Cost Accounting for the Central Bank System of the Euro Area

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Abstract

In this paper the operating expenses of the central bank system of the euro area are analyzed and put into perspective. Contrary to the classical cost-saving argument for central banks and fiat money, our case study shows that the eurosystem operates under relatively high expenses. In fact, its overall operating expenses are very likely to be higher than the proportion of the costs for global gold production that corresponds to the eurozone's share in world GDP. This is of particular interest, because global gold production has considerably expanded even after the transition to a fiat standard in the 1970s and continues to keep real resources diverted from other productive uses. Overall operating expenses of the current central bank system of the euro area amount to about 0.1% of its annual GDP. They are thus between twice and four times as high as White's estimates for the costs of an alternative system based on a gold standard with fractional reserves.

JEL Codes: E02, E50, E58, E59
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1   Introduction

Assessing the economy-wide consequences of central bank monetary policy is a difficult task indeed. The overall costs and benefits for society are never accounted for without a fair amount of speculation and uncertainty. There is, however, a much narrower notion of costs that can be evaluated more easily

and, in principle, with perfect accuracy. These are what we might call the business-management costs of central banking. They are the subject-matter of this paper.

The term business-management costs is in a way misleading, since it suggests that central banks are ordinary businesses, which they are arguably not. Yet, it captures very well what we want to focus on in the following, namely, the items of expenditure that are included in ordinary business accounting.

The conduct of modern monetary policy, and hence the costs of fiat money production, are outcomes of institutional processes that change and evolve over time. As for any legally granted monopoly that does not operate under the full constraints of the profit and loss system (von Mises, 2008), we would expect there to be a tendency for central banks to become less efficient, more wasteful and generally more costly in terms of business-management expenses over time. We would expect the overall costs of maintaining the institution and its operations to grow within the boundaries set by its bureaucratic management. In this paper, we follow up this intuition. We thus focus specifically on this narrower notion of costs for the European Central Bank and the national central banks within the euro area over the past 18 years.

In section 2 we recapitulate the classical cost-saving argument for central banks and fiat money that motivates the analysis that follows. Section 3 looks at the ECB's annual financial statements and the development of selected items of expenditure over time. The operating expenses of the national central banks are studied as well. We then provide an overview of current gold production costs in section 4 in order to put the expenses of European monetary institutions into perspective. Section 5 concludes.

2 The Cost-Saving Argument for Central Banks and Fiat Money

One of the historically most important arguments for central bank produced fiat money is related specifically to the costs of production of money. Its roots can be found already in the writings of the classical economists.

Adam Smith hinted at the advantages of paper notes over commodity money in the second chapter of the second book of the *Wealth of Nations*. The first lesson to learn from his well-known analysis is of course that the quantity of money circulating within a community is as such not part of the community's revenue. Yet, by replacing an expensive money by a cheaper one, the community's net revenue could be increased:

> The substitution of paper in the room of gold and silver money, replaces a very expensive instrument of commerce with one much less costly, and sometimes equally convenient. Circulation comes to be carried on by a new wheel, which it costs less both to erect and to maintain than the old one. (Smith, 2007, [1789], p. 226)

There is thus a permanent or *flow* element of cost saving from replacing precious metal coins by paper notes, in that the notes are cheaper to maintain and replace after wear and tear from ongoing circulation.

Moreover, under what would today be called fractional reserve banking a one-shot gain could be obtained. Smith argued that a smaller quantity of precious metals than the corresponding quantity of paper notes in circulation would suffice to cover occasional demands for redemption. Hence, reserves in excess of the quantity needed, in Smith's example a fifth or 20% of the volume of paper notes, could be exchanged for goods and services from abroad. This would

increase the net revenue of the community.[1]

Subsequently, the argument was made more explicit in the writings of David Ricardo. In his *Principles of Political Economy and Taxation* we find the following passage:

> A currency is in its most perfect state when it consists wholly of paper money, but of paper money of an equal value with the gold which it professes to represent. The use of paper instead of gold, substitutes the cheapest in place of the most expensive medium, and enables the country, without loss to any individual, to exchange all the gold which it before used for this purpose, for raw materials, utensils, and food; by the use of which, both its wealth and its enjoyments are increased. (Ricardo, 1821, pp. 262-263)

The above reflection, however, is merely theoretical. Like Smith, Ricardo did not openly advocate the abolition of convertability of paper notes into coin and bullion, although there is a certain tension in his writings. On the one hand, he deemed it absolutely necessary to keep redeemablility of paper notes into specie in place as a check against potential abuses of the note issuing privilege. Yet, on the other hand, he would allow, within certain limits, for a fluctuating

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[1]Indeed, Smith pointed out that it would be important that the additional revenue was invested and not merely consumed, so that "it promotes industry; and though it increases the consumption of the society, it provides a permanent fund for supporting that consumption" (Smith, 2007, [1789], p. 228). It must further be noted that Smith did not advocate a fiat standard. He merely highlighted the potential benefits from reducing the amount of precious metals held as reserves for redemption. As he explained:

> By this operation, therefore, twenty thousand pounds in gold and silver perform all the functions which a hundred thousand could otherwise have performed. The same exchanges may be made, the same quantity of consumable goods may be circulated and distributed to their proper consumers, by means of his promissory notes, to the value of a hundred thousand pounds, as by an equal value of gold and silver money. Eighty thousand pounds of gold and silver, therefore, can, in this manner, be spared from the circulation of the country; and if different operations of the same kind should, at the same time, be carried on by many different banks and bankers, the whole circulation may thus be conducted with a fifth part only of the gold and silver which would otherwise have been requisite. (Smith, 2007, [1789], p. 227)

market rate at which notes could be redeemed, bringing his scheme in a sense very close to a fiat standard.[2]

Ricardo discussed in some detail the relative advantages of granting the legal privilege of note issue to either banks or the government. He argued that society as a whole would be as well off in one case as in the other, given that the note issue follows the dictates of prudence. Yet, if the government was to issue the notes directly, the public would be relieved of interest payments accruing from banks extending loans to finance government expenses. Banks in turn would no longer receive the respective interest payments. Ricardo saw precisely this as an argument for leaving the responsibility for issuing paper notes in the hands of government.[3]

This line of argumentation was followed in more detail in Ricardo's posthumously published *Plan for Establishment of a National Bank*. The author was sensible to the dangers of such a government privilege and advocated what would today be refereed to as central bank independence with strict limitations on direct government finance:

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[2]See Ricardo (1824), where his monetary reform plan is laid out. According to this plan, new notes would usually come into circulation in exchange for either old notes or precious metals. Point 12 of his plan states that: "The Commissioners in London shall be obliged to buy any quantity of gold of standard fineness, and exceeding one hundred ounces in weight, that may be offered them, at a price not less than £3: 17s. 6d. per oz." (pp. 18-19). This leaves of course open the possibility for a substantially higher exchange rate and relative devaluation of paper notes.

[3]He provided the following example of financing government expenditures in the two alternative ways to illustrate his point:

> Suppose that a million of money should be required to fit out an expedition. If the State issued a million of paper, and displaced a million of coin, the expedition would be fitted out without any charge to the people; but if a Bank issued a million of paper, and lent it to Government at 7 per cent, thereby displacing a million of coin, the country would be charged with a continual tax of £70,000 per annum: the people would pay the tax, the Bank would receive it, and the society would in either case be as wealthy as before; the expedition would have been really fitted out by the improvement of our system, by rendering capital of the value of a million productive in the form of commodities, instead of letting it remain unproductive in the form of coin; but the advantage would always be in favour of the issuers of paper; and as the State represents the people, the people would have saved the tax, if they, and not the Bank, had issued this million. (Ricardo, 1821, p. 263)

There would, I confess, be great danger of this, if Government - that is to say, the ministers - were themselves to be entrusted with the power of issuing paper money. But I propose to place this trust in the hands of Commissioners, not removable from their official situation but by a vote of one or both Houses of Parliament. I propose also to prevent all intercourse between these Commissioners and ministers, by forbidding every species of money transaction between them. The Commissioners should never, on any pretence, lend money to Government, nor be in the slightest degree under its controul or influence. Over Commissioners so entirely independent of them, the ministers would have much less power than they now possess over the Bank Directors. (Ricardo, 1824, pp. 11)[4]

The cost-saving argument for unbacked paper substitutes or fiduciary media has also found its way into the writings of economists of the 20th century. Somewhat surprisingly, it was taken up for example by Ludwig von Mises. According to von Mises (1953, pp. 298-299), fractional reserve banking historically prevented a stronger increase in the exchange value of money in the course of technological progress and the extension of the monetary economy. As a result, fewer capital and labor was directed towards the mining of gold for monetary purposes and was instead available for other productive enterprises.[5] In his later writings, von Mises rejected the alleged benefits of fiduciary media altogether, arguing that they are always causing symptoms of the business cycle, whenever issued (von Mises, 1998, ch. XX).

Indeed, independently of the quesiton of fractional reserve banking, von

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[4]Indeed, here seems to be another tension in Ricardo's writings as the previously mentioned advantage of leaving the note issue in the hands of the government was the interest-free finance of government expenditures.

[5]A whole debate has emerged out these statements by von Mises on whether or not he was a proponent of fractional reserve banking. See White (2014), for an interesting back and forth between some of the contenders.

Mises was no proponent of central banking. He thought a free banking system under a gold standard to be more reliable in checking abuses of excessive note issue. In that regard he was mote inline with the teachings of Smith rather than Ricardo.

Milton Friedman is probably the modern economist who has reinvigorated the cost-saving argument most forcefully. He has pushed it to the point of advocating a complete fiat standard (Friedman, 1960), which implies the necessity for a central bank as the very institution that controls the quantity of fiat money.[6] As the argument goes, such a system would completely free up resources otherwise needed in the production of commodity money, or more specifically in gold mining and refinement. These resources could be employed elsewhere to the benefit of society.

White (1999, pp. 42-48) concisely summarizes Friedman's influential estimate of the flow resource costs of the gold standard (Friedman, 1953, ch. 7; Friedman, 1960). He explains that Friedman decomposed the estimation of the ratio $\Delta G/Y$, where ΔG is the nominal value of the change in the gold stock from one year to the next and Y denotes annual nominal GDP, into three parts:

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[6]As Friedman (1953, p. 216) explained:

> The introduction of fiat elements into the monetary stock immediately raises the question, who is to create the fiat currency and control its issuance? Fiat currency is practically costless, whereas commodity currency is not. Under competition there will be a tendency for each kind to be produced up to the point at which its value equals its costs. This sets definite limits to the quantity of a commodity currency; it means indefinite increase in the quantity of a fiat currency and indefinite decrease in its value. There is no stable competitive equilibrium except when the fiat currency declines so much in value that it becomes a comnlodity currency, the commodity being the paper and services used in producing the currency. Competition is therefore inappropriate for determining the amount of a fiat currency. The production of fiat currency is, as it were, a natural monopoly, which explains why a measure of control has typically been exercised by government, why the privilege of issuing currency has been fought for so vigorously, and why proponents of a private competitive order, like Henry Simons, have held the view - which I share - that the creation of fiat currency should be a government monopoly.

$$\frac{\Delta G}{Y} = \frac{\Delta G}{\Delta M} \frac{\Delta M}{M} \frac{M}{Y}.$$

In the above equation, M corresponds to the money stock M_2. Each of the three ratios was then replaced by its respective empirical counterpart. Friedman assumed a 100%-reserve standard, and hence $\frac{\Delta G}{\Delta M}$ would be equal to 1, that is every increase in M_2 would be fully backed by an increase in the gold stock. As suggested in Friedman (1960) the money stock would have to grow by about 4% to ensure price stability and hence $\frac{\Delta M}{M}$ was set equal to 0.04. The ratio between the money stock M_2 and nominal GDP was estimated to lie around 0.625. Hence, plugging in these values one obtains

$$\frac{\Delta G}{Y} = 1 \times 0.04 \times 0.625 = 0.025.$$

Friedman thus estimated that a 100%-gold-reserve standard on the M_2 money stock and an annual expansion of the money stock that ensures price stability (zero price inflation) would lead to resource costs of 2.5% of GDP each year for acquiring the necessary amount of gold.[7]

White (1999, p. 46) argues that this "calculation gives a huge overestimate of the resource costs of a gold standard with an advanced banking system in the absence of legal reserve requirements." Indeed, an advanced system in White's sense would be one without legal reserve requirements. He points out that with a reserve ratio of about 2% the estimate would turn out to be 0.05% of GDP ($0.02 \times 0.04 \times 0.625$). White further suggests a downward adjustment of the growth rate of the money stock to 2%. A lower growth rate would suffice to ensure price stability, since velocity had increased since Friedman's

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[7]It is interesting to note that Friedman, too, became more critical about the relative benefits of fiat money later in his career emphasizing additional resource costs of a fiat standard that emerge, for example, from hedging against increased future price uncertainty (Friedman and Schwartz, 1986). This, however, one might argue, is not a necessary cost element of a fiat standard. It comes into play only under a poorly managed fiat standard.

work was published. The estimate would thus fall further to 0.025% of GDP $(0.02 \times 0.02 \times 0.625)$.[8]

In estimating the deadweight loss of increased price inflation and assuming that the resource costs of the gold standard could be avoided entirely under a fiat standard, White (1999, p. 49) concludes that a 'country where fiat money is managed so as to keep inflation below 4 percent can do without a gold standard; but a high-inflation country would be better off with gold."

These estimates are arguably arbitrary and could be tweaked in either direction. However, given almost half a century worth of historical experience under fiat money, we are able to investigate the empirical evidence for whether or not the assumption of complete resource-cost saving under fiat money is historically justified. In the following, we will dive into this research question in conducting a case study for the system of central banks of the euro area over the past 18 years.

While, as a matter of principle, it is indisputable that fiat money could be much more cheaply produced than gold or any other commodity money, it is by no means a necessity. Sure enough, a Friedmanite k-percent rule with respect to some monetary aggregate could be implemented by a powerful computer network, a printing press, and some, relatively small, supervisory board. The costs of production would reduce to an annual electricity bill, expenses for ink, cotton (not actually paper) and some other materials needed for banknote production, computer maintenance expenses, salaries for the board members, as well as some other minor expenses, such as maybe an annual board meeting in a pleasant and stimulating environment in order to supervise the constant growth rate. The overall costs of production of money could be truly negligible.

Modern monetary policy is, however, conducted differently. It does not follow any simple and strict rule, but implements, especially in recent years, un-

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[8]The last ratio, M/Y, has not changed systematically according to White.

conventional policy interventions and discretionary adjustments. Their effects are studied empirically and theoretically by numerous expert groups under the payroll of central banks.[9] Modern monetary policy is based on relatively costly data gathering and processing and requires very close and careful supervision of various macroeconomic developments both on the domestic and the international level. The governing council of a central bank meets not only once a year, but around twice a month in the case of the European Central Bank. The overall operating expenses ultimately turn out to be much higher than one might expect.

3 Operating Expenses of the Central Bank System of the Eurozone

The European project of a common currency provides an interesting case study for our purposes. The euro had been introduced as an accounting currency on the 1st of January 1999, three years before it was issued as a physical currency. The annual financial statements of the ECB for the end of 1999 are a suitable starting point for our analysis. They are covered in subsection 3.1. They provide an overview of what items of expenditure initially existed within the newly founded institution.[10] Other items were added later on as the common currency area developed and expanded. We will follow some of them over time in subsection 3.2 in order to get an impression of how the overall costs have evolved. We then proceed with analyzing the national central banks in order to evaluate more accurately the operating expenses of the central bank system of the euro area as a whole. This will be done in subsection 3.3.

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[9]In fact, for the US, White (2005, p. 325) estimates that "some 74 percent of the articles on monetary policy published by US-based economists in US-edited journals appear in Fed-published journals or are co-authored by Fed staff economists."

[10]The annual report 1999 is also the first one that covers an entire calendar year. The report for 1998, the year the ECB was founded, covers only seven months.

3.1 The 1999 Annual Financial Statements of the ECB

At the end of 1999, the ECB employed 732 staff, of which 55 held managerial positions. On average, over the whole year, 648 people were employed by the ECB as compared to only 478 in the previous year during which the institution was founded. This increase is not surprising given the early stage of the ECB's development. Moreover, the year 1999 marked a major step in the implementation of the common currency. In total, 242 new employees were hired that year and only 44 employees left the service (ECB, 2000, pp. 156-157).

The overall staff costs in the profit and loss account of the annual report amount to € 61.0 million. They include € 52.3 million in salaries and allowances, making an average of about € 80,700 annually per employee,[11] as well as total pension costs of € 8.1 million. The latter include a provision of pensions to members of the Executive Board of € 1.8 million. This decision-making body of the ECB consisted, as it does today, of six members, making an average pension payment of € 300,000 per board member for that year.

Administrative expenses, which "cover all other current expenses relating to rental of premises, maintenance of premises, goods and equipment of a non-capital nature, professional fees and other services and supplies, together with staff-related expenses including recruitment, relocation, installation, training and resettlement" (ECB, 2000, p. 157) added up to € 60.7 million.

The third item shown in Table 1 is the depreciation of tangible and intan-

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[11]Today, the lowest salary band, namely, that of Facility Management Operators, starts at a minimum monthly basic net salary of € 2,442.62 according to the ECB's website as of September 18, 2017. The highest band of Director General starts at a minimum of € 11,349.85 per month. The historical development of these salary bands are not readily available. Neither does the annual report of 1999 contain information about the salaries of the highest ranked servants at the ECB, such as president Willem F. Duisenberg, or other Executive Board members, like vice-president Christian Noyer, Otmar Issing and Sirkka Hmlinen. The highest salary currently paid at the ECB is of course the one of president Mario Draghi. It amounts to € 389,760 per year. Vice-president Vitor Constncio's annual salary is € 334,080. The other four Executive Board members of the ECB currently earn salaries of € 277,896, leading to a combined annual salary payment of € 1,835,424 for the entire Executive Board. The total salary for the larger Supervisory Board, of which the Executive Board is a part, is € 2,466,678 (ECB, 2017, p. A56).

gible fixed assets. It amounts to € 10,5 million. This item is included under operating expenses in our analysis, since it serves as a common means in business accounting to spread the costs of the relevant assets over the time span during which they are used by the institution. It is, in a sense, an indicator of capital consumption, and thus relevant in assessing the overall expenses.

Summing up the three items yields total expenditures of around € 132,2 million for the year 1999. During the seven months of the previous year, since its foundation on the 1st of June, 1998, the ECB's operating expenses were € 68.1 million. Adjusted to a full calendar year, total operating expenses thus increased from 1998 to 1999 by about 13.4%. Staff and administrative expenses increased by 19.7% and 17.2%, respectively, while depreciation of assets diminished by 24.4%.

3.2 Selected Items of Expenditure over Time

It is not surprising that the ECB in its early years expanded. The introduction of the common currency, including its circulation in cash and its declaration as legal tender in the twelve initial member states,[12] was completed only in 2002. From that year onward, a fourth item of expenditure was added to the annual accounts, namely, the costs for banknote and coin production services. In the first year the new notes and coins were issued, this item directly reached its maximum for obvious reasons.[13] It amounted to around €118.4 million.

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[12]These are Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Greece, Spain, Portugal, Austria and Finland. Today the common currency area consists of 19 member states. Slovenia entered in 2007. Cyprus and Malta followed in 2008 and Slovakia in 2009. Estonia adopted the euro in 2011, and finally, Latvia and Lithuania followed in 2014 and 2015, respectively. The expansion of the eurozone is of course another aspect that, to a certain extent, justifies increasing operating expenses over time.

[13]The first two months of 2002 were the cash changeover period. The euro became the only legal tender in the eurozone on the 1st of March, 2002. In mid-January, the number of euro banknotes and coins in circulation peaked for that year at around 8.1 billion and 38.6 billion, respectively (ECB, 2003, pp. 130-131). While the overall number of banknotes and coins in circulation slightly decreased thereafter, the face value of the cash money in circulation steadily grew throughout the changeover period, as the number of banknotes with larger denominations increased. The ECB also launched a campaign to inform the public about the

In the next year, it dropped to € 2.1 million. These expenditures do not, however, cover the full costs involved in euro banknote and coin production and distribution. As we will see below, the remainder of the costs is accounted for in the financial statements of the national central banks of the member states.

Table 2 summarizes all four items of expenditure for the years 2002 and 2003. Not only was one item added, but the three original positions grew substantially. Staff costs, administrative costs and depreciation have grown in five years, from 1999 to 2004, by 112.9%, 152.8% and 190.5%, respectively. Total expenses have grown by 138.9%.

The number of full time employees increased over the same period from 732 to 1,213, that is, by 65.7%. The number of employees in managerial positions increased by 52.7% from 55 to 84. Hence, staff costs have disproportionately increased compared to the number of employees. The average staff costs per employee have increased from about € 83,000 to slightly more than € 107,000. It is interesting to note that until 2003, all 1,213 employees of the ECB had been hired on permanent contracts (Luttmer, 2015). Since 2004, this employment policy has changed, and a fraction of the new employees has been hired on limited contracts.

The upper right panel of Figure 1 shows all the above mentioned items of expenditure of the ECB from 1999 to 2016. We can clearly see the peak in expenses for note production services in 2002. After that year, this item showed an increasing trend but always remained below € 9 million. It mostly reflects the costs of cross-border banknote transportation to various national central banks to meet unexpected fluctuations in demand (ECB, 2004, p. 198). Beginning in

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new currency. Most of these costs were accounted for already under administrative expenses in the year 2001, which led to a decrease in administrative expenses in 2002. The annual report of 2002 reads as follows: "The net decrease in administrative expenditure compared with 2001 is primarily due to the fact that in that year additional consultancy fees were incurred in connection with the Euro 2002 Information Campaign" (ECB, 2003, p. 211). This does not change the fact that total expenses have increased over the years.

2013, the new Europe Series of banknotes with enhanced security features has been introduced, which partly accounts for the increase in costs. After the new € 5, € 10, and € 20 notes, the new € 50 note was the latest denomination to enter into circulation in April 2017 (ECB, 2017, p. 80).

Depreciation of assets initially increased between 1999 and 2004, then decreased until 2014, before it sharply increased in 2015 from € 15.3 million to € 64.0 million. That year the new headquarters of the ECB in the East end of Frankfurt were inaugurated after more than four years of construction. Total costs for the new building were more than € 1.3 billion. The additional depreciation on that asset, which is owned by the ECB, explains the sharp increase in the annual accounts for this item of expenditure. Before, the ECB had rented office space in three different locations in the city center of Frankfurt, including the Eurotower and the Japan Center. The ECB continues to rent the Eurotower, which is now home of the Single Supervisory Mechanism (SSM), which supervises and monitors the stability of commercial banks within the eurozone since 2014.

Staff and administrative costs have, some minor off-trend fluctuations notwithstanding, continuously increased over the 18 years of the ECB's existence. In 2016, staff and administrative costs amounted to € 466.5 million and € 414.2 million, respectively. Hence, compared to 1999, they have increased by factors of 7.6 and 6.8, or by an average annual rate of 12.7% and 12.0%, respectively.

Total operating expenses as plotted in the upper right panel of Figure 1 and reported in Table 3 have risen to € 953.7 million in the last year. This corresponds to an average annual growth rate of 12.3%, or € 48.3 million per year.

The sharp increase that can be observed for staff, administrative, and hence overall costs in 2014 is mainly due to the implementation of the SSM (ECB,

2015, p. 153). In the following year, the increase in staff costs remained very high, namely 46.4%. The explanation provided in the annual report, however, is rather unsatisfactory. We only read: "Staff costs increased in 2015, mainly owing to the higher average number of staff employed by the ECB, as well as the higher net expense in relation to post-employment benefits and other long-term benefits" (ECB, 2016, p. A49).

Overall staff as well as staff in managerial positions have indeed increased over the entire period under consideration as shown in the bottom panels of Figure 1. At the end of 2016, the ECB employed the equivalent of 3,171 full-time employees, among which 320 held managerial positions. In only three years, from 2013 to 2016, the ECB on net hired more than 1,381 new full-time employees. The number of employees in managerial positions increased by 151.

While the overall annual operating expenses of the ECB alone have shown an alarming trend over the past 18 years and amount by now to almost a billion euro, they are by no means the only expenses relevant for our purposes. National central banks of member states of the common currency area have not been abolished and replaced by the ECB. They exist side by side at substantial operating costs of their own.

3.3   Adding the National Central Banks

The three biggest national central banks within the euro area are those of France, Germany and Italy. Their operating expenses are plotted in Figures 2, 3 and 4. Each one of these institutions spends substantially more money to finance its activities than the ECB itself.

The Banque de France reports operating expenses in three categories: depreciation on assets, staff costs and other expenses. The latter includes, for example, administrative costs and costs for banknote production services. The

left panel of Figure 2 shows that depreciation remained more or less constant between 1999 and 2016 at around € 140 million. However, staff costs and other expenses show positive trends. Although the ECB was created in 1998 and has taken over important monetary policy responsibilities within the common currency area, the national central bank of France did not shrink in terms of operating expenses. It has even expanded.

Staff costs have mildly increased by € 165.3 million, or by 12.9% over 17 years. That corresponds to a rather small average annual growth rate of 0.7%, but one has to take into account that staff costs had been quite substantial to begin with. In 1999, they amounted to € 1,277.7 million. Hence, in 2016 staff costs of the Banque de France were more than three times as high as those of the ECB.

We observe a similar development for all other expenses. The annual accounts of the Banque de France for 2016 report other expenses of about € 583 million, which is more than twice as much as in 1999. They have grown at an average annual growth rate of 4.3% and are today 38% larger than administrative costs and banknote production services of the ECB.

Overall operating expenses, plotted in the right panel of Figure 2, amounted to about € 2,171 million in 2016. They grew at an average annual growth rate of 1.4%. While this is much slower, in relative terms, than the expansion of the ECB over the same period, overall expenses of the French central bank are still more than 2.3 times as high as those of the ECB.

The German Bundesbank is another big player in the central bank system of the eurozone. The most obvious difference to the Banque de France is that its operating expenses have not grown since the foundation of the ECB. There is no clear trend observable. Expenses have fluctuated between the minimum of € 1,307 million in 2011 and the maximum of € 1,935 million in 2001, one

year before the euro was introduced in cash. As for the Banque de France, staff costs are the most important item of expenditure for the Bundesbank. They fluctuated around € 900 million for most of the period and reached their maximum level of € 1,123 million in 2016.

There is no clear trend for any of the other items of expenditure. Administrative costs slightly increased and amounted to € 396 million in 2016. The other items fluctuated around and below € 200 million. Total costs, as shown in the right panel of Figure 3, peaked the year before the euro became the exclusive legal tender of the currency union and reached a similar level of € 1,811 million last year.

For the Italian central bank there is a decreasing trend in total costs as shown in Figure 4. This, however, is entirely due to one item of expenditure in their annual accounts labeled "other costs." In 2001, it amounted to more than € 1,340 million.[14] It decreased to around € 51 million in 2016. Administrative and staff costs, however, have continuously increased, together by € 619.5 million from 1999 to 2016.

Figures 5 and 6 summarize the development of staff costs and total costs of the big four central banks of the euro area from the foundation of the ECB until today. Overall staff costs have increased by € 1,324 million in 18 years and reached a level of € 4,458 million in 2016. The strongest expansion occurred in the newly founded ECB.

Total operating expenses of all four institutions increased from € 5,506 million in 1999 to € 6,978 million in 2016. They peaked at € 7,211 million in 2001, the year prior to the introduction of the euro as a physical currency. The strongest expansion occurred again, in both relative and absolute terms, in the

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[14]According to the annual report for 2001, it subsumes the following expenses: losses on investments of reserves and provisions (144 million), other allocations to provisions (751 million), prior-year expense (1 million), appropriation of investment income to reserves (393 million), other taxes and duties (45 million), sundry (10 million) (BDI, 2002, p. 302).

youngest of the four institutions.

Hence, considering only the four big players within the central bank system of the euro area, we obtain annual operating expenses of almost € 7 billion. However, the euro area initially consisted of 12 member states. There are thus nine other national central banks that took part in the system from the beginning. They are considerably smaller. Their separate operating expenses are plotted in Figure 7 along with the sum over all of these smaller institutions. The upper panels include, and the bottom panels exclude, the central bank of Greece, which represents a special case within this group.

In 1999, the total operating expenses of all nine smaller central banks amounted to € 1,347 million, which is substantially lower than the operating expenses of any of the three larger national central banks for the same year. Over the past 18 years, operating expenses of the smaller banks have increased to € 2,961 million, which is substantially higher than the operating expenses of any of the big three today. Hence, the smaller central banks within the system have expanded much more than the larger ones after the introduction of the common currency.

Interestingly, there was not nearly as strong a peak in operating expenses for the smaller central banks in the year before the euro became the exclusive legal tender in 2002. This suggests that a disproportionate share of the costs of the introduction of the common currency was borne by the larger central banks of the union.

However, in 2012, there was a sharp increase for the smaller central banks. Overall operating expenses were € 4,568 million, that is, 54.2% higher than even in 2016. This, as we can see from the upper panels of Figure 7, is entirely due to a massive surge in operating expenses of the Greek central bank. Its expenses were € 1,498 million in 2011 and € 2,677 million in 2012. They fell again below € 800 million the next year. Hence, in 2012, the central bank of

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Greece had higher operating expenses than any of the central banks of France, Germany or Italy.

A look at the profit and loss accounts in the annual reports of the Greek central bank for the respective years reveals that the sharp increase reflects a major upward drift in "provisions." This item of expenditure increased by more than a factor of 15, from € 148 million in 2007 to €2,342 million in 2012. In the annual report of 2012, we can find a generic explanation, according to which the provisions increased in order to "cover operational risks and other liabilities of the Bank" (BoG, 2013, p. A51). Digging a little bit deeper into the 249 pages of the document, we find that there are four different categories of provisions, of which "Provision covering the Bank's obligation to provide social insurance to its staff"; "Provision against financial risks" and "Provision against general risks under Article 71 of the Statute" are the most important ones.[15]

The latter category is further explained as a provision intended to cover "any other risks and liabilities potentially arising from the Banks business as the country's central bank and in the context of international agreements" as well as "any additional liabilities of the Bank arising from the provision of social insurance to its staff" (BoG, 2013, p. A34). So it is, on the one hand, again about the social insurance of the staff, just like the first category mentioned. On the other hand, it covers additional risks that would fit under the umbrella of the second and very generic category of "financial risks."[16] What makes these provisions particularly interesting, however, is the fact that during the financial year 2012, a third paragraph was added to Article 71 of the Statute of the Bank of Greece. In this paragraph, we read:

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[15]The remaining category covers "Special provisions against operational risk, unexpected losses and doubtful claims" (BoG, 2013, p. A32).

[16]The second category of "financial risks" is further described in the annual report as "including risks from the Bank of Greece's investment activity and risks in the context of Eurosystem single monetary policy" (BoG, 2013, p. A32), the latter being an instance of international agreements.

Exceptionally for financial years 2012-2020, and following a decision of the General Council taken in implementation of international agreements, the income from Greek government bonds held in the investment portfolio of the Bank of Greece as at 31 December 2011, as well as from Greek government bonds held for monetary policy purposes in the context of the Securities Markets Programme (SMP) of the Eurosystem, may be transferred to the Greek State. (BoG, 2016, pp. 56-57)

In the final analysis, this addition to Article 71 allows for partial government debt cancellation through the Bank of Greece and the Eurosystem. It is obviously a measure undertaken to alleviate the debt burden of the Greek government in the course of the sovereign debt crisis. Whether this qualifies as direct government finance through the central bank system is an interesting legal question that goes far beyond the purpose of this chapter and cannot be discussed here. Yet, we see that at least part of the increased operating expenses of the Bank of Greece can be traced back to its government's indebtedness and increased systemic risk within the euro area.[17] Another part seems to be disguised staff costs.

Recently, provisions of the Greek central bank have decreased again, but it remains the largest among the small central banks of the euro zone in terms of operating expenses. It is followed by the Spanish, Austrian and Belgian central banks, all of which had operating expenses above € 400 million in 2016. The smallest central bank is the one of Luxembourg with annual operating expenses of about € 81 million in the last year.[18]

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[17]The situation, in which the Eurosystem finds itself, is a drastic illustration of the general relationship between debt and systemic risk as described in part for example in Mian and Sufi (2014). The moral hazard encapsulated in the system, as described in Bagus (2012), is an essential cause of the problem.

[18]The exact order and operating expenses in million € of the nine smaller national central banks in 2016 was as follows: Greece (636), Spain (492), Austria (425), Belgium (413),

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We can now add the expenses of all 13 founding members of the central bank system of the euro zone, including the ECB. Figure 8 shows the result. From 1999 onward, overall annual operating expenses have increased by € 3,088 million and amounted to € 9,940 million in 2016. There are two peaks that stand out, the first in 2001 (€ 9,341 million) and the second in 2012 (€ 11,064 million). They reflect the increased expenses right before the introduction of the euro as a physical currency and the massive surge in provisions payed by the Greek central bank in recent years.

There are seven other national central banks that have entered the Eurosystem since its foundation. Some of them are almost negligible in size, such as the central banks of Estonia and Malta. Their annual operating expenses in 2016 were € 17.7 million and € 18.1 million, respectively. Others, however, such as the central bank of Cyprus, an insular state which has a bit less than three times as many inhabitants as Malta, had operating expenses of € 435 million.[19]

All in all, there are 20 central banks, including the ECB, which form the Eurosystem today. Their total annual operating expenses amounted to € 10.6 billion in 2016. This number, in and of itself, does not tell us much, but it suggests that the savings obtained from a fiat money standard in the euro area are not nearly as high as they theoretically could be. We should therefore try to put this result into perspective.

4   A Note on the Gold Mining Industry

The costs of gold mining are the relevant benchmark in order to assess the above result. The historical predecessor of the modern fiat standard was the gold

Netherlands (379), Ireland (233), Portugal (201), Finland (100) and Luxembourg (81). The sum over all nine institutions is € 2,326 million.

[19]The exact order and operating expenses in million € of the remaining seven national central banks in 2016 was as follows: Cyprus (434.7), Slovakia (82.2), Latvia (39.4), Lithuania (36.3), Slovenia (33.1), Malta (18.1), Estonia (17.7). The sum over all seven institutions is € 661.6 million.

standard. The first thing to note is that global gold production has not actually diminished after the transition from gold to unbacked fiat money, a process that was completed with the end of the Bretton Woods system. Moreover, a substantial proportion of the demand for gold nowadays stems from central banks themselves.[20]

In fact, since 1971 world mine production of gold has more than doubled as shown in Figure 9. It initially fell, but started to increase again in the 1980s. In 2015, it reached an all-time high of 3,100 metric tons per year. This is all the more astonishing, given the general tendency for the production costs of gold to increase, irrespective of technological developments. The more easily accessible gold reserves tend to be mined first, before companies proceed to the more arduous methods of production. Part of the increase in global gold production is undoubtedly explained by technological progress. Another part may be explained by gold's perceived role as an anchor against inflation.

Even though gold is not backing the currency directly anymore, it is still demanded as a store of value. It is possible that the fear of potential inflation and actually observed price inflation in the aftermath of the Nixon Shock have led to an increase in private demand for precious metals.[21] Given the ongoing demand for gold by central banks, this might have induced the increase in mine production. It is, however, entirely conceivable that in a counterfactual scenario without the abolition of the gold standard, there would have been an even larger increase in gold production. The relevant comparison is, as so often, a counterfactual one.

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[20]Take, for example, the German Bundesbank. In the balance sheet for 2016, we find gold reserves of about €119 billion under the listed assets, which corresponds to roughly 3,380 metric tons of gold. In recent years, the Bundesbank has made an effort to bring part of its gold reserves, that were stored abroad for historical reasons, most of it in New York, Paris and London, back to Germany. The Bundesbank intends to transfer about 700 tons of gold until 2020 back to Frankfurt (FAZ, 2016). It thereby follows a citizens' initiative called *Holt unser Gold heim* [bring our gold home] (Boehringer, 2015).

[21]This was certainly the case in the US as White (1999, p. 43) points out, since private ownership of gold was prohibited between 1933 and 1975.

In the following we will first look at the expenses of leading gold companies in order to get an impression of what the range of costs in that industry is. Next, we will provide an estimate of the costs of global gold production and calculate a suitable fraction of it as a benchmark for comparison.

4.1 Production Costs of Leading Gold Mining Companies

The three biggest publicly traded and non state-owned gold mining companies in the world are Barrick Gold in Canada, Newmont Mining in the US and AngloGold Ashanti in South Africa.[22] Together these firms covered 14.05% of the annual gold production in 2016. According to the United States Geological Survey database, annual gold production for 2016 was estimated to be the same as in the previous year, that is, 3,100 metric tons. This corresponds to about 100 million troy ounces, which is the value we assume for world output in order to calculate market shares of the three firms summarized in Table 4.[23]

As a measure of production costs, the table includes all-in sustaining costs (AISC) per troy ounce of gold, which is a metric developed by the World Gold Council. It is usually higher than alternative measures such as the cash costs.[24]

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[22]A top ten list was compiled by Basov (2017). The next companies in descending order with their respective market shares are Goldcorp (2.87%), Kinross Gold (2.79%), Newcrest Mining (2.46%), Gold Fields (2.15%), Polyus Gold (1.97%), Agnico Eagle (1.66%), Sibanye Gold (1.51%). Together the top ten publicly traded, non state owned gold mining firms had a market share of 29.46% as summarized in Table 5.

[23]To be precise, 3,100 metric tons correspond to 96,420,778 troy ounces. We round this value to 100 million ounces, which is the same value used in Basov (2017). This rounding does not make operating expenses of central banks appear relatively more important in our later comparison. If anything, the opposite would be the case.

[24]AISC is a non-GAAP metric. According to a press release of the World Gold Council (Murray, 2013) it incorporates the following elements from the income statement of the firm: On-Site Mining Costs (on a sales basis); On-Site General and Administrative costs; Royalties and Production Taxes; Realised Gains/Losses on Hedges due to operating costs; Community Costs related to current operations; Permitting Costs related to current operations; 3rd party smelting, refining and transport costs; Non-Cash Remuneration (Site-Based); Stock-piles / product inventory write down; Operational Stripping Costs; By-Product Credits; Corporate General and Administrative costs (including share-based remuneration); Reclamation and re-mediation - accretion and amortisation (operating sites); and Exploration and study costs (sustaining). Moreover, it incorporates three elements form the cash flow: Capital explo-ration (sustaining); Capitalised stripping and underground mine development (sustaining); and Capital expenditure (sustaining).

Weighting the reported AISCs of the three firms by their respective market share, we obtain an average AISC of $ 859.61 per ounce.

The three firms produced a total of 14,043,000 ounces, or 436.8 metric tons. The total all-in sustaining costs for this volume were thus $ 12,071,562,211 or about $ 12.1 billion. If we take the average exchange rate between US dollar and euro for the year 2016, this sum corresponds to € 10.97 billion.[25]

This measure is of a very similar magnitude as the overall operating expenses calculated for the central banks of the eurozone. However, why should we take the costs of the three leading gold mining companies as the relevant benchmark? Why not the leading two, four, six or maybe all mining companies? Indeed, taking the average AISC of the leading companies as a proxy for the average AISC of world mine production of gold might lead to a bias. It is possible that the leading companies operate at lower costs than the average company, which might be the very reason why they hold the largest market shares. In fact, among the three companies in Table 4, Barrick Gold does not only have the largest market share, but also the lowest AISC per ounce, and AngloGold Ashanti has the highest AISC per ounce and the smallest market share. Let us therefore try to estimate the overall costs of the world production of gold, before we think about what fraction of it could be a suitable benchmark.

4.2   The Total Costs of Gold Mining

As far as we can tell, there is no data on the overall average AISC of gold mining readily available. As a start we can look at some more of the leading gold mining companies in order to see whether the trend of increasing AISC observed for the first three remains stable.

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[25]The average exchange rate for 2016 was at 0.9089 US dollar per euro. This calculation is based on monthly averages provided in the database of `www.x-rates.com`. We have taken the monthly averages weighted by the number of days in the month to calculate the annual average.

If we weight the individual AISCs of the top ten firms by their respective market share, we obtain an average AISC of $ 855.36 per ounce. The average for the top ten is thus even slightly lower than the average for the top three. The trend does not continue within the top ten mining firms, although it might, of course, play out again in an even larger data set. Output of the top ten covered 29.46% of global gold production in 2016. Hence, these firms produced some 913 metric tons of gold with a total AISC of about $ 25.2 billion.

Assuming that the average AISC per ounce of gold for other mining companies was substantially higher, say $ 1000, which is far above any value reported in the annual reports we have consulted, we can calculate a weighted average AISC for world production. It is $ 957.39 per ounce. This would lead us to an estimate of total AISC for world production of gold in 2016 of $ 95.7 billion.

If we assume, even more conservatively, that average AISC per ounce for world production in 2016 have been $ 1000, then our estimation of overall AISC amounts exactly to $ 100 billion. This leaves us with two more or less cautious estimates of the overall AISC of gold mining, which form an interval of $ 95.7 billion to $100 billion.[26]

5   In Comparison

The relevant question is what fraction of the overall costs of gold mining should be taken as a suitable benchmark for comparison with the calculated operating expenses of the central bank system of the eurozone in the financial year 2016? It seems intuitively plausible to take the fraction that corresponds to the eurozone's contribution to world GDP. According to data provided by the ECB,

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[26]Notice again, that for all the above estimates the annual production of gold in 2016 is set equal to 100 million ounces. The estimate in billion US dollars is thus simply given by the assumed overall AISC per ounce of gold divided by 10.

this contribution is about 11.8%.[27]

Depending on which of the above estimates we take, 11.8% of the overall costs of gold mining amount to $ 11.3 billion or $ 11.8 billion. Taking the average exchange rate between euros and US dollars for 2016 as calculated above, these values translate to € 10.3 billion and € 10.7 billion, respectively.

We like to consider it an astonishing coincidence that the interval formed by these two values contains the calculated operating expenses of the central bank system of the euro area for that same year. It is € 10.6 billion. Moreover, this estimate is between twice and four times higher than White's estimates of the resource costs of a fractional-reserve gold standard expressed as a share of GDP. As mentioned above, White (1999) estimates the costs of a fractional-reserve gold standard to lie between 0.025% and 0.05% of GDP. Our calculated costs for the central bank system of the euro area under a fiat standard correspond to about 0.1% of its GDP.

While this finding substantiates to some extent our intuition that costs savings from fiat money are not nearly as high as they could theoretically be, an unfavorable reader might accuse us of tweaking the numbers to fit the results that were intended in the first place, or of comparing apples to oranges. But we would hold that we did neither of the two.

As far as an accusation of sherry picking statistics is concerned, we can only repeat that the above statistics come from official and publicly available sources. We rely in that regard on the prudence of the relevant institutions and firms in communicating key figures of their business affairs to the public. There might be errors and inaccuracies in the data, even systematic ones, but these are, if they exist, unavoidable for the moment.

Now, it is true that the most important items of expenditure are very differ-

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[27]This is the share of world GDP in purchasing power parity of the eurozone in 2016. For more information, see `https://www.ecb.europa.eu/mopo/eaec/html/index.en.html`.

ent in the two sectors considered. Staff costs are astonishingly high in modern central banking, while mining companies invest more in fixed capital and heavy machinery. One could thus point out that modern central banking after all creates jobs. And this can arguably be seen as a benefit, as Yaeger (1990, p. xxi) has wittily put it: "Nowadays, furthermore, it seems reasonable to suppose that central banks are valued for providing prestigious and comfortable jobs." But it nevertheless qualifies as an expense that has to be financed, at least in real terms, by the rest of society. And it is by no means clear that it creates a net surplus of jobs. We can only hold with certainty that it creates a redistribution of real income from other sectors towards employees of the central bank system.

Moreover, if we are willing to leave the realm of the pure business accounting costs of central banking for a brief moment, there is much more to consider here. The ECB alone employed 3,171 full time staff in 2016. Most of these people are very well educated and trained. They are essentially diverted from other productive activities. There is thus also an unaccounted loss in *human capital* in other sectors of the economy.

There is another potential extension that we could make to the above analysis. In fact, central banks are not the sole producers of legal tender in a fractional reserve system. Commercial banks play an important role as well. It would probably be an exaggeration to factor in all the operating expenses of commercial banks, but a certain fraction of it seems adequate. In particular, given the existence of entities like the Single Supervisory Mechanism by which central banks effectively gain partial control over the business affairs of commercial banks, one could argue that the latter are an extended arm of the former. Indeed, in practice, bank supervision means co-management. It grants intervention privileges to central bankers, such as on-site inspections, dividend suspensions, or attendance at credit committees. This indicates a potential

route for further research in this area.

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Tables

Table 1: Operating expenses of the European Central Bank in 1999 and for seven months in 1998 in €

	1999	**1998**
Staff costs	61,022,091	29,744,540
Administrative costs	60,748,855	30,229,686
Depreciation of tangible and intangible fixed assets	10,468,901	8,076,017
Total operating expenses	132,239,847	68,050,243

Sources of data: profit and loss account of the Annual Report 1999 (ECB, 2000, p. 148)

Table 2: Operating expenses of the European Central Bank in 2003 and 2002 in €

	2003	**2002**
Staff costs	129,886,988	120,003,344
Administrative costs	153,549,282	133,966,576
Depreciation of tangible and intangible fixed assets	30,410,140	17,738,206
Banknote production services	2,096,766	118,358,022
Total operating expenses	315,943,176	390,066,148

Sources of data: profit and loss account of the Annual Report 2003 (ECB, 2004, p. 186)

Table 3: Operating expenses of the European Central Bank in 2016 and 2015 in €

	2016	**2015**
Staff costs	466,540,231	440,844,142
Administrative costs	414,207,622	351,014,617
Depreciation of tangible and intangible fixed assets	64,769,605	64,017,361
Banknote production services	8,315,671	8,130,019
Total operating expenses	953,653,129	864,006,139

Sources of data: profit and loss account of the Annual Report 20016 (ECB, 2016, p. 186)

Table 4: Gold production and all-in sustaining costs (AISC) of Barrick Gold, Newmont Mining and AngloGold Ashanti in 2016

	Barrick Gold	Newmont Mining	AngloGold Ashanti
Production in oz.	5,517,000	4,898,000	3,628,000
AISC per oz. in US $	730	912	986
Market share	5.52%	4.90%	3.63%

Sources of data: annual reports of the respective firms

Table 5: All-in sustaining costs (AISC) of the top ten non state-owned, publicly traded gold mining firms

	AISC in US $ per oz.
Barrick Gold	730
Newmont Mining	912
AngloGold Ashanti	986
Goldcorp	856
Kinross Gold	984
Newcrest Mining	763
Gold Fields	980
Polyus Gold	572
Agnico Eagle	824
Sibanye Gold	954

Sources of data: annual reports of the respective firms

Figures

Figure 1: Operating expenses of the ECB between 1999 and 2016

Figure 2: Operating expenses of the Banque de France between 1999 and 2016

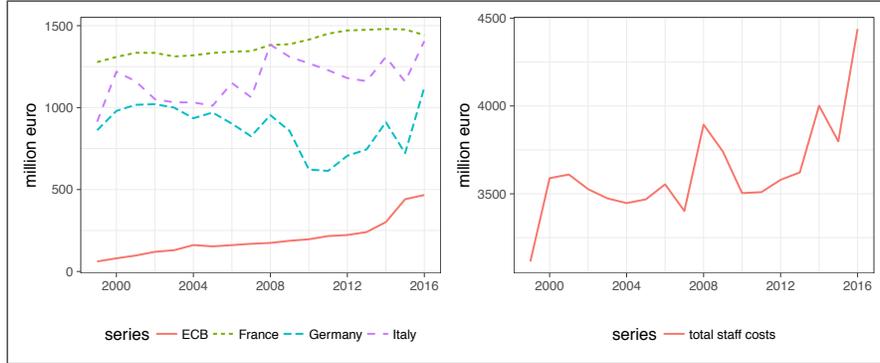Figure 3: Operating expenses of the German Bundesbank between 1999 and 2016
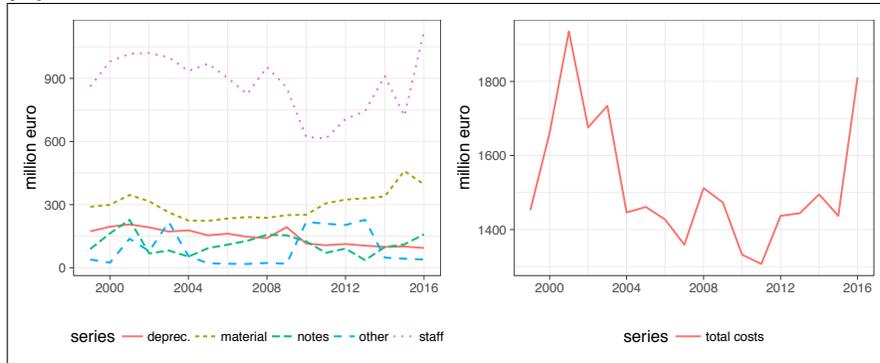
Source of data: annual reports of the German Bundesbank between 1999 and 2016

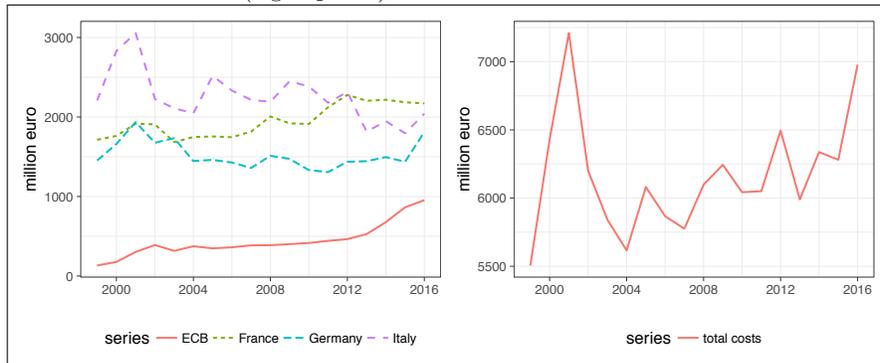Figure 4: Operating expenses of the Banca d'Italia between 1999 and 2016
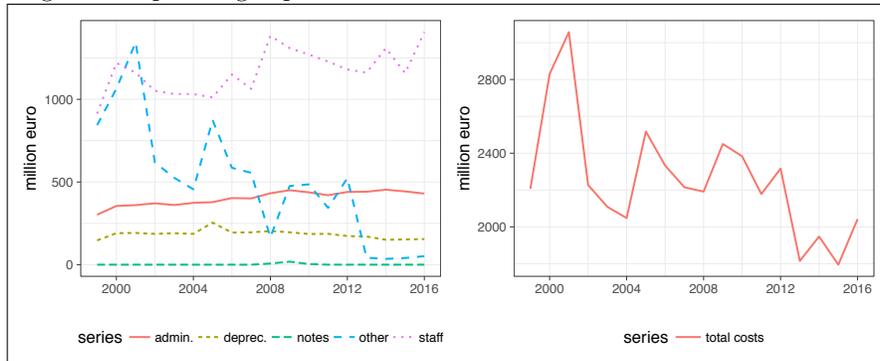
Source of data: annual reports of the Bank of Italy between 1999 and 2016

Figure 5: Staff costs of the ECB, Banque de France, German Bundesbank, and the Banca d'Italia between 1999 and 2016 (left panel); the sum of all four series (right panel)
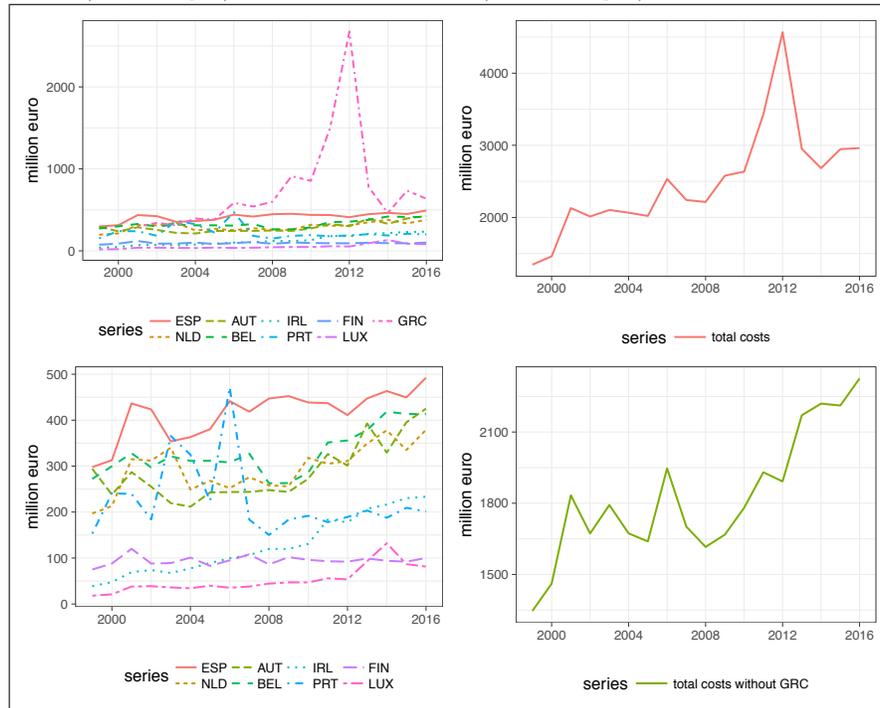

Source of data: annual reports of the respective central banks between 1999 and 2016

Figure 6: Total operating expenses of the ECB, Banque de France, German Bundesbank, and the Banca d'Italia between 1999 and 2016 (left panel) and the sum of all four series (right panel)
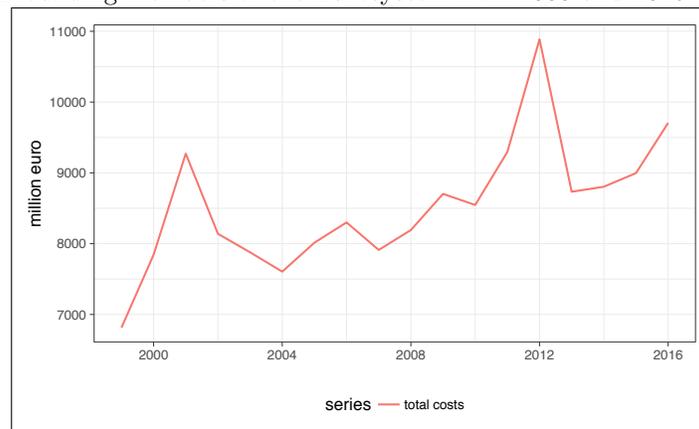

Source of data: annual reports of the respective central banks between 1999 and 2016

Figure 7: Total operating expenses of the national central banks of Spain, Portugal, Greece, Belgium, Luxembourg, the Netherlands, Austria, Finland and Ireland between 1999 and 2016 (left panels) and the sum of all series including Greece (upper right) and without Greece (bottom right)
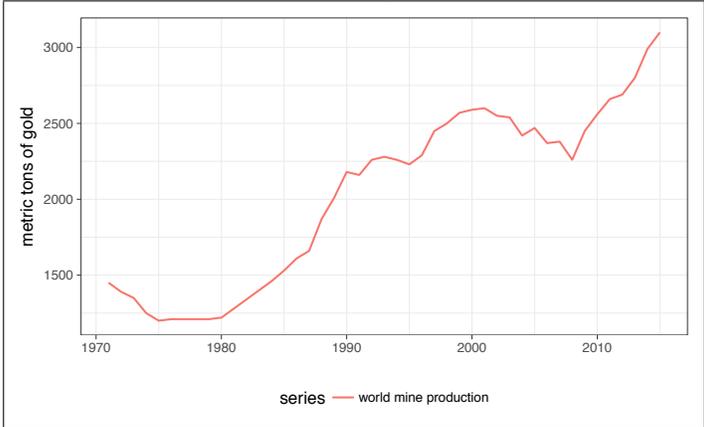

Source of data: annual reports of the respective central banks between 1999 and 2016

Figure 8: Total operating expenses of the ECB and the national central banks of the 12 founding members of the Eurosystem from 1999 and 2016

Source of data: annual reports of the respective central banks between 1999 and 2016

Figure 9: World mine production of gold per year from 1971 to 2015