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JEL Classifications: E61, E62, F36, F42, H77.

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IMPROVING INCOME STABILISATION IN EMU: AN ANALYTICAL EXPLORATION*

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Abstract

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1. INTRODUCTION AND SUMMARY

Finding an acceptable balance between the objectives of sustainability and stabilisation has long fed discussions over the EMU fiscal framework. The current architecture of EMU relies on decentralised fiscal policies under a rule-based framework. Common fiscal rules aim at redressing the possible deficit biases at national level, which create a risk of fiscal dominance that can eventually undermine the sustainability of EMU. At the same time, fiscal stabilisers potentially gain importance in a monetary union as a channel for smoothing asymmetric shocks, in the absence of monetary policy and exchange rate autonomy at national level. The principal aim of the risk-sharing arrangements explored in this paper is to offer additional income stabilisation for countries participating to the single currency, while fully preserving, and possibly even improving the credibility of the rule-based framework supporting the sustainability objective.

The on-going financial crisis has provided grist to the mill for proponents of increased risk-sharing mechanisms in EMU. The boom and then bust highlighted how considerable and persistent cyclical divergences across EMU participants are eminently possible. Sustainable monetary unions have generally been backed by federal fiscal arrangements providing insurance against shocks in parallel with capital markets. Under present arrangements, the overall level of risk sharing in the euro-area is perhaps half that in the United States, Canada and other fiscal federations (IMF, 2013). In theory, a collective insurance system could provide extra stabilisation power by mimicking the effects of more counter-cyclical fiscal policies, inducing tighter retrenchment in booms while offering added breathing space in severe downturns.

This paper explores whether and under what conditions a dedicated risk-sharing scheme could improve income smoothing throughout the cycle. The set-up that we consider is of very simple conception. It functions through annual transfers between the budgets of participating countries and a central fund. The sign and size of the transfer depend for each Member State on its cyclical position, in relative or absolute terms. Our approach can best be described as creating augmented automatic stabilisation, over and above the existing national fiscal stabilisers. In this set-up, the fiscal rules and budget targets as embodied in the current arrangements remain unchanged. But they would effectively be harder to meet in upturns, while being less demanding in bad times. This in essence means increased automatic stabilisation. The systems under study are enshrined in the rule-based framework, fully automatic in their functioning (contributions and payments are determined by output gaps), and focused on insurance (as opposed to redistribution).

Our analysis is enshrined in an already abundant related literature. The potential need for some form of fiscal risk-sharing in monetary unions has long been identified (Kenen, 1969). Over the past two decades a burgeoning empirical literature (reviewed e.g. in Furceri and Zdzienicka, 2012) has quantified the degree of risk-sharing across sub-entities of existing federations. Results vary across studies, but overall they suggest a notable role for federal fiscal arrangements in shock absorption. In the specific context of EMU, fiscal risk-sharing emerged as a key concern in prominent policy papers (MacDougall report, 1977;

Delors report, 1989), leading to a flurry of proposals for stabilisation schemes at the time of launching the single currency (e.g. Goodhart and Smith 1992; Italianer and Pisani-Ferry, 1992). A "second generation" of studies examining the implications of such schemes has recently developed (including von Hagen and Wyplosz, 2010; Wolff, 2012; Furceri and Zdzienicka, 2012; Enderlein *et alii*, 2013).

In relation to this literature we attempt to bring several contributions regarding the conception of such schemes. First, we lay out the necessary requirements for these schemes to be workable. They should: stabilise cyclical shocks to income; allow stabilisation without threatening fiscal discipline; not provide a permanent transfer mechanism by acting on long term differences in income (which risks weakening the need and resolve for deeper structural reforms). Second, we examine what would be the "nice-to-have" design features that will matter for the efficiency and acceptability of these schemes in practice. In particular, we stress that they should focus as much on tightening fiscal discipline in good times as on cushioning adverse shocks. We also argue, on balance, for restricting the activation of payments to relatively large shocks, while leaving the smoothing of more moderate shocks to national public and private stabilisers (which should be sufficient to cope). Moreover, the schemes should strike a desirable balance between simplicity and theoretically optimal design properties. Third, we leave open the question of whether to respond only to relative shocks across countries, or additionally respond to common shocks (with both insurance and rainy day properties). But we examine the pros and cons of each, and simulate both options empirically.

We carry out retrospective simulations of four rule-based schemes over the past decade. The results suggest that all the examined schemes would have significantly contributed to improve income stabilisation in EMU. Based on ex post data, these results are confirmed over a longer simulation period.

The schemes must take into account the existence of a possible real-time bias in measuring the output gap, as suggested by past experience. Retrospective simulations based on the knowledge that we know have of past business cycles give an overly flattering image of the benefits of such schemes, and underestimate their potential problems. The pervasiveness of this issue is a serious challenge to the design of fiscal risk-sharing mechanisms, despite the possible on-going methodological improvements in measuring potential output. To explore to what extent that issue can be mitigated, we include in our preferred schemes a "cautious bias" catering for the observed overestimation of output gaps in real time. In addition, we perform retrospective simulations based on vintage data to assess how the schemes would have genuinely worked in real time. The simulations based on real-time data show that the stabilisation properties of the schemes fall significantly as compared with the same schemes operated with perfect knowledge. Nevertheless, the schemes still bring a valuable contribution to stabilising incomes even in real time. Moreover, our preferred schemes appear reasonably resilient to the real-time measurement issues, maintaining in particular an acceptable overall budgetary balance over the whole period.

In the political economy debate, some observers may question the wisdom of consuming political capital in setting up a stabilisation fund, as opposed to correcting the structural weaknesses of EU economies. The schemes investigated should in principle be complementary to other ongoing structural reforms and are positive for the strengthening the euro area governance. Yet some may still argue that, in a context of limited appetite for building collective tools, other substantive issues addressing widely acknowledged problems in the euro area should be the primary focus of current policy efforts (such as pursuing large reforms in the labour and product markets or completing the banking union and achieving a genuine capital markets union). This issue of political opportunity lies outside the remit of the study.

The remaining of the paper is as follows: section 2 examines the key requirements and design issues for a fiscal risk-sharing scheme to be workable and successful. It also introduces the four schemes that we study empirically. Section 3 presents the data and our methodological framework for the simulations. The results of the retrospective simulations based on "ex post" data (i.e. with the knowledge that we know have of past business cycles) are analysed in section 4. The "real-time" simulations are taken up in section 5. Section 6 concludes.

2. DESIGN ISSUES

This section takes up several issues that arise when designing a stabilisation scheme. We first review the necessary requirements for such schemes to be successful. Then, we turn to the "nice-to-have" design features. We argue in particular that the schemes could preferably focus on large shocks, and should seriously address issues in measuring the business cycle.

2.1 What criteria should a successful scheme fulfil?

For such a scheme to be successful and politically viable, three necessary conditions have to be met:

- First, it should provide net gains in stabilising power in comparison with current arrangements.
- Second, it should not compromise fiscal discipline. On the contrary it should improve the conduct of fiscal policies – by enforcing further tightening in good times, and leaving more breathing space in bad times – so that the credibility of the fiscal framework is improved and the commitment to fiscal discipline is ultimately raised.
- Third, the system should not aim at income equalisation across the zone. It has to address cyclical divergences, not permanent income differentials, and should not be confused with a transfer union. All participants must have similar chances of being net recipients or contributors within the scheme over a long enough period of time.

When developing concrete ideas and simulating their effects on previous periods (section 3), we assess the schemes in light of these criteria: we develop measures of the additional stabilisation power provided by the scheme; we check the overall budget neutrality of the system; and we examine the country distribution of net transfers from the fund. Our simulation analysis is made under a partial equilibrium approach, i.e. abstracting from the reaction of economic agents to the working of the instrument. It is possible to imagine a variety of "second round" effects, but capturing them is beyond the scope of this paper.

2.2 Coverage of the schemes: moderate versus large shocks

The scheme could involve all countries continually, irrespective of the size of shocks, or it could be focused on insuring against large shocks only:

- The simplest scheme of the first type would be of a linear version. In this case, countries would make a payment into the stabilisation fund that rises linearly with either a measure of the cycle (call it the output gap for now), or the difference in their output gap from the area wide average. Small or large output gap countries pay in proportionately.

- The second type of schemes functions similarly, but payments or contributions are triggered only once a threshold has been breached, thereby restricting the effective operation of the scheme to large shocks.

There are merits in both approaches. Continually operating schemes have some strengths. They are simple and easy to understand. And they are immune to gaming by national authorities in moving the boundaries between what is covered and what is not.

There is also a case, though, to focus the scheme on large output gaps of either sign, and exclude moderate cyclical positions from the scheme. There are three arguments to support this view:

- The stabilisation scheme would feel less like a new "euro tax" and more as a "euro insurance" for countries with special enough circumstances that they require the help. At any point in time, countries with moderate cyclical outcomes would be left alone, neither making nor receiving payments. It would instead be a scheme devoted to reducing the bigger risks emanating from the larger cyclical positions.

- The SGP makes a similar distinction. It imposes rules on countries that ensure medium term fiscal sustainability, aiming to prevent gross policy errors. A similar flavour is captured in the stabilisation scheme in focusing on gross movements in the output gap. The SGP and the stabilisation scheme would form a coherent pair.

- Big national cyclical busts are more costly than small slumps. That is because the ability to deal with the former is limited when monetary policy and the exchange rate match the requirements of the euro area as a whole, and the SGP provides only moderate room for fiscal stabilisation (leaving aside the invocation of exceptional circumstances). And as demand slows sharply, downward nominal rigidities exacerbate the scale and persistence of the effects on output. So concentrating the scheme's firepower on paying out to avoid big

slumps has strong merits. It also means paying in more from big booms, on the grounds that big booms tend to lead to big slumps.

This kind of scheme does have some drawbacks though. It looks more complicated for one. And because the scheme only intervenes in some circumstances, it is open to gaming over what those circumstances are. We can try and fix the circumstances down before the scheme begins operations, but there is always the possibility to try and re-engineer ex post.

In our simulations, we examine both kinds of options – with or without thresholds -- and consider both valuable, but our preferred schemes are focused on relatively large shocks (see section 2.5).

Another option is a scheme that only pays out to countries in bad times and is funded by a fixed levy rate upon all participating countries (IMF, 2013). This scheme has some attractions, but we see three main problems with it. One, all countries make the same payments into the scheme, irrespective of whether they are experiencing a small or large boom. We see merits in asking countries with excessive booms to contribute more in order to slow those booms. Two, the scheme then firmly has the appearance of a new "euro tax", reducing the chances of successful implementation. Three, countries with a more inherently variable cycle will in effect receive a permanent transfer from the scheme. That is because they will, on average, receive bigger payments from the scheme during the bad times, but do not make compensating larger payments into the scheme in the good times. Not creating a permanent transfer mechanism is a necessity for this scheme. For these reasons, we would be sceptical of the fixed fee approach.

2.3 Coverage of the scheme: asymmetric shocks versus common shocks

Should the scheme stabilise output against purely idiosyncratic shocks, or additionally common shocks as well? Both approaches are tested in this note:

- The first approach focuses on inter-regional "point-in-time" insurance only. It is essentially about inter-country risk-sharing, acknowledging that participants in the single currency lack the monetary and exchange rate channels that help smooth out shocks in individual countries.

- The second approach involves adding inter-temporal insurance and is more encompassing. It acknowledges that by saving across the EMU as a whole in the good times, a greater degree of stabilisation can be delivered when confronted with common shocks in the bad times. It also offers the possibility to supplement the response of monetary policy to common shocks with more of a fiscal response, which is particularly useful when monetary conditions are constrained by the zero-low bound (an occurrence that is likely to be accompanied by large negative output gaps).

However, while the second approach offers potentially increased benefits, it also raises additional concerns. Specifically, as compared with current arrangements, increased stabilisation power against unfavourable shocks can only be obtained by increasing the total

borrowing flow of the zone in a downturn. This could be seen as a slippery slope towards a relaxation of fiscal discipline, so strong safeguards would be required to maintain the credibility of the overall framework. Some might also see it as attempting to take on the role of aggregate demand management that is already pursued by the ECB through monetary policy.

To make things a little more concrete, consider two very simple example schemes.

Scheme 1: simple relative shocks $P = a*(OG-AOG)$

Scheme 2: simple relative and absolute shocks $P = a*OG = a*(OG-AOG) + a*AOG$

P is the payment the country makes in a boom (or receives in a slump). OG is the output gap and AOG is the average output gap for the area as a whole.

Scheme 1 purely responds to idiosyncratic shocks – all that matters is whether a country has a low or high output gap, relative to the average. For a given distribution of output gaps, shifting AOG does nothing to change the payments under the scheme. So if the euro area as a whole is having a big boom, payments in would be exactly the same as if the area is having a little boom. The rationale for this scheme is that it is the job of monetary policy to stabilise area wide aggregate demand – through its inflation targeting regime – and so the average output gap for the area is excluded from the scheme. Instead, it deals solely with what area wide monetary policy can do nothing about – the fact some countries are growing faster and some slower than the area wide average.

Scheme 1 focuses purely on the making growth converge across countries. One obvious drawback of this simple version of the scheme is that any country experiencing a relatively small boom – it has a positive output gap that is less than the euro area wide average – will have that boom accelerated by receiving payments from the fund. Payments made by the fastest growing countries in boom times would be better saved for a rainy day, rather than used to make positive output gaps across the EMU converge.

Scheme 2 also makes growth converge across countries, but it adds a second element. Countries make payments in proportion to their total output gap. That can be written as the sum of relative output gaps, exactly as in scheme 1, plus a term for the average output gap for the euro area as a whole. So in addition to scheme 1, payments increase (or decrease) with the average level of the output gap across the area.

This provides additional aggregate area wide stabilising power. The argument for the scheme would be that although monetary policy is the ultimate aggregate stabilising mechanism, we would like fiscal policy to be able to contribute more to stabilisation of cycles but without endangering the medium term fiscal rules. Scheme 2 does exactly that.

2.4 How should measurement issues be addressed?

While not without challenges, the variable we should use to assess the state of the cycle is the output gap. To construct a scheme that improves stabilisation of the cycle, we need to measure the cycle. There are many variables that could, at least partially, fit the bill: output, unemployment, credit growth and current accounts among others. Whatever variable is chosen, the sustainable level must somehow be stripped out otherwise it will measure both cyclical and structural components. If it captures structural components, the scheme will become a permanent transfer mechanism and that is contrary to our aims. This means we need a method to estimate the structural component, which instantly makes life complicated. It is well known that estimating structural components is not an accurate science, and estimates are prone to revision as new data arrive. These challenges apply to all of the potential candidates we can think of the instant it is decided to strip out the structural component. Because output remains the most encompassing measure of activity, we prefer to retain the output gap to estimate the state of the cycle.

No clear alternative exists to the use of the output gap to measure the cyclical position. Basing the stabilisation schemes on observable variables, such as unemployment, may sound more intuitive and be more politically appealing in some countries. However, doing so would be at odds with the willingness to focus on cyclical imbalances only, not structural trends. This may result in a permanent transfer to the least performing countries, creating risks of moral hazard apt to weaken the political resolve to carry out structural reforms in the labour market. Alternatively, disentangling the cyclical component of unemployment from its total level would face the same econometric identification difficulty and, thus, the issue of possible substantial revisions between real time data and ex post estimates. A possible alternative (Furceri and Zdzienicka, 2012) is to run regressions to identify the shock in national level output, but this approach is not easy for non-specialists to follow and it is not entirely clear what it is measuring. Its robustness to the real time bias (regarding the measurement on output shocks in particular) is not guaranteed either. However, this absence of clear alternatives should not prevent one from taking seriously the challenges in estimating the output gap. This is what the remainder of the section does.

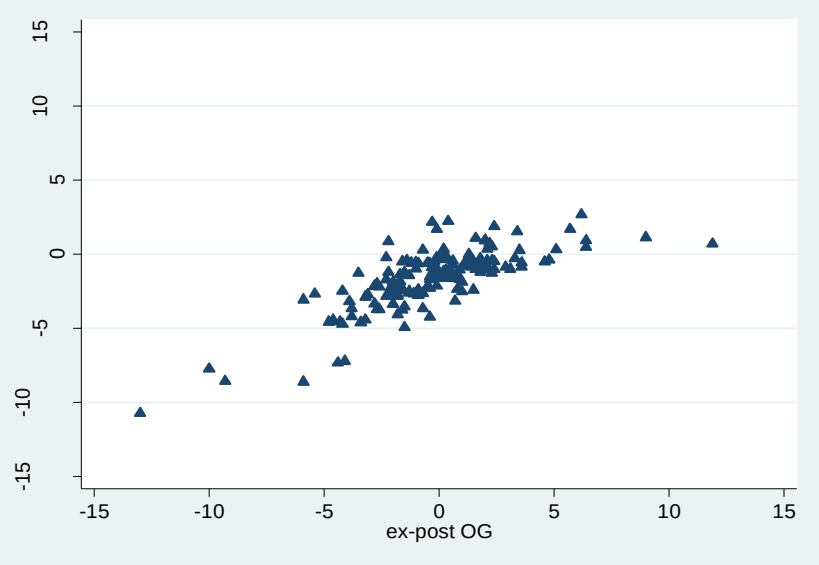
How should we deal with the difficulties of estimating the output gap in real time? Even having decided that output is the best measure of activity, and therefore the best choice among multiple imperfect estimates of the state of the cycle, we still need to measure the output gap accurately. It is well known that output gaps are measured with imprecision. The most pressing aspect of that, from the perspective of constructing a stabilisation scheme, is the issue of revisions to real time estimates of the output gap as the data matures. The various causes of revisions are well documented in d'Auria *et al*. (2010). The outcome is two types of problem:

- **Average bias toward negative values**. There is a tendency for real time output gaps to be under-recorded by on average about 0.5 % of GDP (Kempes, 2012). Figure 1 shows the difference in real time and ex post output gaps through the main summary statistics (means and dispersions). The Figure suggests that the real time output gaps are biased toward

negative values, although the precise sample presented here may exaggerate the issue by including the years of the crisis. A detailed examination suggests the problem is still there during the long upswing.

- **Relative bias**. This occurs when the real time bias is larger than in some countries than in others, so that the ordering of output gaps across countries changes as the data mature. This will be an issue of some importance when we come to look at our empirical results in section 4-5.

Figure 1. Comparison between ex-post and ex-ante Output Gap



Source: AMECO, authors' calculations

Note: The two outliers at the right-hand side of the figure (with ex post output gap close to 10% and beyond) concern Estonia in 2006 and 2007.

These measurement uncertainties raise significant issues that cannot just be ignored. The stability fund needs to balance by having enough money in it to pay out on the bad times by collecting an equal amount of money in the good times. In principle, this should not be a problem because the output gap is defined to average zero over the long run. For any symmetric scheme that pays out equally in the good and bad times, an output gap averaging zero will ensure balance. However, even over relatively long periods the output gap need not average zero, especially when using real time data on which to base payments.

To tackle the possible measurement problems, we propose a combination of strategies. The first route is better methodology. The scale of the issue has been somewhat reduced because of a helpful change in method in 2010 for computing the output gap (d'Auria et al., 2010), which uses capacity utilisation surveys to help identify supply. These surveys do not get revised, which has lowered the spread between real time and mature output gap estimates by around 20% on average. One additional route to explore in trying to further reduce real time uncertainty could be to conduct a study into whether there is anything predictable about revisions to the output gap that can be exploited, even though we know already that forecasts for GDP itself are unbiased (Cabanillas and Terzi, 2012).

Second, we consider schemes that include an explicit cautious bias in design. In our simulations, we present one scheme that balances by construction (scheme 1 from above), another scheme that balances under the condition of mean zero average output gaps (scheme 2) without necessarily balancing in real time, but we also examine asymmetric alternative schemes that would balance in real time. The most common discrepancy between real time and ex post output gap data is under-estimating the size of the positive output gap in a boom, suggesting we should err on the side of taking a little more real time revenue per unit of output gap in the boom phase. This kind of pattern would also help in the difficult task of enforcing fiscal discipline during the upturn, when countries often mistakenly think structural tax revenues are stronger than they really are. The introduction of the asymmetry is not because we seek to build it in per se, but because it is required in the presence of real time output gap errors to make the scheme balance on average. Of course, should the scheme clearly appear fiscally too conservative after a number of years, one may eventually review its precise parameters.

2.5 What do our preferred schemes look like? Why did we choose them?

Schemes 1 and 2 above are simple benchmark examples. Schemes 3 and 4, below, are our preferred offerings. We have tried to ensure the following features in our preferred schemes:

- We have looked for schemes where countries with moderate output gaps of either sign are not dragged in to the scheme at all. There are two reasons for this. One, we do not want the scheme to look like an additional euro tax. Two, it is only big booms and slumps that are difficult for individual countries to deal with on their own.
- We have tried to be as symmetric as possible between the good and bad times. But given the average bias in real time output gaps, to make sure the scheme balances and to build in a little more credibility we have allowed an output gap of size +X to make a bigger payment than a country with output gap –X receives.
- We have only focused on the output gap as a measure of the cycle.

We have chosen two preferred versions nested within these parameters. Scheme 3 does have a degree of insurance against common shocks, but places a greater weight on stabilising relative shocks. Scheme 4 places full weight on stabilising common as well as relative shocks.

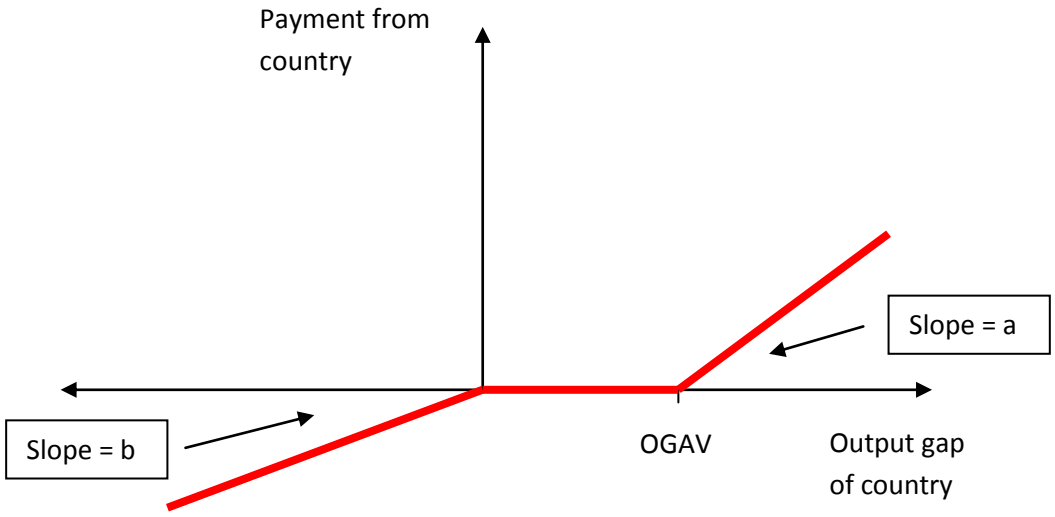
Scheme 3: Preferred scheme to stabilise mainly relative shocks.

Payments under the scheme are shown in Figure 2. It comes in two panels, reflecting the fact that sometimes the area as a whole is booming and sometimes contracting. Part (a) shows what happens if the euro area as a whole has a positive output gap. If an individual country is booming more than the euro area as a whole, then it pays into scheme and if it is having a moderate boom it pays nothing. If the country has a negative output gap when the area as a whole is booming, then it receives a payment. Unlike the simple scheme 1, scheme 3 does not make moderate output gaps more procyclical by receiving a payment from the fund.

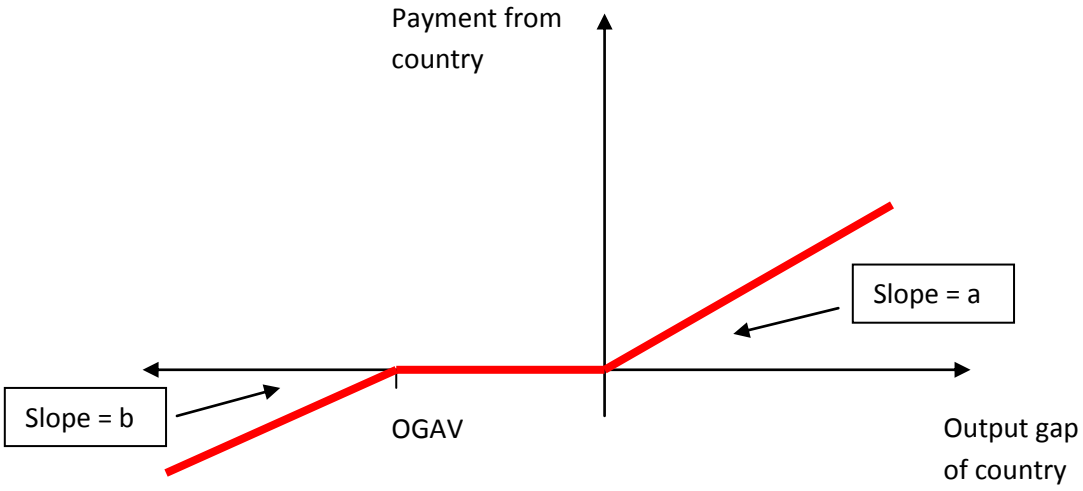
Figure 2

Scheme 3: Preferred scheme to stabilise mainly relative shocks.

Payment when area wide average gap is positive (in an upturn):



Payment when area wide average gap is negative (downturn):



Part (b) is analogous to part (a). When the euro area as a whole has a negative output gap, a country with a more negative than average output gap receives a payment from the scheme, whereas a country with a mildly negative output gap receives nothing. A country with a

positive output gap pays in. Note that if the euro area as a whole has only a small economic cycle, the zone in which individual countries are left out of the scheme totally becomes smaller.

The scheme only deals with large relative shocks, leaving countries with moderate cycles completely out of paying in or taking out altogether. The idea is that in an area wide boom or slump, monetary policy will be a stabilising force by returning the level of demand towards potential. But when a national output gap is bigger than average, the singe interest rate set for the area as a whole needs some help to stabilise more extreme economic positions across EMU. So the scheme aims to achieve what monetary policy cannot do – insurance against relative shocks. The scheme additionally contains an element of insurance against common shocks because when the average output gap for the euro area as a whole is positive, the sum of payments and receipts will always we positive. But this common insurance property is not a big feature of the scheme, unlike in scheme 4 below.

Our aim is to have as much symmetry as possible, so ideally we would set a equal to b. But in practice we have to have a>b to ensure the scheme balances in presence of the average bias in measuring the real time output gap.

The precise analytical expression for the scheme is shown in Annex 2.

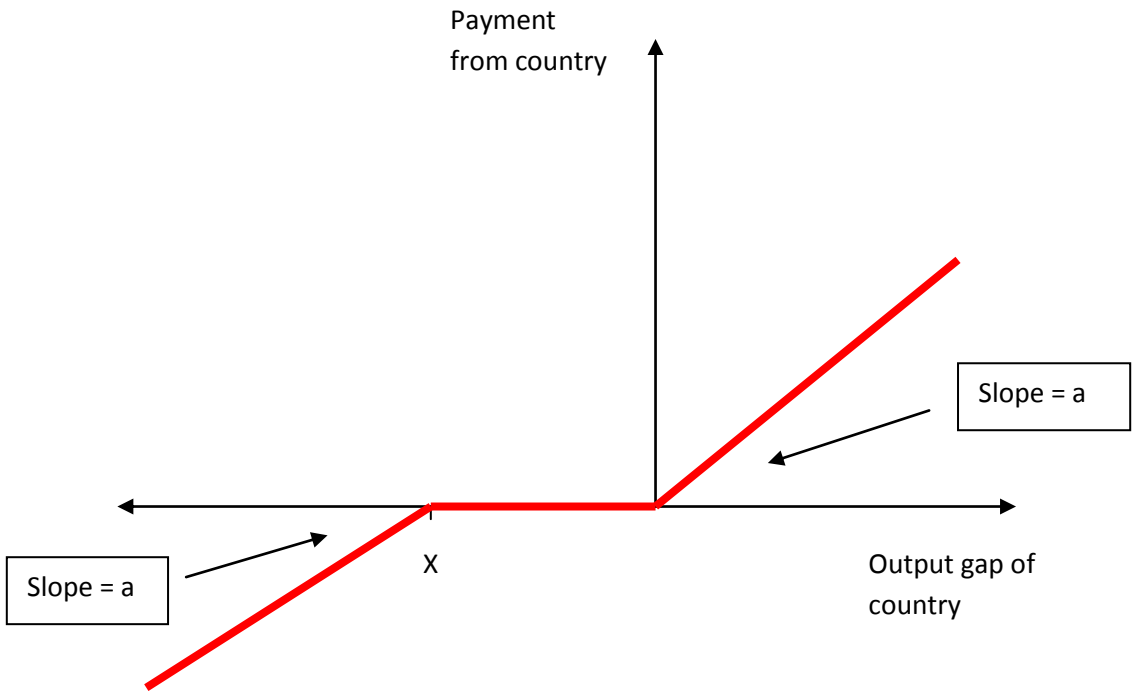
Scheme 4: Preferred scheme to stabilise with full weight on both relative and common shocks

The key difference between schemes 3 and 4 is that in the latter the thresholds for making payments into the scheme or being exempt are fixed, whereas in the former they depend on the average area wide output gap. This, in effect, means that scheme 4 is putting full weight on stabilising both relative and common shocks.

The scheme is illustrated in Figure 3. If a country has a positive output gap, then it pays into the scheme in proportion to its output gap. We would prefer there to be a zone of small positive output gaps where payment and the country is excluded from the scheme, but we do not build that in again because of the average bias in the real time output gap. In other words, an output gap of zero in real time translates on average into a positive output gap on mature data. And we prefer to err on the side of making sure the scheme balances. If the output gap takes a small negative number between 0 and X, then the country skips out of the scheme and neither pays nor receives. And if the output gap is lower than X, then the country receives a payment in proportion to the excess shortfall over X.

The precise analytical expression for the scheme is shown in Annex 2.

Figure 3
Scheme 4: Preferred scheme to stabilise <u>both</u> relative and common shocks



Scheme 4 has two broad differences compared with scheme 3. First, the scheme is simpler in design. Second, it builds in a bigger degree of stabilisation in response to common shocks. The higher the area wide average output gap the more countries pay in during the good times, and vice versa in bad times. In effect, scheme 4 provides both inter-country insurance and rainy day properties, whereas scheme 3 mainly provides insurance. Whether this is a good feature or not depends upon whether countries want to be forced to put money aside in a rainy day fund to be used against common shocks. In principle, countries could already create their own funds. However, if the national fund remains part of general government (as is likely), drawing money from it in order to finance additional spending would be deficit increasing. This implies that a national fund would not allow additional stabilisation in bad times while sticking to the fiscal rules. By contrast a common fund such as scheme 4 allows for doing just that.

3. SIMULATION STRATEGY

3.1 The simulation framework

In this section, we simulate the operation of our four potential schemes (schemes 1-4) over the period 2003-2012. To some degree the parameters of the schemes we examine are fit in sample to this period. Future cycles may have different characteristics. We would much

prefer to employ a longer sample period than 2003-12 throughout the paper, in part to guard against this issue and reduce the weight of the idiosyncratic features of one particular business cycle. In practice, we briefly present and discuss results for the period 1991-2012 as a robustness check. The only reason the main analysis does not focus on the longer sample period is we would lose the ability to gauge the schemes' operation using also real time data.

We assess the schemes with reference to the criteria that we developed in the previous section:

- We look at the ***stabilisation powers of the schemes***. First, we estimate how far the schemes would have reduced cyclical income differentials relative to other euro area countries – in response to asymmetric shocks. This is the *relative* stabilisation power vis-à-vis the euro area average. Second, we assess how far they would have stabilised overall shocks, be they asymmetric or common shocks. This corresponds to the *absolute* stabilisation power, or the capacity to smooth out income fluctuations.

- We track the ***aggregate budgetary evolution of the fund***, in order to assess its overall fiscal credibility. In particular, we examine the cumulated balance of the fund over the simulated period, which is around ten years. Given that our sample barely exceeds a full cycle and contains a major crisis, we do not see it as a binding property that a viable scheme should balance over our particular simulated period. This said, we would not find credible a scheme that delivers a large cumulated imbalance, even over our specific sample period. Moreover, we see it as important to benchmark the extent of absolute stabilisation to the cumulated balance. In particular, a higher stabilisation power, if obtained only at the price of a more than proportional cumulated deficit, may not be regarded as an improvement.

- We look at ***specific country stories***. The aim is two-fold. First, we would like to see how the candidate schemes would have contributed in good or bad times to stabilise particular economies. Second, we want to verify that the condition of non-permanent transfer is likely to hold. This means that countries should tend to alternate between positions of beneficiary and receiver, and do not present a large cumulated balance to the fund (of either sign) over a sufficiently long period. We show in Annexes 3-4 the annual transfers for each country. This transfer could be positive (contribution by a Member State to the fund) or negative (disbursement by the fund to a Member State).

We pay specific attention to *measurement issues,* including *real-time uncertainty*. As noted, the desire to focus extensively on this issue comes at the cost of curtailing the length of the sample available to be used:

- We start by simulating the funds based on the full knowledge that we have ex post, in other words using current estimates of output gaps over the simulated period (section 4).

- Then we do another round of simulations where the schemes function exactly as they would have in real-time. There the transfers and payments are based on output gaps as estimated at the time (section 5). The stabilisation properties, however, are still calculated with reference to current estimates of the output gaps, as they should be.

This robustness exercise ensures we get a fully realistic view of how the possible schemes would have operated in real time, while measuring the effects on the economy as it really was. It partly alters the conclusions, and suggests additional benefits from our preferred schemes (schemes 3-4), compared with the simple benchmark schemes (schemes 1-2). Note though that the *improvements in output gap methodology adopted in 2010* are not available for use in this exercise for the years before 2011, simply because we use actual real time output gaps. So the differences between current and real time estimates that we might expect to observe in the future should be less than those we observed in the past.

One important further consideration is *the robustness of the various schemes*. We have calibrated the schemes to fit the cyclical patterns observed over the period 2003-12, but the future economic cycles will be different to the past. What threat might this pose to the potential schemes balancing or stabilising as we intend? In truth, it is difficult to provide concrete evidence on this, not least because we only have real time data over the period 2003-12. But one argument is that schemes 1 and 3 (mainly relative shocks) provide a degree of insulation against the future turning out differently to the past. This is because the threshold at which payments kick in is defined by the size of the euro area average output gap, rather than being a fixed absolute level of the output gap. Hence the threshold moves with developments in the euro area average cycle, providing a degree of robustness. Scheme 1 is fully future proof because it always balances in every year, and scheme 3 provides an element of future proofing.

3.2 Measuring the stabilisation power

All the schemes considered work in the same way. They set annual transfers between a central fund and each participating country. The amounts can be positive, negative or zero (the latter case especially for schemes 3-4 where there is a zone of inactivity). The transfers occur between the fund and the general government. We do not specify what use the government would make of the additional funds, or how it would finance payments to the fund. What we assume is that the fiscal rules operate exactly as they would without the schemes, so that the government does find additional ways to finance the required contributions (in good times), and spends the additional budgetary leeway provided by the schemes (in bad times). Other stabilisation schemes that could be imagined – for example unemployment insurance schemes – have economically similar features, in that money is taken into the centre and then spent. Building in a requirement on how the money is spent seems unnecessarily restrictive and in practice may be difficult to do sensibly without further integration within EMU (for example by making labour market institutions homogeneous). We take this kind of deepening as beyond the scope of this paper.

The empirical literature (following notably Asdrubali *et al*., 1996) focuses on the effects of risk-sharing arrangements for income and consumption smoothing. In this perspective, the primary objective of risk-sharing arrangements is to de-correlate domestic income and consumption patterns from domestic output. Inter-country risk-sharing offers insurance against national idiosyncratic shocks. International/ inter-temporal risk-sharing additionally

allows smoothing out the effects of common shocks. By contrast this approach leaves aside issues related to the stabilisation of demand or output. In fact, it essentially treats output developments as exogenous.

Our approach follows the risk-sharing empirical literature in spirit, but avoids making radical assumptions regarding output stabilisation. We offer two aggregate measures of the income stabilisation power of the schemes. Specifically, we develop a stabilisation index for asymmetric shocks (relative stabilisation index), and a stabilisation index for all shocks, irrespective of their origin (absolute stabilisation index). These indices, as further detailed below, measure the direct income stabilising effects of the transfers in and out of the scheme. Meanwhile, we do not study the potential impact of the schemes in terms of stabilising demand and output, but we do not claim that there would be no impact. Indeed, we would expect that the schemes would help in smoothing out output gaps. However, to describe the effects on output gaps, we would need assumptions – in effect forcing countries to comply – over the precise use of the transfers, or the way the contributions to the scheme are financed. We can know neither in advance and do not wish to force countries into a given set of instruments. Besides, demand impacts of the past "average" government spending would not apply directly because the spending here is funded by the transfer, rather than future taxes. A stand would also have to be taken on the lag with which changes in spending come through to affect output. Given all of these difficulties we put this extension, as sensible as it would be if it could be done convincingly, to one side.

Instead, in order to derive stabilisation indices, we relate the amounts of the payments and transfers to the size of shocks. We therefore measure to what extent the fund provides stabilisation of national income shocks. Our assumption is simply that before the operation of the schemes, cyclical national income shocks can be equated with output gaps. This assumption is likely to hold reasonably well as a working hypothesis for gauging the stabilisation properties of the proposed schemes.

The construction of the two indices is as follows. For evaluating the *absolute income stabilisation* power, irrespective of the origins of shocks (idiosyncratic or common): we relate the size of the transfers and payments to the output gaps. We relate for each country and period the payment *P* to the fund (if P<0, this means a transfer from the fund) to the size of the output gap:

$M^a = P/OG$

This takes a value of 0 without stabilisation, and 1 for full stabilisation.

This is done for each country. We average these across countries and time to get an aggregate index of the stabilisation power. When averaging across countries, we follow two alternative methods. In one, we give the same weight to each country. This is interesting in so far as shocks are often larger in periphery countries which typically happen to be small. This weighting system acknowledges the fact that a risk sharing mechanism may be especially attractive for these countries. Alternatively, we give country weights that are proportional to

GDP. This is sounder if we want to assess the stabilisation capacity for the area as a whole. In practice, the differences between the two weighing schemes are not huge[1].

To assess the degree of *relative income stabilisation*: we measure to what extent the payments to, and transfers from, the fund reduce the inter-country standard deviation of relative income shocks. We first compute the standard deviation of relative output gaps before the schemes operates. That is, we consider relative output gaps *OG-AOG*, and we compute their standard deviation σ. We take this as a measure of cyclical income differentials. Then, we compute relative income gaps as they are modified by the payments to and from the schemes. We measure the standard deviation of relative income shocks after these payments σ^s. Our stabilisation index for asymmetric shocks is:

$$M^r = 1 - \sigma^s/\sigma$$

Again, this takes a value of 0 when the cyclical differentials are not reduced ($\sigma=\sigma^s$), and is equal to 1 when there is full stabilisation of relative shocks ($\sigma^s=0$). A value between 0 and 1 indicates partial stabilisation. The higher is M^r, the stronger is the relative stabilisation power. The index is calculated for each year and averaged over the sample period (2003-2012).

Our stabilisation indices concentrate on income stabilisation, not consumption smoothing. In this we follow part of the literature (e.g. Melitz and Zuemer, 2002). Another strand is wider in scope and examines the successive risk-sharing channels up to consumption (Adrubali *et al*, 1996). Differences between income and consumption smoothing stem from the lending and borrowing behaviours in credit markets of both private and public agents. Stopping our investigation at the level of income smoothing reflects the partial approach that we adopt, whereby we do not study the use of the transfers. But it also reflects our belief that in practice such schemes would not significantly substitute the risk-sharing channels *via* credit markets[2].

There are two reasons why we see as reasonable the assumption that risk-sharing possibilities through credit markets may not be much reduced. One reason is that the mechanism we have in mind is particularly valuable in times of deep recession when national adjustment is most difficult. The experience from the recent crisis is rather that in the current EMU setting, credit markets tend to freeze up during severe downturns, an insight confirmed more formally by Furceri and Zdzienicka (2012). Therefore, we do not think that the operation of our schemes would threaten the risk-sharing function of credit markets in severe downturns when risk sharing is needed most. In fact, by enhancing the credibility of the

[1] An alternative measure of absolute stabilisation that we rejected would be: $M^{a'} = \Sigma P/AOG$. This would be a good measure of the ability to stabilise common shocks from the area-wide perspective, but it underestimates the overall stabilisation effect. That is because some payments will offset each other with no impact on reducing the euro area average output gap, while they are stabilising at the individual country level. Let's take the example of an area composed of two countries of similar size, with opposite output gap: in this case, the system will stabilise the output gap of each country, but with no effect on the indicator $M^{a'}$.

[2] Roeger and Vogel (2013) offers a model-based analysis of the risks of "crowding-out" between public and private risk-sharing channels.

overall framework and raising trust, it could well improve the functioning of credit markets. Second, other monetary unions such as the US and Canada have stronger fiscal transfers than EMU, but also without having less private risk sharing, as shown in IMF (2013). In short, they end up having double the total degree of risk sharing, compared with EMU. So it does not seem that greater fiscal risk sharing – as an empirical matter – need necessarily lead to less private risk sharing.

In section 5 we extend our simulations to the case where real-time data on output gaps are used for determining the amounts of transfers to and from the fund. In other words, *P* is determined using real-time output gaps. However, we continue to use ex post data (that is, the data that we now have) for simulating the stabilisation powers of the payments. That is, the formula for calculating M^r and M^a are unchanged. This way, we get a genuine assessment of how the schemes would have operated under the imperfect available knowledge at the time.

3.3 Calibration of the schemes

All the schemes are meant to correct around *one quarter* of the cyclical fluctuation in income for countries in which they are active:

- Scheme 1 cushions *all asymmetric* shocks by compensating 25% of the relative output gap of each country.

- Scheme 2 cushions *all asymmetric and common* shocks, by absorbing 25% of the output gap of each country.

- Scheme 3 follows a similar logic to that of scheme 1, but cushions *only large asymmetric income shocks*. It also has a *different functioning between good times and bad times*: the pay-in parameter is set as 30% (payment to the fund by a contributing country), while the pay-out parameter is set to 25% (payment by the fund to a receiving country). The asymmetric treatment is mainly a pragmatic response to improve the financial balancing of the scheme in the presence of the real time bias in measuring the output gap. A complementary argument is that countries find it especially difficult to maintain fiscal discipline in cyclical upswings, so it makes sense for the scheme to be a little tougher in the good times than it is generous in the bad times.

- Scheme 4 follows a similar logic to that of scheme 2, but is working slightly differently between good times and bad times by not compensating small negative fluctuations. Countries with an output gap between 0 and -1 do not receive anything from the fund. Again, this is also a pragmatic response to the real time measurement bias.

4. SIMULATION RESULTS BASED ON EX POST DATA

In this section we analyse retrospective simulations of the schemes over the past decade (an extension over the past twenty-years is in Annex 5). We start by summarising the distribution of flows from and into the funds. We then assess the stabilisation powers of the schemes according to the metrics presented in the previous section, before taking a closer look at

country results. Further simulation results are in Annex 3. All simulations presented in this section rely on the knowledge of the past that we now have. Section 5 will analyse the robustness of the results with real-time simulations.

4.1 Distribution of transfers: summary statistics

Table 1 and Figure 4 summarise the distribution of payments between participating countries and each of the scheme over 2003-2012. To recall, each year a country is either a payer or a recipient (for schemes 3-4, no transfer at all also occur). Table 1 describes the contributions and payments to the countries, while Figure 4 aggregates over countries the transfers to and from the schemes for each year.

Table 1
Distribution of flows between participating countries and the funds
Ex post data over 2003-2012

		In percent of national GDPs		In percent of area-wide GDP	
		Payments to the fund	**Payments from the fund**	**Payments to the fund**	**Payments from the fund**
Scheme 1 Asymmetric shocks	Min.	0.0	0.0	0.00	0.00
	Median	0.2	0.2	0.00	0.01
	Mean	0.3	0.3	0.01	0.02
	Max.	2.0	1.7	0.15	0.15
Scheme 2 Asymmetric and common shocks	Min.	0.0	0.0	0.00	0.00
	Median	0.4	0.4	0.01	0.01
	Mean	0.5	0.6	0.02	0.03
	Max.	2.7	3.7	0.15	0.28
Scheme 3 Mainly asymmetric shocks	Min.	0.0	0.0	0.00	0.00
	Median	0.2	0.2	0.00	0.00
	Mean	0.4	0.4	0.01	0.02
	Max.	2.7	3.1	0.11	0.15
Scheme 4 Asymmetric and common shocks with thresholds	Min.	0.0	0.0	0.00	0.00
	Median	0.4	0.3	0.01	0.01
	Mean	0.5	0.5	0.02	0.03
	Max.	2.7	3.5	0.15	0.21

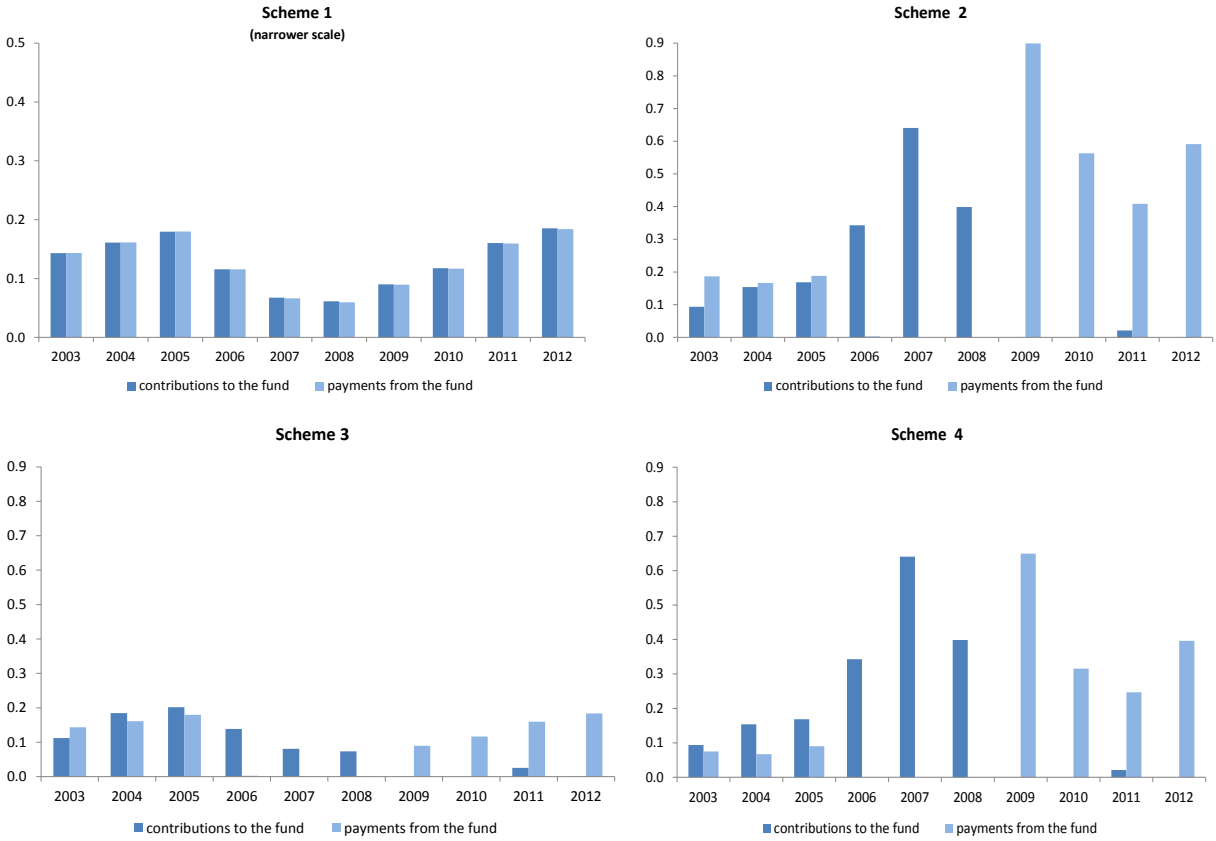
Source: AMECO, authors' calculations.

Payments and contributions typically are in the order of a few decimals of national GDPs (Table 1). There is however some skewness in the distribution of transfers, with

episodic large transfers for large cyclical positions. Rather unsurprisingly the flows are generally lower for the schemes focused on asymmetric shocks (schemes 1 and 3).

The cumulated payments in and out of the schemes (Figure 4) vary significantly over time. Larger shocks, idiosyncratic or common, trigger larger flows. In this sense, there is no "fixed size" of the schemes. However, there is an underlying average size, which is a reflection of the average size of shocks and the choice of the parameters. For a given set of parameters, schemes addressing also common shocks tend to be larger. For schemes 1-3, the annual budget of the scheme hovers around 0,1-0,2% of area-wide GDP. This is more fluctuating, and about double on average, for schemes 2-4.

Figure 4. Flows to and from the fund
In percent of area-wide GDP - Ex post data



Source: AMECO, authors' calculations.

A first comparison of the specialised versus pure schemes (scheme 3 versus scheme 1, scheme 4 versus scheme 2) can also be made. At the very first order, scheme 3 resembles scheme 1, and scheme 4 resembles scheme 2. Yet, there are a couple of distinctive features. Scheme 3 does not force budget balance on a yearly basis (as scheme 1 does). For example in the boom years of 2006-2008, scheme 1 would not only have the most booming countries pay into the scheme, it would also redistribute the money to the booming but less booming

countries. Scheme 3 avoids this counter-cyclical effect. Conversely, during the crisis years, scheme 3 gives money to those countries that are most depressed, but without taking money out of less depressed countries. So it avoids a potentially important problem with scheme 1, at the cost of relaxing the annual budget balance constraint. Similarly, scheme 4 has effects apparently close to what scheme 2 does. But its overall effect looks more symmetric across good and bad times than for scheme 2. In the boom phase the contributions raise as much as with scheme 2, but the payments are somewhat lower already in the early years of the sample. And the payments are a bit less in the downturn.

4.2 Stabilisation properties of the schemes using ex post data

Relative stabilisation: accommodating asymmetric shocks

Table 2 shows the main stabilisation properties of the four schemes. **The relative stabilisation capability is very similar across schemes**. This is perhaps unsurprising as all of the schemes were designed with stabilising relative shocks in mind. All schemes reduce the variability of the relative output gap by around one quarter, which is broadly consistent with their initial parameterisation. What is noticeable however is that schemes 3 and 4 have a relative stabilisation power very close to that of schemes 1 and 2, even though they exclude many country-time points where the output gap is small (the proportion of countries in which the scheme is active on average at a given moment in time is also shown in the table).

Table 2. Stabilisation properties of the schemes
Designed on the basis of and measured with ex post data
Average over 2003-2012

	Scheme 1 Asymmetric shocks	Scheme 2 Asymmetric and common shocks	Scheme 3 Mainly asymmetric shocks	Scheme 4 Asymmetric and common shocks with thresholds
Stabilisation capacity (%)				
*Relative stabilisation index (M^r)**	25%	25%	23%	23%
*Absolute stabilisation index (M^a)**				
Simple country average	8%	25%	11%	18%
Weighted country average	6%	25%	9%	19%
Cumulated balance of the fund (in percent of area-wide GDP)	0.0	-1.2	-0.2	0.0
Average frequency of fund activity	*100%*	*100%*	*68%*	*81%*

* *See section 3.2 for details*

Source: AMECO, authors' calculations.

Absolute stabilisation: accommodating both common and asymmetric shocks

Schemes 2 and 4 are both designed to stabilise common shocks, and do best in this regard. Scheme 4 stabilises close to a fifth of cyclical fluctuation, slightly less than scheme 2 (25% by definition). This is because scheme 4 is more targeted and implicitly disregards the small output gaps. For some countries in some years, where the output gap is between zero and -1% (around 25% of the cases), the fund remains inactive, with no financial inflow or outflow.

By design scheme 4 has much stronger stabilising property in absolute terms than scheme 3. Yet, the latter does provide a non-negligible amount of stabilisation of common shocks. That is because when the euro area output gap is positive countries with above average output gaps pay in to the scheme, but only countries with negative output gaps will receive payouts. So the scheme will accumulate a surplus during boom times for use during a rainy day, and vice versa during recessions.

As noted earlier, a greater degree of absolute stabilisation does not necessarily imply superiority. Some might see stabilising the euro area average cycle as the job of monetary policy rather than relatively large payments of tax-payers money into a central fund. Instead, they would argue the stabilisation scheme should mainly focus on what monetary policy cannot affect: differences across countries within the euro area.

4.3 Overall budgetary features of the schemes

The schemes appear to be broadly balanced, with the possible exception of scheme 2. By construction scheme 1 balances in each and every period. Indeed, that is one of the main arguments in its favour. Table 2 shows that using ex post data, schemes 3 and 4 also achieve complete – or close to complete – budgetary balance over the sample period. These results are unavoidably period-dependent, and the chosen sample is relatively short. However, since about half of the period corresponds to a large downturn, it seems fair to conclude that schemes 3-4 present rather good credentials from the view point of fiscal credibility, at least based on ex post data. Scheme 2 appears less convincing in this regard, with a non-negligible deficit (of over 1% of the GDP of the zone) at the end of the period.

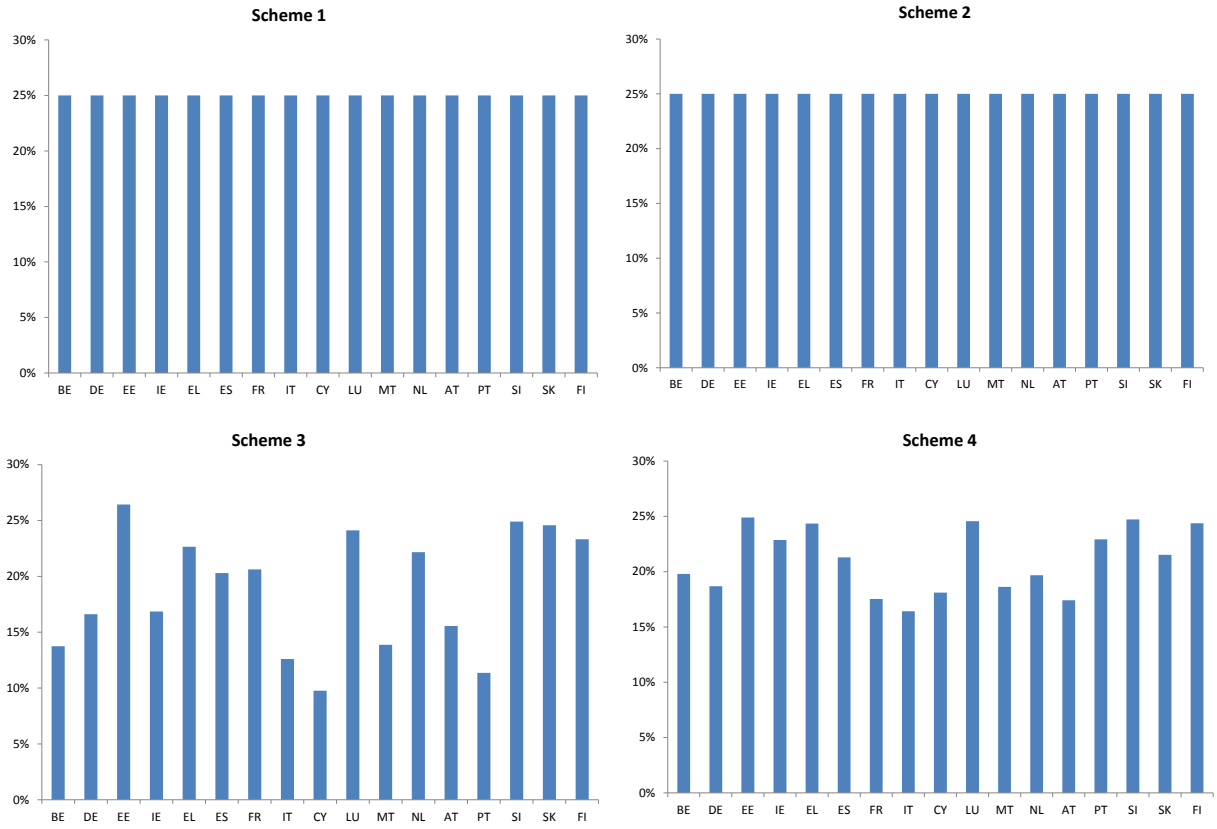
Given the extent of the crisis, this relatively small imbalance with scheme 2 may not appear as too problematic, or could in fact seem warranted. However, it is also a first indication that the slightly higher stabilisation power of scheme 2, compared with scheme 4, comes with higher risks for overall fiscal discipline. While we return to the issue later based on real-time data, it is worth noting that extending the sample period backwards to the early 1990s corroborates these conclusions (see Annex 5)[3].

[3] Over the period 1991-2012 schemes 3 and 4 also yield a cumulated surplus of 0.2 and 2,0 percent of GDP, respectively, and scheme 2 achieves a balanced budget, while keeping their absolute and relative stabilisation

4.4 Country-specific transfers

The aggregate stabilisation properties of the four schemes across countries are broadly intuitive. We can look at country-specific indices to assess the stabilising performance of the schemes (Figures 5 and 6). By design schemes 1-2 provide uniform relative stabilisation of a quarter. The other two schemes have more uneven effects, notably scheme 3. The same kind of picture emerges from the consideration of absolute stabilisation indices, where the performance of scheme 4 moderately depends on the country.

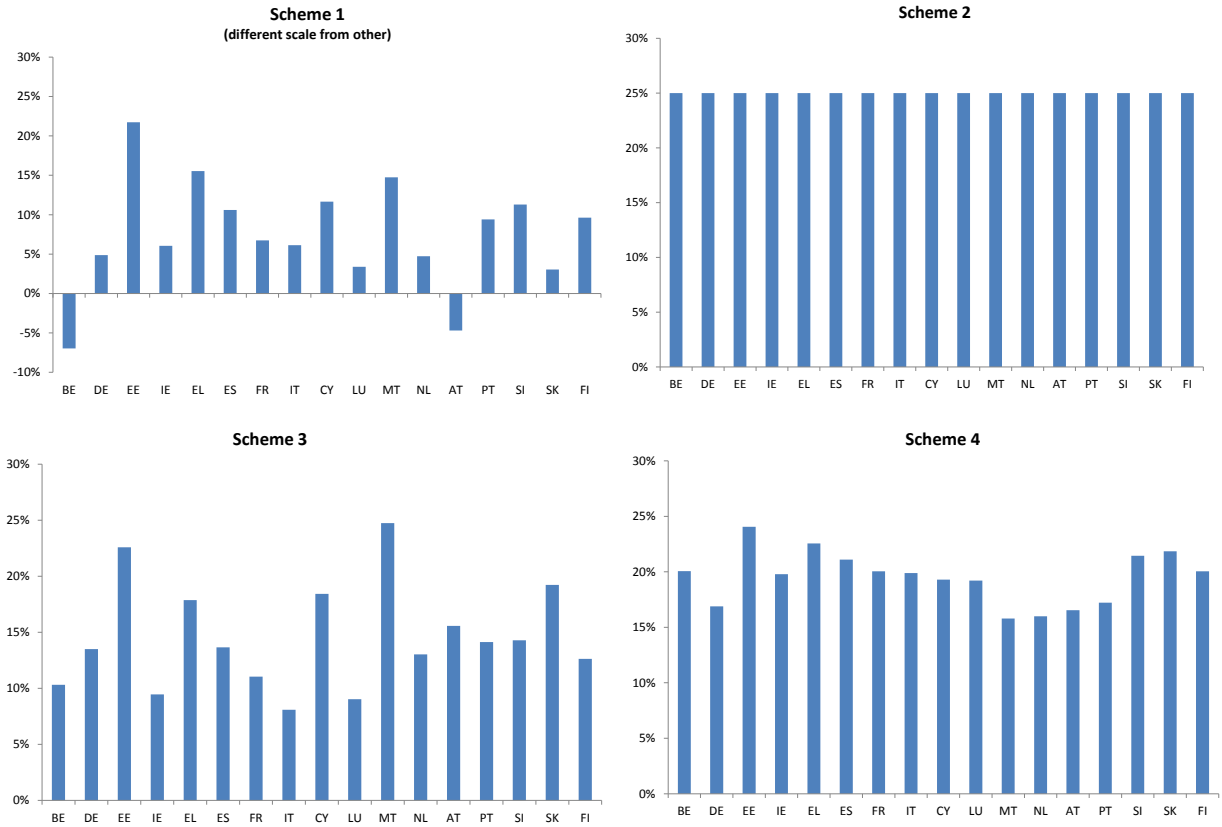
Figure 5. Relative stabilisation index over 2003-2012 (ex post data)



Source: AMECO, authors' calculations.

properties relatively unaltered. The "size" of the schemes is also the same, whereas the average frequency of the fund activity drops, particularly for scheme 4. This partly reflects the fact that the policy parameters (including the threshold in scheme 4 and the asymmetric rate between pay-in and pay-out in schemes 2, 3 and 4 have been calibrated on the shorter sample period 2003-20012, much more affected by the recent crisis in proportion of its smaller size.

Figure 6. Absolute stabilisation index over 2003-2012 (ex post data)



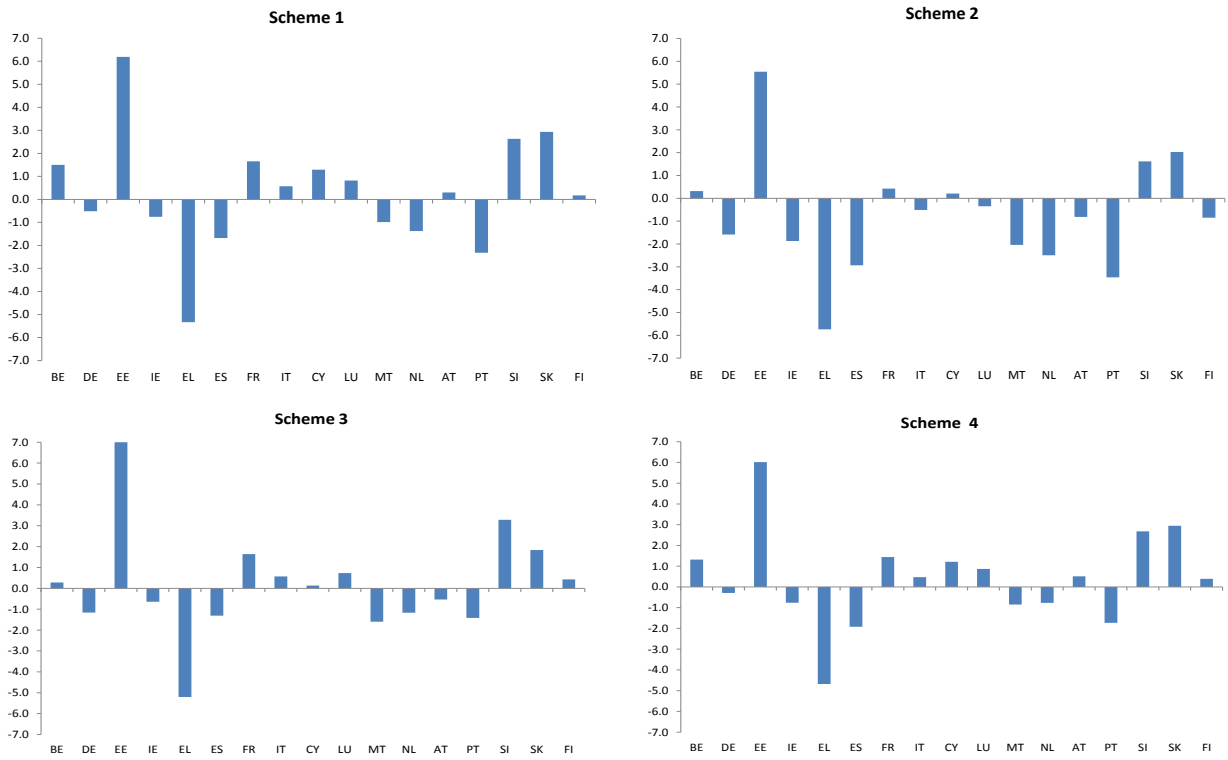
Source: AMECO, authors' calculations.

Since schemes 3-4 focus on large shocks, the differences across countries are a reflection of past differences in cyclical developments. Relatedly, an apparent feature of schemes 3-4 is a greater degree of action on the smaller economies. This is far from being a consistent pattern, but comes out on average as natural consequence of their design, given that small economies tend to experience bigger fluctuations.

Does it look as though the scheme could have helped to stabilise income shocks in an intuitive way across countries over the past? Figure 7 summarises the cumulative transfers for each country over the entire 2003-12 period. The statistics in this table average through two quite different phases (payments into and out of the schemes at all points in time for selected countries are shown in Annex 3). Interestingly, the cumulated transfers are quite similar for each country across schemes. Estonia, Slovenia and Slovakia would have been significant net contributors (in terms of their GDP) to the fund over the particular sample period, given large positive contributions before the crisis. By contrast the long standing programme countries – Greece, Ireland, Spain and Portugal – would have been net receivers as a whole, reflecting the scale of their recent economic slumps. However, over the entire period, any particular country would be paying in to the scheme in the boom and taking out of the scheme in their slump. Regarding the three largest countries, the cumulated transfers

appear typically limited, with Germany a net receiver. The picture is as one would generally expect.

Figure 7. Cumulated transfers over 2003-2012
Ex post data, percent of national GDP



Note: a positive transfer means a payment from the country to the fund.
Source: AMECO, authors' calculations.

All of the schemes have the merit of ensuring distributional neutrality, as they do not generate permanent transfers from some Member States to others. This was one of our key aims. The detailed results in Annex 3 shows the absence of unidirectional payments. The transfer is contingent on the relative position of the cycle, having differenced out variations in trend growth. The resulting output gap series move around sufficiently quickly over time and across countries to avoid any permanent transfers. Spain and Ireland are good examples. In both countries, as the economy booms prior to the financial crisis, payments into the scheme would have been positive. On the other side of the coin, with the scale of their recessions, they would both be large receivers of the payments during the recession. We will come on to see that the results using real time data are not as intuitive.

5. SIMULATION RESULTS BASED ON REAL-TIME DATA

The previous results correspond to the various schemes based on complete knowledge about data set for the whole period. This section analyses "real-time" simulations to evaluate the robustness of the schemes to issues in assessing the business cycle. The real time series for the output gap are reconstructed using the AMECO vintage of data: real time estimates correspond to the forecast output gap for year Y, as reported in the Commission Spring Forecast of the same year[4].

We present the results in the same order as in the previous section. Further simulations are reported in Annex 4. One partial caveat to the results here is that differences between the real time and ex post estimates should in future be smaller than over the past, following the 2010 methodological improvement. But it is only a partial caveat.

5.1 Distribution of transfers: summary statistics

Table 3 summarises the distribution of payments between participating countries and each of the scheme over 2003-2012. The orders of magnitude are similar to those obtained with ex post data (as reported in Table 1). Two differences appear at the margin: first, the maximum payments are a tad lower than using ex post data, perhaps reflecting a tendency to underestimate very marked cycles in real time. Second, average payments from the fund tend to exceed average contributions to the schemes, notably for the schemes addressing common shocks. This provides a first indication of the increased difficulty in balancing the schemes over the cycle in real time. We dig deeper into this in section 5.3.

[4] For some countries the real time series of data are only available for a limited number of years. in particular, the data for Cyprus, Malta, Slovenia and Slovakia cover the period 2005-2012; for Estonia 2006-2012; for Luxembourg 2004-2012.

Table 3
Distribution of flows between participating countries and the funds
Real-time data over 2003-2012

		In percent of national GDPs		In percent of area-wide GDP	
		Payments to the fund	**Payments from the fund**	**Payments to the fund**	**Payments from the fund**
Scheme 1 Asymmetric shocks	Min.	0.0	0.0	0.00	0.00
	Median	0.2	0.2	0.00	0.01
	Mean	0.3	0.3	0.01	0.01
	Max.	0.9	2.4	0.13	0.06
Scheme 2 Asymmetric and common shocks	Min.	0.0	0.0	0.00	0.00
	Median	0.2	0.4	0.00	0.01
	Mean	0.3	0.5	0.01	0.03
	Max.	0.7	3.0	0.07	0.24
Scheme 3 Mainly asymmetric shocks	Min.	0.0	0.0	0.00	0.00
	Median	0.3	0.2	0.00	0.01
	Mean	0.3	0.3	0.01	0.01
	Max.	0.8	2.4	0.08	0.06
Scheme 4 Asymmetric and common shocks with thresholds	Min.	0.0	0.0	0.00	0.00
	Median	0.2	0.4	0.00	0.01
	Mean	0.3	0.5	0.01	0.02
	Max.	0.7	2.8	0.07	0.16

Source: AMECO, authors' calculations.

5.2 Real time stabilisation properties of the schemes

Table 4 shows the "effective" stabilisation power using real time data, as opposed to the "theoretical" stabilisation power based on the ex post data of Table 2.

Relative stabilisation: accommodating asymmetric shocks

The four schemes do provide relative income stabilisation in real time, though to a lesser extent. In general, the relative stabilisation capacity seems to be cut by around half for all of the schemes, when using real time data instead of ex post data. However, an interesting result hold true with real time data, as it did with ex post data: the power to stabilise asymmetric shocks seems to be similar across schemes. All of them tend to reduce the variance of relative output gap by 10% or slightly more. This is despite the fact that schemes 1 and 3 are designed to mainly stabilise relative shocks across euro area countries. Recall, though, that we showed earlier that scheme 2 is just a combination of a scheme to stabilise relative shocks and a

scheme to stabilise common shocks, so we should expect both schemes 2 and 4 to have power in stabilising relative shocks. That said, scheme 3 does get similar relative stabilisation power for a lower budget deficit than schemes 2 and 4.

Table 4. Stabilisation properties of the schemes
Designed on the basis of real time data and measured with ex post data
Average over 2003-2012

	Scheme 1 Asymmetric shocks	Scheme 2 Asymmetric and common shocks	Scheme 3 Mainly asymmetric shocks	Scheme 4 Asymmetric and common shocks with thresholds
Stabilisation capacity (%)				
*Relative stabilisation index (M^r)**	12%	11%	10%	11%
*Absolute stabilisation index (M^a)**				
Simple country average	2%	16%	5%	12%
Weighted country average	2%	13%	2%	11%
Cumulated balance of the fund (in percent of area-wide GDP)	0.0	-4.2	-0.8	-2.1
Average frequency of fund activity	*100%*	*100%*	*61%*	*74%*

* *See section 3.2 for details*
Source: AMECO, authors' calculations.

Absolute stabilisation: accommodating both common and asymmetric shocks

Similarly, all of the schemes considered – particularly scheme 2 – turn out to display a lower absolute stabilising power when determining the transfers on the basis of real time data. Only schemes 2-4 seem to maintain a non-negligible degree of absolute income smoothing.

Using real-rime data illustrates benefits of focusing on larger shocks and including a cautious bias, as scheme 4 does. In terms of average indices, scheme 2 maintains a slight edge over scheme 4. However, scheme 4 is more resilient to the use of real time data than scheme 2, in terms of loss of stabilising power. Moreover, a more in-depth analysis of the results show that scheme 4 would have "got it right" more often. As evidenced in Figure 8, scheme 4 would have been better at detecting the upturn prior to the crisis and have countries pay to the scheme at the time (a straightforward country illustration in annex 4 would be France). Finally but crucially, scheme 2 would have implied a much more deteriorated fiscal position of the fund by the end of the sample period. Designing a good scheme is all about finding a good balance. Of the two schemes specifically designed to stabilise common shocks,

scheme 4 fares well because it has similar absolute stabilising properties with a better budget balance.

As with the ex post data, scheme 3, mainly meant to correct asymmetric shocks, offers some (more limited) power to stabilise common shocks as well. That is a general feature of that scheme because when the area wide average output gap is positive, during the "boom" phase the scheme will always accumulate a positive balance for a rainy day. Unlike scheme 1, it does not offer payments to "speed up" countries that are only experiencing mild booms of less than average strength, saving it instead for the repayment in the slump. The fact that scheme 3 does not stabilise common shocks as well as schemes 2 and 4 is by design. Whether that is a good or bad feature of the scheme of course depends upon whether one wants to have a scheme that helps smooth through common shocks. One argument for not just leaving it to monetary policy is that the stabilisation scheme might kick in at the zero lower bound. Of course individual countries could borrow more debt themselves at the zero bound, but the countries that need it most may be constrained in doing so. The schemes aimed at stabilising common shocks aid the process by enforcing saving in the good times and by making the borrowing collective rather channelling it all on the countries that need it most.

5.3 Overall budgetary features

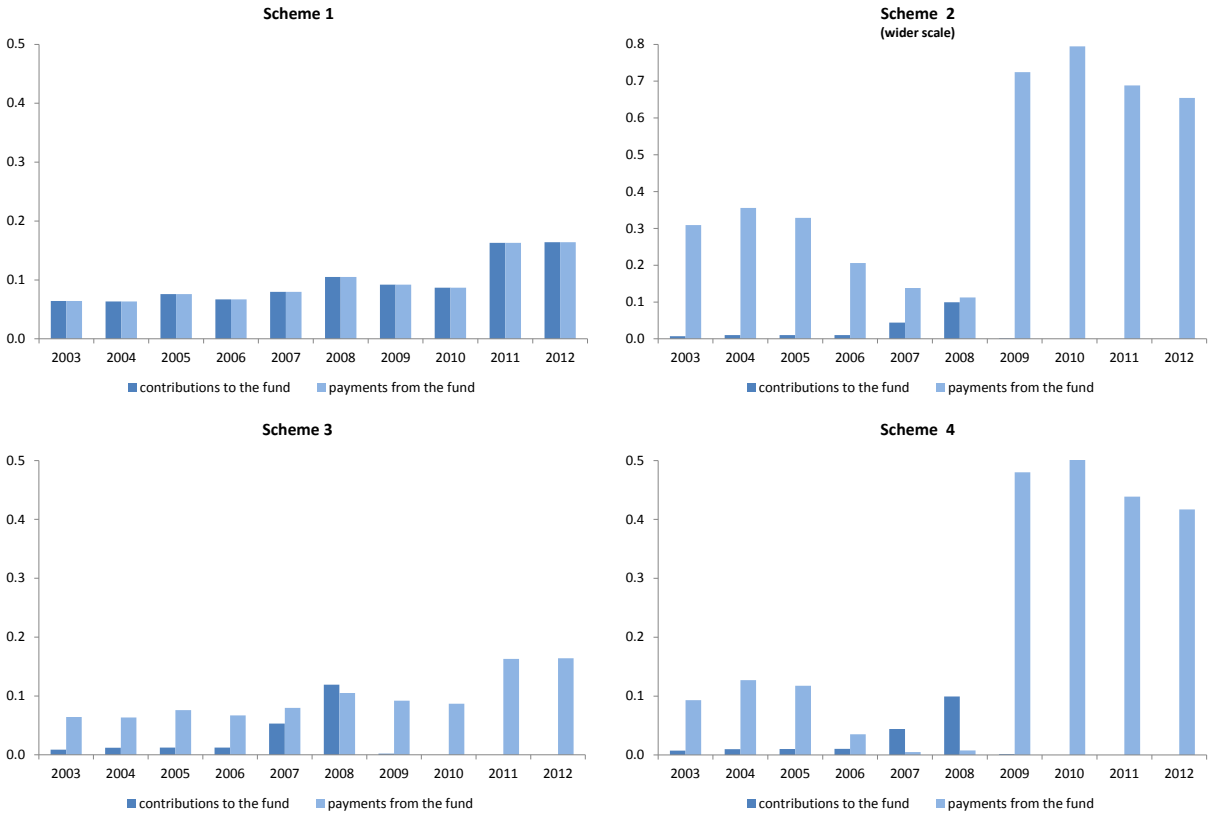
Generally, balancing the schemes over this particular period is an issue using real time data. Table 4 shows that all the schemes, with the important exception of scheme 1 that still balances by definition, display larger deficits than with the ex post data (see also Table 2 for comparison). This guaranteed budgetary balance in scheme 1 is probably its main selling point. For the other schemes, the one that deteriorates least is scheme 3, but we do not know for sure how general this result is. It may, though, be a reasonably robust result because the deterioration in budgetary performance occurs because in real time the output gap is under-recorded on average during the boom phase. Scheme 3 makes an allowance for this because payments are calibrated relative to the measured euro area average output gap. This builds in some tolerance to mis-measuring the real time output gap.

The big problem is that real time data makes it hard to generate enough revenue during the upswing. This is because, at least over the period that we have been examining, the extent of the upswing is under-recorded in real time. And that can make the schemes hard to balance financially because the payments out in the downswing outweigh payment in during the upswing. Figure 8 shows annual payments into and out of the schemes. It illustrates the problem: during the years that fund should be building up, using real time data does not generate enough inward payments.

However, our specialised schemes are relatively resilient to the problem. Scheme 3 is least affected by the issue, but even it is to some degree. As with ex post data, scheme 4 also appears more balanced than scheme 2, as it seems to collect more money in good times and

give away less money in bad ones. Overall, the cumulated deficit generated by scheme 4 (about 2% of GDP, equivalent to 0,2% per year on average), and most clearly scheme 3 (less than 1% of GDP), can be seen as non excessive - bearing in mind the depth of the recent crisis. Besides, all is not lost. Perhaps the future will be unlike the past. The recent improvements in potential output methodology should help. And we should examine, over time, other potential ways to make the measurement of the output gap more robust in real time. For example, recent work to incorporate the impact of financial factors in the calculation could be promising (Borio *et alii*, 2013). We also examined the idea of a clawback scheme to be imposed on countries, but that idea generates some unpleasant procyclical effects (see Annex 1).

Figure 8. Flows of the fund with real time output gap (% of total GDP)



Source: AMECO, authors' calculations.

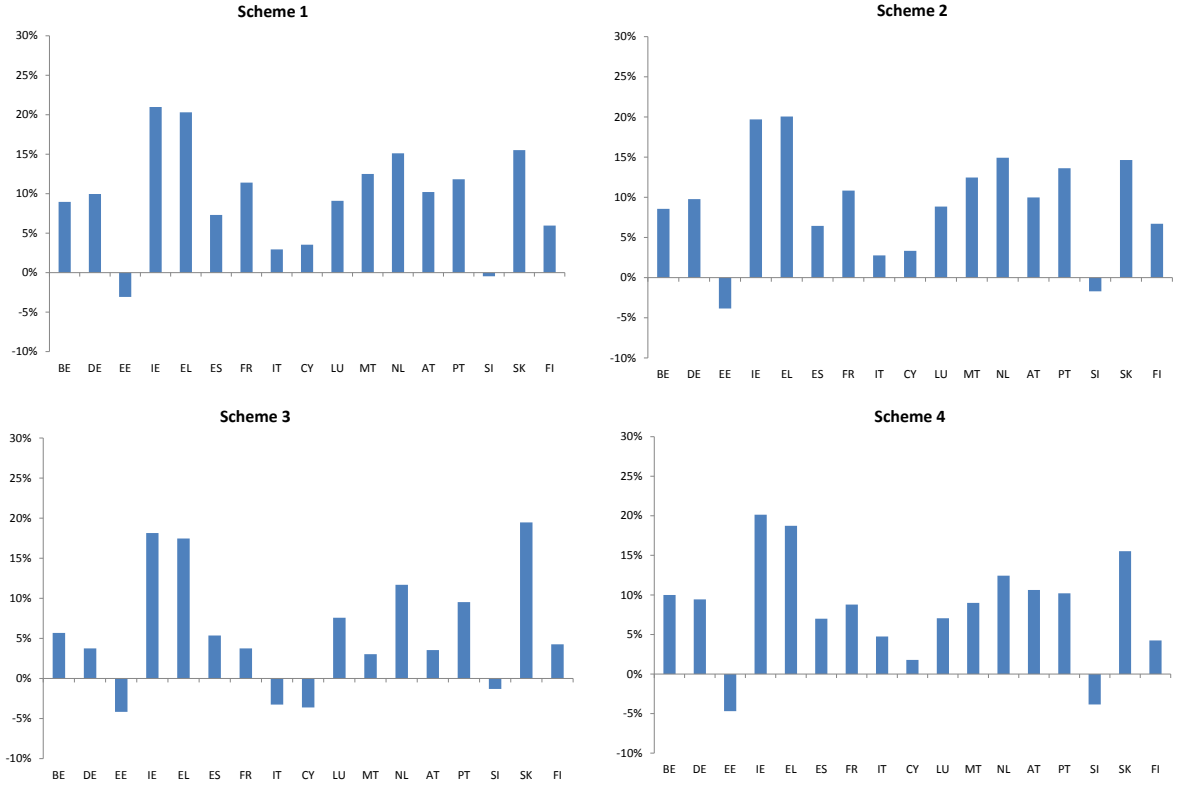
5.4 Country-specific transfers

Do the quite intuitive results obtained when using ex post data survive the switch to real time data? Of course the future will not be like the past, not least because of improvements we have made in measuring output gaps in real time, but nevertheless it is an important exercise to undertake. The short answer is that the results do change, mainly because real time data has trouble in measuring the full extent of positive output gaps. Importantly, the scale of this mismeasurement was not constant across countries and so it affected some more than

others. Figures 9-10-11 gives an overview of country results, and Annex 4 gives more country-time details.

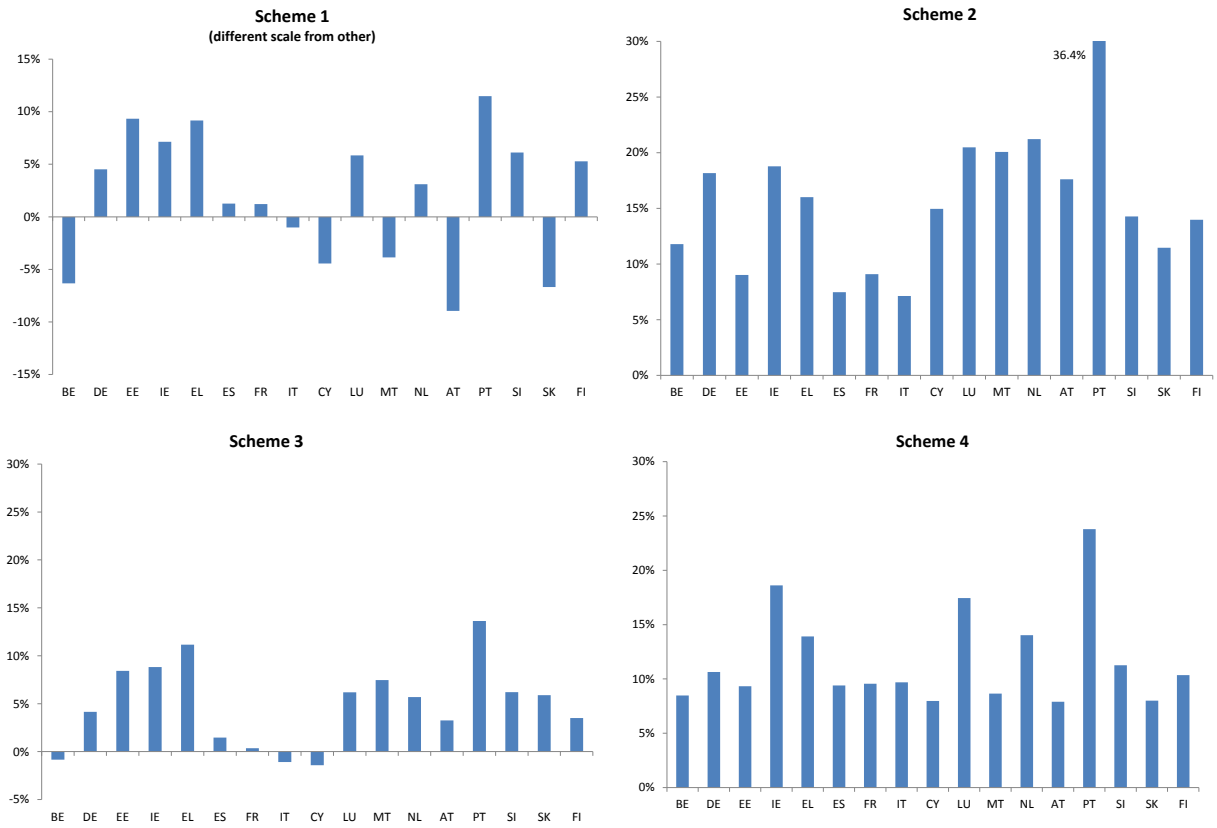
Concerning relative stabilisation (Figure 9), the pattern is rather similar across schemes. Interesting results are obtained in particular for Ireland and Greece, followed by Slovakia, the Netherlands and Portugal. Rather unsurprisingly, the relative stabilisation properties are generally more attractive for small economies, although this is not a uniform pattern and the precise effects on countries is sample-dependent. The disappointing case of Estonia in Figure 9 (negative relative stabilisation) is not very relevant, as it relies on a particularly short time period (starting in 2006 only given limited availability of real time data for Estonia – see footnote 2).

Figure 9. Relative stabilisation index over 2003-2012 (real time measured with ex post data)



Source: AMECO, authors' calculations.

Figure 10. Absolute stabilisation index over 2003-2012 (real time measured with ex post data)

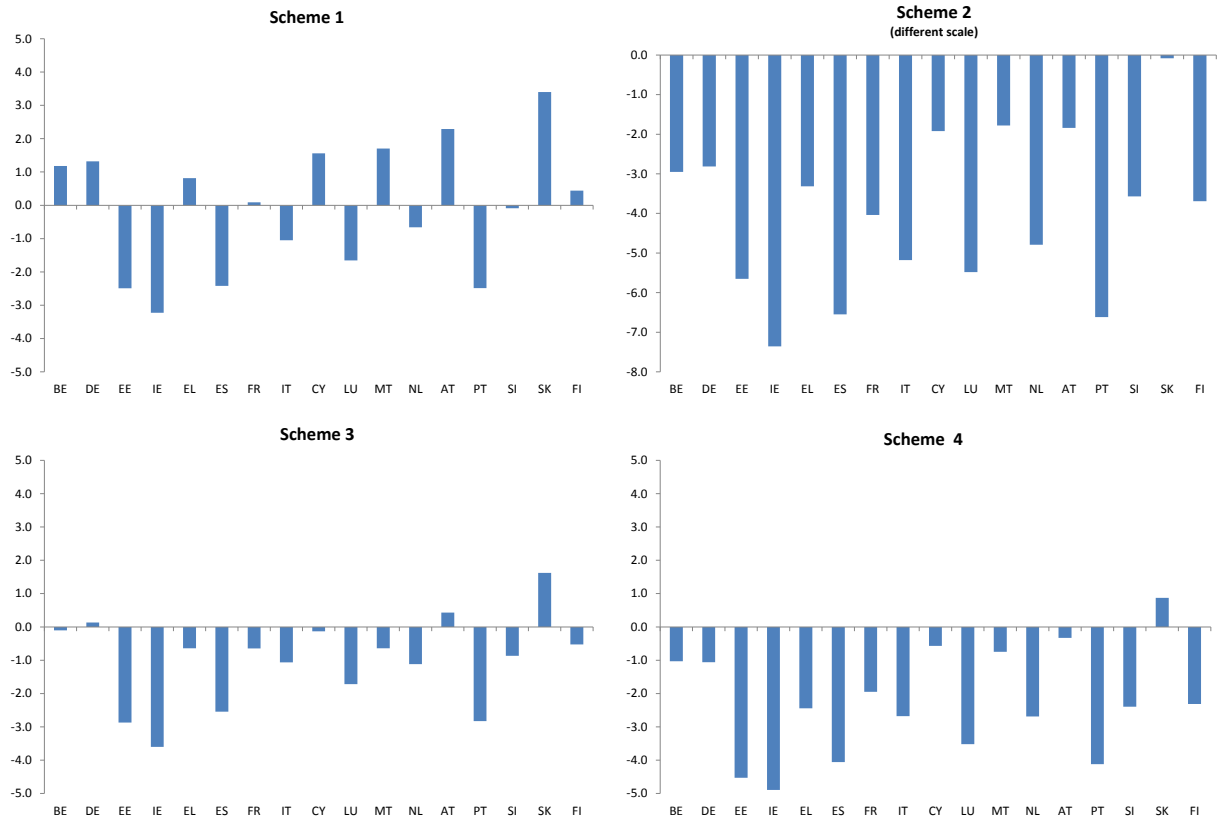


Source: AMECO, authors' calculations.

As expected, the absolute stabilisation performance at country level is best for scheme 2 and scheme 4 (Figure 10). With these two schemes countries benefit from added stabilisation on average over the period. The most interesting results are obtained for Portugal, Ireland and Luxembourg, followed by the Netherlands, Greece, Slovenia and Finland. As with ex post data, the stabilising power is more moderate for larger countries, hovering around 10% for scheme 4.

Except with scheme 1, most countries would overall have been net receivers from the fund over the sample period (Figure 11). Scheme 1 is excellent at preserving budgetary balance irrespective of whether real time or ex post data is used, but this can be at the cost of drawing money from countries in a weak cyclical position to give to other countries in an even weaker state. This is what would have happened throughout the crisis. Scheme 3 avoids this feature largely, while limiting the risks of a sustained debt accumulation, but as we saw it provides only limited insulation from common shocks.

Figure 11. Cumulated transfers over 2003-2012 (% of national GDP, real time data)



Source: AMECO, authors' calculations.

Schemes 2 and 4 result in all countries being net receivers (except Slovakia in scheme 4) over the period 2003-12, illustrating the scale of the issue in trying to make the schemes balance. This is partly explained by vulnerable countries of the periphery receiving significant money in the current downturn. However, annex 4 shows that it is also partially driven by Ireland and Spain not registering real time booms. How much of a problem is this? We argued above that perhaps future mis-measurement problems might be less severe than over the past. Even in the worst case scenario where the future is no better than the past at all, that does not mean that we cannot derive benefits from these kinds of stabilisation schemes. It does mean that our ability to help squeeze some of the pressure out of booms as they develop might be curtailed. But it does not appear as hard to measure the slumps in real time and the schemes can still be used to provide extra fiscal resources for countries that are experiencing especially big slumps. This would enable national authorities to respond with additional fiscal spending, without endangering medium term fiscal sustainability, exactly as we intended with the design of the scheme.

5.5 Conclusions from the simulations

We conclude that scheme 4 seems best if there is a desire to smooth common shocks, otherwise scheme 3 looks like the best choice. Our paper has reviewed theoretical arguments and provided case studies of the effective stabilisation properties of four potential schemes to enhance automatic stabilisers across the euro area. They have been examined over the ten-year historical sample for which we possess both real time and ex post data. In Table 5 we list the main pros and cons of the different schemes, as we see them based on the evidence in the paper.

To some extent all the schemes we examined present pros and cons. Scheme 1 focuses on risk-sharing against asymmetric shocks, which is the most widely acknowledged challenge in a currency union. As an important plus, it runs at budget balance in each and every period. There are however less desirable consequences. Scheme 1 does not have by definition any absolute stabilisation property. Unpleasantly, it acts to speed up countries with moderate booms towards an even more booming euro area average, with similar procyclical features in downturns. This may lead to significant political economy problems in actual operation.

Scheme 2 is a simple, powerful scheme addressing both idiosyncratic and common shocks, but a risky one. The big issue with scheme 2 is the large emerging cost in our simulations. This is partly a reflection of our particular sample period, which includes the large recent crisis, but not only. Scheme 2 requires symmetric output gaps over the cycle in order to even out, and there are strong reasons to take this assumption cautiously, despite ongoing methodological improvements. In the end, if euro area policymakers are one day ready to embark on a system as scheme 2, they might as well have reached a degree of mutual trust enabling deeper fiscal union than the simple rule-based stabilising schemes explored in this paper.

Our preferred schemes, schemes 3-4, despite being a bit more complex, overcome to some extent the limitations of the stylised schemes 1-2. Scheme 4 seems to be the best compromise if the ability to smooth through common shocks is desired: it combines a fairly good absolute stabilisation power with good relative stabilisation properties, and a tolerable budgetary balance. Scheme 3 is also appealing, as it provides strong relative stabilisation property with some (more modest) absolute stabilisation power, and a fund budget close to balance.

Table 5

Summary of simulation results

	Scheme 1	Scheme 2	Scheme 3	Scheme 4
Pros	**Always balanced budget** (by construction) **Best relative stabilisation capacity**	**Best relative stabilisation capacity** **Best absolute stabilisation capacity**	**Almost balanced budget** **Strong relative stabilisation power** (close to schemes 1 and 2) **Targeted: ignoring small fluctuation** (unlike scheme 1) **Budgetary costs less exposed to real time problem:** more efficient for relative stabilisation than scheme 4 in real time	**Strong relative stabilisation power** (as good as scheme 3 and close to schemes 1 and 2). **Strongest absolute stabilisation across countries** (with respect to scheme 2). **Fairly resilient absolute stabilisation power in real time** (with respect to scheme 2). **Absolute stabilisation power good per unit of per money spent** (because focused on correcting large fluctuation. When fund is active, it has the same absolute capacity as scheme 2).
Cons	**Relative stabilisation power halves in real time** **No real absolute stabilisation power** (by construction) C**an be procyclical** and speed up moderate output gaps	**Relative and absolute stabilisation power halve in real time** **Most costly** **Largest budgetary slippage in real time**	**Fairly limited absolute stabilisation power** (may be a weakness or a strength depending on how you see it) **Uneven relative stabilisation across countries** and more cases of pro-cyclical effect (negative index).	**Some budgetary slippage in real time** **Possibly less politically acceptable** (some may see responding to common shocks as the sole preserve of monetary policy)

Schemes 3-4 are more robust to real-time data constraints. The absolute stabilisation power of scheme 4 is fairly resilient when considering the real time output gap instead of the ex post output gap. Moving to the real time output gap, the loss of relative stabilisation power is similar across the schemes. However, if the focus is placed on correcting asymmetric shocks only, scheme 3 becomes more appealing then, because of its smaller budgetary costs. Scheme 3 and 4 have also the merit of being more targeted at large fluctuations, leaving countries with moderate cycles alone to manage for themselves. This accords with the intuitive idea that it is only really large shocks that are difficult to handle in EMU. They also allow a different functioning between good times and bad times (being more stringent in period of positive output gap), which we see as helpful for ensuring fiscal discipline in the upswing.

Choosing between schemes 3 and scheme 4 would certainly depend on the prominence given to the absolute stabilisation versus the relative stabilisation. This is not really an empirical matter, but more of a choice of preference. Is it preferable to design a scheme that helps the monetary policy smooth through the area wide business cycle, especially when monetary policy might struggle at the zero lower bound, in which case scheme 4 is a good

choice? By contrast if the implied fiscal cost of stabilising common shocks is considered politically unpalatable and/or the scheme should focus only on what monetary policy cannot do, then scheme 3 seems the best choice.

6. CONCLUSIONS

This paper explored whether possible stabilisation schemes could improve the conduct of fiscal policies throughout the cycle and improve income smoothing. The instruments we consider function through payments to and from Member States depending on their cyclical position. They are of simple conception, and the payments to and from the scheme are relatively modest. None of the schemes would represent a sea change in the way EMU operates, but they could offer an improvement on the current functioning by offering a greater degree of "automatic" income stabilisation particularly in response to national shocks. This would be valuable, but cannot be done at the expense of jeopardising the fiscal rules that lie at the heart of EMU. That is not the case and, if anything, we believe such schemes have the potential to deepen the credibility of the existing fiscal rules.

These common income stabilisation schemes should not really be thought of as trying to achieve something radically new in EMU. Instead they are best thought of as incremental improvements complementing existing initiatives to achieve existing objectives. The income stabilisation schemes could form a powerful complement, both in substance and in political economy terms, to steps taken for strengthening fiscal governance. Over the recent years, these steps include the six-pack and two-pack at the E(M)U level, and the intergovernmental Treaty enshrining the fiscal compact. Further steps reinforcing fiscal governance could yet be taken in the future. The kind of system that we study would work in full conjunction with the rule-based framework.

Another dimension is complementing efforts to take tail risks off the table. The ESM, for example, provides conditional financial assistance after countries start operating under financial stress. The risk sharing schemes we consider would apply continually and provide a first layer of insurance by contributing to deflating rapid booms before they can cause financial distress.

An area-wide fiscal stabilisation would also complement efforts to generate greater margins for adjustment to national shocks. The financial crisis has shown how costly the lack of national adjustment mechanisms can be. Macro-prudential supervisory tools can be thought of in this emerging class of instruments, complementing an income stabilisation scheme. Both tools have a similar aim of reducing the cyclicality of national economies. Fiscal stabilisation schemes could contribute by creating more space in the downturn and leaving less in the boom phase. Macro-prudential tools do it by slowing bank lending in the upturn and speeding it up in the slump. Neither tool is perfect, but both could contribute to providing a more significant margin of adjustment to national shocks, used in tandem as both "belt and braces".

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ANNEX 1 - Scheme with pay-back clause

To correct for the mismatch between real time and ex post measurement of the output gap, a system could be envisaged with a partial payback clause. The underlying idea is that, since the measurement of the output gap improves in more mature data, the scheme would use such updated information set to amend ex post past transfers based on the real time measures. In practice, transfers under such schemes would comprise two separate components: the baseline transfer defined on the basis of current stabilisation needs as measured in real time, and a backward looking 'correction factor' which would cater for the discrepancy between the past actual transfer and the transfer which should have been made as calculated with the updated information. At each point in time t, then, the revision would be made for the year t-n. There is however a trade-off between measurement accuracy, arguably increasing as (t-n) gets larger, and effectiveness of the stabilisation transfer, which would call for the correction to be made as close as possible to the reference year t, that is, arguably, under the same cyclical conditions. To accommodate that, n could be fixed at a value of 3, that is the revision would be calculated with a three-year lag. Moreover, it seems reasonable to have a payback parameter smaller than the parameter determining the baseline transfer, say 0.1. All in all, the ' corrected' net transfer at time t would look like:

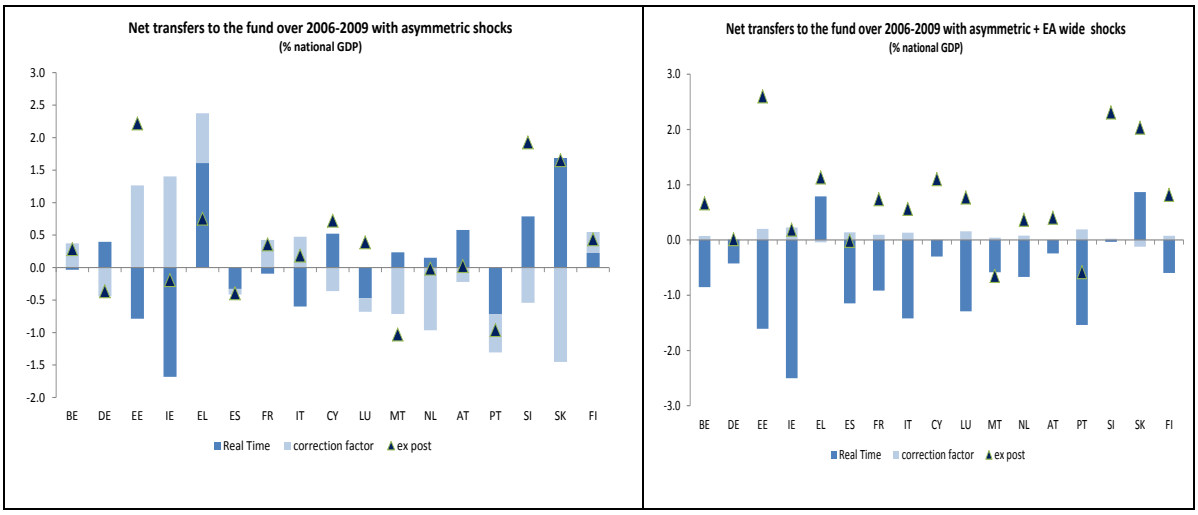
$$P_t^{corr} = P_t^r - 0.1*(P^r_{t-3} - P_{t-3})$$

where the first term on the rhs indicates the transfer calculated in real time and the second term is the correction factor amending for the transfer at time t-3. In other words, when the transfer made at t-3 (P^r_{t-3}) turns out larger than its counterfactual using the information set at t (P_{t-3}), a payment in the opposite direction is envisaged.

Transfers allowing for the correction are simulated for the two basic schemes, i.e. the one catering for purely idiosyncratic shocks, and the one accommodating asymmetric and euro area wide shocks. Applying the correction to the real time data series implies that the results can be obtained only for the years 2006-2009. Cumulated transfers over this period are reported in the graphs.

The results show that, overall, the correction factor indeed operates in the 'right' direction, that is it brings real time transfers closer to the ex post values. Exceptions are mostly the small, more volatile economies over the period, such as Slovenia, Slovakia, and Greece.

Although this scheme is appealing theoretically, it remains fairly difficult to assess its performance given the data availability on which our assessment was carried out (only three years, due to the time lags and the use of the real time data). Moreover, it is risky as the stabilisation power could be blurred by the principle of delayed reimbursement. The fund could in theory become pro-cyclical in some countries or/and years, if the lagged payback due more than offset the stabilisation transfer.



Source: AMECO, authors' calculations.

ANNEX 2

Formulas of schemes 3-4

Scheme 3*: Preferred scheme to stabilise mainly relative shocks.*

Our preferred scheme is:

(a) When a country is in an upturn (OG>0):

- When OG >AOG then pay: P = a*MIN{OG, OG-AOG}
- When OG<AOG then P = 0

(b) And symmetrically when a country is in a downturn (OG<0):

- When OG<AOG then receive R = b*MIN{-OG, AOG-OG}
- When OG>AOG then R = 0

This scheme (illustrated in Figure 2 in the main text) may look a little complicated in the formula, but it is a relatively simple principle. Part (a) says if a country is booming more than the euro area as a whole, then pay into scheme and if it is having a moderate boom pay nothing. The reason for the payments having the slightly complicated expression is that we include the payment of a*(OG-AOG) for the case where the AOG is positive, but that would not work if the area average is negative (AOG<0) because the payment would be enormous. So the OG term is intended to pick up a more reasonable payment when OG>0 but AOG<0. Unlike the simple scheme 1, scheme 3 does not make moderate output gaps more procyclical.

Part (b) is symmetric to part (a). It says simply that for a country with a large negative output gap, measured against the area wide average, the country will receive money from the fund. If the output gap is negative but small, it receives nothing and stays out of the scheme. As with part (a), the AOG-OG term is intended to capture payments when the area wide average is negative, and the OG term when AOG is positive.

Scheme 4*: Preferred scheme to stabilise with full weight on both relative and common shocks*

Our preferred scheme is:

When OG>0, then pay P = a*OG

When -X<OG<0, then P = 0 (X negative, e.g. X = -1.5)

When OG<-X<0, then receive R = a*(X-OG)

The scheme (illustrated in Figure 3 in the main text) is straightforward. If a country has a positive output gap, then it pays into the scheme in proportion to the output gap. There is no zone of small positive output gaps where payment is zero because of the average bias in the real time outputs – in other words, on average an output gap of zero in real time translates into a positive output gap on mature data. And we prefer to err on the side of making sure the scheme balances. If the output gap takes a small negative number between 0 and X, then the country skips out of the scheme and neither pays nor receives. And if the output gap is lower than X, then the receipt is in proportion to the excess shortfall over X.

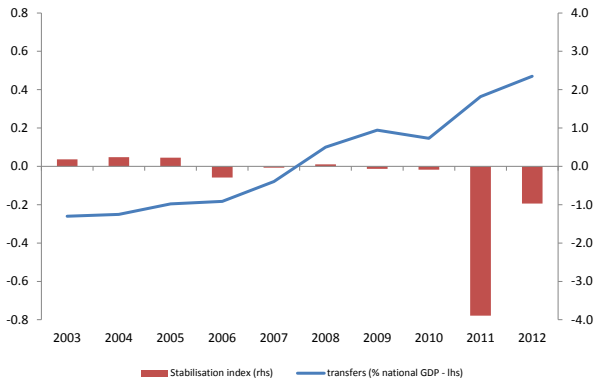
ANNEX 3

RESULTS BY COUNTRY OVER TIME

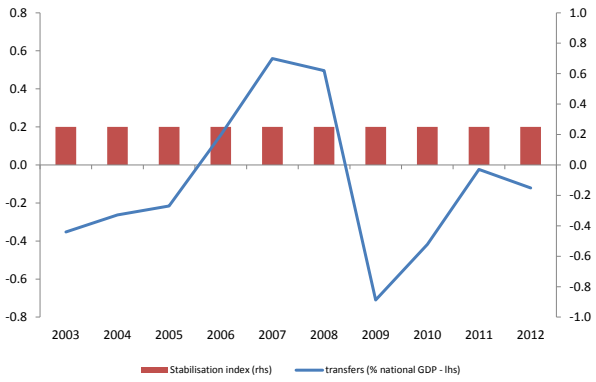
Simulations based on ex post data

AUSTRIA

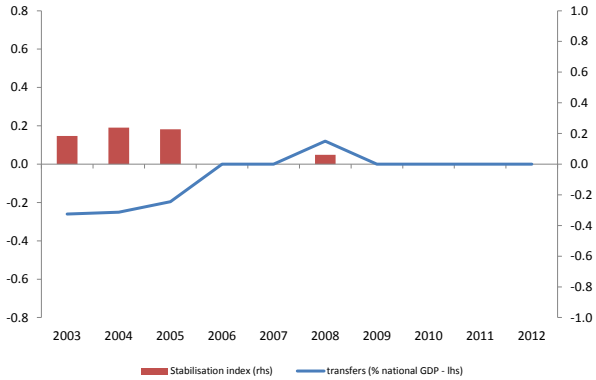
Scheme 1



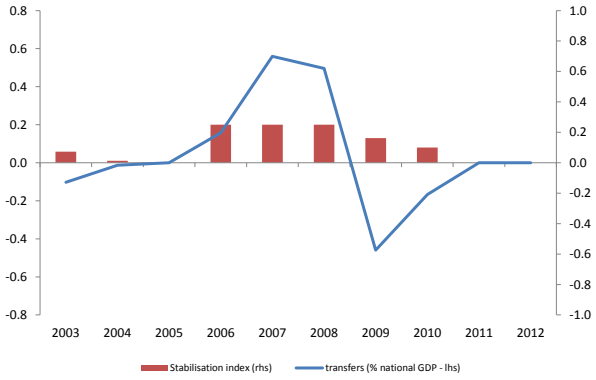
Scheme 2



Scheme 3



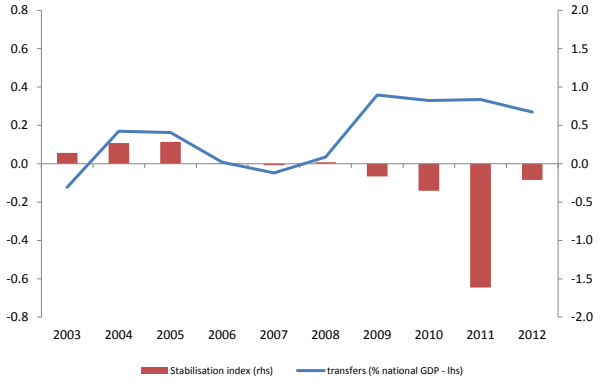
Scheme 4



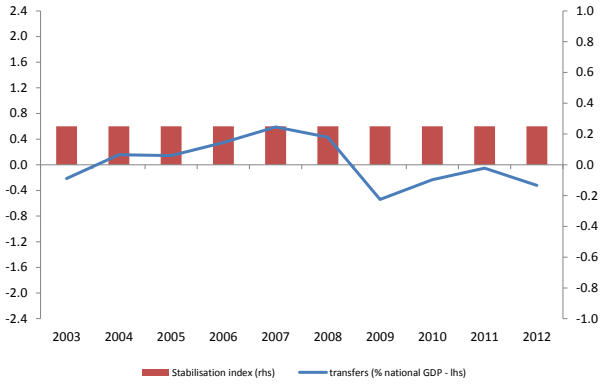
Source: AMECO, authors' calculations.

BELGIUM

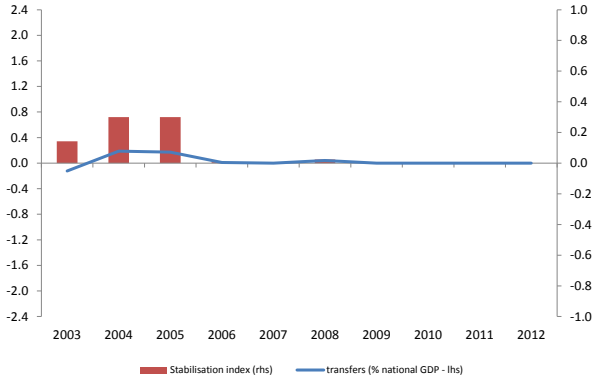
Scheme 1



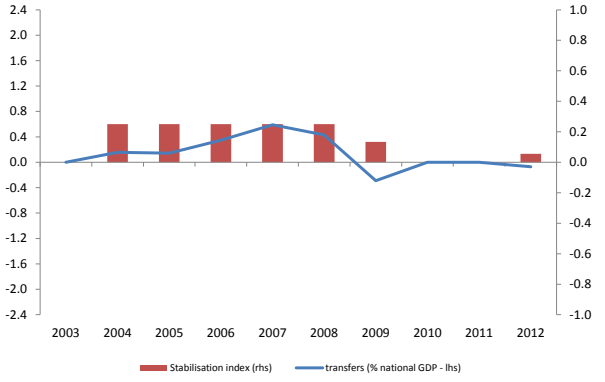
Scheme 2



Scheme 3



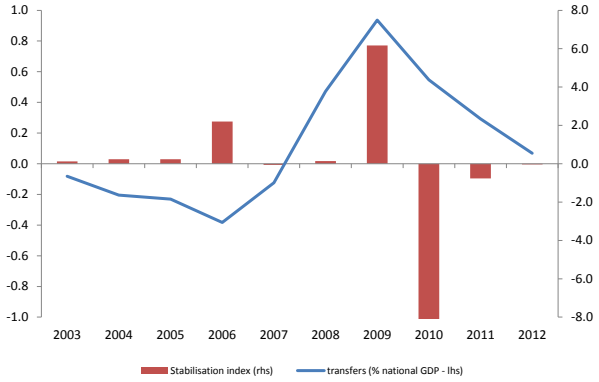
Scheme 4



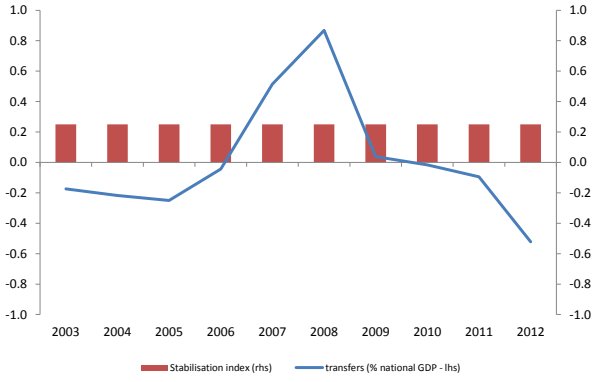
Source: AMECO, authors' calculations.

CYPRUS

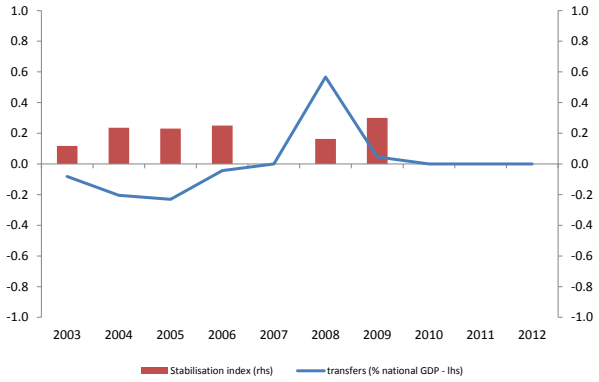
Scheme 1



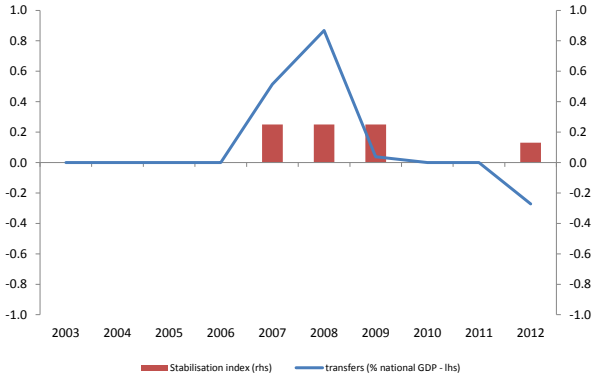
Scheme 2



Scheme 3



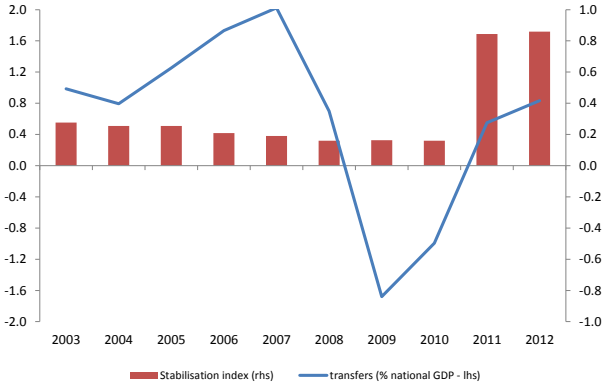
Scheme 4



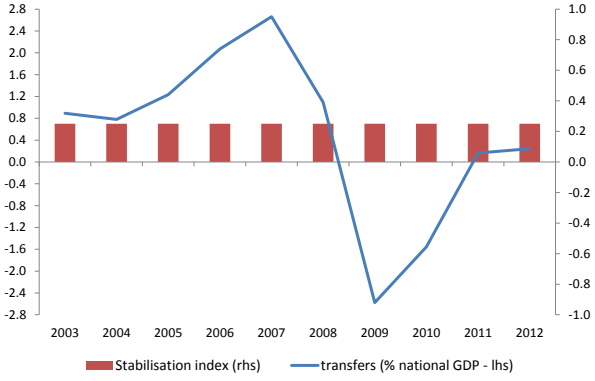
Source: AMECO, authors' calculations.

ESTONIA

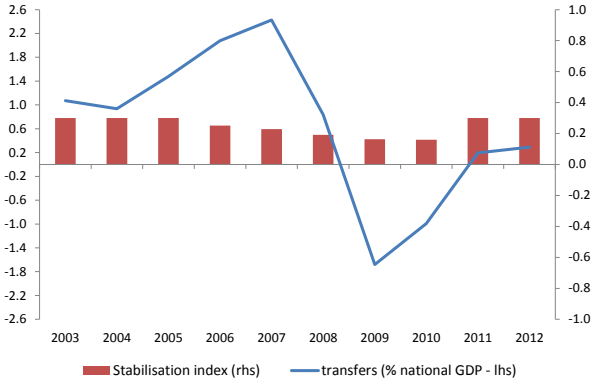
Scheme 1



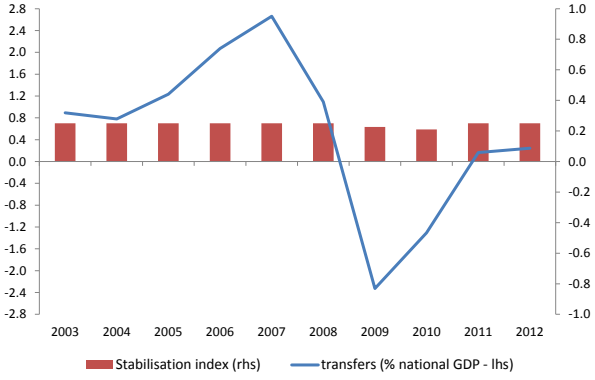
Scheme 2



Scheme 3



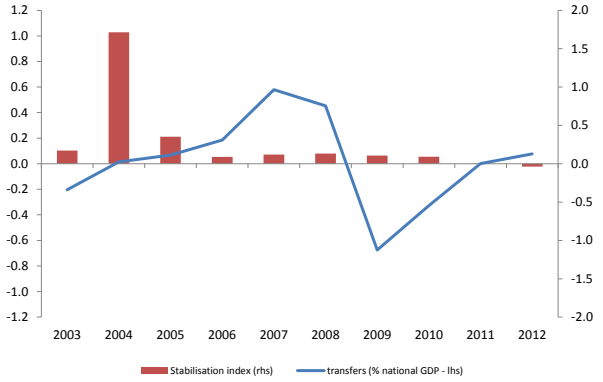
Scheme 4



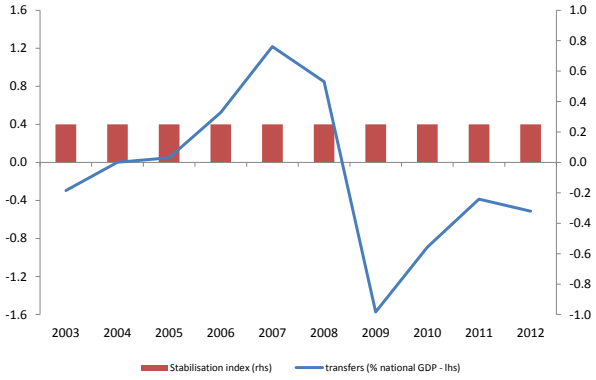
Source: AMECO, authors' calculations.

FINLAND

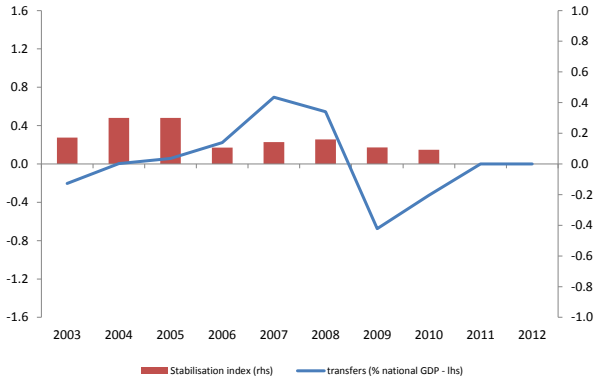
Scheme 1



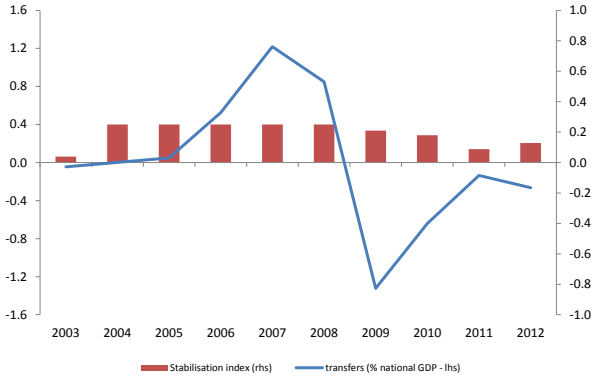
Scheme 2



Scheme 3



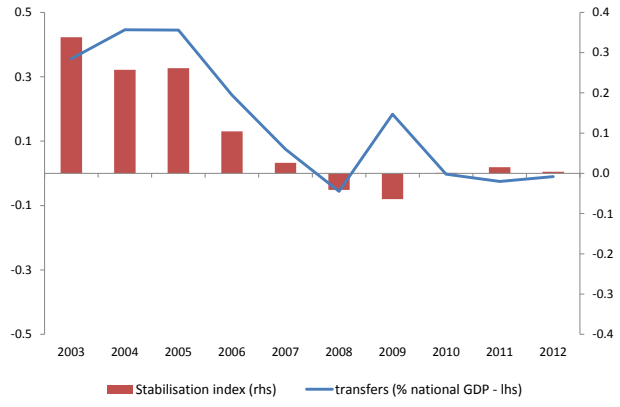
Scheme 4



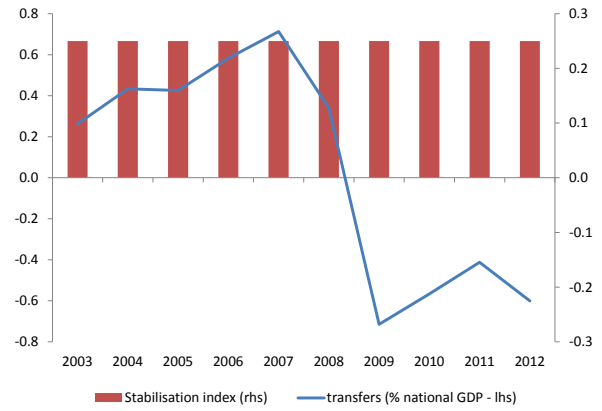
Source: AMECO, authors' calculations.

FRANCE

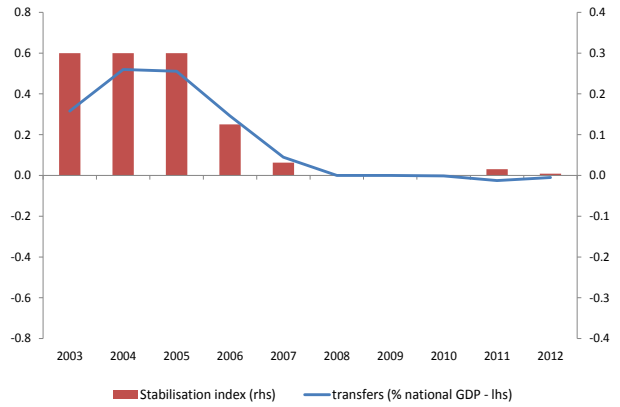
Scheme 1



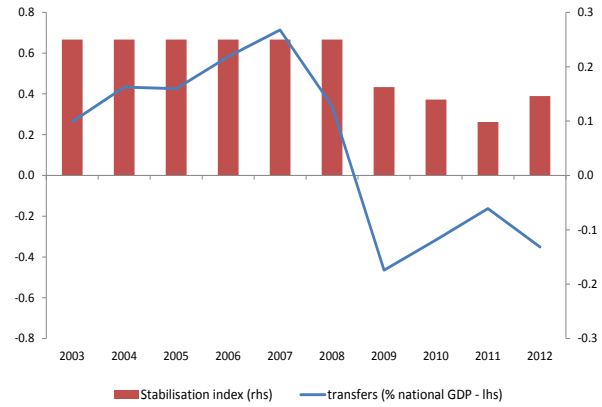
Scheme 2



Scheme 3



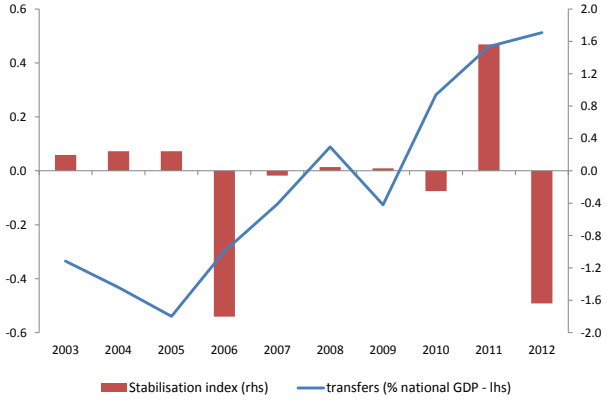
Scheme 4



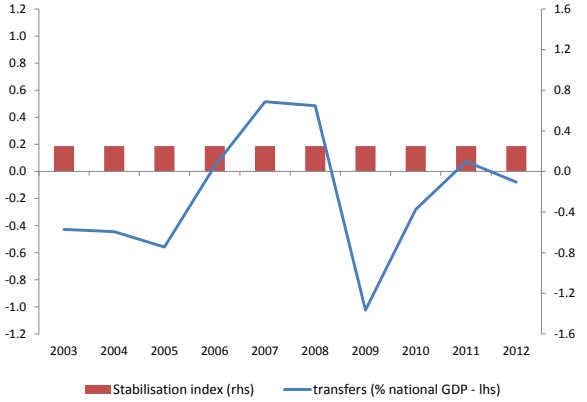
Source: AMECO, authors' calculations.

GERMANY

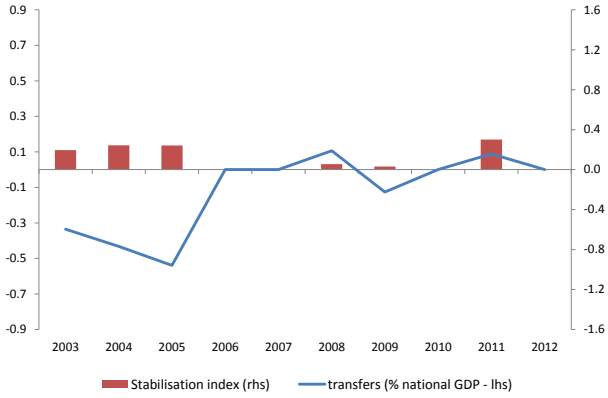
Scheme 1



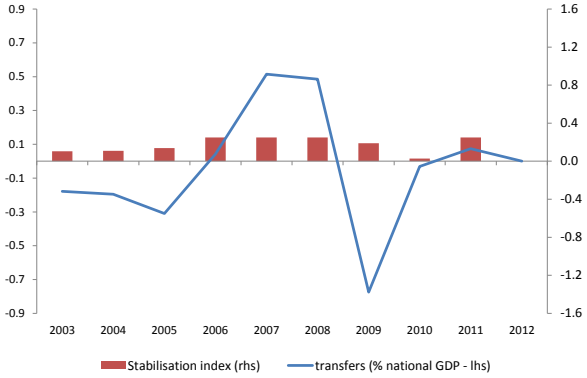
Scheme 2



Scheme 3



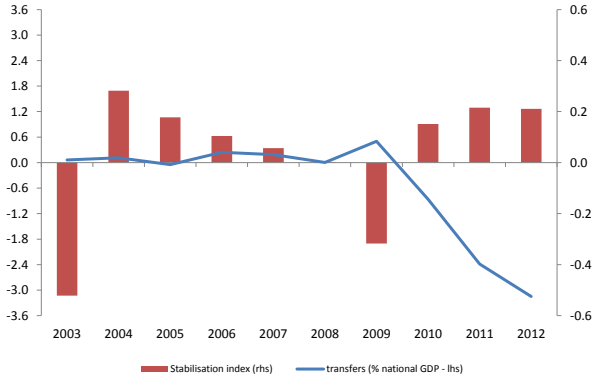
Scheme 4



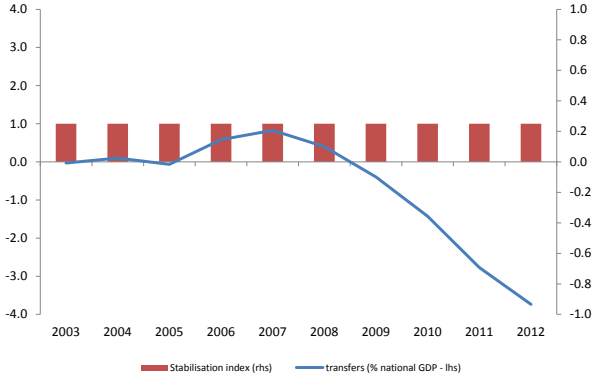
Source: AMECO, authors' calculations.

GREECE

Scheme 1

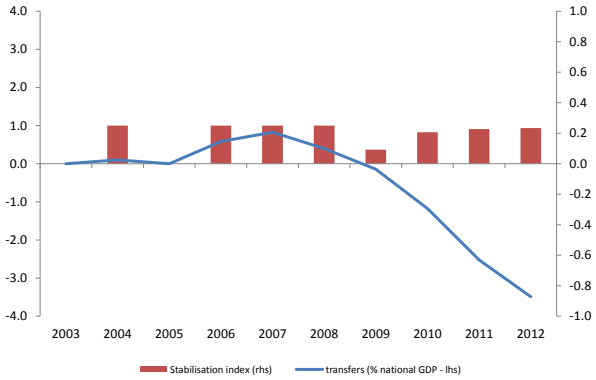


Scheme 2



Scheme 3

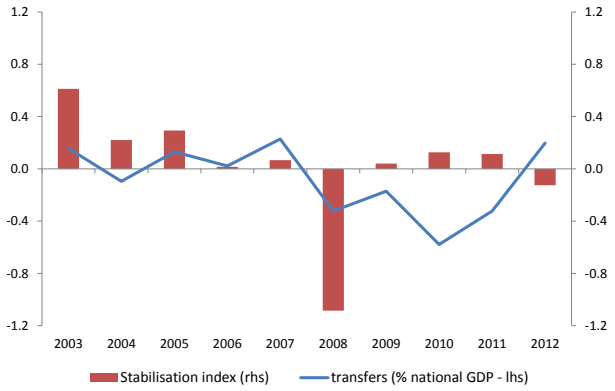
Scheme 4



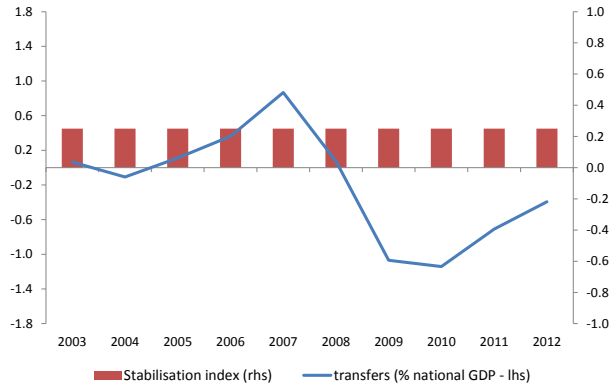
Source: AMECO, authors' calculations.

IRELAND

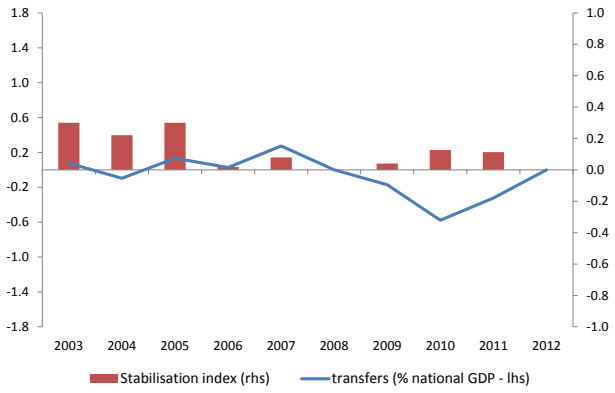
Scheme 1



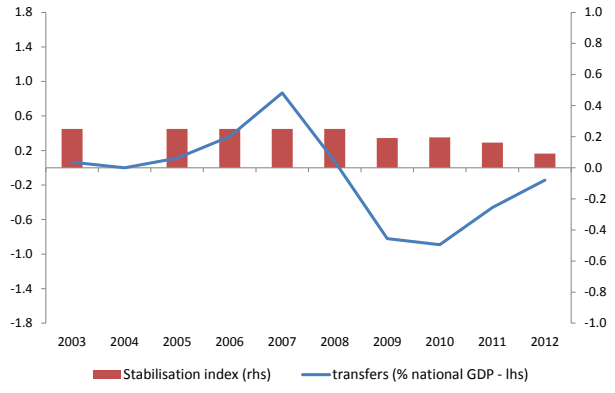
Scheme 2



Scheme 3



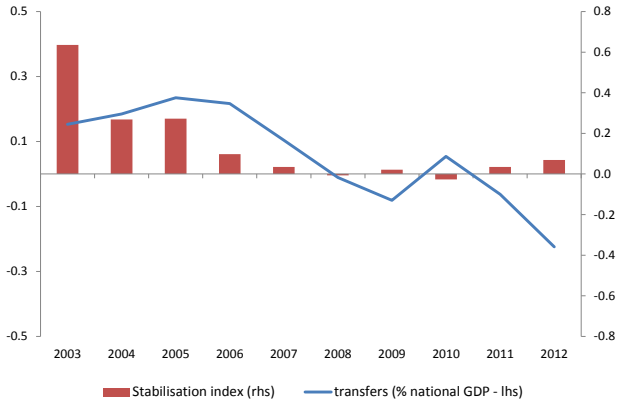
Scheme 4



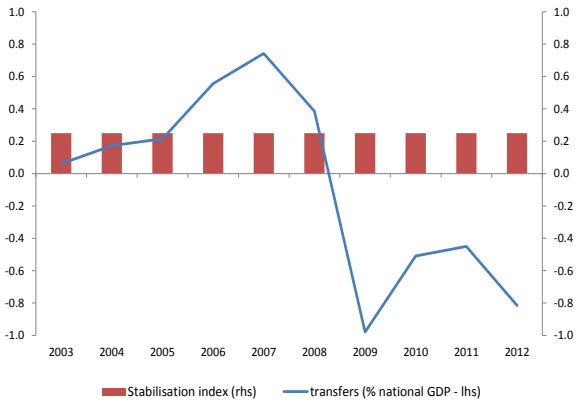
Source: AMECO, authors' calculations.

ITALY

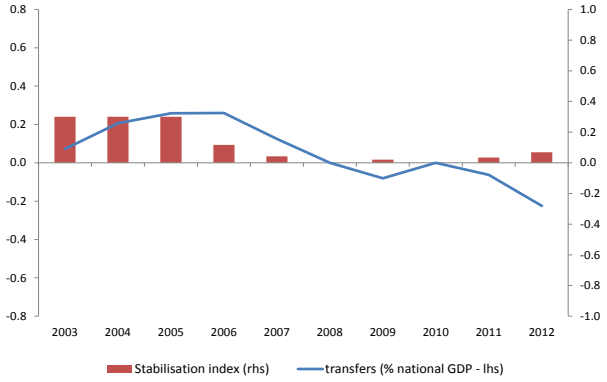
Scheme 1



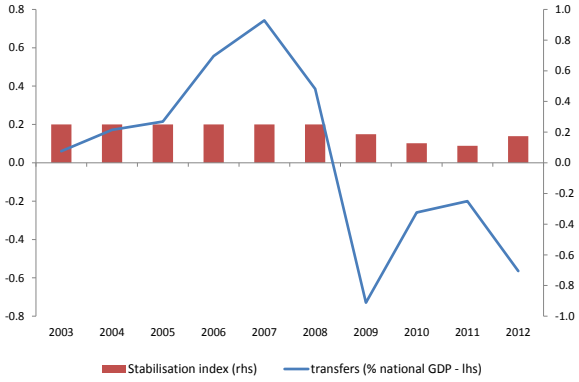
Scheme 2



Scheme 3



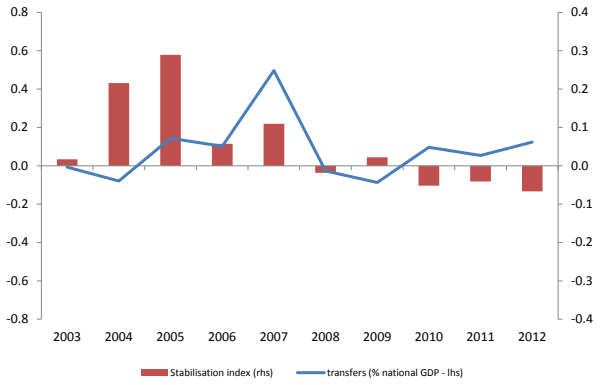
Scheme 4



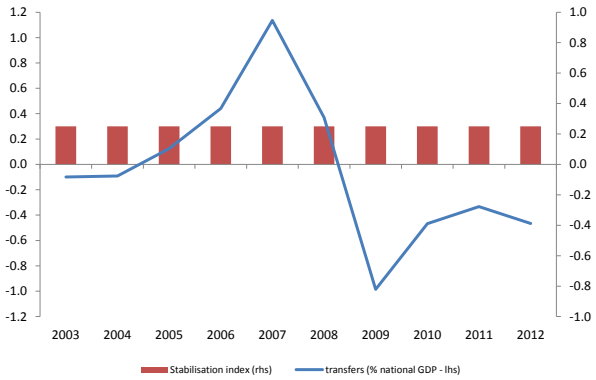
Source: AMECO, authors' calculations.

LUXEMBOURG

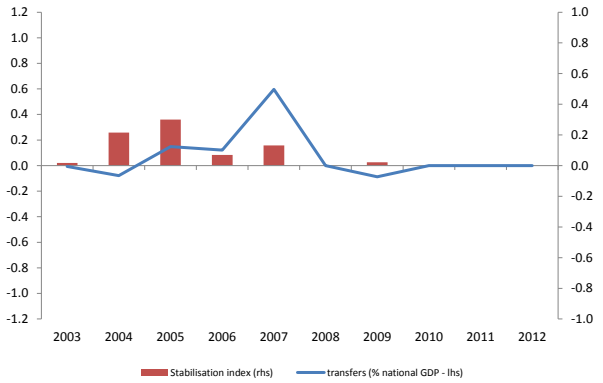
Scheme 1



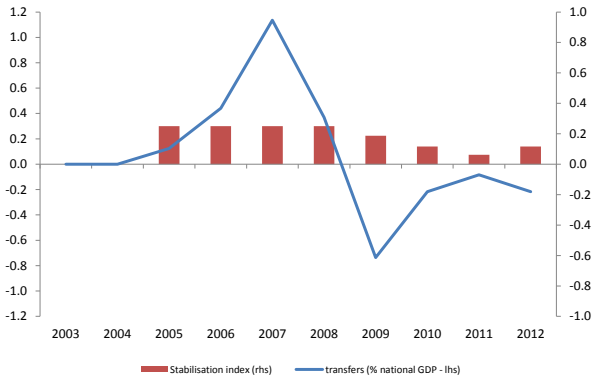
Scheme 2



Scheme 3



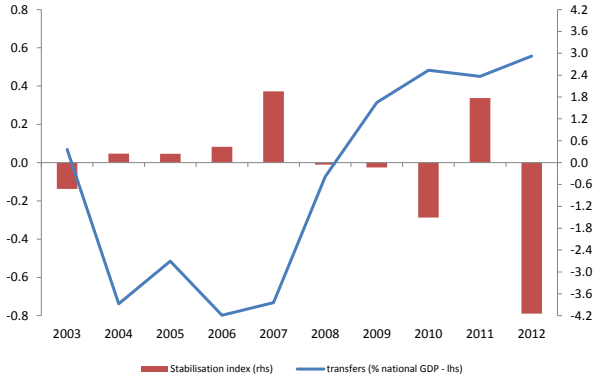
Scheme 4



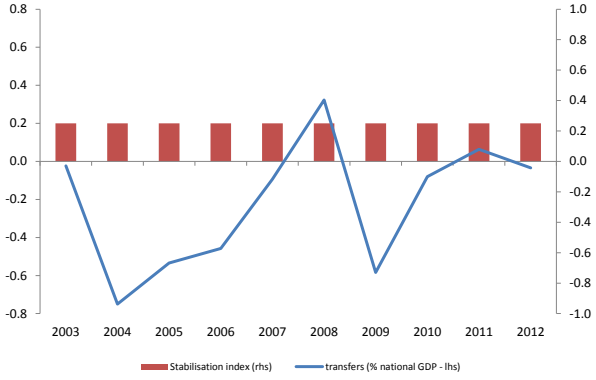
Source: AMECO, authors' calculations.

MALTA

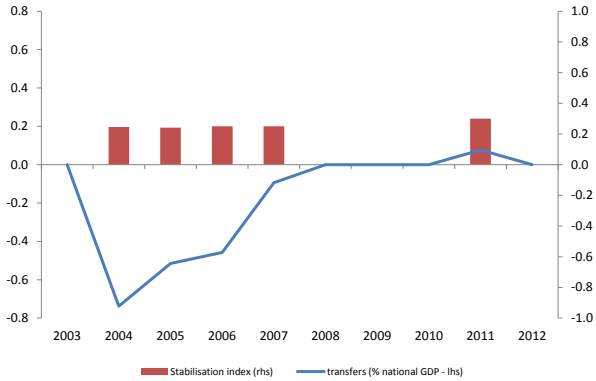
Scheme 1



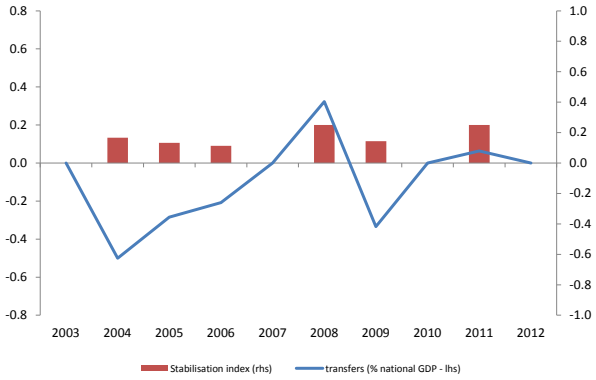
Scheme 2



Scheme 3



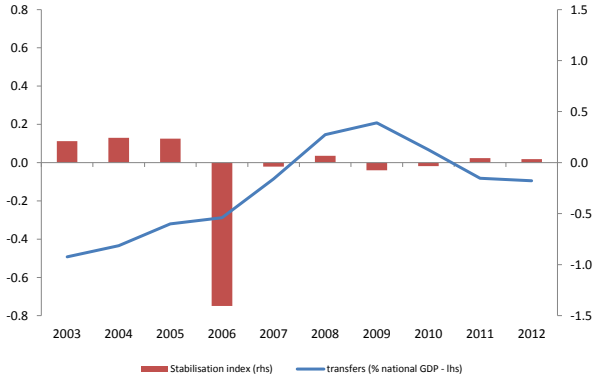
Scheme 4



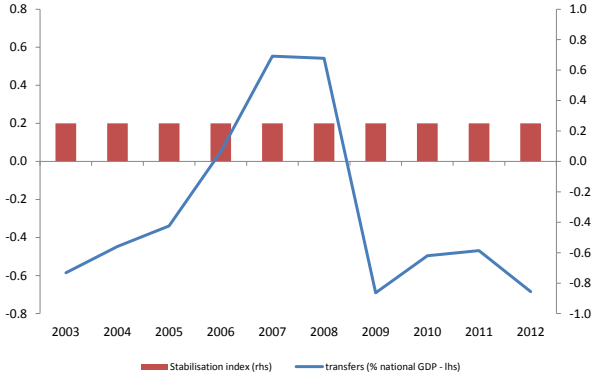
Source: AMECO, authors' calculations.

NETHERLANDS

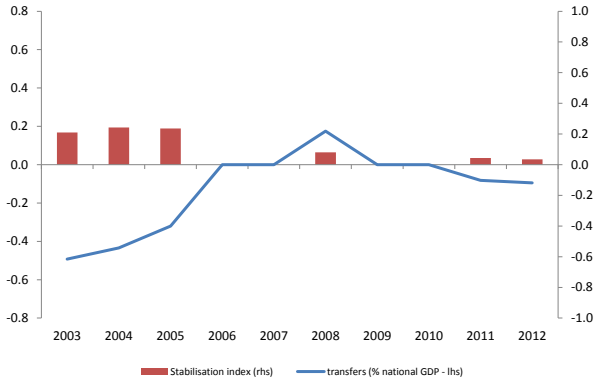
Scheme 1



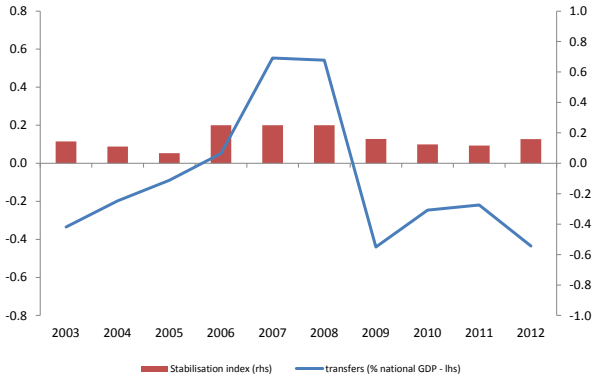
Scheme 2



Scheme 3



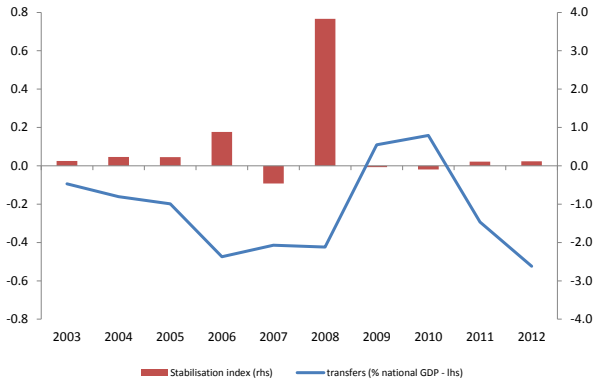
Scheme 4



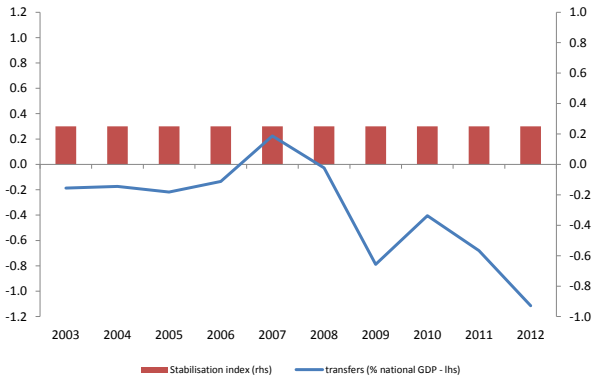
Source: AMECO, authors' calculations.

PORTUGAL

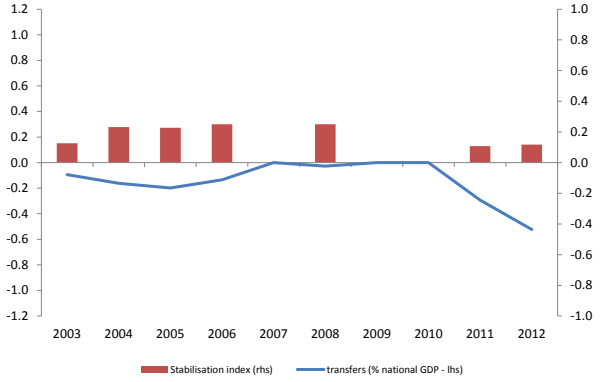
Scheme 1



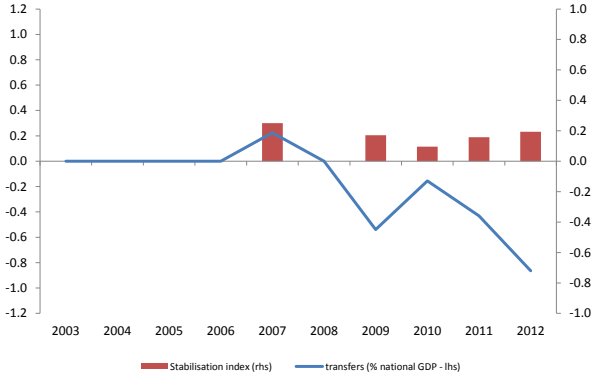
Scheme 2



Scheme 3



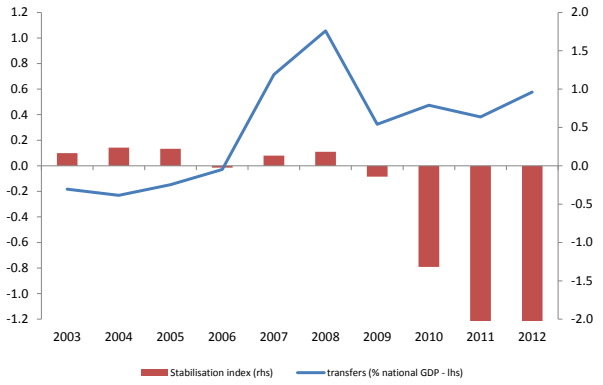
Scheme 4



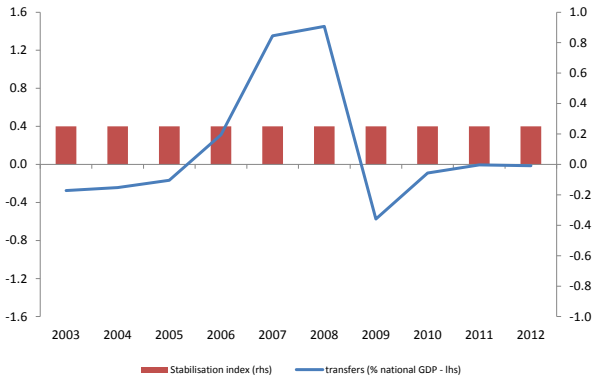
Source: AMECO, authors' calculations.

SLOVAKIA

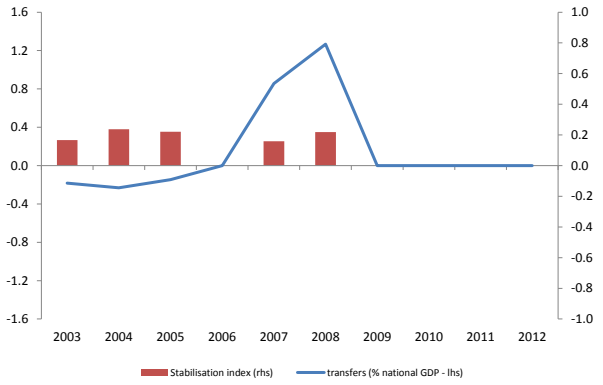
Scheme 1



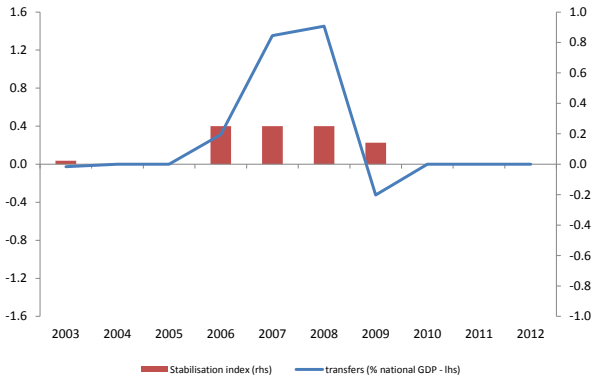
Scheme 2



Scheme 3



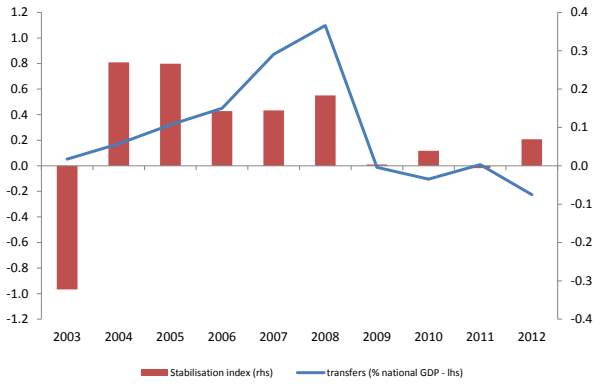
Scheme 4



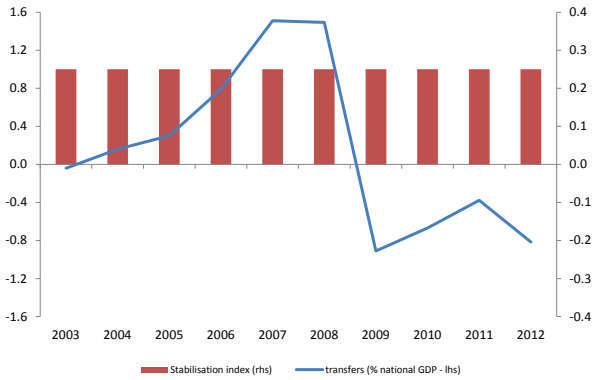
Source: AMECO, authors' calculations.

SLOVENIA

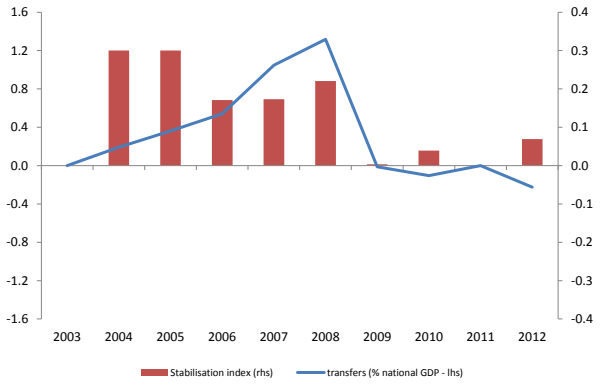
Scheme 1



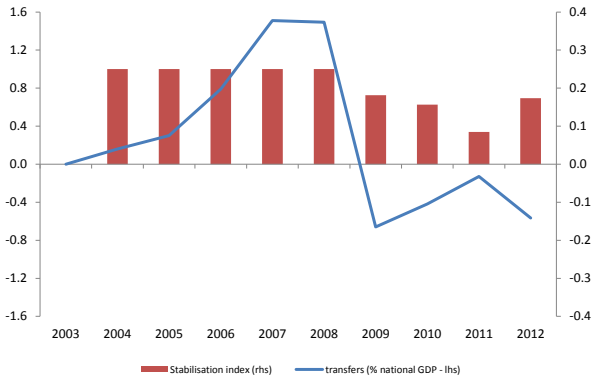
Scheme 2



Scheme 3



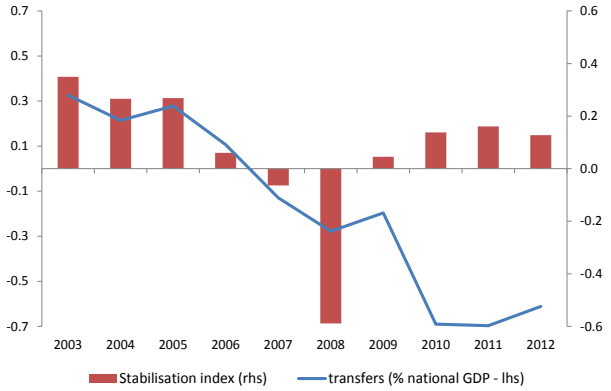
Scheme 4



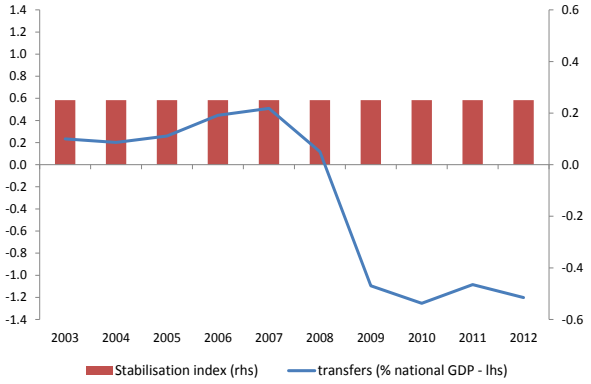
Source: AMECO, authors' calculations.

SPAIN

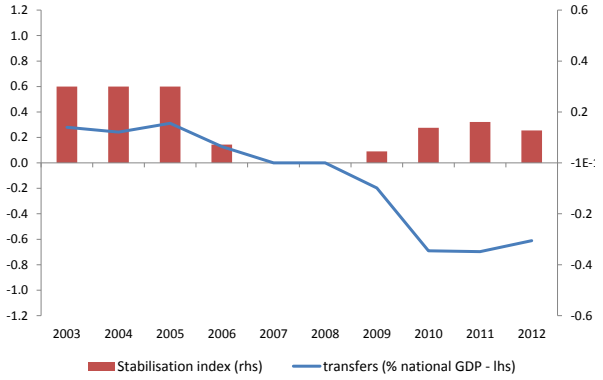
Scheme 1



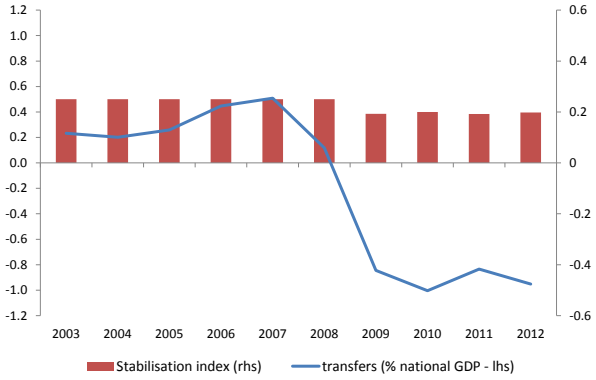
Scheme 2



Scheme 3



Scheme 4



Source: AMECO, authors' calculations.

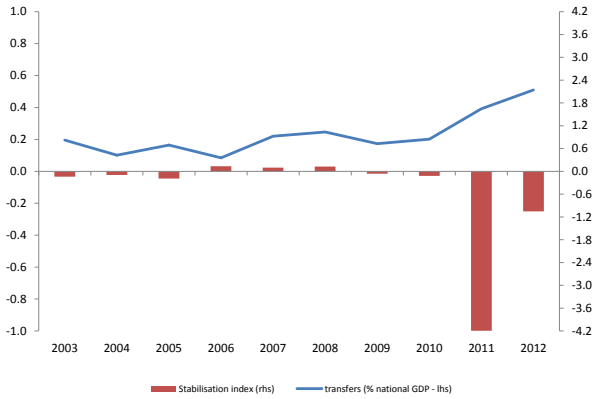
ANNEX 4

RESULTS BY COUNTRY OVER TIME

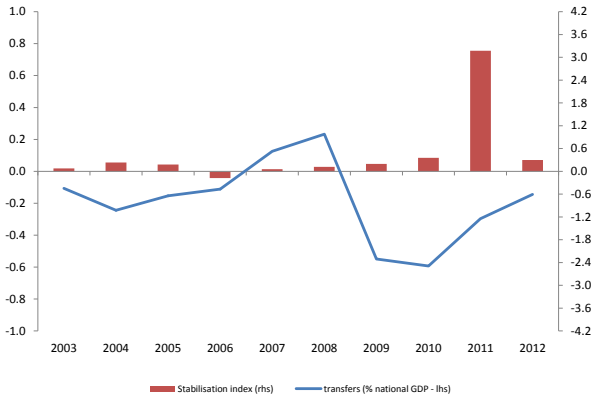
Simulations based on real time data

AUSTRIA

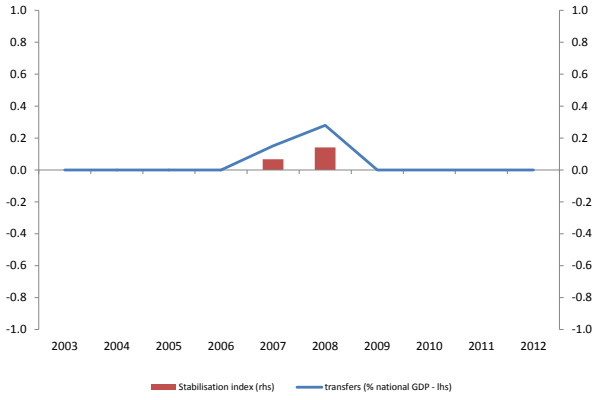
Scheme 1



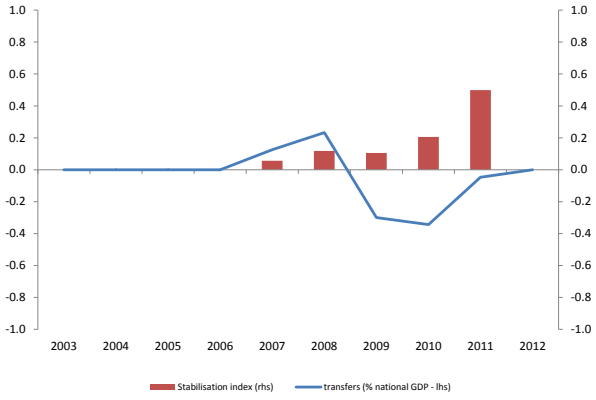
Scheme 2



Scheme 3



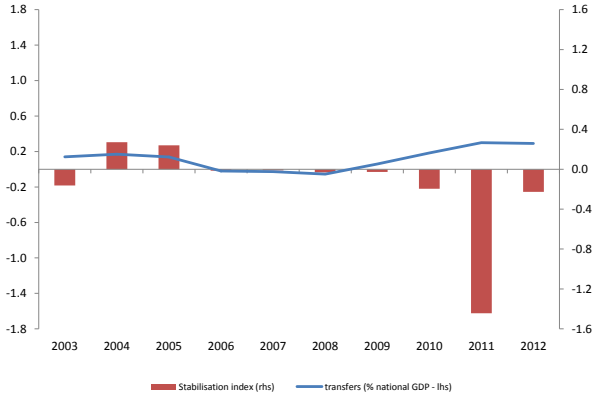
Scheme 4



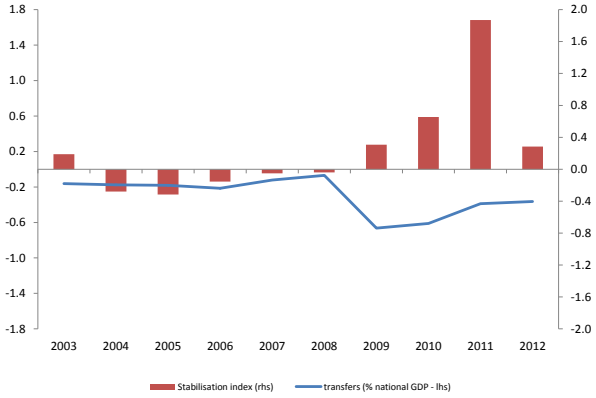
Source: AMECO, authors' calculations.

BELGIUM

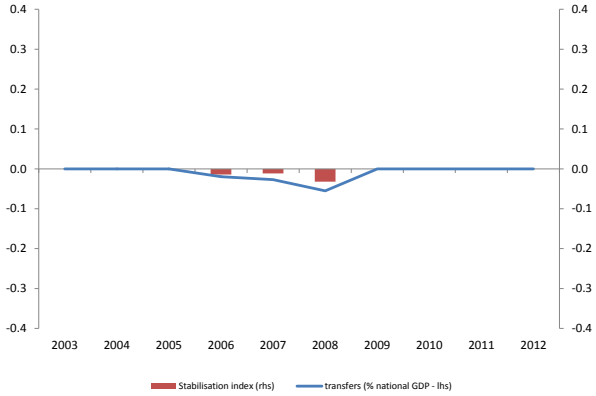
Scheme 1



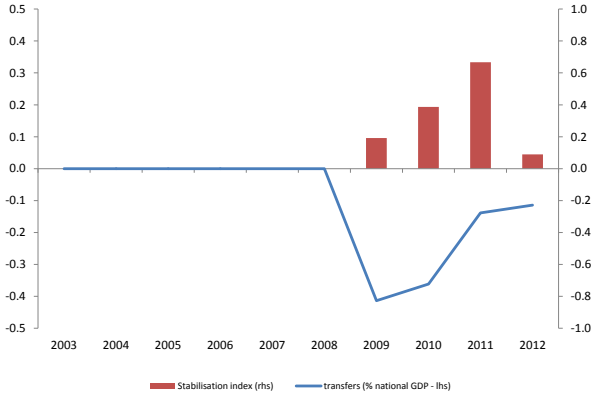
Scheme 2



Scheme 3



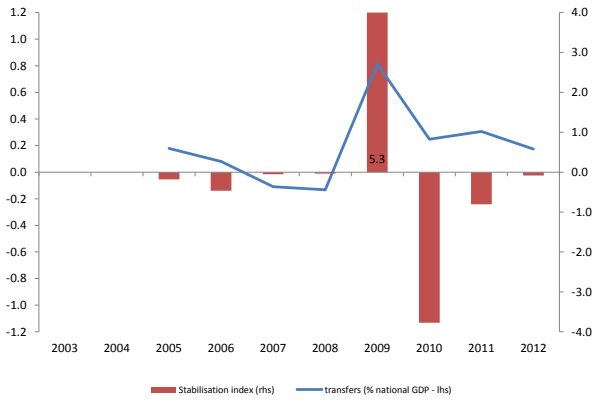
Scheme 4



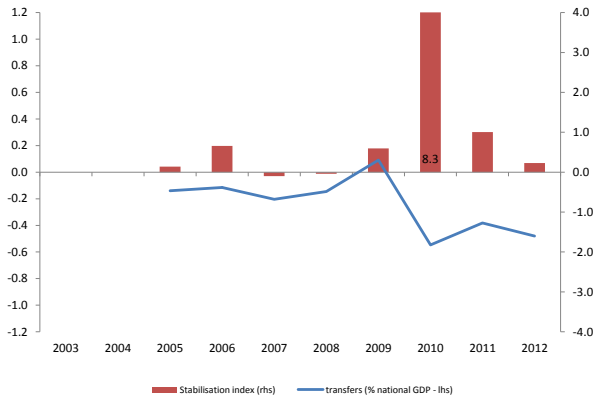
Source: AMECO, authors' calculations.

CYPRUS

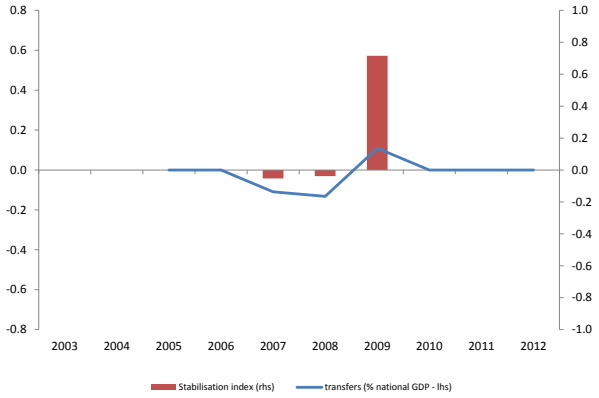
Scheme 1



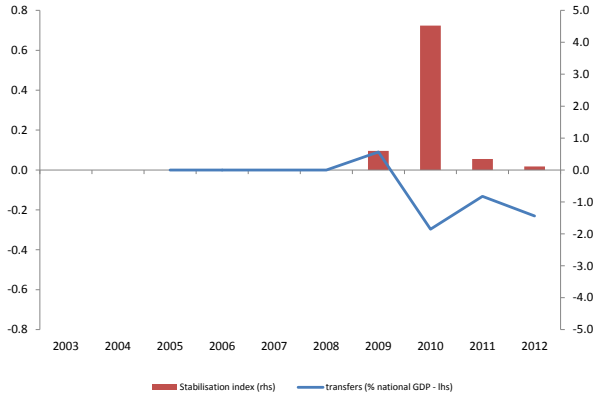
Scheme 2



Scheme 3



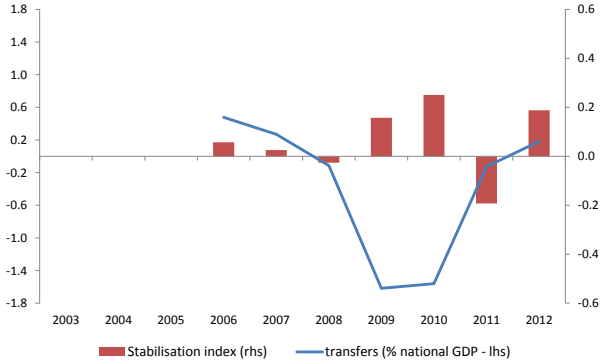
Scheme 4



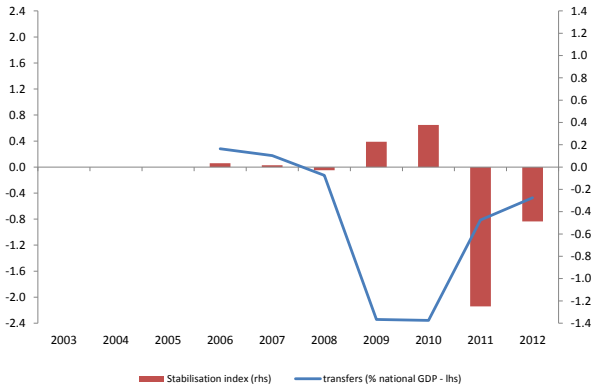
Source: AMECO, authors' calculations.

ESTONIA

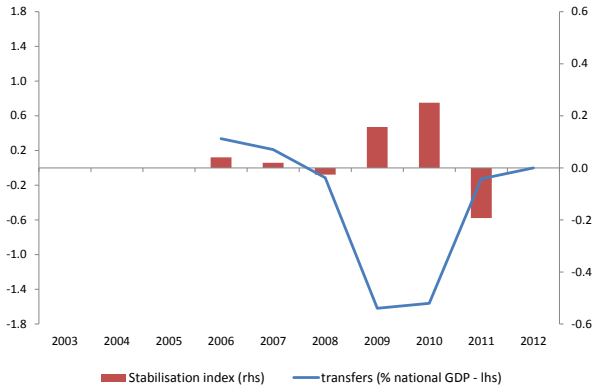
Scheme 1



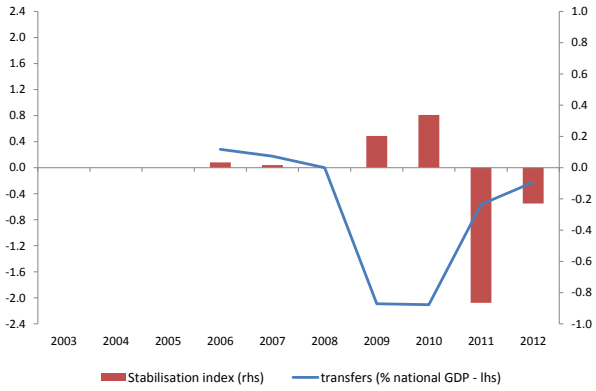
Scheme 2



Scheme 3



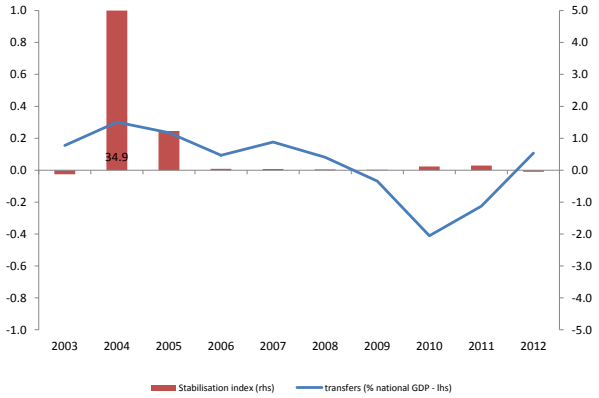
Scheme 4



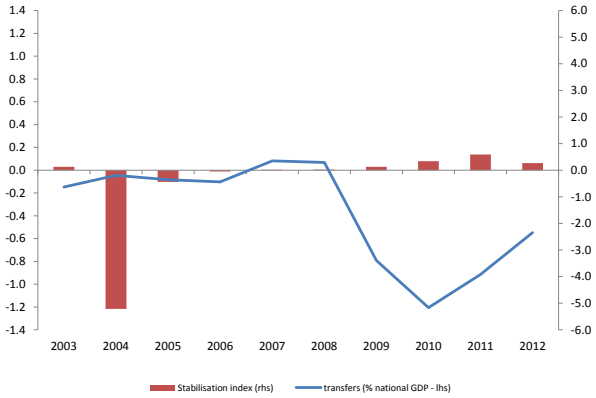
Source: AMECO, authors' calculations.

FINLAND

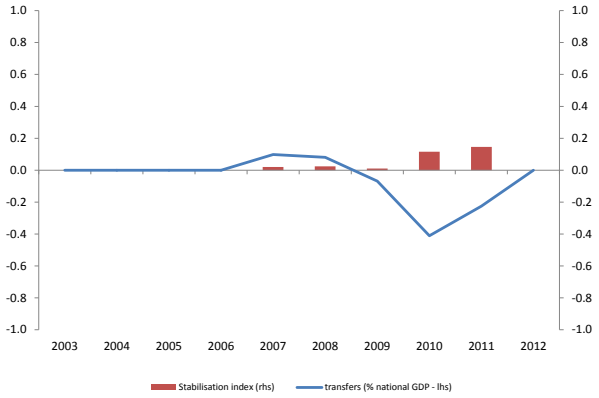
Scheme 1



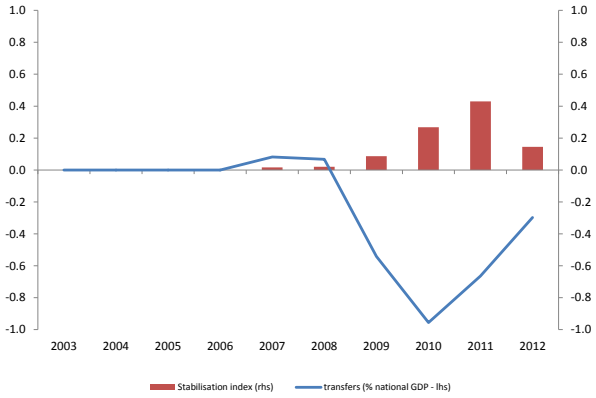
Scheme 2



Scheme 3



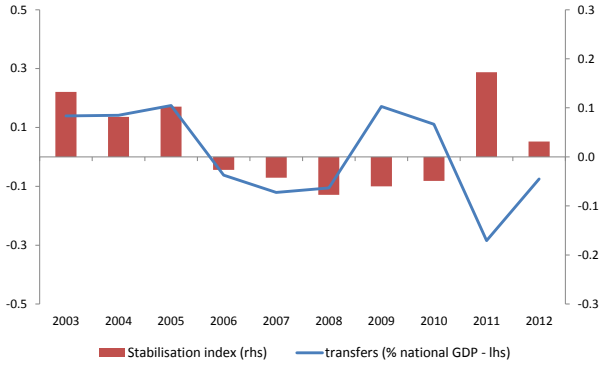
Scheme 4



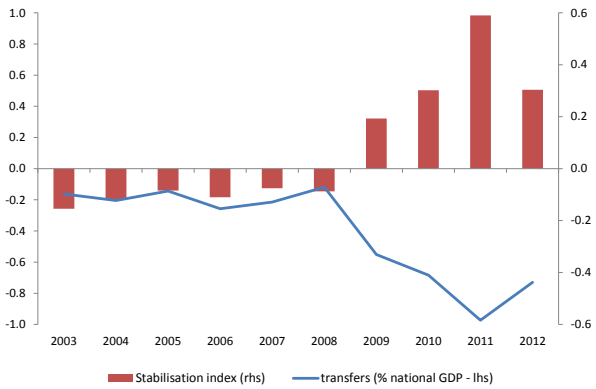
Source: AMECO, authors' calculations.

FRANCE

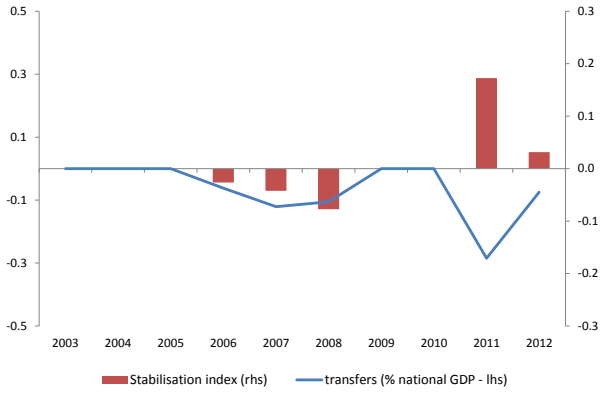
Scheme 1



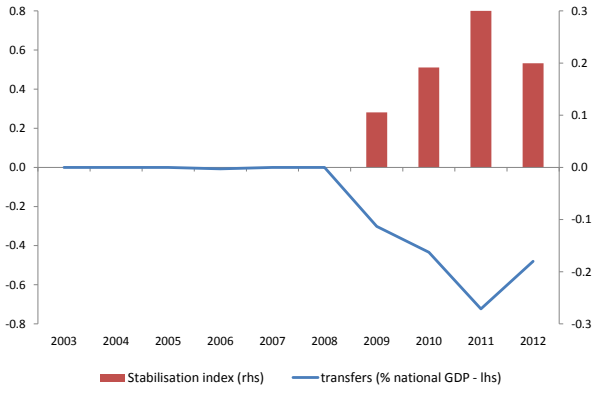
Scheme 2



Scheme 3



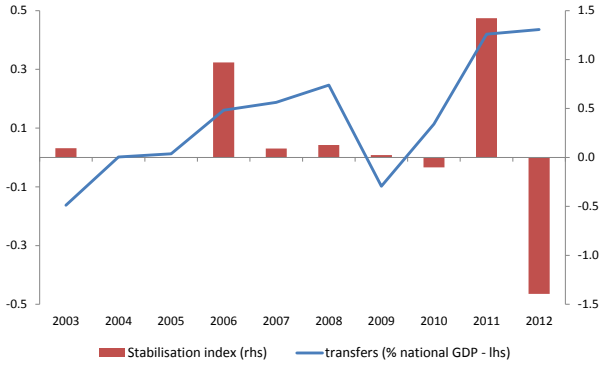
Scheme 4



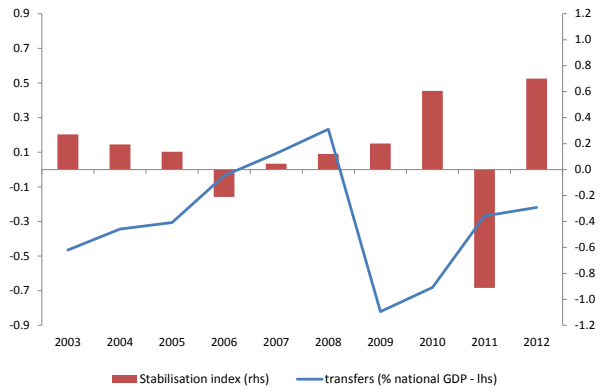
Source: AMECO, authors' calculations.

GERMANY

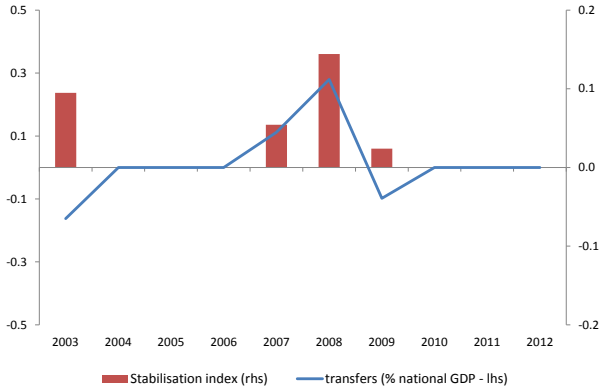
Scheme 1



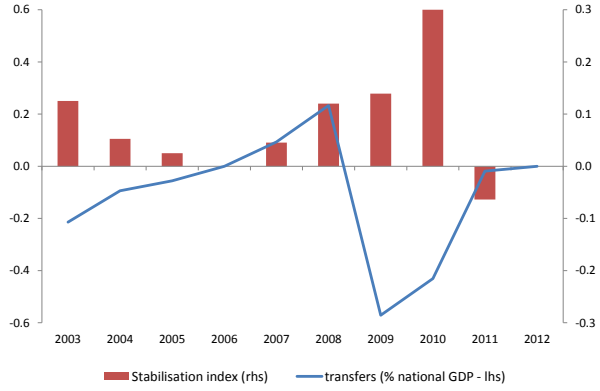
Scheme 2



Scheme 3



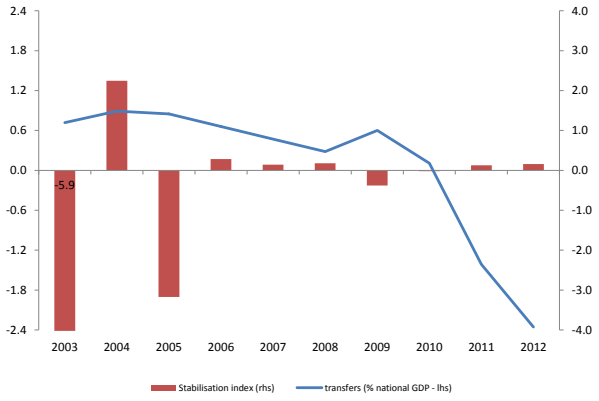
Scheme 4



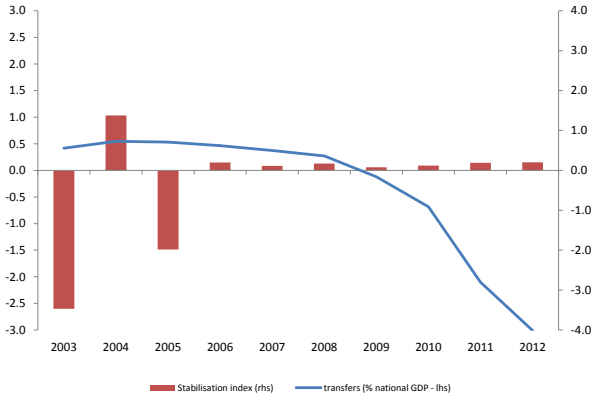
Source: AMECO, authors' calculations.

GREECE

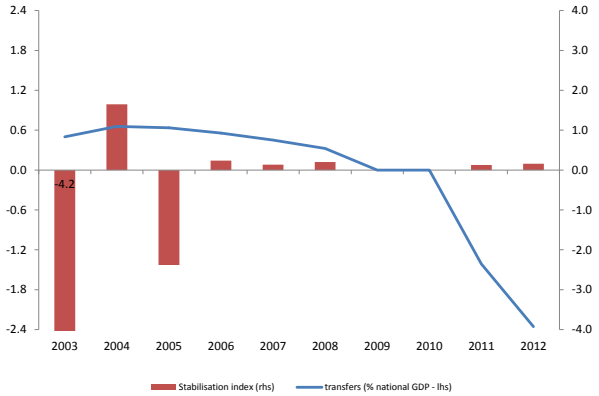
Scheme 1



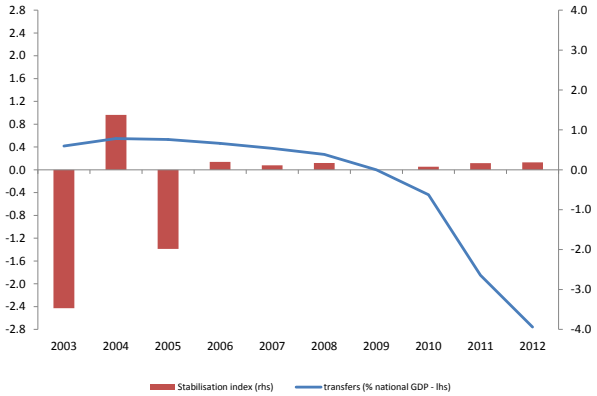
Scheme 2



Scheme 3



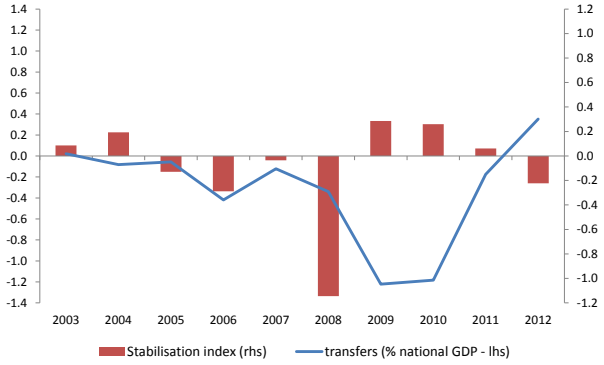
Scheme 4



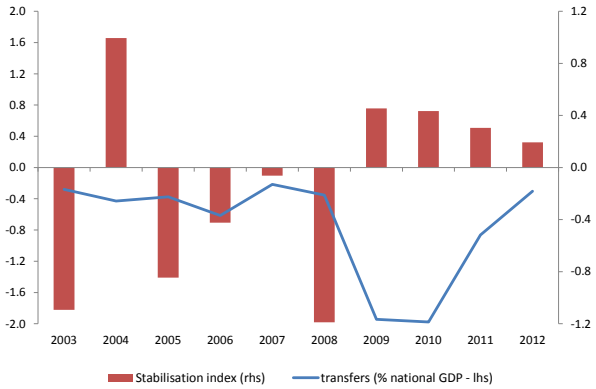
Source: AMECO, authors' calculations.

IRELAND

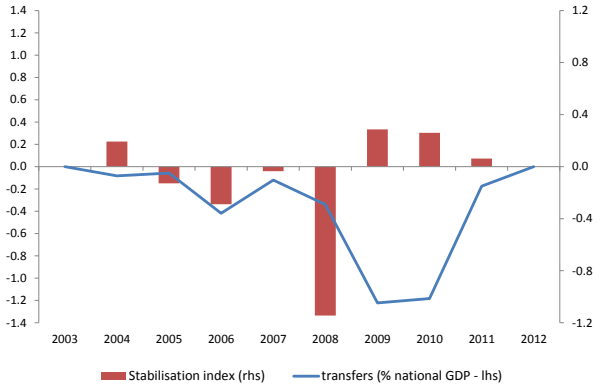
Scheme 1



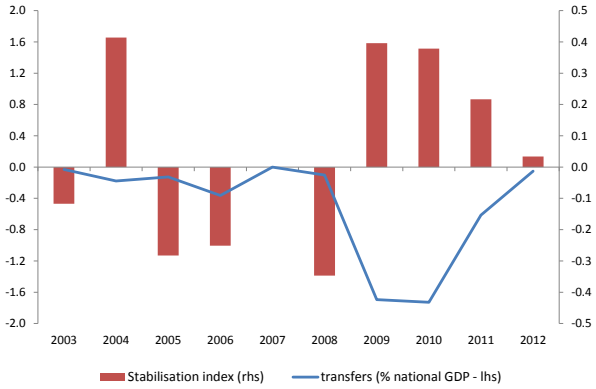
Scheme 2



Scheme 3



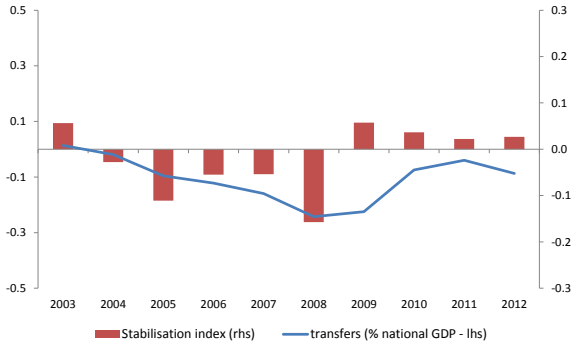
Scheme 4



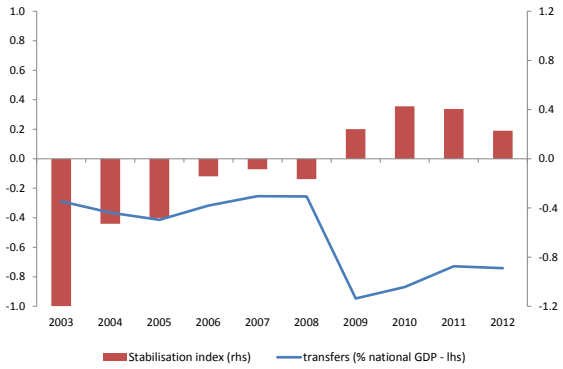
Source: AMECO, authors' calculations.

ITALY

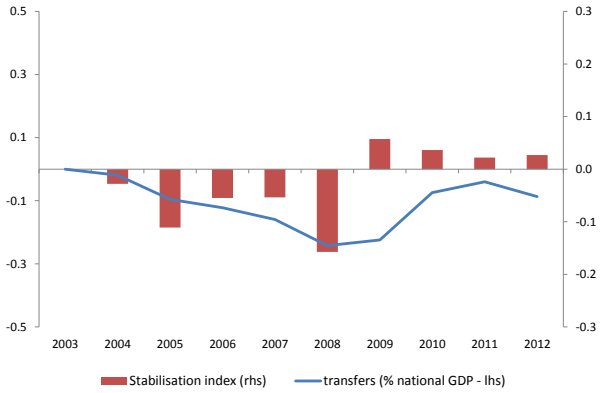
Scheme 1



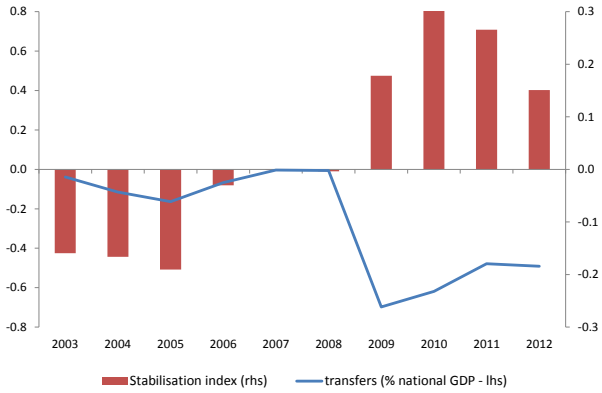
Scheme 2



Scheme 3



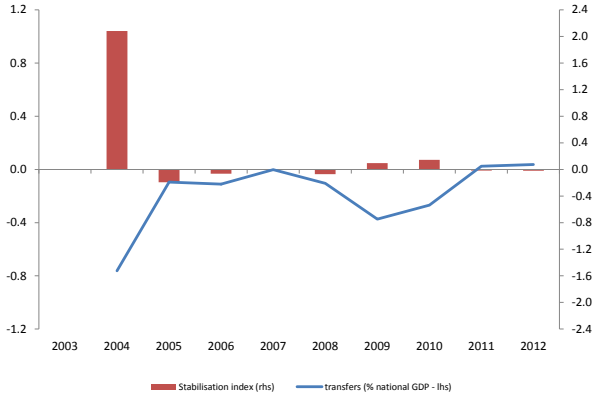
Scheme 4



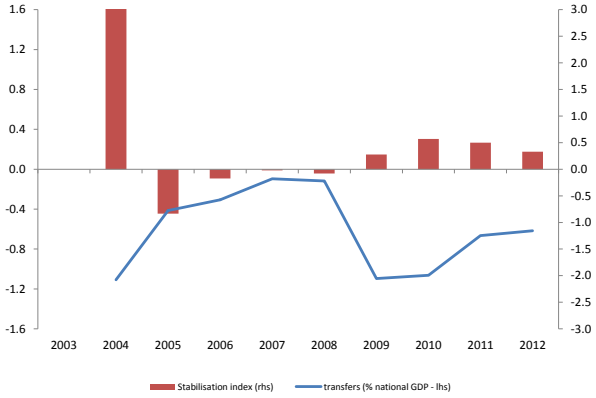
Source: AMECO, authors' calculations.

LUXEMBOURG

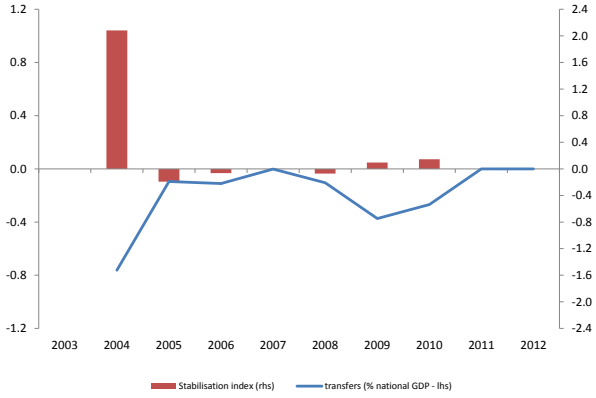
Scheme 1



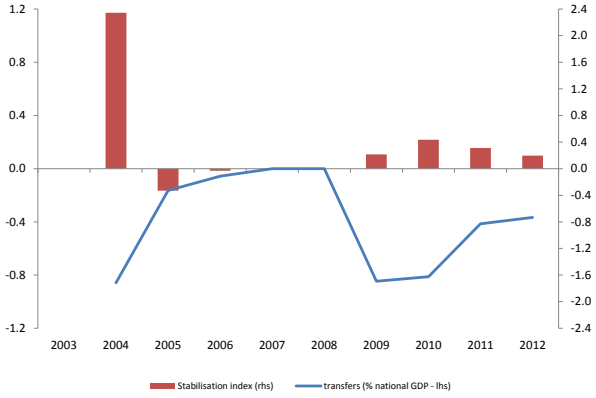
Scheme 2



Scheme 3



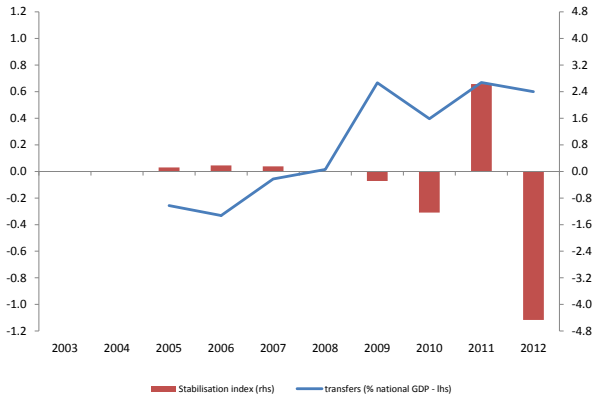
Scheme 4



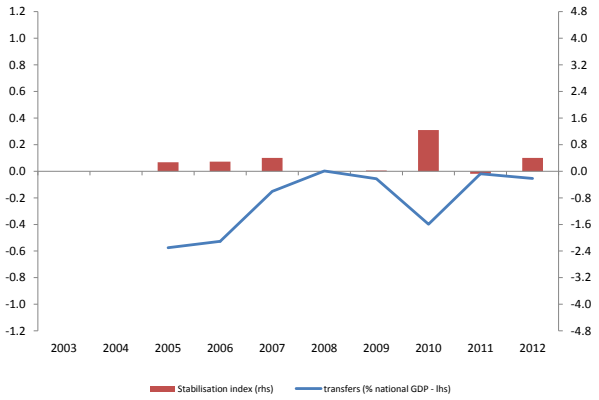
Source: AMECO, authors' calculations.

MALTA

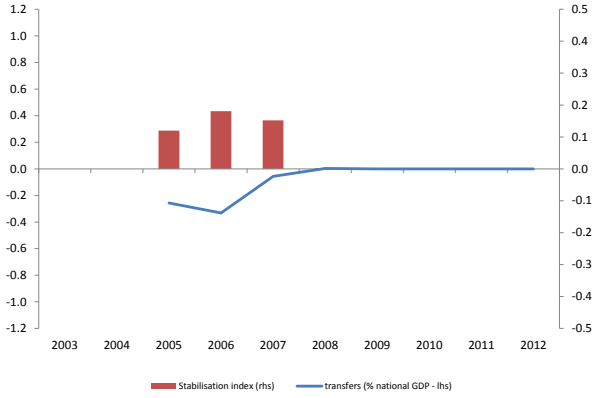
Scheme 1



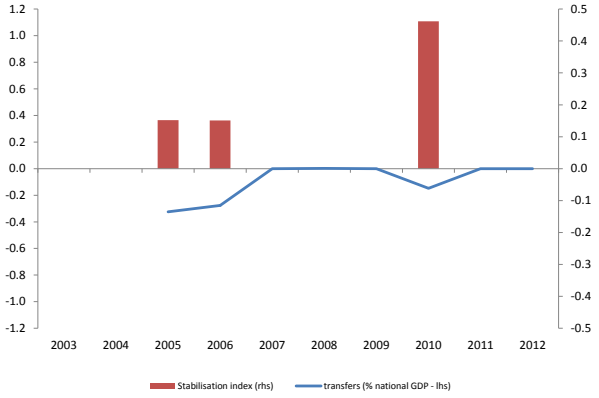
Scheme 2



Scheme 3



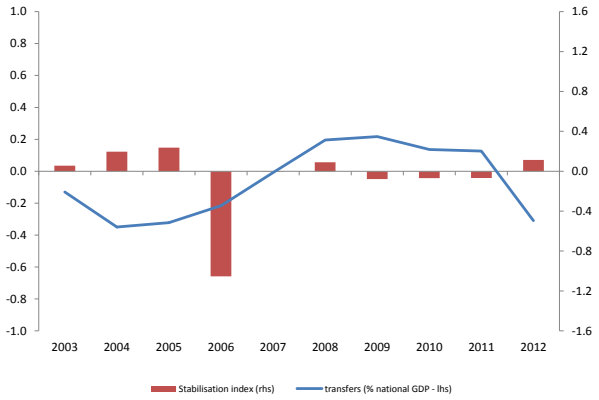
Scheme 4



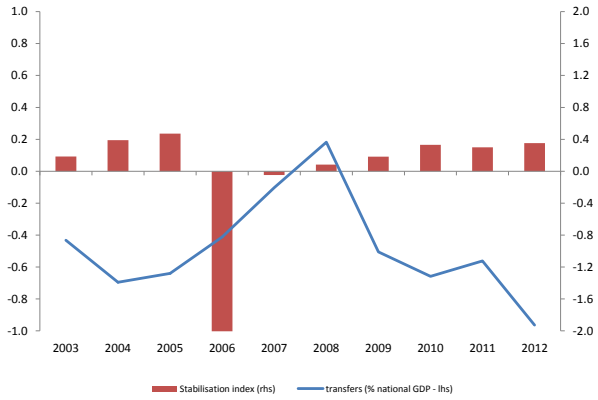
Source: AMECO, authors' calculations.

NETHERLANDS

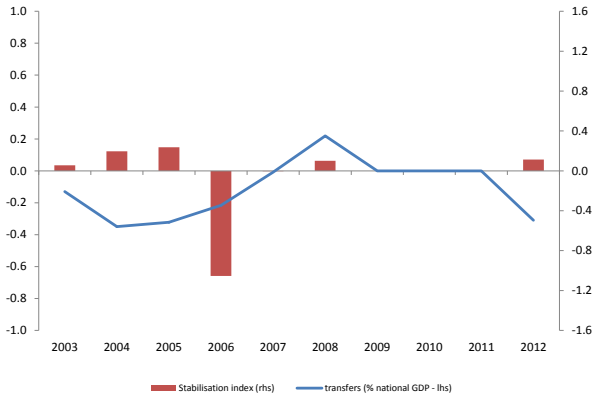
Scheme 1



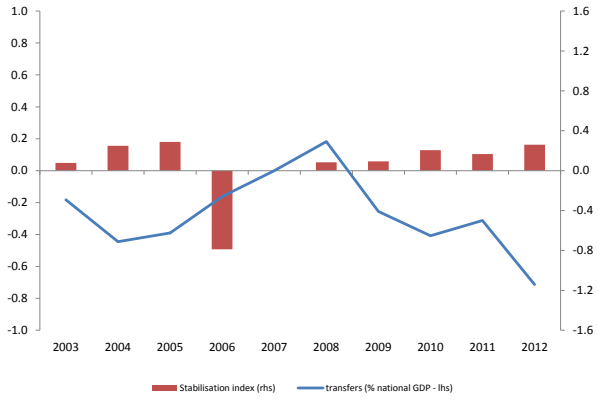
Scheme 2



Scheme 3



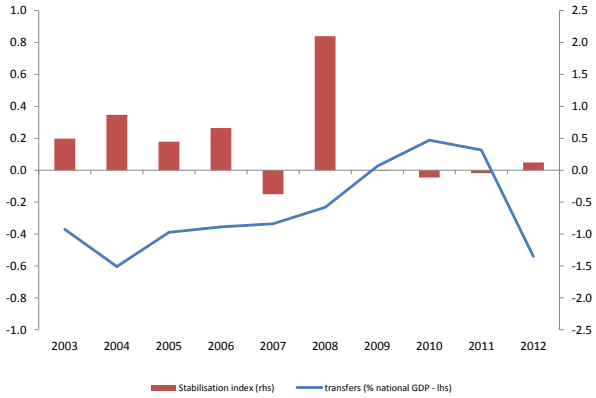
Scheme 4



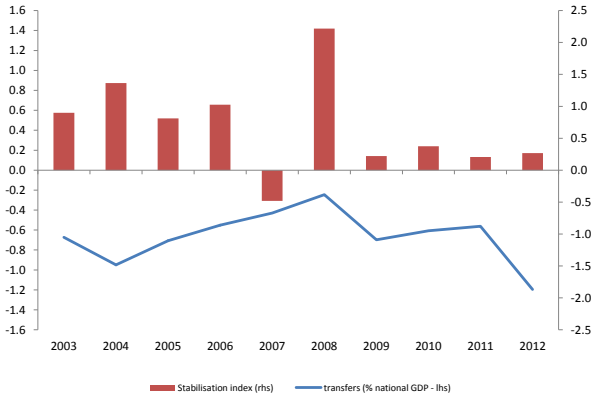
Source: AMECO, authors' calculations.

PORTUGAL

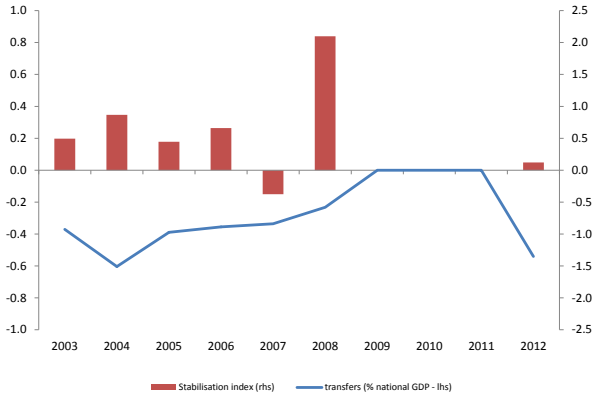
Scheme 1



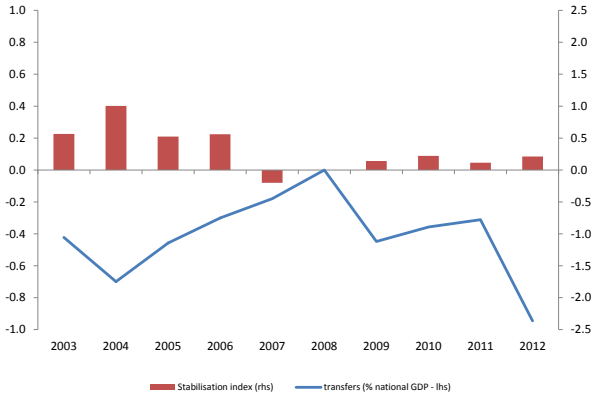
Scheme 2



Scheme 3



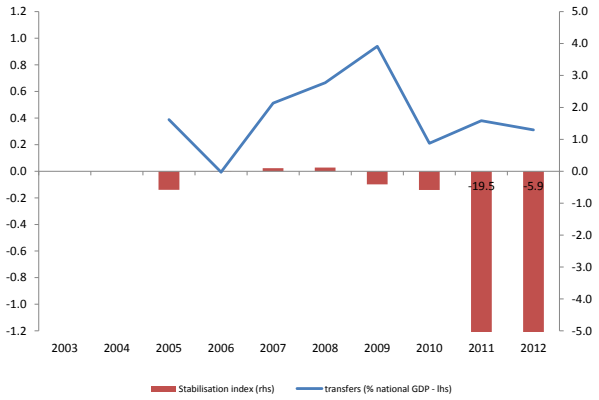
Scheme 4



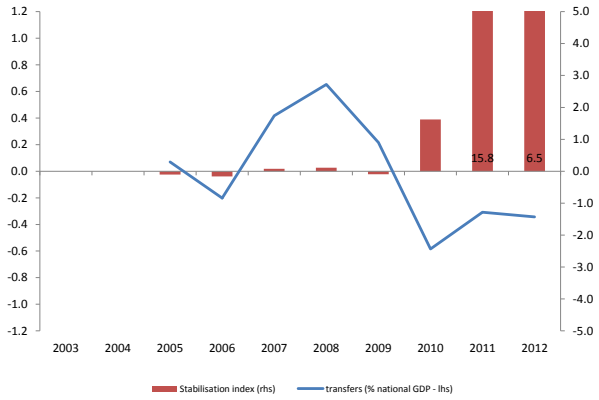
Source: AMECO, authors' calculations.

SLOVAKIA

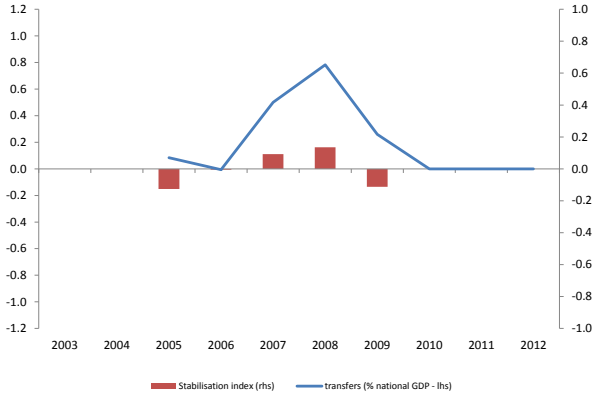
Scheme 1



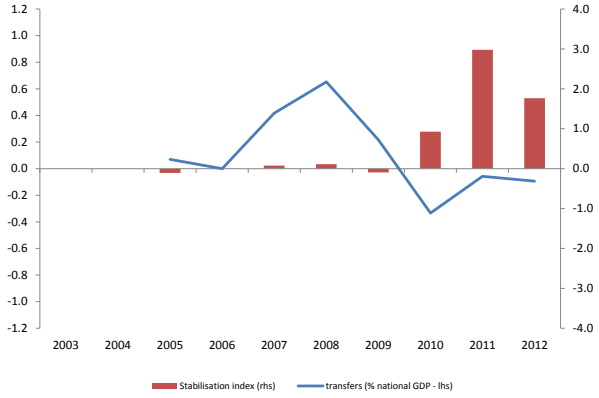
Scheme 2



Scheme 3



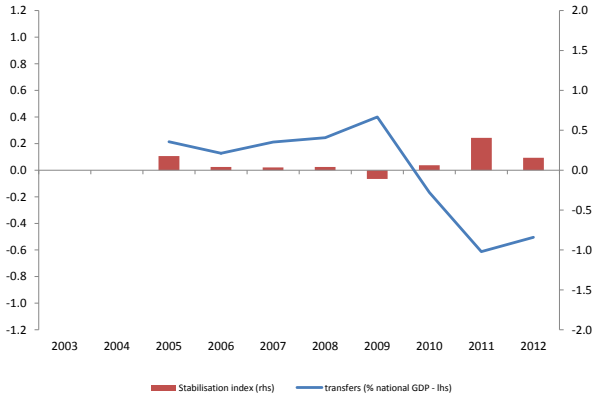
Scheme 4



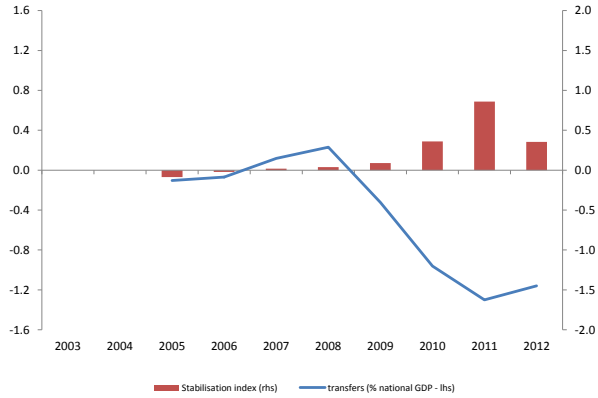
Source: AMECO, authors' calculations.

SLOVENIA

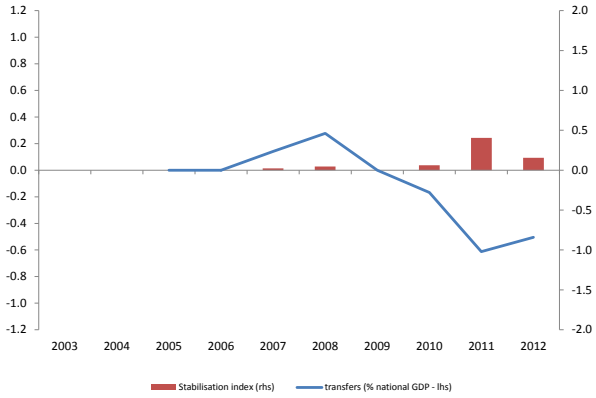
Scheme 1



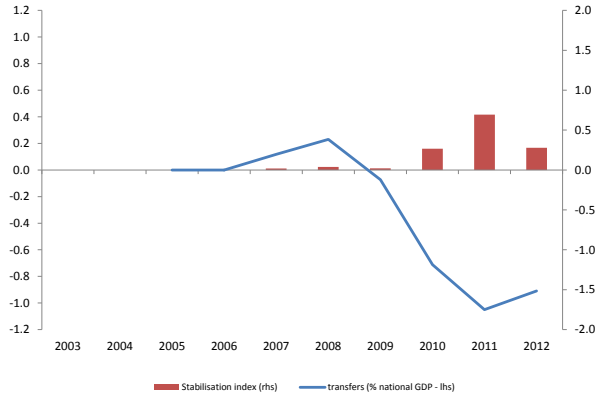
Scheme 2



Scheme 3



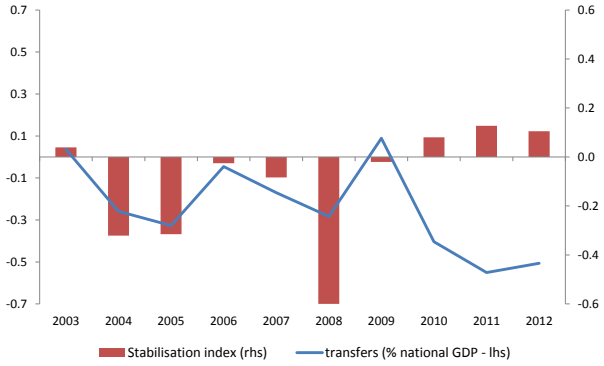
Scheme 4



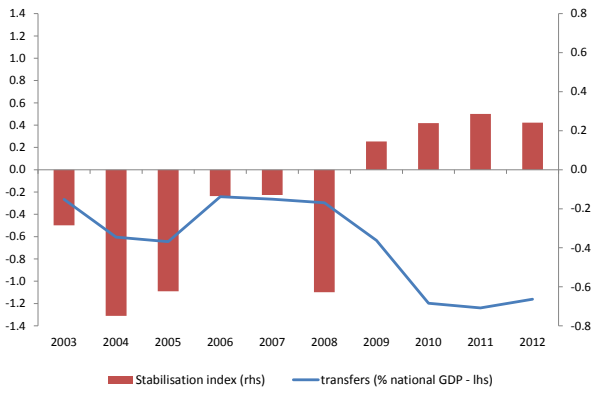
Source: AMECO, authors' calculations.

SPAIN

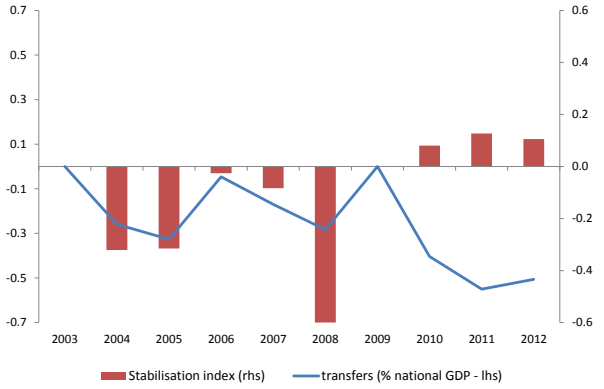
Scheme 1



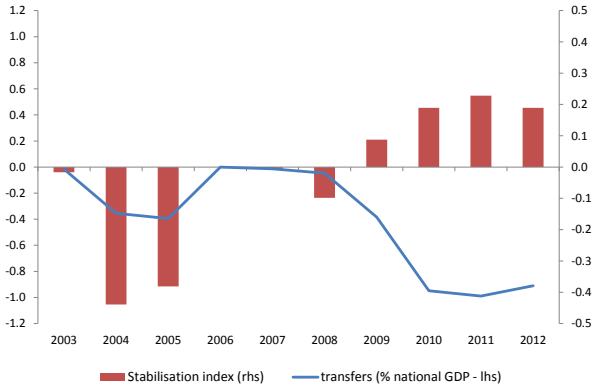
Scheme 2



Scheme 3



Scheme 4



Source: AMECO, authors' calculations.

ANNEX 5

ROBUSTNESS CHECK: RESULTS FOR 1991-2012

Table A1. Stabilisation property of the schemes
(designed on the basis of and measured with ex post data)
(average 1991-2012)

	Scheme 1 Asymmetric shocks	Scheme 2 Asymmetric and common shocks	Scheme 3 Mainly asymmetric shocks +	Scheme 4 Asymmetric and common shocks with thresholds
Stabilisation capacity (%)				
*Relative stabilisation capacity index (M^r)**	25%	25%	21%	22%
*Absolute stabilisation capacity index (M^a)**				
simple country average	9%	25%	12%	19%
weighted country average	7%	25%	10%	19%
Cumulated balance of the fund (% GDP)	0.0	0.0	0.2	2.0
Max annual flow in/out of the fund (% GDP)	0.2/0.2	0.6/0.9	0.2/0.2	0.6/0.6
Average frequency of fund activity	100%	100%	62%	73%

** see section 3.2 in the text for details*

+ pay-in parameter: 0.30; pay-out parameter: 0.25

Source: AMECO, authors' calculations.