks in the relevant series.[12]

[11] Growth in M0 in particular over the past few years has also been boosted by QE and other unconventional balance-sheet driven monetary policy measures by major industrial country central banks. Higher-than-usual currency issuance has not been part of the monetary policy response, but currency demand may also have been boosted by concerns about the health of banking systems in many advanced economies.

[12] Full details of the estimation are provided in the appendix.

The output elasticity of currency demand is very robustly estimated at around 0.8. The interest-rate semi-elasticity is less precisely pinned down, with most values between 2 and 4.

The estimation yields a very robust estimate of the relationship between output and currency demand – the estimated 'output elasticity of currency demand' is around 0.8, implying that every one percent increase in real output calls forth a 0.8% increase in real currency balances held. The relationship between the opportunity cost of holding money (the interest rate on a close substitute asset – e.g. highly liquid short-term government securities) and currency demand is somewhat less precisely estimated, but the average 'interest rate semi-elasticity of currency demand' estimated is around 3, implying that a 100bps increase in a short-term market interest rate (our opportunity cost measure) implies a 2% decrease in real currency balances. Full details of the data used, the estimation methodology and the result are given in the Appendix.

Currency demand is subject to a 'seigniorage Laffer curve'.

The first driver of currency demand – the transactions demand for currency in the economy – depends positively on the nominal value of transactions and therefore also inflation. However, because the demand for real currency balances also depends negatively on its opportunity cost – a short nominal interest rate – and because the short nominal interest rate rises with expected inflation, real seigniorage or the real value of central bank revenue from the issuance of base money is subject to a 'seigniorage Laffer curve'. For low levels of inflation (actual and expected), higher (actual) inflation implies higher real demand for currency. However, there comes a point where, at high levels of (actual and expected) inflation, the higher opportunity cost of holding money balances associated with further increase in expected inflation induces a reduction in average real currency/money balances held which would translate into reductions in real (and conceivably even nominal) seigniorage income. We are primarily interested in the non-inflationary loss absorption capacity (NILAC) of the ECB/Eurosystem, both because we do not think that inflation higher than the ECB's target of 2 percent is *necessary* to solve the combined sovereign and banking sector solvency and liquidity crises in the EA, and because we think that the ECB is not *likely* to accept inflation substantially higher than its target without tightening monetary policy. We therefore assume that inflation runs at 2% on average, consistent with the ECB's target of price stability over the medium term.

We assume 2% inflation, as we are interested in the non-inflationary loss absorption capacity of the ECB.

For real growth, we consider 1%pa growth, on average, to be a reasonable base case for the euro area for the medium term. Note that the relevant growth rate here is the average growth rate in the future, with the horizon being very long (infinite, actually), so using an expected growth rate for the near term or even the next decade would not be appropriate if we considered his growth rate to be quite different from the 'steady state', as is likely for the EA. Our base case rate to discount the stream of seigniorage income is 4% which is roughly twice what the 10-year German Bunds yield currently, so we consider this rate to be quite conservative.

Assuming a 4% interest rate to discount future seigniorage, and 1% long-term real growth, the present value of future seigniorage is around €2trn in the EA.

Figure 12 presents the estimates for the value of seigniorage based on these benchmark assumptions as well as a number of alternative assumptions for real GDP growth rates and interest rates. As the table indicates, the resulting value would be just over €2trn (or 21.5% of 2012 EA GDP) at a 1% average real growth rate and with a discount rate of 4%. Raising the average growth rate of real GDP to 1.5% almost doubles the estimate of the value of seigniorage.

Figure 12. Present Discounted Value of Future Seigniorage (S) in the Euro Area (α= 0.8; β=2.9)

€ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	€1,886	€1,273	€956	€763	€632
1.0%	€3,717	€2,065	€1,421	€1,078	€865
1.5%	€13,090	€3,817	€2,216	€1,553	€1,189
2.0%	Infinite	€10,966	€3,888	€2,345	1,670

Note: α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity.

Source: Citi Investment Research and Analysis

Above, we noted that the output elasticity of currency demand is estimated extremely precisely and robustly, including across different samples, different statistical methodologies, and different countries. There is therefore little need to dwell on the impact of different assumptions about this elasticity and we relegate that discussion to the Appendix. We also noted that the interest rate semi-elasticity is less precisely estimated. However, as Figure 13 and Figure 14 show, the quantitative impact of different values for this semi-elasticity is limited, reducing the estimated value of seigniorage in our benchmark case (for a real growth rate of 1% and a nominal interest rate of 4%) by 3% if the semi-elasticity is increased by one third (from 3 to 4) and raising it by 3% if it is reduced by one third (from 3 to 2).

Figure 13. Present Discounted Value of Future Seigniorage (S) in the Euro Area (α= 0.8; β=2)

€ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	€1,929	€1,308	€987	€790	€658
1.0%	€3,801	€2,121	€1,466	€1,118	€901
1.5%	€13,388	€3,921	€2,287	€1,609	€1,239
2.0%	Infinite	€11,266	€4,013	€2,431	€1,739

Note: α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

Figure 14. Present Discounted Value of Future Seigniorage (S) in the Euro Area (α= 0.8; β=4)

€ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	€1,835	€1,232	€920	€730	€602
1.0%	€3,616	€1,998	€1,367	€1,032	€824
1.5%	€12,735	€3,693	€2,133	€1,486	€1,132
2.0%	Infinite	€10,610	€3,741	€2,244	€1,589

Note: α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

This estimate is still conservative, as our growth and discount rate assumptions are conservative and we ignore potential seigniorage from issuing central bank reserves.

A conservative estimate of the NPV of seigniorage of the Eurosystem derived from its currency issuance is therefore at least 5 times the size of even a broad measure of the Eurosystem's CLAC. This estimate is conservative for at least two reasons. First, we consider the assumptions we make on growth rates and interest rates to be conservative. Second, we consider only currency issuance and not the entire monetary base. In the case of the euro area, the non-currency part of the monetary base has tended to be relatively small in the past, but is not insignificant (currency accounted for just under two thirds of the total EA monetary base in December 2011). Once we take into account the current stock of currency, the discrepancy between the CLAC and the NILAC becomes even starker: together they increase the loss absorption capacity almost seven-fold for the EA as a whole, and by even more for the relatively undercapitalized NCBs, e.g. in Spain.

Figure 15. EA Countries – CLAC and NILAC (millions €) as of end-2010

Country	Capital and Reserves	Revaluation Accounts	Implied share of seigniorage	Implied share of stock of currency
Austria	4,166.3	8,690.2	57,298.5	23,640.5
Belgium	3,537.0	7,690.0	71,578.1	29,532.0
Cyprus	116.7	478.1	4,039.8	1,666.8
Estonia	343.1	8.8	5,282.2	2,179.3
Finland	2,175.0	2,274.0	37,001.9	15,266.4
France	28,611.0	67,961.0	419,659.9	173,145.0
Germany	5,000.0	110,500.0	558,829.4	230,564.1
Greece	815.4	3,263.7	57,983.1	23,922.9
Ireland	1,723.0	230.3	32,776.2	13,522.9
Italy	21,149.4	70,206.2	368,767.9	152,147.7
Luxembourg	182.0	298.0	5,155.3	2,127.0
Malta	266.5	12.3	1,865.0	769.5
Netherlands	7,244.0	20,365.0	117,689.6	48,556.9
Portugal	1,380.6	10,054.6	51,653.4	21,311.3
Slovakia	358.3	544.5	9,702.7	4,003.2
Slovenia	802.0	188.1	20,461.9	8,442.2
Spain	1,950.0	9,274.6	245,046.5	101,102.3
Total	**79,477.3**	**312,030.4**	**2,064,791.4**	**851,900.0**

Note: Implied share of seigniorage and implied stock of currency are calculated using the adjusted ECB's capital shares for each country.
Source: Citi Investment Research and Analysis

The loss absorption capacity of the Eurosystem in euros, unconstrained by an inflation ceiling, is of course infinite.

The implied NILAC for each NCB is not available for an individual NCB to use or borrow against.

The loss absorption capacity of the Eurosystem in euros, unconstrained by an inflation ceiling, is of course infinite.

In the introduction, we commented on the recent decision of the ECB to lower selectively for seven EA NCBs (in Austria, Cyprus, France, Ireland, Italy, Portugal, and Spain) minimum criteria for accepting collateral (in this case specifically for credit claims/loans) for Eurosystem lending operations. This selective lowering came with the proviso that losses arising from lending against this collateral would be for the books of the lending NCBs only. One undesirable implication of this decision would be that NCBs' creditworthiness would be considered differentially be counterparties, adding to the ongoing bifurcation of the euro area into a 'soft EA' and a 'hard EA', particularly once one compares the CLAC of individual NCBs with their balance sheet size or exposure. Looking at Figure 15, one may be tempted to relegate such concerns, as the implied NILAC capacity of e.g. the Spanish NCB is equal to a multiple of its CLAC. However, the NILAC is not available at will for an individual NCB to use or to borrow against – that would require decisions to be taken by the ECB Governing Council.

4. ECB/Eurosystem balance sheet size and exposure

ECB exposure is not limited to items recorded on its own balance sheet.

As monetary policy in the euro area is implemented decentrally by the NCBs, but profits and losses for operations undertaken for monetary policy purposes shared between the NCBs, it is usually more appropriate to consider the Eurosystem's balance sheet rather than the ECB's.

In this section, we look at the asset side of the Eurosystem's balance sheet in more detail to assess the potential credit risk exposure arising from its outright purchases under the Securities Markets Programme and the two Covered Bonds Purchase Programmes (CBPPs) and from its collateralized euro and foreign currency lending operations.

The ECB's total balance sheet size was €163.5bn at end-2010, the most recent time for which data are available.[13] As indicated in Figure 1, the ECB is exposed to potential losses through its holdings of gold, investments and foreign exchange reserves as well as other assets. The entries for claims of EA credit institutions and outright purchases of debt are relatively small. The reason is that monetary policy in the Eurosystem is in general centrally decided but implemented in a decentralized fashion by the NCBs. Eurosystem lending by NCBs is recorded on the NCB balance sheets and as part of the consolidated Eurosystem balance sheet. Profits earned and losses incurred by the Eurosystem as a result of operations undertaken for monetary policy purposes (including both the lending facilities and outright purchases) are generally pooled and shared at the level of the Eurosystem and can potentially affect the ECB's capital position. An exception to this rule applies to lending against credit claims accepted by NCBs as a result of the recent (February 9) announcement of the ECB to allow nation-specific collateral eligibility criteria for seven EA NCBs. According to verbal statements by several ECB officials, including ECB President Draghi, exposure from this lending is for the balance sheet of the offering NCB only, and not that of the Eurosystem. Profits and losses from NCB ELA (Emergency Liquidity Assistance) exposure are also not pooled and shared.

But it remains true that in general it is more appropriate to consider the asset side of the Eurosystem's balance sheet rather than the ECB's alone when estimating the exposure arising from the monetary policy operations of the ECB. However, just looking at the Eurosystem balance sheet would also not be appropriate. This is because not all of the capital of the NCBs consolidated in the Eurosystem balance sheet automatically absorbs losses arising from monetary policy operations or other activities of the Eurosystem. Nor are all activities and exposures of individual NCBs automatically exposures of the Eurosystem (with the profits and losses consequently shared between the constituents of the Eurosystem). For example, total holdings of gold, foreign exchange and other investments of the Eurosystem stood at more than €600bn at the end of 2010, while the ECB's holdings were only around €63bn. ECB capital is only at risk for the latter smaller amount, not the former. Similarly, ELA lending by NCBs is also exposure that is on the balance sheet of the NCBs granting the assistance, but the resulting profits and losses are not shared with the rest of the Eurosystem.

The Eurosystem balance sheet has risen by 126% between June 2007 and December 2011, compared to 264% for the BoE and 237% for the Fed. Relative to GDP, the increases are much more similar.

As noted above, the consolidated balance sheet of the Eurosystem is available on a weekly basis.[14] On February 17, 2012, the total assets of the Eurosystem amounted to €2.7trn (around 28% of 2011 euro area GDP), up from €2.0trn at end-2010. The size of the Eurosystem's balance sheet has risen since the onset of the financial crisis in 2007, along with those of the other major industrial country central banks, but the proportional growth rate has been lower than that of the Bank of England or the Fed, but higher than that of the Bank of Japan. Thus, the Eurosystem's balance

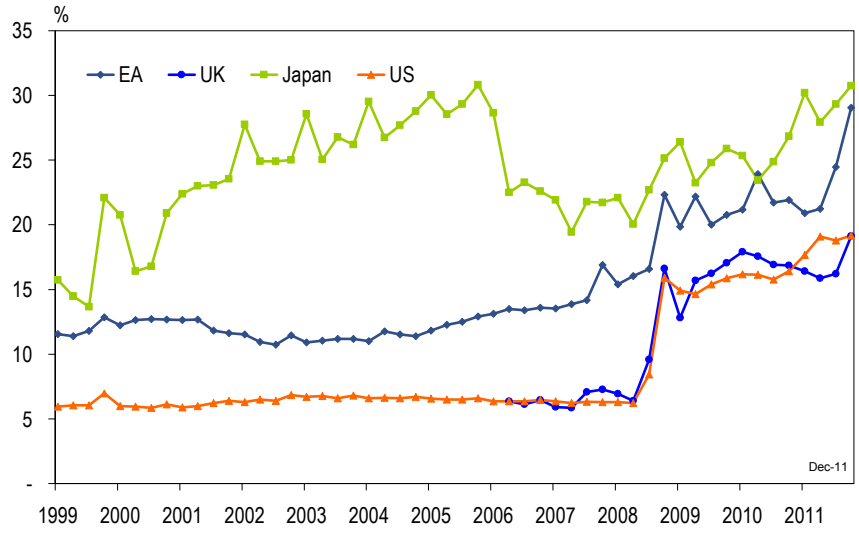
[13] Annual reports are usually published in April or May of the following year. Annual accounts are usually published slightly earlier, at some point in March.

[14] http://www.ecb.int/press/pr/wfs/2011/html/fs111129.en.html

sheet rose by 126% in local currency terms between June 2007 and end-December 2011, the BoE's by 264%, the Fed's by 237% and the BoJ's by 43%. And this already includes the effect of the Eurosystem's December 3-year LTRO with an uptake of €489bn. Between June 2007 and November 2011, the balance sheet of the Eurosystem had only risen by 89%. A further €1trn increase in the ECB balance sheet following its upcoming LTRO (much above our base estimate of €400-500bn, with some upside if non-EA bank participate in substantial size) would imply that the ECB's balance sheet has increased by 209% since June 2007, while a €500bn 3-Y LTRO allotment would imply an increase of 168%.[15]

As shown in Figure 16, the Eurosystem's balance sheet has tended to be much larger relative to the size of the EA economy than the corresponding relative central bank balance sheet size in the UK and the US, owing to the greater role of banking in financial intermediation in the EA, to the greater reliance of the domestic banking sectors on central bank credit in the EA, and to the comparatively large size of currency outstanding in the EA (relative to the size of the economy). The larger increases in balance sheet size in the UK and US have much reduced the gap with the Eurosystem since 2008. Meanwhile, after more than a decade of 'zero interest rate policy' and stop-start quantitative easing and credit easing, the size of the balance sheet of the Bank of Japan has generally been higher (in % of GDP) than those of the other major central banks. It was briefly matched in early 2011 by the ECB (see Figure 16) and is more likely than not to be overtaken at least by the Eurosystem in terms of size relative to the size of the domestic economy soon, likely as early as the beginning of March when the next 3-year LTRO of the Eurosystem is settled.

Figure 16. Selected Countries – Central Bank Balance Sheet Size (% of GDP), 1999 – 2011



Note: Values for GDP 2011Q4 for the EA, UK and Japan correspond to Citi forecasts

Source: ECB, Bank of England, Federal Reserve Board of Governors, Bank of Japan and CIRA

In the remainder of this section, we will focus on exposure of the Eurosystem based on its outright purchases for monetary policy purchases (SMP and CBPP), its collateralized lending operations (in euro and foreign-currency lending), and ELA. We will neglect exposure from the other asset holdings of the Eurosystem, including

[15] Even a €1trn allotment for the upcoming 3-Y LTRO would be very unlikely to increase the total balance sheet size of the Eurosystem by the full amount, as EA banks would likely reduce their uptake of other ECB facilities, such as the main refinancing operation or the shorter-maturity LTROs.

its foreign exchange reserves, gold holdings and other investments, but note that the other investments include some holdings of EA government bonds.

4.1. The Securities Markets Programme and the Covered Bonds Purchase Programmes

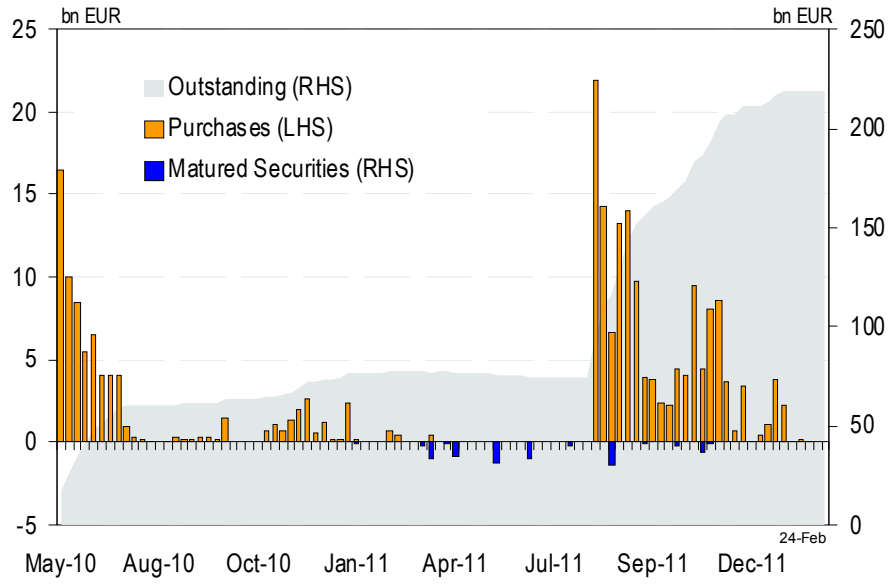
Total holdings of EA sovereign debt purchased in secondary markets through the ECB's Securities Markets Programme stand at €219bn currently.

The ECB created the Securities Markets Programme (SMP) on May 9, 2010. According to the letter announcing the ECB's decision, the SMP was created to safeguard the monetary policy transmission mechanism in the euro area and to address 'malfunctioning securities markets', but the true purpose of the programme was first and foremost to prevent disorderly default of an EA sovereign and to prevent a full market meltdown of the woefully undercapitalized EA/EU banking system. Under the SMP, the ECB can purchase any public or private debt security in secondary markets. It publishes the total size of its purchases on a weekly basis, but does not provide any more information on those purchases, including which securities were bought, from which counterparty or at what price. In the following week, the ECB issues one week-fixed-term deposits (carrying an interest rate up to the main refi rate) to absorb the additional liquidity created through the SMP. Purchases are centrally decided, but carried out by the NCBs.

Activity in the SMP has fallen dramatically recently.

On February 24, 2012, the ECB's holdings under the SMP stood at €219.5bn (Figure 17) and purchases were zero for the second consecutive week. Over the past four weeks, purchases have equaled €1.8bn, sharply down from the €8-10bn weekly average in late November, and likely indicating that the ECB intends to 'take a break' from using the SMP. Over the course of the program, purchases averaged €2.4bn, but in 30 of the 94 weeks so far no purchases were made at all, such that during weeks were purchases did take place, the average was €3.5bn.

Figure 17. ECB – SMP Weekly Purchases and Total Outstanding, 2010 – 2012



Source: ECB and Citi Investment Research and Analysis

The ECB does not publish any details on the composition of its purchases. We estimate that 43% of the ECB's holdings are of Italian debt, followed by Greek debt (21%) and Spanish debt (19%).

As noted, the ECB does not publish any information on the composition or price of the purchases or the identity of the counterparty. Nor do any of the NCBs. In Figure 18, we therefore estimate the composition of its purchases and holdings, based on the available data and some rather heroic but at least simple assumptions. To arrive at these estimates we assume that the ECB has purchased mostly EA sovereign debt of Greece, Ireland and Portugal from May 2010 until March 2011 and mostly Italian and Spanish government debt since August 2011, in broad proportion to the size of their respective bond markets (stocks outstanding) in May 2010 and August 2011.[16] We further assume that purchases were equally divided between 5-year and 10-year debt and that the prices at which the transactions took place were the average of the daily highs for these bonds during that particular week.

At face value, holdings are somewhat larger, as most bonds were purchased at a discount.

According to our estimates, purchases of Italian sovereign account by far for the largest component currently on the Eurosystem's books at EUR98.0bn at carrying value or 45% of the total, followed by sovereign debt of Spain (EUR41.4bn or 19%), Greece (EUR40.4bn or 18%), Portugal (EUR22bn or 10%), and Ireland (EUR17.1bn or 8%).

However, since these bonds were often purchased at a discount to face value, applying a haircut to these face values would overestimate the implied loss for the ECB. According to our methodology, the average purchase price for the bonds ranged from 80 cents to the euro for Greece and 93 for Portugal to 100 for Spain (both Ireland and Italy at 97 would be in between). Using these purchase price estimates, we estimate the face value of the ECB's bond holdings of Italy at EUR103bn (43% of the total), of Greece at EUR50bn (21%), of Spain at EUR41bn (17%), of Portugal at EUR25bn (11%), and of Ireland at EUR18bn (8%).

According to our estimates, the current MTM loss of the ECB would be around €43bn, most of it accounted for by its Greek holdings.

In an optimistic scenario, losses may amount to just €12bn, while downside scenarios imply ECB losses of up to around €150bn.

We can now use the estimates of the ECB's holdings to compute the ECB's losses under various scenarios. We distinguish four scenarios. In our benchmark scenario, Greek debt will be haircut in NPV by 75% and both Portuguese and Irish debt by 50%, while the other EA sovereigns escape debt restructuring. In that scenario the ECB would incur losses of €41bn.[17] It would potentially earn a profit of about €5bn on its purchases of Italian debt. In our optimistic scenario (50% haircut for Greece, 25% for Portugal, no haircuts on Ireland and the others), losses would be just under €13bn, while the potential profit on the non-restructured sovereign debt would rise to €6bn.

A more conservative scenario which implied a full writeoff of the Greek debt, a 75% haircut on Portuguese and a 75% haircut on Irish debt, while still maintaining no haircut on Italian or Spanish debt would yield losses of €64bn. A full writeoff of Irish, Greek and Portuguese holdings and a 50% haircut on Spanish and Italian debt would imply losses of €147bn. The maximum loss the ECB can incur as a result of

[16] We deviate from applying the size of bond markets in the following way: First, we assume that in the first two weeks of the SMP, 3/4 of the total purchases were of Greek debt, while from October 2010 until March 2011, Greek bonds were slightly underweighted relative to the size of its bond market. Second, we assume that when the SMP was reopened in August 2011, 5% of total purchases were allocated to Irish and Portuguese bonds, and that for the first week in August during which purchases took place purchases of Italian debt were at 2/3 of the levels implied by the size of its bond market. We also take into account matured amounts of ECB SMP holdings and the fact that the ECB keeps these bonds on its books at purchase value and amortizes them over the life of the asset, at the end of each quarter. The adjustments for matured amounts and amortization imply that the carrying value of the bonds differs slightly from the purchase value of the bonds.

[17] This base scenario is not equivalent to our estimate of either the haircut required to restore solvency for the sovereign in these countries, nor to our expectation of what is the most likely haircut. Rather, we choose our base case here with a focus to be conservative.

the SMP is of course equal to the total amount of its purchases, which currently stand at €219.5bn.

Note that having obtained de-facto senior creditor status to the private creditors involved in the Greek PSI currently underway, does not protect the ECB/Eurosystem against future losses on their EA periphery sovereign debt holdings – whether these turn out to be further restructurings of Greek sovereign debt or first-time restructuring of Portuguese, Irish or other EA sovereign debt. Even for the IMF, preferred creditor status is a 'common law' privilege, not written down in any Treaty, Convention or international agreement. The senior creditor status of the ECB/Eurosystem is, in our view, largely a function of the ECB's control of access by EA commercial banks to the Eurosystem and the ELAs for collateralized funding. It is controversial, contestable and not secure.

Figure 18. Eurosystem – SMP purchases

Country	Holdings by purchase value		Holdings by face value		MTM capital gain/loss	Capital gain/loss (billions EUR)			
	bn EUR	Share	bn EUR	Share	bn EUR	Benchmark	Optimistic	Conservative	Risk
Greece	40.4	18%	50.2	21%	-29.2	-27.8	-15.3	-40.4	-40.4
Portugal	22.0	10%	25.0	11%	-6.9	-9.5	-3.2	-15.7	-22.0
Ireland	17.1	8%	18.4	8%	0.1	-7.9	1.3	-12.5	-17.1
Spain	41.4	19%	41.3	17%	1.4	-0.1	-0.1	-0.1	-20.8
Italy	98.0	45%	102.6	43%	3.8	4.5	4.5	4.5	-46.8
Total	**218.9**		**237.5**		**-30.8**	**-40.8**	**-12.8**	**-64.2**	**-147.0**

Note: MTM stands for Marked to Market. Holding by purchase values are estimated as the accumulated sum of implied weekly purchases by country (for assumptions on purchases by country over time see footnote 14) adjusted by subtracting matured securities and adding quarter-end adjustments. Holdings by face value are computed as the accumulated sum of the product of implied weekly holding by country and an average of daily peak average prices of 5-year and 10-year bonds. MTM capital gain/loss is computed as the difference of the MTM value of bonds held (at weekly close) and implied holdings by county. The benchmark scenario assumes a writeoff of 75% on Greek debt, 50% on Portugues, 50% on Irish and no haircuts on Spanish and Italian debt. The Optimistic scenario haircuts are 50% for Greece, 25% each for Portugal and Ireland, and no haircut for Spain and Italy. The Conservative scenario implies a full writedown for Greece and haircuts of 75% each for Portugal and Ireland, and no haircuts for Spain and Italy. The 'Risk' scenario implies a full writedown for Greece, Ireland and Portugal and a 50% haircut for Italy and Spain.
Source: Citi Investment Research and Analysis

As noted above, SMP purchases have slowed down considerably over the past few weeks and ECB representatives have expressed on various occasions that they are likely to retire the SMP for good once the ESM is in place. In our view, such statements are somewhat premature. We regard the SMP as an inefficient way to avoid default by an EA sovereign, as it cannot be focused on primary markets. We also appreciate that the quasi-solvency that the ECB asserted for its holdings as part of the Greek PSI have likely diminished the effectiveness of SMP purchases in stabilizing the sovereign debt markets in which they are made. But the option of outright purchases will remain a useful tool for the ECB to carry out its financial stability mandate and associate role as lender of last resort for sovereigns and market maker of last resort in systemically important asset markets (for further discussion, see Global Economics View - Why Does The ECB Not Put Its Mouth Where Its Money Is? The ECB As Lender Of Last Resort For Euro Area Sovereigns And Banks).

The ECB has also bought covered bonds through its Covered Bonds Purchase Programmes. Outstanding values stood at €57bn and €7bn for the first and second programme, respectively.

In addition to the SMP, the ECB has bought covered bank bonds outright through the Covered Bonds Purchase Programme (CBPP). So far, there have been two CBPPs. The first one was announced in May 2009 and created in June with a total capacity of €60bn in nominal terms, a limit it reached by June 2010, its original termination date. Recently, the CBPP was reopened (under the name of 'new covered bonds purchases programme' or CBPP2) with a target capacity of €40bn in nominal terms.[18] Unlike the SMP, the CBPPs can act both in primary and in

[18] The announcement that a new CBPP would be launched was made on October 6, 2011. The program was launched in November 2011 (details were published on November 3, 2011, see http://www.ecb.int/press/pr/date/2011/html/pr111103_1.en.html and

secondary markets. On February 24, 2012, €7.1bn was outstanding under CBPP2 and €57.2bn under the original CBPP.

For the first CBPP, the ECB used to publish monthly reports that provided some additional information on the purchases made and the total holdings. Thus, the last such report of June 2010, stated that in the first CBPP, 422 different bonds were purchased at a price of €61,118mn, as on average the purchase price was above par.[19] 27% of these bonds were bought in the primary market, while the remaining 73% were bought in the secondary market. The report further stated that most bonds purchased had maturities of between three and seven years and an average modified duration of 4.12 years as of June 2010.

Covered bonds offer additional protection compared to other ABS, but are not free of credit risk.

Covered bonds tend to offer additional security relative to other asset-backed securities, as creditors not only have recourse to the assets backing the covered bonds (usually residential mortgages, public sector loans or shipping loans), but also to the issuing credit institution. Covered bonds have been particularly common in Germany (total issuance outstanding stood at €640bn at end-2010), but also in Denmark (€339bn) and Spain (€362bn). We do not have any information about the regional split of the purchases. And while covered bonds do have the double security discussed above, the fact that the performance of the underlying asset and the issuing credit institution can be quite high (think e.g. of mortgage-backed covered bonds issued by Spanish banks), the ECB's exposure to loss arising from its CBPP holdings is non-negligible, though the total amounts are small relative to the ECB's NILAC.

Figure 19. Eurosystem – Daily Purchases and Total Outstanding under Covered Bonds Purchase Program (CBPP, Bn €), 2009 – 2012

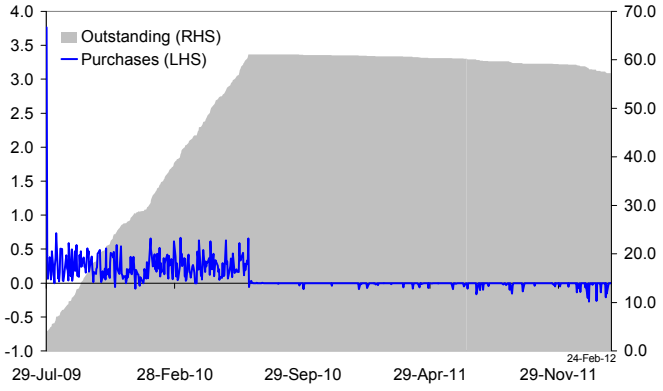
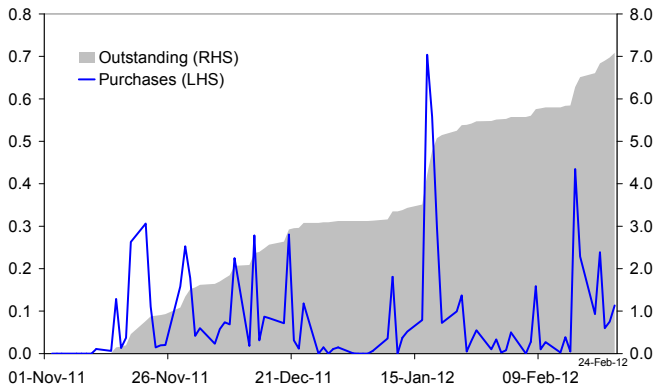


Figure 20. Eurosystem – Daily Purchases and Total Outstanding under New Covered Bonds Purchase Program (CBPP2, Bn €), 2009 – 2012



Note: negative amounts in weekly purchases consist of matured securities. Both purchases and outstandings are expressed at purchase prices.
Source: ECB and Citi Investment Research and Analysis

http://www.ecb.int/ecb/legal/pdf/en_ecb_2011_17__f_sign.pdf) and is expected to be wound down by end of October 2012. For the first CBPP the modalities were that the bonds had i) be eligible for use as collateral for Eurosystem credit operations, ii) have an issue volume of about €500m or more and, in any case not lower than €100m, iii) have a minimum rating of AA or equivalent by at least one of the major rating agencies and, in any case, not lower than BBB-/Baaa3, iv) have underlying assets that include exposure to private and/or public entities. For the CBPP2, the modalities were adjusted such that the bonds must have an issue volume ≥ €300m, a minimum rating of BBB-, and a maximum residual maturity of 10.5 years. (please see http://www.ecb.int/ecb/legal/pdf/l_17520090704en00180019.pdf?951526d458d51b72e94c636b8372c796)

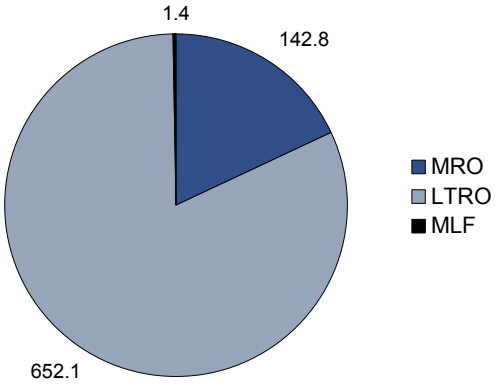
[19] http://www.ecb.int/pub/pdf/other/monthlyreporteurosystemcoveredbondpurchaseprogramme201007en.pdf

4.1. Exposure through Eurosystem euro and foreign currency funding operations

The ECB provides euro liquidity through a number of facilities with maturity varying from overnight to 3 years in its extraordinary LTRO. The ECB also provides dollar liquidity for 7 days and three months, respectively.

As noted above, it is the NCBs rather than the ECB that operationally offer credit to EA financial institutions (eligible counterparties) and we therefore refer to the Eurosystem balance sheet only in this section. As of February 17, 2012, Eurosystem credit to EA banks in euros stood at €796bn, of which €143bn was through the one week main refinancing operation (MRO), €652bn was through longer-term refinancing operations (LTRO, these are currently, one-month, 3-month, 6-month, and 3-year operations), and €1bn through the marginal lending facility, which is overnight, (Figure 21). All Eurosystem euro-funding for banks (eligible counterparties) is currently provided through fixed rate, full allotment procedures.

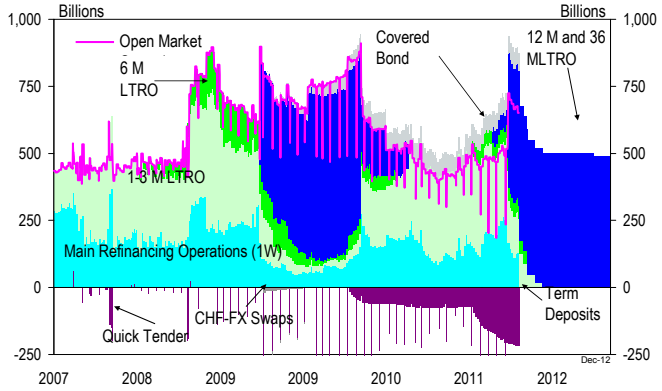
Figure 21. Eurosystem – Composition of Total Lending to EA Credit Institutions (Bn Euros), as of Feb 17, 2012



Note: MRO stands for Marginal Refinancing Operation, LTRO for Long-term Refinancing Operations, and MLF for Marginal Lending Facility

Source: ECB and Citi Investment Research and Analysis

Figure 22. Eurosystem – Open-Market Operations (Bn €), 2007 – 2012



Source: ECB and Citi Investment Research and Analysis

French banks currently receive the largest amount of Eurosystem credit at €218bn, closely followed by Italian and Dutch banks.

By country, French banks currently receive the largest amounts of ECB credit, closely followed by Italian and Dutch banks. In December 2011, French banks borrowed €218bn, €50bn more than in November and an all-time euro-area high. The December amount was €30bn higher than peak French Eurosystem borrowing during 07-09 (in November 2008) and almost five-and-a-half times what they requested in June 2011. For other countries in the 'soft core' of the EA the picture is very similar. In Italy, Eurosystem borrowing in December stood at €213bn for Italy (up almost €55bn on the month and almost five times the level just six months earlier) and in the Netherlands at €163bn in the Netherlands (up less than €7bn from November, but still more than four times the level of June 2011).[20]

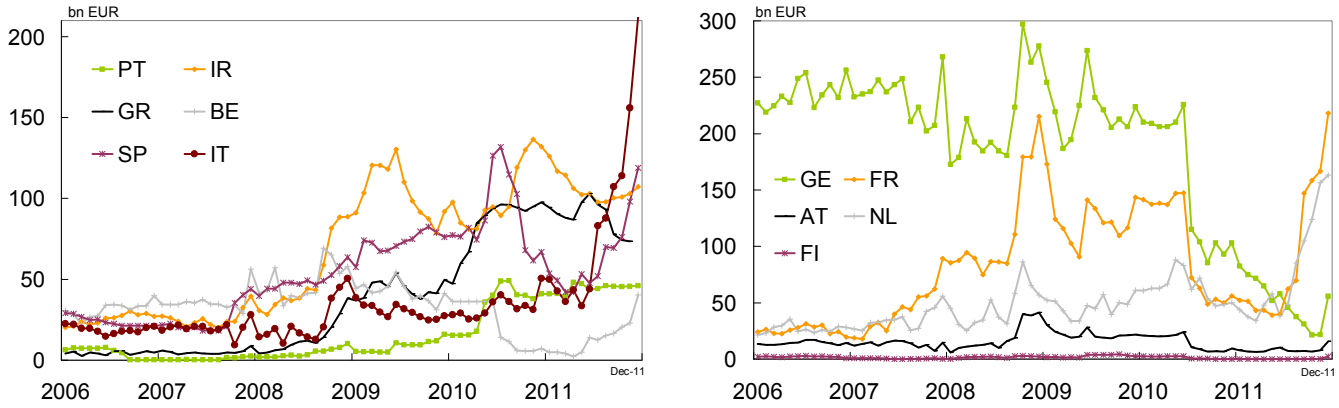
Relative to the size of the banking sector, reliance on the ECB/Eurosystem remains highest in Greece (15.3% of total MFI assets in November, the latest available date), Portugal (8.0% in December) and Ireland (8.2% in December).[21] It has also reached rather high levels in the Netherlands (6.7% in December) and Italy (5.2% in December). Only in Germany, Greece and Ireland have we observed reductions in borrowing from the Eurosystem in recent months. In Germany, ECB borrowing rose

[20] In Italy, January data showed a small decrease of Eurosystem borrowing, from €213bn in December to €203bn.

[21] These data include non-domestic credit institutions in Ireland. For domestic credit institutions, Eurosystem borrowing is also high and has remained relatively stable recently before increasing with the 3-Y LTRO in December.

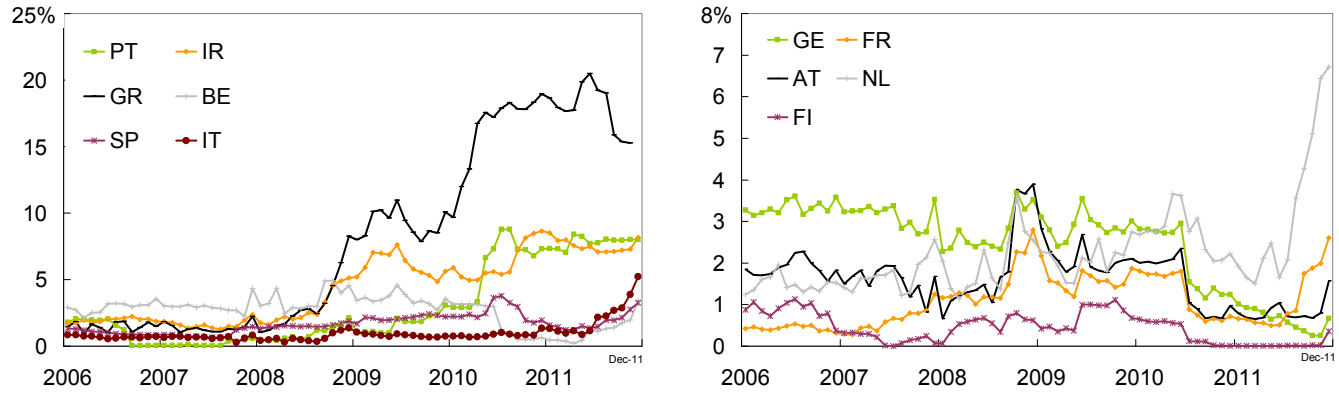
in December but had fallen to unusually low levels over the previous two years (in December, ECB borrowing by German banks only accounted for 0.66% of total MFI assets and that was already after a relatively large uptake of the 3-Y LTRO by German banks led to a more than doubling of German banks' borrowing from the Bundesbank). In Ireland, ECB borrowing has fallen as the banking sector is slowly shrinking, while in Greece conventional ECB funding has been replaced by ELA (on which more below). In many countries, reliance on the ECB has surpassed the highs set in the '08/'09 crisis, but not in all (apart from Germany, Eurosystem borrowing by banks in Austria, Belgium, France, and Ireland remains substantially below the 08/09 peaks).

Figure 23. Selected EA Countries – Banks' Use of ECB Open Market Operations (bn Euros), 2006 – 2011



Source: National Central Banks, and Citi Investment Research and Analysis

Figure 24. Selected EA Countries – Banks' Use of ECB Open Market Operations (% of total MFI assets)



Source: National Central Banks, and Citi Investment Research and Analysis

Figure 25. EA countries – Lending to EA Credit Institutions Related to Monetary Policy Operations (bn €), as of Dec 31, 2011 and Dec 31, 2010

Country	Total			MRO		LTRO		FTRO		MLF		Lending in Foreign Currency		
	Dec-11	Dec-10	Peak over 2007-2009	Dec-11	Dec-10	Dec-11	Dec-10	Dec-11	Dec-10	Dec-11	Dec-10	Dec-11	Dec-10	Peak over 2007-2009
Austria	15.9	8.2	41.3	n/a	4.2	n/a	3.5	n/a	0.5	n/a	0.0	n/a	0.1	0.2
Belgium	40.4	7.2	69.2	8.2	3.1	18.0	4.1	n/a	0.0	14.2	0.0	13.9	12.4	11.1
Cyprus	5.7	5.5	7.6	n/a	0.6	n/a	4.9	n/a	0.0	n/a	0.0	n/a	0.5	0.8
Estonia	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Finland	2.3	0.1	4.3	0.0	0.0	2.3	0.1	0.0	0.0	0.0	0.0	0.6	0.7	2.7
France	166.6	56.1	215.3	35.8	1.3	64.8	32.1	n/a	n/a	0.8	0.0	n/a	n/a	n/a
Germany	55.8	103.1	297.1	8.6	68.4	47.1	33.5	0.0	1.2	0.0	0.0	18.1	0.0	63.3
Greece	73.4	97.7	97.7	12.6	18.0	60.8	78.4	0.0	1.3	0.0	0.0	0.8	0.3	3.4
Ireland	107.2	132.0	130.4	30.5	63.7	76.3	56.0	0.0	12.3	0.4	0.0	1.2	0.1	11.4
Italy	212.7	50.6	50.5	49.4	16.6	160.6	31.0	0.0	0.1	0.0	0.0	2.9	2.1	8.4
Luxembourg	5.2	2.8	47.0	1.8	1.1	3.4	1.6	0.0	0.0	0.0	0.0	3.6	0.1	12.0
Malta	0.5	1.1	1.3	n/a	0.4	n/a	0.7	n/a	0.0	n/a	0.0	n/a	0.3	0.2
Netherlands	n/a	2.6	37.6	n/a	1.7	n/a	0.9	n/a	0.0	n/a	0.0	n/a	0.7	14.2
Portugal	46.0	40.9	16.1	7.0	17.1	39.0	23.0	0.0	0.0	0.0	0.0	n/a	0.6	0.0
Slovakia	1.9	1.0	2.6	n/a	0.8	n/a	0.2	n/a	0.0	n/a	0.0	n/a	0.1	0.2
Slovenia	1.7	0.6	2.1	0.1	0.1	1.7	0.5	0.0	0.0	0.0	0.0	n/a	0.3	0.3
Spain	118.9	67.0	82.5	47.1	22.2	85.3	47.5	2.0	0.2	0.4	0.0	n/a	0.0	8.9

Note: For France and Greece, values correspond to November. MRO stands for main refinancing operations, LTRO for Longer-term refinancing operations, FTRO for Fine-tuning reverse operations, and MLF for Marginal Lending Facility. For France and Spain the sum of MRO, LTRO, FTRO and MLF may not add to the total, as they rely on slightly different data sources. Lending in foreign currency numbers correspond to balance sheet item claims on euro area residents in foreign currency

Source: National Central Banks, and Citi Investment Research and Analysis

Use of the ECB's dollar offerings remains quite high relative to H1 2011, but remain far below the 2008/9 highs.

In addition to euro lending facilities, the ECB regularly provides US dollar liquidity (and in the past temporarily provided British pound and Swiss franc liquidity, too) which take the form of repurchase operations against eligible collateral, with a maturity of approximately one week and three months.[22] These operations are part of foreign exchange swaps agreements that the ECB has entered into with other central banks, mainly the Federal Reserve, the BoE, and the SNB, whereby the national central banks (or the ECB) buy or sell euro spot against a foreign currency and at the same time sell or buy them back in a forward transaction.

The first swap agreement was signed with the Fed in September 2001 (following the 9/11 terrorist attacks). Under this agreement, the ECB was eligible to draw up to US$50bn to provide to EA banks.[23] Since 2007 the ECB has renewed and signed additional agreements with both the Fed and other NCBs, including dollar liquidity swap lines with the Fed in December 2007 (originally up to US$20bn, but later expanded up to a maximum of US$240bn in September 2008), and sterling liquidity swap lines in December 2010 and September 2011 (up to £10bn) with the BoE. In November 2011, the ECB, the Fed, the BoE, the BoJ, the SNB, and the Bank of Canada announced the establishment of a network of reciprocal swap lines to provide each NCB with the capacity to offer liquidity to national institutions in currencies of the counterparty central banks. The swap lines are authorized through February 1, 2013. As of this announcement, the price for accessing US dollar swap was lowered to 50 basis points over the US dollar overnight index swap (OIS) rate.

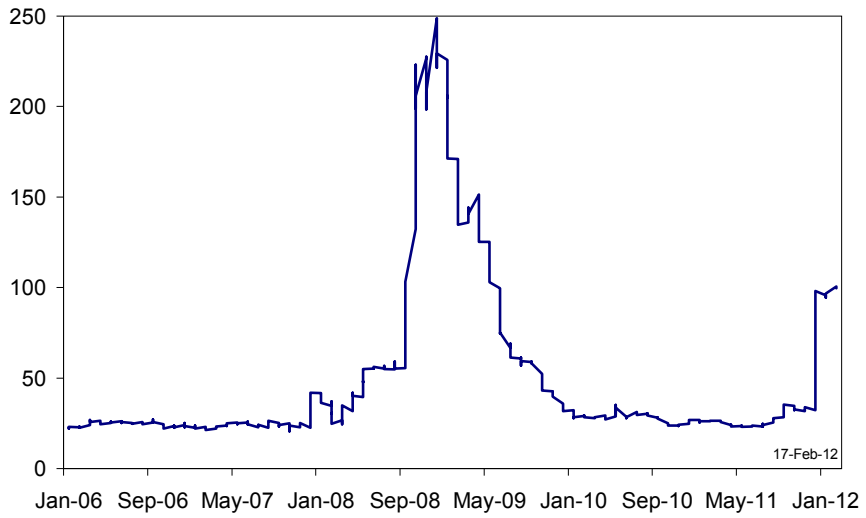
The FX operations of the ECB including exposure through swap lines are recorded as 'Claims on EA residents in foreign currency' on the Eurosystem balance sheet (see Figure 26). On February 17, 2012 these claims stood at €99.6bn, €1bn less

[22] The consolidated calendar for euro, US dollar and Swiss franc operations of the Eurosystem is available on the ECB's website (http://www.ecb.int/mopo/implement/omo/pdf/EUR_USD_CHF_calendar.pdf?049b7d9a6eee571ce5fedf61eb6feb7c)

[23] http://www.ecb.int/press/pr/date/2001/html/pr010913_1.en.html

than in the previous week, and up from €32bn at the beginning of December. The outstanding balance is still far from the high of almost €250bn reached at the end of 2008.[24] Banks in most countries are likely to have obtained dollar funding from the Eurosystem recently, but the bulk of the total was requested from banks in Belgium, Germany, Ireland, Luxembourg and the Netherlands. Curiously, USD borrowing from the Eurosystem by German banks has recently exceeded their euro borrowing.

Figure 26. Eurosystem – Claims on EA residents in Foreign Currency (bn €), Jan 2006- Feb 2012



Note: this item includes i) securities investments inside the euro area not registered in the item "Other financial assets" (e.g. notes and bonds, bills, zero bonds, money market paper, equity instruments held as part of the foreign reserves, all issued by euro area residents), and ii) other claims on euro area residents not registered in item "Other financial assets" (e.g. loans, deposits, reverse repo transactions, sundry lending)

Source: ECB and Citi Investment Research and Analysis

4.3. Collateral

ECB lending is collateralized. It accepts both marketable and non-marketable debt as collateral and has come up with a number of requirements for collateral to be eligible to be used for accessing its funding facilities.

ECB/Eurosystem lending is collateralised – which is pretty much the only constraint that the ECB Statute imposes on the ECB Governing Council (GC) for its lending operations.[25] The ECB accepts a wide range of collateral and regularly adapts the assets it accepts as collateral as well as the terms and conditions of the funding, including minimum ratings thresholds for eligibility, position limits, valuation and haircuts it applies to collateral. Very little information is available on the collateral that is held against Eurosystem credit operations. The limited information that is available appears in the ECB's Annual Report. The ECB accepts both marketable and non-marketable assets as collateral (but the ECB only buys marketable assets outright). In 2010, the latest year for which data was available, the total value of collateral put forward at the ECB was €2trn, pretty much unchanged from the year before.

[24] This balance sheet entry includes other items beside USD-providing operations which were around USD90bn recently.

[25] See the ECB "General Documentation on Eurosystem Monetary Policy Instruments and Procedure", December 2011 (http://www.ecb.int/pub/pdf/other/gendoc201109en.pdf)

At end 2010, 24% of the collateral submitted to the ECB were ABS, 18% non-marketable claims, 21% uncovered bank bonds, 17% government bonds, and 13% covered bonds.

Of the €2trn, around €360bn (or 18% of the total) were non-marketable claims, which are mostly bank loans. Of the remaining, €482bn (24%) were asset-backed securities (ABS), €422bn (21%) uncovered bank bonds, €342bn (17%) government bonds, €261bn (13%) covered bank bonds, €80bn (4%) corporate bonds and €20bn (1%) other bonds. The share of ABS rose drastically during the financial crisis – while the overall amount of collateral put forward rose by just over 50% between 2006 and 2008, the amount of ABS collateral roughly quadrupled from €112bn in 2006. By contrast, the amount of government bonds put forward as collateral was on a downward trend until 2009 when it rose from €205bn to €285bn before growing to €342bn in 2010 – an increase of two thirds over two years when the total collateral pool grew by less than 30%, as more and more debt of troubled EA sovereigns found its way as collateral into ECB credit operations. It is likely that the use of government bonds as collateral grew substantially more in 2011 again. Until 2007, non-marketable assets were not included in the uniform list of assets eligible for Eurosystem funding ('tier one' collateral), but could be accepted by NCBs as 'tier two' collateral, subject to minimum requirements set by the ECB GC. In 2007, the ECB GC included bank loans in the ECB's standard uniform procedures (the 'Single List').[26] Non-marketable assets already accounted for 10% of the total collateral pool in 2007, a percentage which has gradually increased since then.

For collateral to satisfy the general, uniform collateral standards, it needs to be equivalent to having a maximum probability of default of 0.4% over a year, which the ECB translates as a minimum rating of BBB- by one of four accredited rating agencies.

For assets to be eligible as collateral for Eurosystem operations, they generally need to satisfy certain minimum standards, including that assets be denominated in euros and that the debtor be based in the euro area. In general, these minimum requirements include that that the assets be rated at least as BBB- by one of four rating agencies (S&P, Moody's, Fitch, DBRS), equivalent to a one-year probability of default of 0.4%.[27] Until October 2008, the minimum rating threshold was A-, equivalent to a one-year probably of default of 0.1%.[28] The Eurosystem accepts three alternatives to rating agency assessments for credit quality:[29]

1. NCB 'In-House Credit Assessment System' (ICASs) assessments. Prior to February 9, 2010, the NCBs of Germany, France, Spain, and Austria had such systems in place for the assessment of non-financial corporations. The Central Bank of Ireland also has a system to assess mortgage-backed promissory notes of Irish credit institutions.

2. Internal ratings-based system (IRB) assessments of the banks submitting the credit claims.

3. Rating tools (RTs) provided by third parties. Currently there are three such tools in place to assess non-financial corporations in Italy, Greece and Portugal.

[26] See http://www.ecb.int/press/pr/date/2005/html/pr050722.en.html.

[27] The ECB refers to rating agencies as 'External Credit Assessment Institutions' (ECAIs). The ECB applies the so-called 'first-best' rule for ratings according to which only the highest rating awarded by any of the four recognized ECAIs matters for assessing credit quality.

[28] http://www.ecb.int/press/pr/date/2008/html/pr081015.en.html

[29] Euro Weekly - ECB — Watch Out For the Details

In the case of Greece, Ireland and Portugal, the minimum rating requirements were waived for government and government-guaranteed bonds.

In the case of government bonds and government-guaranteed bonds from Greece, Ireland, and Portugal, the minimum ratings threshold has been suspended.

Collateral is generally MTM for marketable debt and marked-to-model for non-marketable debt. Haircuts are applied to the valuation of the collateral which range from 0.5 to 46% for marketable assets

Collateral is generally marked to market for marketable assets on a daily basis, and marked to model for non-marketable assets. To that valuation, a haircut is applied that depends on the asset type, the rating and the maturity of the asset. For assets of liquidity category I which include all (!) EA government bonds, haircuts range from 0.5%-5.5% (depending on maturity) for assets rated at least A- to 5.5%-10.5% for lower-rated assets and this latter haircut range applies to Irish, Greek and Portuguese government bonds, which no longer satisfy even the lower minimum rating requirements but for which these requirements have been waived.

Figure 27. Eurosystem – Levels of Valuation Haircuts Applied to Eligible Marketable Assets

Credit Quality	Residual Maturity (Years)	Liquidity categories								
		Category I		Category II		Category III		Category III		Category V
		fixed coupon	zero coupon	fixed coupon	zero coupon	fixed coupon	zero coupon	fixed coupon	zero coupon	
Steps 1 and 2										
(AAA to A-)	0-1	0.5	0.5	1.0	1.0	1.5	1.5	6.5	6.5	16
	1-3	1.5	1.5	2.5	2.5	3.0	3.0	8.5	9.0	
	3-5	2.5	3.0	3.5	4.0	5.0	5.5	11.0	11.5	
	5-7	3.0	3.5	4.5	5.0	6.5	7.5	12.5	13.5	
	7-10	4.0	4.5	5.5	6.5	8.5	9.5	14.0	15.5	
	>10	5.5	8.5	7.5	12.0	11.0	16.5	17.0	22.5	
Step 3										
(BBB+ to BBB-)	0-1	5.5	5.5	6.0	6.0	8.0	8.0	15.0	15.0	
	1-3	6.5	6.5	10.5	11.5	18.0	19.5	27.5	29.5	
	3-5	7.5	8.0	15.5	17.0	25.5	28.0	36.5	39.5	Not eligible
	5-7	8.0	8.5	18.0	20.5	28.0	31.5	38.5	43.0	
	7-10	9.0	9.5	19.5	22.5	29.0	33.5	39.0	44.5	
	>10	10.5	13.5	20.0	29.0	29.5	38.0	39.5	46.0	

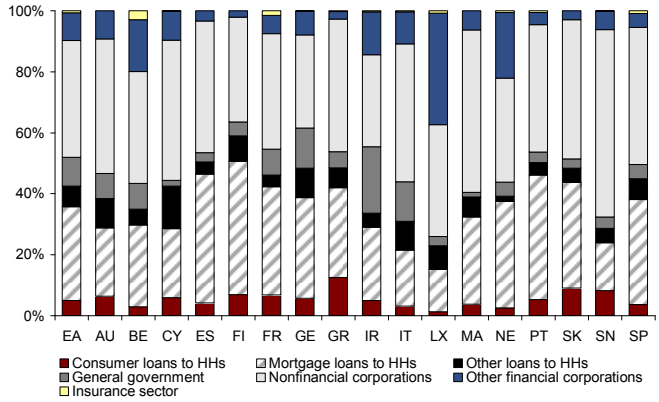
Source: Citi Investment Research and Analysis
Note: for categories II to V individual asset-backed securities, covered bank bonds (jumbo covered bank bonds, traditional covered bank bonds and other covered bank bonds) and uncovered bank bonds are subject to an additional valuation haircut. This haircut is directly applied at the level of the theoretical valuation of the individual debt instrument in the form of a valuation markdown of 5%.

Before the recent change that reintroduced nation-specific collateral eligibility criteria (after this practice had been discontinued at the beginning of 2007), three types of non-marketable assets were eligible as collateral in the single framework for eligible assets: fixed-term deposits from eligible counterparties, credit claims and non-marketable retail mortgage-backed debt instruments. For credit claims, before February 9, 2012, the guidelines for accepting them as collateral were that the debtors be either non-financial corporations (including SMEs), public sector entities, or international or supranational institutions. Minimum size requirements for credit claims also applied.[30]

Haircuts for credit claims are subject to haircuts that range from 8% to 44.5% for claims rated above A- and 15.5% and 64.5% for claims rated below A- but above BBB-. Nonmarketable retail mortgage-backed debt is subject to a valuation haircut of 24%, while fixed-term deposits are not subject to any haircuts.

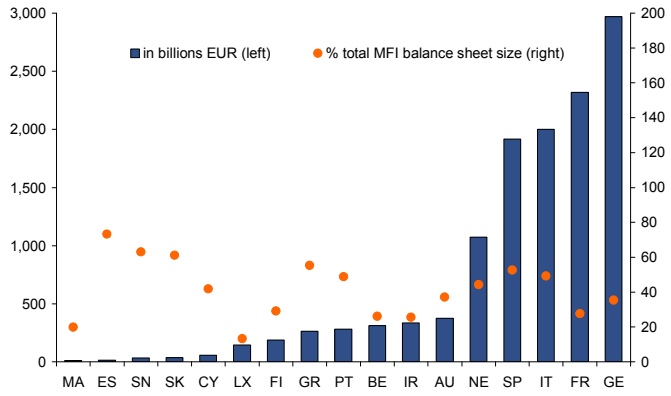
[30] For example, the minimum size for cross-border use of a credit claims as collateral was €500,000. Domestic minimum sizes were much smaller (e.g. €10,000 in the case of the Bundesbank).

Figure 28. EA countries – Composition of MFsl Lending to Non-MFIs , December 2011



Source: ECB and Citi Investment Research and Analysis

Figure 29. EA countries – MFI Lending to Non-MFIs, December 2011



Source: ECB and Citi Investment Research and Analysis

On February 9, 2012, the ECB reintroduced nation-specific collateral requirements for seven EA NCBs. These amended requirements lowered the minimum requirements for bank loans in terms of credit quality, currency, debtor/guarantor type and minimum size.

On February 9, 2012, the ECB's GC approved, for seven NCBs (of Ireland, Spain, France, Italy, Cyprus, Austria and Portugal) "… specific national eligibility criteria and risk control measures for the temporary acceptance of additional credit claims as collateral in Eurosystem credit operations".[31] The details of the amended nation-specific collateral rules and procedures are to be communicated by national central banks and in subsequent ECB decisions. The available information from NCB indicates that standards have been amended in five areas:[32]

- **Credit quality:** The Bank of Portugal and the Bank of Cyprus raised their acceptable probability of default to 1.5% (over one year) from the standard 0.4%, while the Bank of Spain, the Bank of Italy and the Bank of Austria raised their acceptable default probabilities to 1%. [33]

- **Currency:** The Bank of France noted that it will accept credit claims denominated in USD, while the Bank of Cyprus stated that credit claims in USD, pound sterling, Swiss franc, or Japanese yen would potentially be eligible. The Bank of Spain noted that it would accept credit claims in euros or 'major foreign currencies'.

- **Debtor/guarantor type**: The Irish and French central banks said that they would start accepting real estate/mortgage-backed loans (while the Spanish and Cypriot central banks excluded those from the extension of their collateral pool). All central banks indicated some form of extension of the types of debtors or guarantors eligible.

- **Minimum Size:** The Bank of Portugal lowered the threshold from €500,000 to €100,000, while the CB of Cyprus stated that it no longer applied any minimum size.

Most central banks noted that procedures would also be changed (often supposedly simplified or streamlined), that haircuts would be raised commensurately with lowering credit quality standards and that changes would be phased in.

[31] ECB Press Release, 9 February 2012, http://www.ecb.int/press/pr/date/2012/html/pr120209_2.en.html

[32] In the appendix we provide the additional information we could find on changed collateral standards on the NCB websites.

[33] The Bank of Spain noted that for the time being the default probability threshold remains unchanged at 0.4%, but that it will be raised over time to 1%.

According to ECB President Draghi around €600-700bn of additional collateral would become available as a result of the new collateral rules.

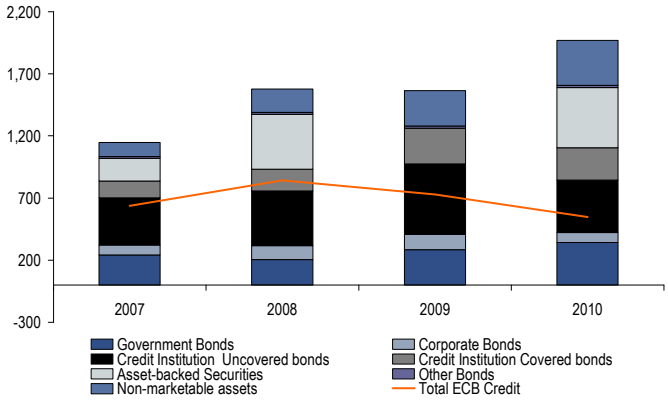
In the Press Conference and Q&A following the ECB GC meeting of February 9, 2012, Mr. Draghi mentioned that around €600bn to €700bn of loans would be available in the seven member states mentioned above and that the new eligible credit claims would be subject to valuation haircuts of around 2/3. The valuation to which this haircut would be applied was not specified. Because individual corporate loans are almost impossible to value by third parties, we assume that for loans that are current, the valuation will be at par. This suggests that banks might be able to obtain around €200bn at the February 29 3Y LTRO amid the widening of the eligible collateral pool.

In addition to the standard guidelines for collateral eligibility, the Eurosystem can also apply asset –or institution-specific limits to its exposure. To our knowledge such position limits had not been imposed until sometime in 2011 when they may have been enforced against Greek banks. Greece is also not on the list of seven countries eligible to re-introduce nation-specific collateral eligibility criteria. We don't know that this is because Greece did not want this additional latitude, whether it applied but was turned down or whether it was persuaded not to apply, so as to avoid being turned down. Beyond the requirement that lending needs to be collateralised, the ECB GC is free to change any and all of the terms and procedures for accepting collateral at any time.

Banks tend to 'over-collateralise' their borrowing from the Eurosystem to avoid being caught out by margin calls.

Comparing the figure of €2trn in collateral deposited at the ECB with the €864bn in outstanding credit highlights two further aspects: First, haircuts are applied to ECB collateral. Second, banks typically deposit excess collateral at the ECB in order to be able to quickly respond to margin calls. The ratio between collateral put forward and credit outstanding stood at 3.7 at end-2010, having already risen from 1.9 to 2.8 between 2008 and 2009.

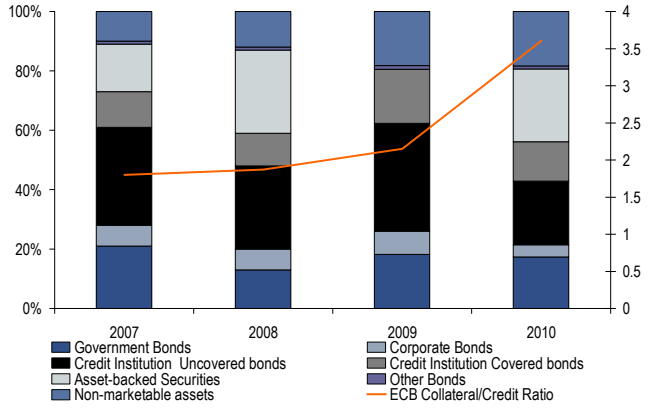
Figure 30. Eurosystem – Collateral Put Forward in Credit Operations, by Asset Type (Bn €), 2007-2010



Note: Total ECB credit refers to total lending to EA credit institutions in the Eurosystem balance sheet.

Source: ECB and Citi Investment Research and Analysis

Figure 31. Eurosystem – Composition of Collateral Put Forward in Eurosystem Credit Operations by Asset Type (% of total), 2007-2010



Note: Collateral/Credit Ratio is defined as the fraction of the amount of collateral put forward in credit operations in the Eurosystem and the total Eurosystem lending to EA credit institutions. All indicators are measured on the left axis except collateral/credit ratio.

Source: ECB and Citi Investment Research and Analysis

When considering the exposure of the Eurosystem as a result of its lending operations, it is important to take both collateral valuation and the haircuts into account. Take the example of a Greek government bond with a residual maturity of 6 years that currently trades at 30 cents on the euro. The maximum amount of Eurosystem credit extended against this exposure would be around 27.6 cents to the euro. The maximum loss for the ECB would therefore be 27.6 cents per unit of face value of the bond. And for this maximum loss to materialise, the respective

bank would first have to go bankrupt first, second not have any excess collateral deposited with the ECB, and third have a zero recovery rate for unsecured creditors.

4.4. Emergency liquidity assistance (ELA)

Under emergency liquidity assistances (ELA), banks that are not creditworthy enough to access the Eurosystem or which do not have collateral that satisfies the Eurosystem's minimum requirements, can obtain funding from their NCB.

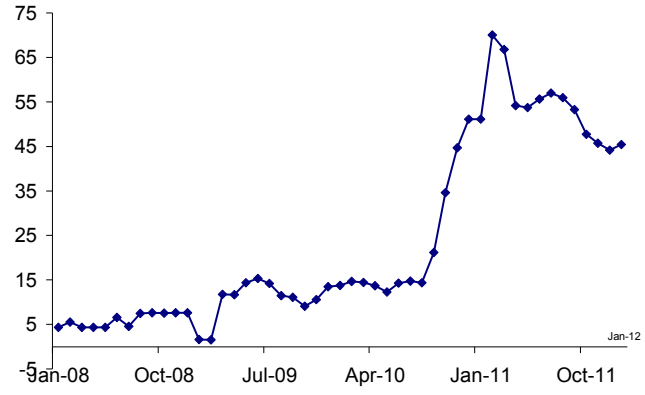
In addition to conventional Eurosystem credit, NCBs can offer domestic banks credit via emergency liquidity assistance (ELA). ELA facilities can be created by NCBs when the counterparty banks in their jurisdictions can no longer fund themselves at the regular facilities of the Eurosystem, either because their creditworthiness has deteriorated too much or because the quality of the collateral they offer is too poor to be acceptable at the Eurosystem. The ELA facilities can, subject to a number of provisos, take collateral not acceptable at the Eurosystem from counterparties that are not sufficiently creditworthy to access the Eurosystem.

ELA lending is explicitly guaranteed by the relevant sovereign and gains and losses on ELA lending are not pooled and shared between the members of the Eurosystem.

ELA lending is explicitly guaranteed by the relevant sovereign and gains and losses on ELA lending are not pooled and shared between the members of the Eurosystem (see Global Economics View - ELA: An Emperor without Clothes?). Terms and conditions for ELA lending are set by the NCBs and can differ from conventional ECB lending, notably in terms of collateral accepted, interest rate charged or valuation haircuts applied.

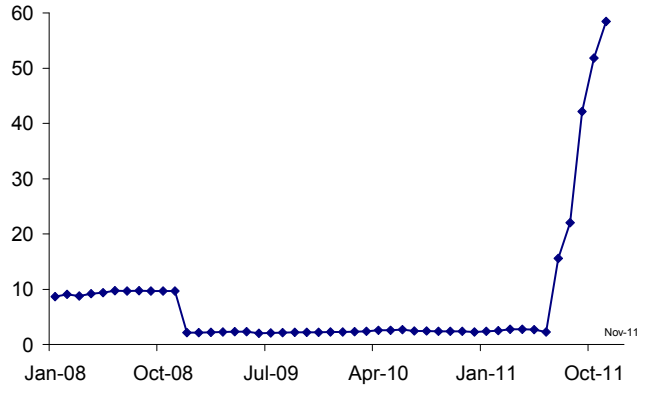
Data on ELA, including its terms and conditions, the collateral used, and even the total size of the lending are not generally publicly available. The way in which NCBs account for their ELA activities is also not standardised. From the published data it is difficult to extract a complete picture and the incomplete picture is presented in Figure 32 to Figure 35.[34] According to the information that we have, five EA countries have used ELA: Belgium, Cyprus, Germany, Ireland and Greece. Germany used ELA only in 2008 when the financial crisis stuck. Ireland has been the biggest user of ELA over the past two years, with a peak size in February 2011 of at €68.5bn. At end-January 2012, ELA of the Irish central bank amounted to around €45.5bn. In Greece, ELA has risen fast since July 2011 and stood at €56.2bn at the end of November.

Figure 32. Ireland – Central Bank of Ireland Other Assets, 2008-Dec 2011 (Bn €)



Source: Central Bank of Ireland, CIRA

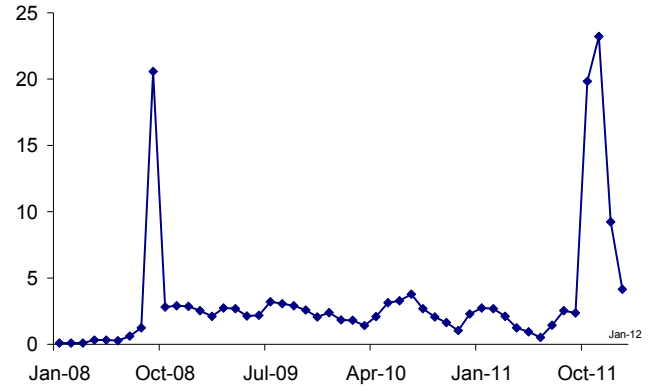
Figure 33. Greece – Bank of Greece Remaining Assets, 2008-Nov 2011 (Bn €)



Source: Bank of Greece, CIRA

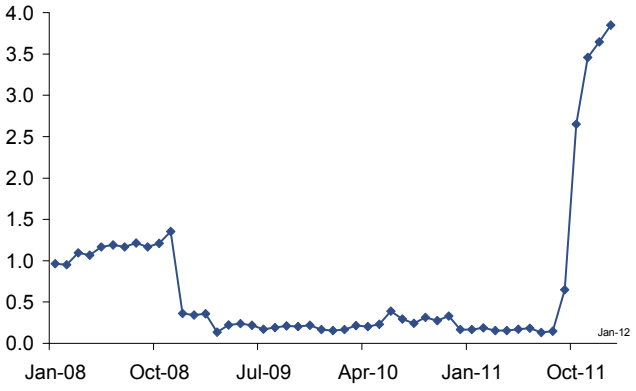
[34] Figure 35 to Figure 38 present the evolution of the balance sheet items that in our assessment contain (but are not limited to) ELA exposure.

Figure 34. Belgium – Banque Nationale de Belgique Claims in EA Credit Institutions Denominated in Euros (Bn €)



Source: Baque Nationale de Belgique, CIRA

Figure 35. Cyprus – Central Bank of Cyprus Other Assets, 2008-Dec 2011 (Bn €)



Source: Central Bank of Cyprus, CIRA

If the ELA-granting NCB and its sovereign are insolvent, ELA is likely to end up as exposure of the Eurosystem.

As noted above, ELA is explicit guaranteed by the respective sovereign. However, in the case of an insolvent sovereign, such a guarantee is likely to be worth very little. It is therefore only appropriate to include ELA in the list of exposures of the Eurosystem.

5. Will it all end in tears?

5.1. What happens if the ECB makes a loss? Would it default?

The ECB is exempt from regulatory capital requirements and accounting rules. It could choose to run on negative equity or 'evergreen' its exposure indefinitely.

The ECB is not subject to either regulatory capital requirements or national or international accounting rules (statutory or otherwise). That means that the ECB could *choose* to realise losses and potentially run with negative regulatory equity should the losses exceed its on-balance sheet loss absorption capacity. Or the ECB could *choose* to 'evergreen' its exposure indefinitely, for example, by recording assets at purchase prices even if these assets are non-performing or in default. The ECB is exempt from the EU's Capital Requirements Directive (CRD). The ECB does have two obligations to submit to external auditing. One is to an independent external auditor recommended by the Governing Council and approved by the European Council to audit the ECB's accounts.[35] But this audit is not consequential in the sense that even if the auditor did not sign off on the accounts, such a judgment would not carry any corrective or enforcement implications (though it may clearly have reputational effects). On top of that, Article 26 of the ECB's Statute makes clear that it is the ECB GC that determines the 'principles' according to which the annual accounts of the ECB are drawn up, and it is the GC that approves the accounts. The auditor is thus there to check that the ECB conforms to its self-imposed rules. The second auditing obligation is to the EU's Court of Auditors, but this obligation only applies for 'examination of the operational efficiency of the management of the ECB' (see footnote 35).

[35] "Article 27 Auditing

27.1. The accounts of the ECB and national central banks shall be audited by independent external auditors recommended by the Governing Council and approved by the Council. The auditors shall have full power to examine all books and accounts of the ECB and national central banks and obtain full information about their transactions.

27.2. The provisions of Article 287 of the Treaty on the Functioning of the European Union shall only apply to an examination of the operational efficiency of the management of the ECB.

According to the ECB Statute, ECB losses are supposed to be met first by reductions in its risk provision and capital reserves. Should these prove to be insufficient, the ECB's monetary income can be reduced.

There is no explicit provision in the Statute that NCBs are required to recapitalise the ECB if both reserves and income are insufficient to compensate for losses incurred.

That negative equity or endless evergreening are possible for the ECB does not mean that they are likely. The ECB has realised losses on its exposure in the past. In fact, there is a more or less standard procedure in place to deal with losses: In the event of a loss, the ECB first reduces its so-called 'risk provision'. Once the risk provision is exhausted, the remaining losses are deducted from the ECB's general reserve. Provisions and the general reserve are built up over time out of retained profits to guard against potential losses but are capped at 100% of the level of the ECB's regulatory capital (the Statute is not quite clear whether that is the subscribed capital, currently €10.8bn, or the paid-up capital, currently €6.4bn to go up to €7.5bn by end-2012). The ECB Statute prescribes that up to 20% of the profit of the ECB/Eurosystem can be transferred to the general reserve, with the remainder of the profit to be distributed to the NCBs, but profits are only calculated after additions and subtractions to the risk provision are accounted for.[36] The risk provision was thus created to allow the ECB to build up reserves more quickly than the general reserve. Once the risk provision is exhausted, losses will be deducted from the general reserve, and only then against the monetary income (see footnote 36).

In autumn 2008, five counterparties defaulted on refinancing operations undertaken by the Eurosystem, namely the Lehman Brothers' German subsidiary (borrowing from the Eurosystem through the Bundesbank), three subsidiaries of Icelandic banks borrowing through the Banque centrale du Luxembourg, and Indover NL borrowing through through the Dutch central bank. The total nominal value of the Eurosystem's claims on these credit institutions amounted to some €10.3 billion at end-2008 (according to media reports €8.5bn of this exposure was to Lehman Brothers[37]). The collateral put forward for these transactions mainly consisted of asset-backed securities (ABS). In response to these defaults, the ECB GC decided that the NCBs should build up provisions equal to €5.7bn. According to the same FT article, the risk provision had been reduced to €2.2bn by the end of 2010 and was expected to be reduced further in 2011.

In the ECB Statute or the EU Treaties there is no mention of losses eating into the ECB's capital. The Statute does mention that the ECB could increase its capital, following its own decision.[38] Given that the Statute also stipulates that the NCBs

[36] "Firstly, pursuant to Article 33.1 of the Statute of the ESCB and of the ECB, up to 20% of the profit in any year may be transferred to the general reserve fund, subject to a limit equal to 100% of the ECB's capital. The remaining net profit is to be distributed to the NCBs, as shareholders of the ECB, in proportion to their shares in the paid-up capital. Losses may be offset against the general reserve, and upon a decision of the Governing Council, against the monetary income of the relevant financial year (see Article 33.2 of the Statute). The transfers to and from the reserve take place after the financial year is closed, i.e. after the annual profit or loss has been determined, and are hence outside the profit and loss account.

[37] See http://www.ft.com/cms/s/0/30d1a26e-42b8-11e1-93ea-00144feab49a.html#axzz1nEdqUh00

[38] ECB Statute

Article 28

Capital of the ECB

28.1. The capital of the ECB shall be euro 5 000 million. The capital may be increased by such amounts as may be decided by the Governing Council acting by the qualified majority provided for in Article 10.3, within the limits and under the conditions set by the Council under the procedure laid down in Article 41.

28.2. The national central banks shall be the sole subscribers to and holders of the capital of the ECB. The subscription of capital shall be according to the key established in accordance with Article 29.

28.3. The Governing Council, acting by the qualified majority provided for in Article 10.3, shall determine the extent to which and the form in which the capital shall be paid up. 28.4. Subject to Article 28.5, the shares of the national central banks in the subscribed capital of the ECB may not be transferred, pledged or attached.

shall be the sole subscribers to and holders of the capital of the ECB, the source of the capital increase can be inferred to be the EA NCBs, but the Statute does not explicitly spell out an obligation of the NCBs to respond to a call for more ECB capital.

There is nothing in the Statute or the Treaty on the possibility that NCB capital may be insufficient to cover losses of the ECB and what would be done in that case. In particular, the Treaty or Statute does not include any requirement for member state governments to recapitalise the NCBs, even if this were to be necessary for the NCBs to be able to recapitalise the ECB. The ECB has issued Opinions that argue that an obligation of the EA member states to recapitalize their NCBs so as to enable them to recapitalize the ECB is implied by the Treaty-based independence of the ECB. Independence, in this view, implies financial independence, which requires adequate capital. Until this Opinion of the ECB is tested in the European Court of Justice, however, it remains just an opinion.

In the history of the ECB, there has only been one capital increase. This was announced in December 2010 and involved an increase in ECB capital from €5.76bn to €10.76bn *"in view of increased volatility in foreign exchange rates, interest rates and gold prices as well as credit risk."*[39] The capital increase was supposed to be paid up in three tranches at the end of each year between 2010 and 2012 and two of these tranches have now been paid.

5.2. Does expanding the ECB/Eurosystem balance sheet or using the NILAC imply printing 'money'?

A further increase in the Eurosystem balance sheet does not necessarily imply 'printing money' – the balance sheet can be increased by issuing either monetary or non-monetary liabilities.

No. An increase in the size of the ECB's or the Eurosystem's balance sheet need not imply an increase in the monetary liabilities of the central bank. These are commonly defined as the monetary base or high-powered money – the sum of currency in circulation and overnight deposits or reserves (both required reserves and excess reserves) held by commercial banks with the central bank. Instead of funding an increase in assets by creating additional base money, the impact on the monetary base of central bank asset purchases or loans can be sterilised through the issuance of non-monetary liabilities. These include, but are not restricted to, term deposits, and ECB bills. The ECB's outright purchases of sovereign debt under the SMP have been sterilised through the issuance of one-week term deposits since the beginning of the programme. We have called this 'semantic sterilisation', because one-week term deposits, which are not part of the conventionally defined monetary base, are very close substitutes for overnight deposits which are part of the conventionally defined monetary base. In addition, one-week term deposits with the ECB can be used as collateral to borrow overnight from the ECB, making them functionally equivalent to overnight deposits (reserves) with the ECB.

The Eurosystem also has on the liability side of its balance sheet an item "Debt certificates issued" – currently outstanding in amount zero. In the 'marketable assets' category for eligible collateral for Eurosystem credit operations, there is also a reference to ECB debt certificates and to debt instruments issued by central banks. ECB debt certificates are marketable ECB liabilities with a maturity of less

28.5. If the key referred to in Article 29 is adjusted, the national central banks shall transfer among themselves capital shares to the extent necessary to ensure that the distribution of capital shares corresponds to the adjusted key. The Governing Council shall determine the terms and conditions of such transfers.

[39] See http://www.ecb.int/press/pr/date/2010/html/pr101216_2.en.html

than 12 months – what we would call ECB bills.[40] The ECB's 'Guidelines on monetary policy instruments and procedures of the Eurosystem' also states that "The Governing Council of the ECB may, at any time, change the instruments, conditions, criteria and procedures for the execution of Eurosystem monetary policy operations."' Thus, unlike the Fed, the ECB can at any time expand its instrument to include not only marketable short-term securities, but also marketable securities with maturities of longer than one year – ECB bonds. To our knowledge, the ECB has not yet done so.

5.3. Could a €2trn SMP be sterilized?

The ECB could sterilise balance sheet extensions of any size by varying the terms on the non-monetary liabilities it would offer.

Yes. On at least two occasions (November 28, 2011and June 25, 2010, targets of €203.5bn and €55bn versus actual of €194.2bn and €23.1bn, respectively), there was not enough demand up to the maximum interest rate offered (the refi rate) for the amount of fixed-term deposits the ECB issued to absorb the liquidity it had injected. These occasions have created concern that the ECB would not be *able* to absorb the liquidity it would provide to the market if it substantially expanded its balance sheet. To us, such concerns are misplaced. By varying the terms (including the interest rate offered) on its non-monetary liabilities, the ECB can achieve any degree of sterilization of asset purchases it desires. So far, the ECB has simply chosen not to do so by limiting the maximum rate offered to the refi rate and by only offering one-week fixed-term deposits to absorb the liquidity.

Asset purchases by the central bank need not imply 'printing money' or creating it electronically. Whether it would be desirable to increase monetary liabilities is a different question, but that would not change the fact that it remains a policy choice of the ECB whether it increased its balance sheet by increasing monetary or non-monetary liabilities.

5.4. Would a €2trn SMP cause inflation?

Even a big increase in the ECB balance sheet is unlikely to lead to inflation.

Broad measures of the money supply have risen much less than the monetary base, as the base money multiplier in the euro area has collapsed.

As long as demand is weak and output gaps remain large, inflation pressures in the EA are likely to remain muted.

And if loan and credit growth start to reaccelerate, the ECB has the tools to reduce inflationary pressures e.g. by increasing minimum reserve requirements or by increasing the interest rate it pays on banks' excess reserves.

Not necessarily. There are one bad and two good arguments to support the proposition that such a large increase in the ECB's balance sheet would not be likely to cause – or even be associated with – high inflation in the future.

The bad reason first. Above, we noted that a big increase in SMP purchases or other liabilities need not imply a large increase in the ECB's monetary liabilities. However, as we also noted, much of the distinction between monetary liabilities and, for example, the very short-term non-monetary liabilities that the ECB currently issues to absorb SMP liquidity is semantic. The inflation implications of increasing the ECB balance sheet via increasing its monetary liabilities or via issuing one-week term deposits would likely be rather similar.

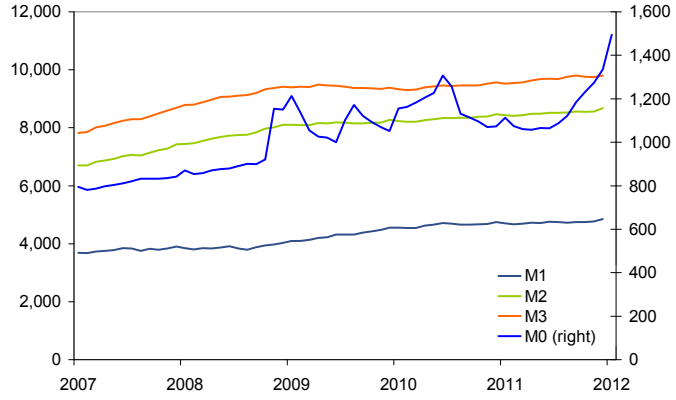
The first good reason is that an increase in the monetary base, even if it leads to an increase in broad money (M1, M2, M3, etc) and/or in bank credit, is not inflationary if there is excess capacity in the economy. The simplistic identification of growth in monetary aggregates (narrow or broad) with inflation is bad economics. The correct assertion that sustained inflation is always and everywhere a monetary phenomenon should not be confused with the incorrect assertion that, regardless of the circumstances (initial conditions, domestic excess capacity, global economic conditions, expected inflation and other sources of inflationary momentum) large increases in the monetary base and/or in broad money and bank credit are always

[40] European Central Bank, Guideline of the European Central Bank of 3 February 2005, amending Guideline ECB/2000/7 on monetary policy instruments and procedures of the Eurosystem (ECB/2005/2), (2005/331/EC), http://www.ecb.int/ecb/legal/pdf/l_11120050502en00010083.pdf

inflationary. Instead such expansions in the monetary aggregates they can prevent deflation (negative inflation), prevent a financial crunch or even mitigate a financial crisis. One has to do the hard work of detailed economic and monetary analysis to determine whether an observed development in the monetary aggregates is the first step on the road to Weimar or instead a necessary step to prevent a catastrophic collapse of economic activity and widespread deflation.

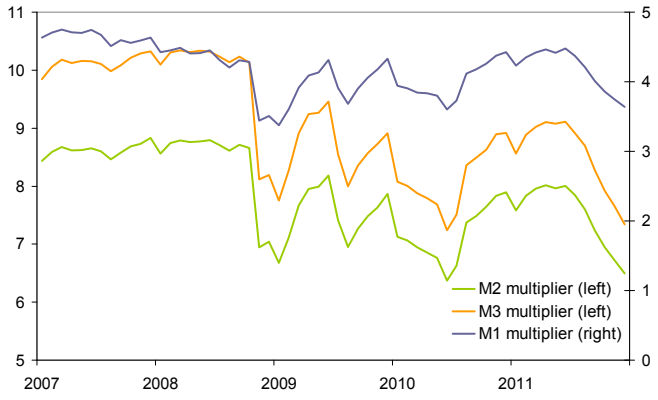
In the euro area, broader measures of the money supply have not risen nearly as fast as the monetary base (Figure 36). Thus, while M0 rose by 68% between January 2007, the M1, M2, and M3 measures of the money supply have risen by only 32%, 29%, and 25%, respectively, with much of the increase in the broader measures of the money supply preceding the large rises in the monetary base that started in September 2008.[41] Base money multipliers, i.e. the ratio between broader measures of the money supply and the monetary base/M0 have collapsed (Figure 37). Measures of credit have at best remained stable and output gaps remain large in most countries in the euro area other than Germany.

Figure 36. Euro Area – Money Supply Measures (Mn €), 2007 – 2012



Source: ECB and Citi Investment Research and Analysis

Figure 37. Euro Area – Base Money Multipliers, 2007 – 2011



Note: Multipliers are computed as M1, M2, and M3 divided by M0.

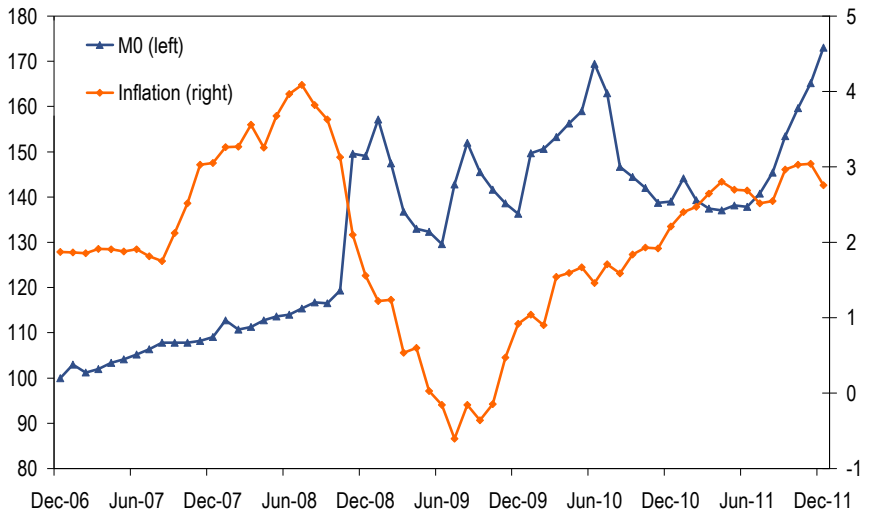
Source: Citi Investment Research and Analysis

Looking back at the experience over the past four years, inflation pressures in industrial countries have remained relatively contained, despite the very large increases in central bank balance sheets (Figure 38 and Figure 41). The second half of 2008 and the first half of 2009, which saw the balance sheets of the ECB, the Fed and the BoE balloon due to a variety of quantitative easing and credit easing measures, were associated with a *fall* in inflation. Of course, we do not imply causation here, i.e. we do not argue that increases in the moneysupply cause reductions in inflation. We are also fully aware that any inflationary effects of increases in the money supply should only be expected to materialise gradually over time. Rather, we would like to highlight that the first and second round of unconventional, balance-sheet increasing measures taken by central banks have taken place in an environment where inflation was falling rapidly and output gaps were rising fast. This coincidence of falling inflation and large output gaps would also be true currently in the EA (as well as in the US and Japan). Further increases in the ECB's balance sheet, even a further doubling of its balance sheet are unlikely to drive a material increase in inflation, as long as the ECB is willing to act to neutralize incipient inflationary pressures if and when they materialize. The instruments to do so – sterilisation, higher reserve requirements, higher interest

[41] Between September 2008 and December 2011, M0 rose by 48%, M1 rose by 25%, M2 by 11% and M3 by 7%.

rates on excess reserves and higher official policy rates are more than sufficient to keep inflation under control. We elaborate on this below.[42]

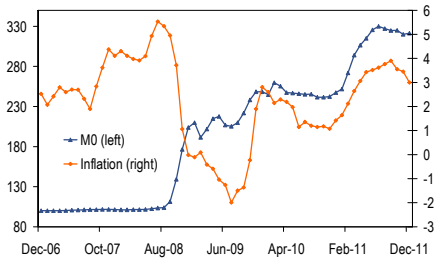
Figure 38. Euro Area – Monetary Base (2007=100) and Inflation (%YoY), 2006 – 2011



Note: Inflation correspond to year-on-year percentage changes in the Harmonized CPI (seasonally adjusted)

Source: ECB and Citi Investment Research and Analysis

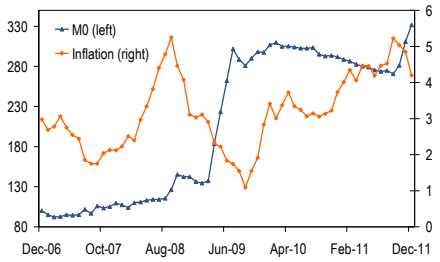
Figure 39. US – Monetary Base (2007=100) and Inflation (%YoY), 2006 – 2011



Note: Inflation corresponds to year-on-year percentage changes in the seasonally adjusted CPI.

Source: Bureau of Labor Statistics, Federal Reserve Board, and Citi Investment Research and Analysis

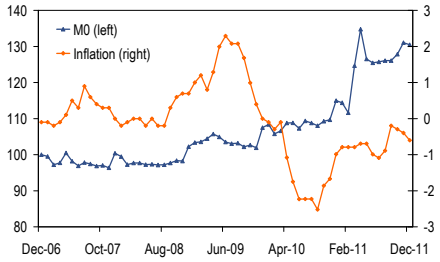
Figure 40. UK – Monetary Base (2007=100) and Inflation (%YoY), 2006 – 2011



Note: Inflation corresponds to year-on-year percentage changes in the non seasonally adjusted CPI.

Source: Office for National Statistics, Bank of England and Citi Investment Research and Analysis

Figure 41. Japan – Monetary Base (2007=100) and Inflation (%YoY), 2006 – 2011



Note: Inflation corresponds to year-on-year percentage changes in the non seasonally adjusted CPI.

Source: Ministry of Internal Affairs and Communications, Bank of Japan and Citi Investment Research and Analysis

The second good reason why even a further doubling of the ECB's balance sheet size is unlikely to lead to high inflation is that the ECB has the tools to stop it. We already noted that currently a large part of the stock of Eurozone base money is held as excess reserves at the Eurosystem. What would happen if the banking system got its mojo back and exited the liquidity trap by trying to lend its excess reserves to households or enterprises, thus setting in motion an expansion of bank deposits and bank lending that could easily become multiples of the initial stock of excess reserves? Should the central bank wish to prevent this expansion of bank deposits and bank credit, it has two instruments at its disposal. The first is reserve

[42] Large increases in the EA base money supply or the ECB's balance sheet size could still be *associated* with an increase in inflation caused e.g. by a large supply-shock driven increase in commodity prices, notably oil prices.

requirements. These were just lowered (on December 8 2011) from 2 percent of eligible deposits to 1 percent. They could be raised to any level deemed necessary by the authorities. The cost of higher reserve requirements to the banks can be altered by varying the remuneration of required reserves. The second instrument for controlling the money multiplier or the base money-bank credit multiplier is the remuneration rate on excess reserves. By setting the interest rate on excess reserves high enough, the central bank can induce banks to hold these reserves idle at the central bank rather than trying to lend them out to private customers. Either reserve requirements or the interest rate on excess reserves would provide adequate control over the broader monetary aggregates and the stock of bank credit. The two together most definitely can prevent excessive broad money growth from resulting from an expansion of the monetary base.

We take the commitment of the ECB to price stability as the overriding objective of the ECB seriously. We believe nothing that has been done so far – indeed nothing that is likely to be done by the ECB – is likely to create an inflationary future for the euro area. Instead it remains consistent with the prevention of financial instability, deflation and depression.

7. Appendix

7.1. The Full ECB and Eurosystem Balance Sheets

Figure 42. ECB – Balance Sheet as of December 31, 2010

Assets (€ millions)		Liabilities (€ millions)	
1. Gold and gold receivables	17,016	1. Banknotes in circulation	67,176
2. Claims on non-euro area residents denominated in foreign currency	39,714	2. Other liabilities to euro area credit institutions denominated in euro	33
2.1 Receivables from the IMF	415	3. Liabilities to other euro area residents denominated in euro	1,072
2.2 Balances with banks and security investments, external loans and other investments, external loans and other external assets	39,299	3.1 Other liabilities	1,072
3. Claims on euro area residents denominated in foreign currency	4,327	4. Liabilities to non-euro area residents denominated in euro	1,202
4. Claims on non-euro area residents denominated in euro	1,800	5. Liabilities to non-euro area residents denominated in foreign currency	478
4.1 Balances with banks, security investments and loans	1,800	6. Intra-Eurosystem liabilities	61,430
5. Other claims on euro area credit institutions denominated in euro	33	6.1 Liabilities equivalent to the transfer of foreign reserves	40,204
6. Securities of euro area residents denominated in euro	17,926	6.2 Other liabilities within the Eurosystem (net)	21,225
6.1 Securities held for monetary policy purposes	17,926	7. Other liabilities	1,812
7. Intra-Eurosystem claims	67,176	7.1 Off-balance-sheet instruments revaluation differences	568
7.1 Claims related to the allocation of euro banknotes within the Eurosystem	67,176	7.2 Accruals and income collected in advance	750
7.2 Other claims within the Eurosystem (net)	0	7.3 Sundry	494
8. Other assets	15,532	8. Provisions	5,217
8.1 Tangible and intangible fixed assets	282	9. Revaluation accounts	19,627
8.2 Other financial assets	13,250	10. Capital and reserves	5,306
8.3 Off-balance-sheet instruments revaluation differences	147	10.1 Capital	5,306
8.4 Accruals and prepaid expenses	1,319	11. Profit for the year	171
8.5 Sundry	533		
Total assets	**163,523**	**Total liabilities**	**163,523**

Source: ECB and Citi Investment Research and Analysis

Figure 43. Conventional Balance Sheet of the Consolidated Eurosystem, as of Feb 10, 2012

Assets (€ millions)		Liabilities (€ millions)	
1. Gold and gold receivables	423,445	1. Banknotes in circulation	869,355
2. Claims on non-euro area residents denominated in foreign currency	245,805	2. Liabilities to euro area credit institutions related to monetary policy operations denominated in euro	807,200
2.1 Receivables from the IMF	85,517	2.1 Current accounts (covering the minimum reserve system)	132,473
2.2 Balances with banks and security investments, external loans and other external assets	160,288	2.2 Deposit facility	454,356
3. Claims on euro area residents denominated in foreign currency	99,629	2.3 Fixed-term deposits	219,500
4. Claims on non-euro area residents denominated in euro	23,512	2.4 Fine-tuning reverse operations	0
4.1 Balances with banks, security investments and loans	23,512	2.5 Deposits related to margin calls	871
4.2 Claims arising from the credit facility under ERM II	0	3. Other liabilities to euro area credit institutions denominated in euro	1,931
5. Lending to euro area credit institutions related to monetary policy operations denominated in euro	796,332	4. Debt certificates issued	0
5.1 Main refinancing operations	142,751	5. Liabilities to other euro area residents denominated in euro	110,572
5.2 Longer-term refinancing operations	652,097	5.1 General government	100,466
5.3 Fine-tuning reverse operations	0	5.2 Other liabilities	10,106
5.4 Structural reverse operations	0	6. Liabilities to non-euro area residents denominated in euro	118,157
5.5 Marginal lending facility	1,436	7. Liabilities to euro area residents denominated in foreign currency	4,701
5.6 Credits related to margin calls	48	8. Liabilities to non-euro area residents denominated in foreign currency	7,401
6. Other claims on euro area credit institutions denominated in euro	69,197	8.1 Deposits, balances and other liabilities	7,401
7. Securities of euro area residents denominated in euro	624,679	8.2 Liabilities arising from the credit facility under ERM II	0
7.1 Securities held for monetary policy purposes	283,029	9. Counterpart of special drawing rights allocated by the IMF	55,942
7.2 Other securities	341,649	10. Other liabilities	212,316
8. General government debt denominated in euro	31,176	11. Revaluation accounts	394,029
9. Other assets	349,488	12. Capital and reserves	81,657
Total assets	**2,663,261**	**Total liabilities**	**2,663,261**

Source: ECB and Citi Investment Research and Analysis

7.2. The ECB Profit and Loss Account

Figure 44. ECB – profit and loss account (€ millions), 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1. Net interest income	1,414	771	995	715	690	1,270	1,972	2,421	2,381	1,547	1,422
1.2 Total interest income	7,165	3,979	3,683	2,689	2,612	3,552	5,399	7,739	11,658	7,096	5,816
1.2.1 Interest income on foreign reserve assets	2,507	1,707	991	541	422	889	1,318	1,355	997	700	366
1.2.2 Interest income arising from the allocation of euro banknotes within the Eurosystem			727	698	733	868	1,319	2,004	2,230	787	653
1.2.3 Other interest income	4,657	2,271	1,965	1,450	1,457	1,794	2,762	4,380	8,431	5,608	4,796
1.3 Total interest expense	-5,750	-3,207	-2,688	-1,975	-1,922	-2,282	-3,427	-5,319	-9,277	-5,549	4,393
1.3.1 Remuneration of NCBs' claims in respect of foreign reserves transferred	-1,375	-1,509	-1,141	-808	-693	-710	-965	-1,357	-1,400	-443	-346
1.3.2 Other interest expense	-4,375	-1,698	-1,547	-1,167	-1,229	-1,572	-2,462	-3,962	-7,877	-5,106	4,047
2. Net result of financial operations, write-downs and risk provisions	752	1352	612	-879	-1,957	-940	-1,622	-2,042	-679	1,099	-884
2.1 Realised gains/losses arising from financial operations	3,353	1,352	735	525	136	149	475	779	662	1,103	474
2.2 Write-downs on financial assets and positions	-1	-109	-277	-3,973	-2,093	-97	-718	-2,534	-3	-37	-195
2.3 Transfer to provisions for foreign exchange rate and price risks	-2,600	109	154	2,569	0	-992	-1,379	-286	-1,339	35	-1,163
3. Other income and expenses from fees and commissions	2	2	4	3	6	18	11	7	8	8	48
4. Staff costs	-80	-97	-120	-130	-161	-153	-161	-169	-174	-187	-196
5. Administrative expenses	-83	-185	-134	-154	-176	-158	-166	-185	-183	-186	-196
6. Depreciation of tangible fixed assets	-14	-20	-18	-30	-34	-32	-29	-26	-23	-21	-13
7. Banknote production services			-118	-2	-3	-4	-5	-5	-7	-6	-8
Profit/loss for the year	**1,990**	**1,822**	**1,220**	**-477**	**-1,636**	**0**	**0**	**0**	**1,322**	**2,253**	**170**

Source: ECB and Citi Investment Research and Analysis

7.3. ECB Open Market Operations

With regard to their aims, regularity and procedures, the Eurosystem's open market operations can be divided into the following four categories.[43]

1) The main refinancing operations (MROs) are regular liquidity-providing reverse transactions with a weekly frequency and a maturity of normally 1 week. These operations are executed by the NCBs on the basis of standard tenders.

2) The longer-term refinancing operations (LTROs) are liquidity-providing reverse transactions with a monthly frequency and a maturity of normally 3 months. These operations are aimed at providing counterparties with additional longer-term refinancing and are executed by the NCBs on the basis of standard tenders. Since 2007, the ECB has carried out a number of extraordinary LTROs of 6-month, 12-month and recently even 36-month maturity.

3) Fine-tuning operations are executed on an ad-hoc basis with the aim of managing the liquidity situation in the market and steering interest rates, in particular in order to smooth the effects on interest rates caused by unexpected liquidity fluctuations in the market. Fine-tuning operations may be conducted on the last day of a reserve maintenance period to counter liquidity imbalances which may have accumulated since the allotment of the last main refinancing operation. Fine-tuning operations are primarily executed as reverse transactions, but may also take the form of either foreign exchange swaps or the collection of fixed-term deposits. The instruments and procedures applied in the conduct of fine-tuning operations are adapted to the types of transactions and the specific objectives pursued in the operations. Fine-tuning operations are normally executed by the NCBs through quick tenders or bilateral procedures. The Governing Council of the ECB can decide that, under exceptional circumstances, fine-tuning bilateral operations may be executed by the ECB itself.

4) In addition, the Eurosystem may carry out structural operations through the issuance of ECB debt certificates, reverse transactions and outright transactions. These operations are executed whenever the ECB wishes to adjust the structural position of the Eurosystem vis-à-vis the financial sector (on a regular or non-regular basis). Structural operations in the form of reverse transactions and the issuance of debt instruments are carried out by the NCBs through standard tenders. Structural operations in the form of outright transactions are normally executed by the NCBs through bilateral procedures. The Governing Council of the ECB can decide that, under exceptional circumstances, structural operations may be executed by the ECB itself.

7.4. Seigniorage

In the main text, we already described the main results from our econometric exercise. Here, we present our econometric procedure, data specifications, results in some more detail and provide some robustness checks.

A common measure of the revenue or resources appropriated in a given period, t, by the central bank through the issuance of base money is what is commonly called

[43] For more detailed definitions and explanations, see
http://www.ecb.int/ecb/legal/pdf/l_33120111214en000100951.pdf

seigniorage. Narrow seigniorage is the change in the stock of currency between two periods, $\Delta C_t = C_t - C_{t-1} = S_t$.

The above equation corresponds to the value of seigniorage at a given point in time. The net present discount value of current and future seigniorage income, is given by the following identity:

$$NPV_t\{\Delta C\} = NPV_t\left\{\left(\frac{i}{1+i}\right)C\right\} - C_{t-1} \quad (1)$$

where, $NPV_t\left\{\left(\frac{i}{1+i}\right)C\right\} = I_t$, denotes the net present discounted value of current and future interest saved. Here i is the interest rate the central bank would have had to pay if it had not been able to issue currency (a short nominal interest rate free of default risk, like that on safe, short maturity Treasury bills), and C_{t-1} is the stock of currency outstanding at the beginning of period t. Hence,

$$S_t = I_t - C_{t-1} \quad (2)$$

Given the above, to obtain an estimate of the NPV of future narrow seigniorage, we need to impose a currency demand function. A typical long-run currency demand function takes the following form:

$$\frac{C}{P} = kY^{\alpha}e^{-\beta\left(i-i^C\right)} \quad (3)$$

where P is the general price level, Y is some scale variable like real GDP, α is the output (scale) elasticity of the demand for currency and β is the semi-elasticity of currency demand with respect to the opportunity cost of holding currency.

We consider a scenario where the future growth rate of real GDP, γ, the future inflation rate, π, and the future nominal discount rate, i, are all constant. Let the future proportional growth rate of the stock of currency be μ. Then S, the NPV of current and future narrow seigniorage, is, if μ is also constant, given by (from (1)):

$$S = \left(\frac{1+i}{i-\mu}\right)\mu C_0 \quad (4)$$

Also, the above assumptions imply the following (from (3)):

$$1+\mu = \left(1+\pi\right)\left(1+\gamma\right)^{\alpha}$$

Substituting in (4) we get our final NPV of S estimator, as:

$$S = \left(\frac{1+i}{1+i-\left(1+\pi\right)\left(1+\gamma\right)^{\alpha}}\right)\left(\left(1+\pi\right)\left(1+\gamma\right)^{\alpha}-1\right)C_0 \quad \textbf{(5)}$$

To obtain our estimates of the present value of current and future seigniorage we then take the following steps:

• First, we estimate the parameters (α, β), as detailed in the next section, and pick values for γ, π, μ, and i.

• Second, we back out k (in (3)) to replicate the observed amount current outstanding currently, given parameters α, β and a value for i.

• Third, we compute Co using (3).

• Fourth, we calculate S using (5)

7.5. Estimating currency and money demand

We estimated money demand functions for the EA, using cointegration techniques based on Johansen's (1991), for the above money demand specification given in (3).

The sample for our baseline estimation is quarterly and runs from 1977Q1 - 2011Q2. The variables used were:

* Real currency demand: From 1977Q1 to 2011Q2, we created a proxy aggregate for the Euro Area based on data from Germany, France, Italy, Spain and Netherlands (these five countries accounted for 84% of Euro Area GDP in 2010).

The proxy was produced by summing nominal currency demand for the above countries (all in millions of Euros, end of period, and provided by the IMF) and deflated by an aggregated consumer price index (computed as a weighted average of quarterly consumer price indices, normalised such that for each 2005=100, and with the country weights calculated as the share of quarterly nominal GDP for that country divided by total nominal GDP for the five countries in that period).

* Real GDP: We created a proxy aggregate by summing real GDPs for the above countries (in millions of chained 2000 Euros, provided by the OECD).

* Interest rate: We again constructed a proxy aggregate by computing a GDP-weighted average of the short-term interest rates for the 5 countries (3 months Treasury bills, quarterly average from monthly data, and provided by the OECD).

We then used a vector error correction model, following Johansen (1991), partly because this method allows us to determine the number of cointegrating vectors (in contrast to the Engle-Granger approach which assumes the existence of only one cointegrating vector).

The steps taken for the estimation were the following:

1. First, all variables (real currency demand, output, interest rate) were tested for whether they have one or two unit roots using the augmented Dickey-Fuller test (ADF), where the Akaike's criterion is employed to select the appropriate lag lengths. The variables were all integrated to the first order (I(1)).

2. A three variable VAR was estimated in order to select the lag length, using the Schwarz criterion, testing for 1-8 lags and selecting 5 lags as the preferred specification. Also, residuals were checked to discard the presence of possible outliers or breakpoints. This exercise provided information for introducing the following dummy variables for the EA: 1992, 2001, 2001Q4, 2002Q4, 2003 and 2008. The final regression equation took the following form:

$$\log(\frac{C_t}{P_t}) = k + \sum_{p=0}^{5} \alpha_p \log(Y_{t-p}) - \sum_{p=0}^{5} \beta_p i_t + \sum_{d=1}^{6} \delta_d dummy_d + \varepsilon_t$$

3. Johansen's (1991) maximum likelihood based test was then used to test for the presence of cointegration vectors. The maximum eigenvalue tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of r +1 cointegrating vectors. A unique cointegration vector (χ) was generally found, linking real output, real currency demand and interest rate.

$$\chi_t = \log(\frac{C_t}{P_t}) - \alpha \log(Y_t) + \beta i_t$$

4. A Vector Error Correction Model (VECM) with no intercept or trend was estimated.

$$\Delta \log(\frac{C_t}{P_t}) = \lambda_t \chi_{t-1} + \sum_{p=0}^{5} \mathrm{A}_p \Delta \log(Y_{t-p}) - \sum_{p=0}^{5} \mathrm{B}_p \Delta i_t + \sum_{d=1}^{6} \delta_d dummy_d + \varepsilon_t$$

Figure 45. Overview of Regression Results and Robustness

	Benchmark	GDP Deflator	Sample Period 2001q1 - 2011q2	Sample Period 1977q1 - 2000q4	Official Interest Rate (1)	Long Interest Rate (2)	E&G Methodology (3)	Other EA Proxy (4)	No dummies	For US (5)	For UK (6)	For Japan (7)
Log(GDP)	0.849**	0.851**	0.899**	0.856**	0.845**	0.855**	0.835**	0.903**	0.865**	0.791**	0.802**	0.692**
(s.d.)	(0.004)	(0.004)	(0.013)	(0.005)	(0.003)	(0.004)	(0.001)	(0.015)	(0.010)	(0.027)	(0.016)	(0.004)
Int	-2.923**	-3.122**	-16.416**	-3.431**	-4.191**	-3.946**	-2.895**	-5.83**	-1.455	-7.241**	-1.696	-12.166**
(s.d.)	(0.651)	(0.654)	(5.358)	(0.707)	(0.674)	(0.739)	(0.253)	(1.245)	(1.784)	(3.069)	(2.333)	(1.355)
dummy_1992	0.008*	0.013**		0.015*	0.014*		0.107**					
(s.d.)	(0.009)	(0.009)		(0.015)	(0.008)		(0.056)					
dummy_2001	-0.051**	-0.052**			-0.049**	-0.057**	-0.153**	-0.115**				
(s.d.)	(0.011)	(0.010)			(0.010)	(0.010)	(0.063)	(0.017)				
dummy_2001q4	-0.234**	-0.240**			-0.232**	-0.229**	-0.291**					
(s.d.)	(0.021)	(0.021)			(0.019)	(0.020)	(0.125)					
dummy_2002q4	0.256**	0.258**			0.253**	0.247**	-0.237**	0.065**				
(s.d.)	(0.022)	(0.022)			(0.020)	(0.020)	(0.109)	(0.018)				
dummy_2003	-0.019*	-0.017**			-0.023**	-0.019**	-0.257**					
(s.d.)	(0.011)	(0.011)			(0.010)	(0.010)	(0.056)					
dummy_2008	0.019**	0.021**			0.022**	0.014**	0.19**	0.017*				
(s.d.)	(0.009)	(0.009)			(0.008)	(0.008)	(0.056)	(0.017)				
No. Observations	132	132	42	93	184	176	138	132	135	207	152	164
R^2	0.821	0.837	0.044	0.293	0.822	0.819	0.869	0.330	0.077	0.523	0.072	0.967

Note: Standard deviations (s.d.) are in brackets

(1) Official interest rate corresponds to a weighted average (in terms of GDP share) of main refinancing rates across countries

(2) Long interest rate corresponds to a weighted average (in terms of GDP share) of 10 year country bond yields

(3) Using Engle and Granger (1987) 2 steps approach

(4) Using observed EA data from 1999 onward (source OECD) and benchmark proxy variables prior 1999

(5) Variables: Real GDP (in millions of chained 2005 US$, source BEA), real currency (in millions of chained 2005 US$, source Federal Reserve), short interest rate (Federal Reserve). Sample Period 1959q1-2011q2

(6) Variables: Real GDP (in millions of chained 2008 GBP, source OECD), real currency (in millions of chained 2008 GBP, and provided by the IMF), and the short term interest rate (provided by OECD). Sample Period 1973q1-2011q2

(7) Variables: Real GDP (Billions of chained 2000 Yen, source OECD), real currency (Billions of 2000 Yen, and provided by Bank of Japan) and the Short interest rate (provided by the OECD). Sample Period 1970q1-2011q2

Source: Citi Investment Research and Analysis

The first column of Figure 45 contains the results for the regression specification discussed in the main text. As noted above, all coefficients have the predicted sign

and are highly significant (e.g. estimated standard deviations are small relative to the size of the estimated coefficients).

The other columns in the table present alternative specifications of the regression. In the second column, we use the GDP Deflator instead of the CPI when computing real currency demand and the other real variables. Different sample periods are used in column three (where we only use data after the introduction of the euro, but the sample size is in principle too short to use cointegration techniques reliably) and four (where we only use data from before the introduction of the euro). Subsequent columns present results using alternative interest rates (a long, 10-year government bond rate, or an official policy interest rate), cointegration test procedures (using the Engle and Granger (1987) method), or using a slightly different way to compute a proxy variable for the EA, a version without dummies, and regression results for other countries (e.g. US, UK and Japan).

As is clear from the figure, our regression results are reasonably robust. In particular, the sign of the coefficients remains unchanged in virtually all cases and the magnitudes involved are also rather similar. In particular, the output elasticity of currency demand tended to fall in a narrow range between 0.8 and 0.9 and was always highly significant. The interest rate semi-elasticity was both less precisely estimated and tended to vary much more strongly depending on the regression specification.

7.6. Estimates of the PDV of Seigniorage

7.6.1. For the Euro Area

We then used the above estimates of the parameters of the currency demand function to compute an estimate of the present discounted value of current and future seigniorage for the EA. For all cases, inflation is assumed to be consistent with the ECB target of 2%. The below table presents our benchmark results which use an output elasticity of currency demand of 0.8 and an interest-rate semi-elasticity of currency demand of 2.9.

Figure 46. Present Discounted Value of Future Seigniorage (S) in the Euro Area (α= 0.8; β=2.9)

€ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	€1,886	€1,273	€956	€763	€632
1.0%	€3,717	€2,065	€1,421	€1,078	€865
1.5%	€13,090	€3,817	€2,216	€1,553	€1,189
2.0%	Infinite	€10,966	€3,888	€2,345	€1,670

Note: α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

We have done extensive robustness analysis for our estimates. In the main text, we already discussed the (small) effects for imposing different values for the interest-rate semi-elasticity. Here, we show that the effect of changing the output elasticity of currency demand is much higher – if we retain all other assumptions, the value for the PDV of seigniorage falls by roughly 30% if we reduce the output elasticity from 0.8 to 0.5, while it rises by about 25% if we raise the elasticity to one.

Figure 47. Present Discounted Value of Future Seigniorage (S) in the Euro Area (α= 0.5; β=2.9)

€ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	€1,502	€1,062	€817	€662	€555
1.0%	€2,100	€1,382	€1,025	€812	€669
1.5%	€3,106	€1,834	€1,294	€995	€805
2.0%	€5,158	€2,515	€1,652	€1,224	€968

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

Figure 48. Present Discounted Value of Future Seigniorage (S) in the Euro Area (α= 1; β=2.9)

€ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	€2,104	€1,384	€1,027	€812	€670
1.0%	€5,221	€2,532	€1,661	€1,229	€972
1.5%	Infinite	€6,172	€2,962	€1,935	€1,430
2.0%	Infinite	Infinite	€7,148	€3,392	€2,209

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

7.6.2. Estimates of the present value of seigniorage in the US, UK and Japan

We also estimated the present value of seigniorage for the US, UK and Japan. Here, we present the results under two different scenarios – one where we use the value for the interest-rate semi-elasticity that is estimated using country-specific data, and one where impose the same value as for the euro area. We always maintain 0.8 as the value for the output elasticity of currency demand used.

Figure 49. Present Discounted Value of Future Seigniorage (S) in the United States (α= 0.8; β=7.2)

USD (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	$1,727	$1,150	$849	$664	$540
1.0%	$3,186	$1,795	$1,226	$918	$724
1.5%	$8,669	$3,096	$1,839	$1,285	$974
2.0%	Infinite	$7,077	$3,005	$1,864	$1,329

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

Figure 50. Present Discounted Value of Future Seigniorage (S) in the United States (α= 0.8; β=2.9)

USD (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	$1,995	$1,346	$1,011	$806	$668
1.0%	$3,931	$2,184	$1,503	$1,140	$915
1.5%	$13,843	$4,036	$2,344	$1,642	$1,258
2.0%	Infinite	$11,597	$4,112	$2,480	$1,766

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

Figure 51. Present Discounted Value of Future Seigniorage (S) in the United Kingdom (α= 0.8; β=1.7)

£ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	£98	£67	£51	£41	£34
1.0%	£182	£105	£74	£56	£46
1.5%	£514	£183	£111	£79	£62
2.0%	Infinite	£432	£183	£116	£85

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

Figure 52. Present Discounted Value of Future Seigniorage (S) in the United Kingdom (α= 0.8; β=2.9)

£ (bn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	£95	£64	£49	£39	£32
1.0%	£177	£101	£71	£54	£43
1.5%	£499	£176	£106	£76	£59
2.0%	Infinite	£416	£176	£111	£80

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

Figure 53. Present Discounted Value of Future Seigniorage (S) in Japan (α= 0.7; β=12.1)

Yen (trn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	¥136	¥90	¥65	¥50	¥40
1.0%	¥225	¥131	¥89	¥66	¥51
1.5%	¥457	¥203	¥125	¥88	¥66
2.0%	¥2,438	¥360	¥185	¥120	¥86

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

Figure 54. Present Discounted Value of Future Seigniorage (S) in Japan (α= 0.8; β=2.9)

Yen (trn)	Interest/ Discount Rate (i)				
Real Growth Rate (g)	3.5%	4.0%	4.5%	5.0%	5.5%
0.5%	¥184	¥125	¥94	¥75	¥63
1.0%	¥343	¥197	¥137	¥105	¥84
1.5%	¥969	¥343	¥207	¥147	¥114
2.0%	Infinite	¥809	¥341	¥215	¥156

Note: From equation (3) α represents the long run income elasticity of the money demand function, and β the corresponding interest rate semi-elasticity

Source: Citi Investment Research and Analysis

7.7. NCB details on changed collateral standards

7.7.1 Portugal [44]

At its meeting on 8 December 2011, the Governing Council of the ECB decided to adopt (decision ECB/2011/25) additional temporary measures relating to Eurosystem refinancing operations and eligibility of collateral, and established that national central banks (NCBs) may accept as collateral for Eurosystem monetary policy operations additional credit claims that satisfy specific eligibility criteria. According to the same decision, the NCBs shall establish the new eligibility criteria and the appropriate risk control measures, which shall be subject to prior approval by NCBs and the Governing Council of the ECB.

In this vein, at its meeting on 9 February 2012, the Governing Council of the ECB decided to approve the following temporary measures proposed by Banco de Portugal, which will widen the scope of credit claims to be accepted as collateral in Eurosystem credit operations:

a. To accept individual credit claims with a probability of default not exceeding 1.5%, which shall be subject to more demanding risk control measures than those currently in force.

b. To extend the acceptance of the COFACE Rating Tool as a tool to evaluate the credit quality of debtors belonging to Service, Trade and Other activity sectors.

c. To accept homogeneous portfolios of credit claims relating to:

i. Mortgage-backed loans to households;

ii. Consumer credit to households; and

iii. Loans to enterprises other than financial corporations.

Credit claim portfolios shall not be subject to minimum credit quality requirements, but shall be subject to specific and strict risk control measures.

Individual additional credit claims shall be reported to Banco de Portugal, according to the same operational procedures used for claims accepted within the scope of the general framework of collateral described in the Annex to Instruction No 1/99 on credit claims.

[44] http://www.bportugal.pt/en-US/OBancoeoEurosistema/ComunicadoseNotasdeInformacao/Pages/combp20120209.aspx

The operational procedures regarding the mobilisation of credit claim portfolios shall be the object of a specific framework that will be established in an Instruction to be published by Banco de Portugal.

All detailed technical documentation will be published on BPnet portal, in the 'Money Market' section, under 'EEB'.

In addition, Banco de Portugal has decided to introduce a number of changes in the general framework on credit claims, that aim to simplify the mobilisation of credit claims and which will be reflected in Instruction of Banco de Portugal No 1/99. Thus, regarding individual credit claims accepted under Instruction No 1/99, Banco de Portugal has decided to:

a. Reduce the minimum amount of credit claims accepted as collateral from €500,000 to €100,000.

b. Allow for the simplification of the ex ante procedures regarding the authorisation to use credit claims. In those situations the participating institution shall inform Banco de Portugal, in writing and before the start of credit claims mobilisation, about the internal procedures implemented to communicate the information on credit claims to be mobilised, guaranteeing that all requirements are complied with. The external auditors report shall be submitted to Banco de Portugal within the maximum period of one year after the start of the mobilisation of credit claims as collateral.

c. Change the process for sending credit claims information, which will be made through BPnet's File Transfer service (file upload).

d. Adjust the set of information that must be reported on credit claims, changing some mandatory variables into optional, according to the new data scheme, to be made available on BPnet portal.

e. Adjust the codes of some variables to be reported. The new code list will be available on BPnet portal.

7.7.2 Ireland [45]

Under this programme, the Bank will accept pools of secured (including mortgages) and unsecured credit claims (other loans) as collateral against Eurosystem operations. Such credit claims will be subject to the Bank's valuation and risk control criteria and will be accepted by the Bank under contractual arrangements with individual counterparties. The Bank intends to phase-in the various collateral types which it will accept under this initiative over several months. Counterparties may contact the Bank at ORDMonetaryPolicy@centralbank.ie to indicate expressions of interest.

7.7.3 Spain [46]

The Banco de España will accept performing corporate and Public Sector Entity credit claims, other than mortgages, that are denominated in euro or in major foreign currencies and whose estimated credit risk, as assessed by the Banco de

[45] http://www.centralbank.ie/press-area/press-releases/Pages/EligibilityCriteriaforAdditionalCreditClaims.aspx

[46] http://www.bde.es/webbde/en/secciones/prensa/Notas_Informativ/anoactual/presbe2012_4e.pdf

España using reliable sources, has a probability of default equal to or lower than 1%, although initially it will accept only collateral with a probability of default equal to or lower than 0.4%. Credit claims not governed by and structured in accordance with Spanish law might be accepted, at a later stage, subject to individual legal assessment.

Technical and operational details as well as risk management issues will be communicated bilaterally to interested counterparties.

7.7.4 Italy [47]

Further to the decision of the Governing Council of the European Central Bank to allow the National Central Banks of the Eurosystem to temporarily accept as collateral for Eurosystem monetary policy operations additional performing credit claims that do not satisfy ordinary eligibility criteria, Banca d'Italia has decided to accept credit claims having the following characteristics:

1. A probability of default over a one year horizon up to 1%;

2. In addition to the other accepted ECAF sources, bank loans' creditworthiness can be assessed according to the internal credit assessment system VALCRE run by Banca d'Italia. Only counterparties that have not already selected, as main credit assessment source, an *Internal Ratingbased System (*IRB) or an ECAI or a third party Rating Tool (RT) will be allowed to use VALCRE, unless the main credit assessment source selected does not provide sufficient coverage.

3. Financial leasing and non-recourse factoring contracts, as well as loans guaranteed by SACE; in this regard leasing and factoring companies, including those without a banking licence, will be considered as valid providers of pledge on credit claims in favour of the monetary policy counterparty that belong to the same banking group.

Banca d'Italia, as other Eurosystem NCBs, continues to work on developing specific national eligibility criteria for additional credit claims.

The above-mentioned criteria will remain in force until further communication. All the other eligibility criteria for credit claims stated in the General Documentation remain unchanged.

7.7.5 France [48]

The ECB Governing Council has decided on December 8th 2011 to allow national central banks, as a temporary solution, to accept additional performing credit claims that satisfy specific eligibility criteria as collateral for the Eurosystem credit operations. The Governing Council has approved on February 9th 2012 the following temporary eligibility criteria set by Banque de France:

– Measures applicable to currently eligible credit claims

[47] http://www.bancaditalia.it/media/comsta/2012/com_bce_09022012/Comunicato_stampa_09022012_en.pdf

[48] http://www.banque-france.fr/uploads/tx_bdfgrandesdates/2012-02-9-eligibility.pdf

Minimum accepted credit standard is lowered from credit quality step 3 to credit quality step 4 in the Eurosystem's harmonized rating scale[1], which corresponds to a maximum probability of default of 1% at one year.

The following credit claims are also accepted insofar as all other eligibility criteria are satisfied:

1. Credit claims denominated in USD

2. Export credit guaranteed by Coface

– Measures applicable to new categories of credit claims

Real-estate residential loans are eligible if they benefit from:

1. A mortgage or a first-rank privilege, or

2. A guarantee (including French "*cautionnement*") from a credit institution or an insurance company

3. And if they satisfy additional criteria, among which: debtor located in France, loan agreement governed by French law, and residual maturity of 1 month at least.

These additional credit claims are subject to increased haircuts which are set according to their individual features

7.7.6 Austria [49]

On February 9, 2012, the Governing Council of the ECB endorsed the temporary expansion of the country-specific eligibility criteria applicable to nonmarketable assets (credit claims).

To enable Austrian banks to optimize their liquidity management, the OeNB has decided to lower the minimum credit score for credit claims to a one-year default probability of 1% on the part of the debtor. The related risk of the OeNB will be overcompensated by strongly raised haircuts.

As soon as the OeNB has taken the technical measures necessary for implementing this amendment, further details will be notified to counterparties participating in open market operations with the OeNB

7.7.7 Cyprus [50]

The Governing Council of the ECB, within the context of its decision to allow national central banks to accept temporarily additional performing credit claims as collateral for Eurosystem monetary policy operations, has approved the following specific national eligibility criteria proposed by the Central Bank of Cyprus and risk control measures:

1. Acceptance of performing additional credit claims with a probability of default over a one-year horizon of up to 1.5%.

[49] http://www.oenb.at/en/presse_pub/aussendungen/2012/2012q1/pa_20120209_oenb__ecb_governing_council_endorses_expansion_of_eligibility_criteria_for_nonmarketable_assets_245288_page.jsp#tcm:16-245345

[50] http://www.centralbank.gov.cy/nqcontent.cfm?a_id=11970

2. The Central Bank of Cyprus' counterparties' internal rating-based rating systems shall be used for the assessment of the additional credit claims' credit quality.

3. (a) Additional credit claims for which Central Bank of Cyprus counterparties can claim full repayment in case of default, other than leasing contracts, syndicated loans and credit claims backed by real estate assets, are eligible.

(b) The type of debtor /guarantor shall conform to the related provisions for eligible credit claims stated in the ECB's publication "The implementation of monetary policy in the euro area: General documentation on Eurosystem monetary policy instruments and procedures". Furthermore, individuals, municipalities and other local authorities are eligible debtors.

(c) The debtor and the guarantor must be established in the euro area. Furthermore, the debtor and the guarantor can be established in the European Economic Area in cases where the Central Bank of Cyprus is the home supervisor of the counterparty.

(d) Additional credit claims must have a minimum residual maturity of one month at the time of their submission for use as collateral by the counterparty.

(e) There is no applicable minimum threshold for additional credit claim size.

(f) Additional credit claims can be denominated in euro, US dollar, pound sterling, Swiss franc, Japanese yen.

(g) All the other eligibility criteria for credit claims and the operational procedures regarding their mobilisation contained in the ECB's publication "The implementation of monetary policy in the euro area: General documentation on Eurosystem monetary policy instruments and procedures" remain unchanged.

The Central Bank of Cyprus retains the right to apply discretion in the acceptance of additional credit claims on the grounds of prudent risk management considerations.

4. The applicable haircuts are the following:

Figure 55. Central Bank of Cyprus - Haircut Schedule for Euro-Denominated Additional Credit Claims

Maturity Bucket (yrs)	CQS 1&2 PD: 0,1%	CQS 3 PD: 0,4%	CQS 4 PD: 1%	CQS 5 PD: 1,5%
0-1	10,0	17,5	42	54
01-Mar	17,5	34,0	62	70
03-May	24,0	46,0	70	78
05-Jul	29,0	51,0	78	83
07-Oct	34,5	55,5	78	84
>10	44,5	64,5	80	85

Note: CQS = Credit Quality Step, PD = Probability of Default
Source: Central Bank of Cyprus and Citi Investment Research and Analysis

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Appendix A-1

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