Automatic stabilizers

Summary

The macroeconomic literature on automatic stabilization tends to focus on taxes and dismiss the relevance of government expenditure except for unemployment compensation. Our results go sharply contrary to this view. We engage in an empirical analysis of 21 OECD countries from 1982 to 2003 and find that age- and health-related social expenditure as well as incapacity and sick benefits all react to the cycle in a stabilizing manner. While possibly new in the macro literature, this conforms to many results in studies in labour economics. The policy implications are broad since much previous analysis of discretionary fiscal policy rests on official figures for automatic stabilization. There are also major implications for efforts to incorporate automatic fiscal policy in simulation models.

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Social spending and automatic stabilizers in the OECD

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1. INTRODUCTION

The macroeconomic literature on automatic stabilization tends to focus on taxes and to dismiss the relevance of any government spending besides unemployment compensation. In this study, we test this fundamental view. We examine the cyclical responsiveness of government expenditure on health, retirement benefits, incapacity benefits and sickness pay as well as unemployment compensation and we do so by pulling together data from the OECD Social Expenditure database and from the OECD Economic Outlook database. (Melitz, 2006, relied exclusively on the OECD national income database in earlier related work.) The results go sharply contrary to the idea that unemployment compensation is the sole element of social expenditure that responds to the cycle. We find that expenditures on health, retirement, incapacity and sick pay

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also react prominently to the cycle. Furthermore, these spending categories do so in a stabilizing manner. Thus they enhance total automatic stabilization. The policy implications of this finding are broad since much previous analysis of discretionary fiscal policy rests on official figures for automatic stabilization. If those figures ignore some sources of automatic stabilization, automatic stabilization is higher and the results of those studies concerning discretionary fiscal policy fall into question. In addition, the danger that members of the European Union would violate the 3% limit on deficit spending of the Stability and Growth Pact during recessions is greater. There are also implications for efforts to incorporate automatic fiscal policy in simulation models.

A focus on taxes and unemployment compensation simply pervades the current textbook literature in macroeconomics in discussing automatic stabilization. There may be an occasional vague reference to counter-cyclical income support coming from other government spending besides unemployment compensation. However, with the outstanding exception of Hall and Taylor (1991, ch. 13, which subsequently became Hall and Pappell, 2005, ch. 13), unemployment compensation is the only spending item that receives mention. The textbooks are representative. In defending the exclusive consideration of unemployment compensation as a counter-cyclical spending category (except for small items like food stamps), Auerbach and Feenberg (2000), for example, say: 'The logic is straightforward: discretionary spending is, after all, discretionary, not automatic, and interest payments and the most important mandatory spending programs, Social Security and Medicare, are based on longer-term factors' (p. 52). Likewise, Galí and Perotti (2003) maintain: 'Among primary expenditures [apart from interest payments], only unemployment benefits probably have a non-negligible built-in response to output fluctuations.' Perotti (2002) is more explicit: 'Items like old age, disability and incapacity pensions – the bulk of transfers to households – do not have built-in mechanisms that make them respond automatically to changes in employment or output contemporaneously. Unemployment compensation obviously does.'

1.1. Preliminaries

The idea in these quotes that other items of social spending besides unemployment compensation can be simply dismissed in analysing automatic stabilization because they lack adequate theoretical foundation will not stand up to examination. The literature on labour economics is replete with theoretical arguments for systematic influences of the cycle on retirement benefits, invalidity pay and sickness pay. As regards invalidity pay and sickness pay, the hypotheses in labour economics are contradictory but that does not call for a draw. We know of no study of the cyclical response of social spending on health care. But there is an active literature on the impact of the cycle on health (not health care), not in labour economics but in the field of public health, and this literature finds that health is highly countercyclical – not only in the US, but also in a number of European countries, and not only recently, but going back to the first half of the twentieth century (see, for example, Tapia Granados, 2005a).

The reasons for entertaining the possibility of automatic cyclical responses of retirement benefits, invalidity pay, paid sick leave and social health spending are important to indicate at the outset. In the case of retirement benefits, there are strong forces that act to lower the average age of retirement in recessions, thereby causing the numbers of retirees to exceed the long-term trend, and to raise the average age of retirement in expansions, thereby causing the number of retirees to fall below trend. A counter-cyclical movement in pension expenditure can easily result even if the same people who retire in recessions do not necessarily return to work in expansions. Supporting evidence abounds. Darby, Hart and Vecchi (2001) report a significant impact of the cycle on labour participation rates for both sexes, especially in the over 54 age group in France, Japan, Sweden and the US. Blanchard and Diamond (1990) similarly show that following a negative output shock, the highest consequent movement of workers from employment to non-employment is concentrated among teenagers and people over 65 in the US. Rebick (1994) shows that new recipients of retirement benefits rise during recessions and fall during expansions in Sweden and Japan. Of course, since retirement decisions are long term, labour participation decisions alone may not adequately explain the observed countercyclical behaviour of pension payments (see Mitchell and Fields, 1984 and Haveman and Wolfe, 1984). However, demand-side factors act to the same effect. Unemployment is a major pathway to retirement in many countries, including Sweden, Belgium, France, Germany and Japan, which would indicate that involuntary loss of employment in recessions contributes to retirement. Coile and Levine (2006) (who cite studies for each of the preceding countries) show that downturns increase retirement decisions in the US. Hutchens (1999) has also recently pointed out that firms have strong incentives to encourage early retirement and to lay off older workers during recessions in many Western countries on the basis of the structure of payroll taxes, contributions to health insurance, private pension plans and social security systems. Since Hutchens' writing, Hakola and Uusitalo (2005) have confirmed the importance of firm behaviour in contributing to the counter-cyclical movement of retirements in Finland. All of these results accord with our cross-country findings.[1]

On the connected questions of paid sick leave and incapacity related benefits, the labour literature is divided about the expected cyclical response. There is a section that advances the theoretical argument, owing largely to Shapiro and Stiglitz (1984), that when times are bad, shirking is dangerous. Vulnerable workers – those on

[1] As an interesting qualification, Cohen and Follette (2000, n. 35) observe that any cyclical movement in retirement benefits will be partly muted by the reduction of retirement benefits accruing to people who retired early in previous recessions once they have reached statutory retirement age. This offsetting effect may rise for a while (perhaps in a pro-cyclical manner), following a fall in the average age of retirement, and may generally modify the cyclical movement. But we cannot follow Cohen and Follette in dismissing the whole issue of the counter-cyclical behaviour of retirement benefits without further investigation on this ground alone.

temporary contracts or with a history of health problems – will be particularly loath to report sick (see Arai and Skogman Thoursie, 2005 and Barmby, Ercolani and Treble, 2004). When times are good, workers are able to report sick with less fear of unemployment. Also, in good times people with permanent health problems have less difficulty in holding down a job. Furthermore, since the pace of work is greater, there may be more work accidents, especially in dangerous industries. This literature points to an inverse relationship between rates of absenteeism and rates of unemployment, and interprets this negative relationship as indicating that absenteeism is pro-cyclical (see Boone and van Ours, 2002; Khan, Gerdtham and Jansson, 2004 and Leigh, 1985; and see also Kaivanto, 1997 for more references, and Barmby, Ercolani and Treble, 2002 for general cross-country evidence on sickness-related absence). The previous literature also relates to paid sick leave far more than incapacity related benefits.

On the other hand, there is an opposing literature arguing that when layoffs rise during recessions, the people with a choice between declaring illness, incapacity or unemployment will base their decision on the rate and the duration of replacement of wages through social benefits. Thus, more people with health problems will report ill and incapacitated during bad times. In this case, the supporting evidence, which relates to incapacity benefits as well as sick pay, tends to show that sick pay and incapacity benefits move together over the cycle, along with unemployment compensation. This evidence comes mostly from studies that compare the performance in depressed and prospering regions within the same country. McVicar (2006) provides a useful review article. This literature tends to emphasize the fact that changes in social legislation over the last 30 years or more have facilitated the ability to claim these benefits, and have resulted in secular increases in the percentages of the labour force receiving sickness and incapacity related cash benefits in the West, despite the absence of evidence that health has declined (see Bound and Burkhauser, 1999 and Beatty, Fothergill and Macmillan, 2000 (who refer to the 'hidden sick')). Our results favour this last interpretation of the stabilizing cyclical behaviour for both incapacity benefits and sick pay.

In the light of the conflicting theory and results concerning the cyclicality of incapacity and sickness related benefits, one methodological issue bears attention at once. The part of the literature arguing that paid sick leave is pro-cyclical commonly treats the rate of unemployment as the indicator of the cycle. Leigh (1985) does so in explaining the behaviour of absenteeism; Boone and van Ours (2002) do so too in explaining that of incapacity pay; as do Khan, Gerdtham and Jansson (2004) in explaining both sick pay and incapacity pay. However, both theory and evidence show that the numbers of the unemployed, recipients of paid sick leave and recipients of incapacity pay are determined simultaneously. In this connection, Black, Daniel and Sanders (2002) and Autor and Duggan (2003) are important in providing detailed analyses of the impact of the disability programme on the long-term rate of unemployment in the US. See also Beatty, Fothergill and Macmillan (2000) and Holmlund (2004) for related theoretical discussion. Thus, there is a considerable objection to treating unemployment as the measure of the cycle in explaining illness and disability pay. This treatment poses a simultaneity problem, and the problem becomes all the greater if, as in the relevant literature, the level rather than the first difference of unemployment is adopted as the measure of the cycle. We take our measure of the cycle to be the output gap or the ratio of output to potential output (an alternative measure of the gap) rather than the unemployment rate. We shall also use first differences rather than levels in order to focus attention upon short-term responses, and we shall take steps to allow for the potential simultaneity of fiscal variables and the output gap.

As regards health expenditure, there is considerable interest in labour economics in the relation of health and health insurance to the retirement decision as such (see Blau and Gilleskie, 2001; Disney, Emmerson and Wakefield, 2003; Dwyer and Mitchell, 1999 and Gruber and Madrian, 1995). However, the relation of health spending to the cycle has not come in for special study. Yet if health care is cyclical, government spending on health will probably be so too. As indicated already, related research comes from specialists in public health and focuses on health not health spending. In addition, the results are not necessarily intuitive. We might think that recessions would have detrimental effects on the health of those losing jobs or in fear of losing jobs, largely for socio-psychological reasons (see for example Neumayer, 2005). But the main results go the other way: they say that health is counter-cyclical and worsens during booms (Gerdtham and Ruhm, 2006; Ruhm, 2000, 2001, 2003, 2005a, b, 2006; Ruhm and Black, 2002; Tapia Granados, 2005a, b). The key factor is that the relevant studies concern the impact of the cycle on the total population, whereas the unemployed and the precariously employed only form a minority in all phases of the cycle. Accordingly, the proposed reasons for worsening health during expansions are longer working hours, job-related stress, less physical activity, less sleep, and the direct effects of some physically dangerous work activities as well as greater consumption of health-damaging goods (tobacco, alcohol and saturated fats). The typical measure of health in these studies is mortality at different ages from different causes (including crime and traffic accidents). However, of course, movements in government spending on health could deviate widely from movements in health since the spending depends on health care, which though clearly related to health is not the same. Much health care can be postponed. Even if people are healthier on average in recessions, the lower value of leisure at these times could lead to greater health care, particularly in cases of coverage by health insurance. Indeed, the extra health care when time has a lower opportunity cost could be an additional reason for the better health of the population during recessions.[2] As regards this line of thinking, Jacques Mairesse has suggested to us the interesting analogy to firms' treatment of physical capital. During

[2] Ruhm (2000) makes many of the same points in a study of the impact of the cycle on population health as such. As he notes too, the relative price of health might be lower in recessions. But this could affect health spending either way depending on the elasticity of demand.

booms firms tend to fail to replace machines and other equipment, preferring to bring older standby equipment into operation, and devote minimal resources to upkeep and repair. Then when business slows down, they undertake major repairs and renovations. The logic is the same.

A further, but lesser explanation for countercyclical movements in health spending is that more people than usual may become eligible for government-sponsored health programmes during recessions. This may be true even in countries with universal support of health care, since governments may require lower co-payments for those on low incomes, the disabled and the unemployed. However, in our view, our results about health spending go too strongly in the counter-cyclical direction to make it likely that this factor dominates the preceding one of general decisions about health care in the population of the eligible. The dominance of those general decisions is probably particularly important in the case of the older members of the population, who are responsible for a disproportionate share of health spending, as we shall emphasize later on.

In sum, theory and empirical evidence both argue for the possible role of every major category of social spending in our discussion in automatic stabilization. Of course, this does not preclude major international differences in the stabilizing properties of the various new social programmes in our discussion. Interestingly enough, this point may play an important role in the current neglect of these programmes, at least if we judge from a recent OECD working paper by Girouard and André (2005) on automatic stabilization. The authors dismiss any items of social spending besides unemployment compensation on the ground that 'data coverage and cyclical variation are uneven across time and countries' (p. 20). The other items they cite are subsidized employment and early retirement. However, if our figures for automatic stabilization are to be limited to the mechanisms that exist for decades and apply everywhere, how much faith can we have in any national application?

1.2. Key results and the organization of the paper

We shall study automatic stabilization by examining the automatic impact of an extra percentage-point of output gap (output divided by potential output) on an extra percentage-point of budget surplus relative to output. We find that every percentage-point of an output gap yields around 0.06 of a percentage-point of unemployment compensation in our 21-country OECD panel. But there is also 0.3 of a percentage-point of additional social spending on health, retirement, incapacity and sick benefits. The extent of automatic stabilization through all elements of social expenditure on households therefore is six times larger than the part coming from unemployment compensation alone. Either health spending or retirement benefits alone are more important than unemployment compensation, especially retirement benefits which account for 0.15 of a percentage-point. Total automatic stabilization from all sources equals around 0.44 of a percentage-point. Therefore social expenditures account for most of the total. The rest of the stabilization comes from other sorts of government expenditures. Taxes, in fact, are destabilizing; they do not even keep up with the cycle. Broadly speaking, these results agree well with Arreaza, Sorensen and Yosha (1999), who were, to our knowledge, the first to estimate automatic stabilization in ratios to output. They too found taxes to be destabilizing and spending to be the overriding stabilizing force.

These same results evidently go contrary to the impression that it is taxes that underlie most of automatic stabilization; however, the contradiction can be explained. The usual numbers for automatic stabilization stem from study of the impact of a euro of output gap on the number of cents of net government surplus. In other words, they stem from study of levels. In this case, if tax ratios are high, proportional taxation alone implies that taxes contribute heavily to automatic stabilization. In addition, all government spending that fails to respond to the output gap in the short run shows up without any stabilizing property at all (even though such spending rises (falls) as a percentage of output following a cyclical drop (rise) in output). In this light, it is interesting to check what happens if we perform the study of automatic stabilization in levels rather than percentage points. We do so in an appendix. The ensuing results show taxes to be important in accordance with usual impressions. But they still display the significance of social spending quite clearly. In addition, they support the conclusion that most of the stabilizing response of social spending comes from other social programmes rather than unemployment compensation.

The next section sets out the framework for our analysis and compares our approach to the dominant official one to estimating automatic stabilization. Fuller details of our econometric procedures are presented in a separate appendix. In the subsequent section, we will present the basic results for our entire panel of 21 countries. Next, we will present some robustness tests regarding smaller country sub-samples and across discrete sub-periods. We will also provide some tests of symmetry of responses in recessions and expansions and of the linearity of responses to the cycle. As a separate robustness test, we will present an estimate of the core model with a variable for the 'real time' business cycle reflecting the current state of information about the output gap. This current state of information contains data that will subsequently be revised, and whose separate importance, in the presence of the final data, therefore would reflect discretionary fiscal policy. Unfortunately, this test is only possible for the second half of our sample period. Following, we shall provide individual-country results. Finally, we shall offer some discussion of the policy and research implications of our results. A short concluding section will close the paper.

2. OUR FRAMEWORK OF ANALYSIS

2.1. The official method of estimating automatic stabilization

The official method of estimating automatic stabilization used by the OECD, the European Commission and the US Congressional Budget Office alike, distinguishes five different elements of the government budget balance and then studies each of them independently. These are: household direct taxes, business direct taxes, social security contributions, indirect taxes and unemployment compensation (see Giorno *et al.*, 1995). The official practice is to estimate the cyclical response of the five respective bases on which these five tax and spending items rest, and then to apply the national tax code or else to assume a unitary elasticity of response to the base in order to derive the five items, whichever seems more appropriate. Van den Noord (2000) offers a clear and detailed review of the method (in the OECD version, used by the EC as well). To quote from his summary:

> First, the elasticities of the relevant tax bases and unemployment with respect to (cyclical) economic activity, i.e. the output gap, are estimated through regression analysis. Next, the elasticities of tax proceeds or expenditure [unemployment compensation] with respect to the relevant bases are extracted from the tax code or simply set to unity in cases where proportionality may be assumed. These two sets of elasticities are subsequently combined into reduced-form elasticities that link the cyclical components of taxes and expenditure to the output gap.[3]

This method deals with automatic stabilization expressed entirely in levels. But research tends to focus on ratios. It is easy to see why. Stabilization policy relates to smoothing economic performance or keeping output close to potential, and consequently, the problem of fiscal policy is often seen as keeping the ratio of actual output to potential output close to one. Given this view, the critical fiscal policy variable becomes the ratio of the net budget balance to output, and the critical issue is to determine how the ratio responds to the cycle aside from any discretionary behaviour by the authorities. However, when the issue becomes one of ratios, it is fairly standard practice to continue using the official estimates of automatic stabilization to correct the budget balance in levels for non-discretionary responses and then to simply divide the derived discretionary response by output in order to obtain the ratios of cyclically adjusted figures to output or potential output. The European Commission adopts this approach in its annual surveys of country members' adherence to the Stability and Growth Pact. But the Commission is not alone. Two prominent recent academic examples are Taylor (2000) and Galí and Perotti (2003). Both explicitly proceed from cyclically adjusted figures in levels based upon official numbers (from the US Congressional Budget Office in one case, the OECD in the other) to subsequent division by output (Taylor) or potential output (Galí and Perotti) in order to analyse the behaviour of discretionary fiscal policy. Yet if the issue is the impact of the ratio of output to potential output on the ratio of the net government surplus to output, it is

[3] There have appeared two particularly sophisticated applications of the method, both of which we have already had occasion to mention. Cohen and Follette (2000) investigated the response of the five relevant tax and spending items in the US in the frequency domain in order to test the significance of the responses at business cycle frequencies. Girouard and André (2005) introduced some lag structure in the cyclical adjustment of the separate items and made some use of the method of seemingly unrelated regressions in a study dealing with numerous OECD members. For another interesting and detailed recent study (more favourable toward our broader treatment of the issue of automatic stabilization) see Bouthevillain *et al.* (2001).

difficult to see why we would not estimate in ratios directly. On a simple intuitive plane, this would be more transparent. From a technical econometric standpoint, the estimate would be more efficient. Such an estimate also proves to be more robust. We will estimate in ratios.

2.2. Our approach

Apart from estimating in ratios, we shall deviate from the foregoing official practices in a number of ways in our research. The four relevant classes of taxes in the official estimates depend on distinct tax schedules of varying complexity that change over time and have different collection periods and delays. From this standpoint alone, there is something to be said in favour of estimating the tax responses directly rather than inferring them from some preset figures after studying the responses of the tax bases, however well-founded those preset figures may be. In addition, the cyclical responses of the various bases for taxes and unemployment compensation will tend to be correlated. Hence, the residuals in the separate estimates of these bases will be correlated too. On this ground, systems estimation would be fitting. Finally, individual taxes and government spending items could have reciprocal effects on the output gap, even within an observation period as short as a calendar year (Blanchard and Perotti, 2002). This would then argue for admitting the potential endogeneity of the output gap. On all these grounds, we shall apply three stage least squares (3SLS).

In some important respects, however, we follow official practices. In particular, we adopt the usual Keynesian perspective on automatic stabilization. That is, we suppose that the issue is the automatic positive (negative) stimulus to aggregate demand that comes in recessions (expansions) through deficit spending (surplus revenue). In addition, in attempting to estimate the automatic effect of the business cycle on the net government surplus, we rely strictly on a reduced form. Quite specifically, we try to isolate the automatic effect of the cycle on the budget by controlling for other influences rather than specifying a general structural model. Accordingly, we follow Galí and Perotti in correcting for the possible reciprocal effect of the net government surplus on the output gap by instrumenting the cycle (as well as the other current influences on the net government surplus). But like them too, we will not attempt any general simultaneous-equation estimation of net government surplus and the output gap (and these other influences). Quite specifically, we will not try to go further and obtain a separate coefficient for the impact of the current net government surplus on the cycle. This would require a broader modelling of the cycle beyond what we need to capture the automatic effect of the cycle on the net government surplus – the parameter of interest to us. Last, except in one exercise, we shall simply assume that the contemporaneous influence of the cycle on the net government surplus is entirely automatic. In this respect, of course, we rely on earlier evidence that changes in tax regulations take significant time as do fresh spending decisions. The literature on fiscal policy underlines these delays (see, for example, Canzoneri, Cumby and Diba, 2002; European Commission, 2004). But since the output gap in the preceding year could reflect discretionary fiscal policy, we will include the last year's output gap as one of our controls in our estimates.

Our basic estimating equation will then be:

$$\Delta(x_i/Y)_t = \alpha_{oi} + \alpha_{1i}t + \alpha_{ti} + \alpha_{ci} + \beta_{1i}\Delta(Y/Y^*)_t + \beta_{2i}\Delta\pi_t + \beta_{3i}r_{Lt} + \beta_{4i}\Delta(Y/Y^*)_{t-1} + \beta_{5i}(x_i/Y)_{t-1} + \beta_{6i}\Delta(x_i/Y)_{t-1} + \varepsilon_{ti} \quad (1)$$

for $i = 1 \ldots 15$

The x_i variables here refer to individual sorts of receipts and expenditures. There are then as many equations (1) as the number of x_i variables (that is, 15 of them); t refers to the time trend, α_t is a set of time fixed effects (year dummies), α_c is a set of country fixed effects. We also incorporate a German reunification dummy to take account of the fact that the pre-unification data refers strictly to West Germany. Y is annual output, Y^* is the OECD series for potential annual output, π is the rate of inflation, and r_L is the long-term interest rate. We experimented with the short-term and the long-term interest rate in the OECD database, and the long-term one is much more important. As far as π and r_L are concerned, the results are little affected by the use of levels or first differences. We kept the interest rate in levels while stating inflation in first differences in conformity with the rest of the specification. Our reason for keeping the interest rate in levels is that any automatic influence of this variable on the government budget would depend largely on initial debt and therefore could be cumulative. If so, the level of the interest rate would affect the first difference of the budget balance as well as the level. As mentioned in the preceding paragraph, our decision to include the lagged change in the output gap $\Delta(Y/Y^*)$ relates to the issue of control for discretionary policy. We also added the lagged level and lagged first difference of the dependent variable since current responses may result partly from lagged responses of the dependent variable.[4] As a further guard against omitted variable bias, we experimented with a number of non-policy conditioning variables that are not shown in the equations, since they gave rise to virtually identical results. These refer to the dependency ratio, the proportion of the population aged 25–54 and the female participation rate, all expressed alternatively in levels and first differences.

In addition to the previous 15 equations for the individual revenue and spending variables, we require three more instrumenting equations in order to control for the reciprocal influences of the dependent variables (x_i/Y) on the output gap, inflation and the interest rate. Our instruments include contemporaneous oil price inflation in order to capture the major exogenous supply shocks during the study period. They also include lags of the endogenous variables – that is, more specifically, government current expenditures and revenues and aggregate OECD GDP. Further, they include

[4] Both the time trend t and the lagged level of the dependent variable, $(x_i/Y)_{t-1}$ are intended to control as much as possible for persistence. In line with this service of $(x_i/Y)_{t-1}$, the variable may not even be stationary. But any problem of non-stationarity of this variable is not likely to affect β_{1i}, concerning the output gap (especially in first differences), which is the only coefficient of central concern to us.

the lagged change in the proportion of the population not working and the contemporaneous change in exports as a percentage of GDP. In addition, we introduced lags of the instrumented variables themselves and country and time fixed effects in the instrumenting equations. Given these equations, in all we then have 18 equations to estimate with 3SLS or as a system.[5]

Our basic reason for estimating equations (1) in first differences is to focus better on the impact effect, or the short-run response. Galí and Perotti (2003) chose to conduct the analysis of discretionary fiscal policy in levels instead of first differences on the grounds that the usual simple theoretical models of the impact of fiscal policy on the economy are stated in levels. However, in our view, working in levels may confuse structural and cyclical responses. This problem may not have concerned Galí and Perotti as much as us since they were interested in discretionary fiscal policy and structural changes in the net government surplus are part of such policy (along with deliberate responses to the cycle). However, as we are concerned exclusively with automatic stabilization, excluding any long-run structural influence seemed essential to us. So we deemed the use of first differences preferable. Issues of stationarity also lead us to prefer the differenced approach.

The critical coefficient in the system is obviously β_1, which relates to the impact of the output gap. Suppose β_1 is 0.1 in one of the equations (1). This says that a percentage-point increase in the output gap Y/Y^* raises the relevant receipt or expenditure item by 10% of one percentage-point relative to output. Therefore, β_1 is a pure number (though not an elasticity).[6] Note that x_i, Y and Y^* can all remain in national currencies. In addition, they can all be stated in nominal terms as long as we accept the usual view that the same deflator applies to all of them.

In closing, we should mention that we still cannot rule out the possibility that our critical coefficient β_1 partly reflects some discretionary policy response since some such response could occur within the same calendar year. Progress on this important issue, it seems to us, will require introducing discretionary fiscal policy simultaneously into the analysis. We hope to do so in the future. However, in one of our exercises, we will introduce a variable containing some such reflection. This variable is the 'real time business cycle' and refers to contemporary data about the output gap. By admitting such data, together with the final figures, we will allow for a contemporary response

[5] Fiscal policy research frequently focuses on the primary government balance rather than the observed one while we use the observed balance and introduce the interest rate as a separate explanatory variable. In fact, we do not have particularly strong views on this topic. However, it would be wrong to suppose that because of our choice, the outstanding net government debt drops out of our analysis. This debt is the sum of a starting value minus the cumulated value of net government surpluses over the study period (based on the consolidated government accounts including the central bank). Our country fixed effects incorporate any influence of the starting values of the debt in our analysis, while we explicitly admit the lagged values of net government surpluses.

[6] An elasticity would refer to the effect of a percentage change in the first difference in the ratio of output to potential output on the percentage change in the first difference in the ratio x_i/Y. Concern with β_1 or the impact of a percentage-point of output gap on a percentage-point of net government surplus is frequent. See, for example, Aghion and Marinescu (2007) and Buti and Sapir, eds. (1998), ch. 9.

of discretionary fiscal policy to the cycle in the estimation of automatic fiscal policy. Any separate effect of current information about the output gap, as distinct from the final data, could only reflect current perceptions and therefore discretionary fiscal policy. Unfortunately, this test is only possible for the sub-section 1993–2003 of our sample period. Otherwise, we would have relied on it more broadly.

3. DATA AND RESULTS

3.1. Description of the data

The data we employ are taken from the separate OECD databases for National Income and for Social Expenditure. The National Income data are from the Economic Outlook database in the 2007:2 release of the OECD compendium CD-ROM. The Social Expenditure database in our analysis is the 2007 release, which provides data for each country from 1982 to 2003 at best, and therefore shortens the estimation period that would have been possible based on the National Income database alone. If we were to restrict ourselves to the countries for which the full 1982–2003 sample is available we would be limited to just 12 countries. In order to maximize degrees of freedom we have employed an unbalanced panel of 21 countries for the main part, which give us a total of 383 observations. Our database includes 13 of the 15 members of the European Union in 2003 (the missing EU members are Luxembourg and Greece) and the eight OECD countries outside the EU are Australia, Canada, Iceland, Japan, New Zealand, Norway, Switzerland and the US.

It may be wise to take a general look at the orders of magnitude for the variables on the expenditure side in our study before we turn to the results. Table 1 shows averages and standard deviations of these variables as percentages of total government expenditures or else as percentages of GDP for the 383 observations.

Table 1. Government spending and its composition

	% of Total government expenditure		% of GDP	
	Mean	Std. Dev.	Mean	Std. Dev.
Total government expenditure	100		47.0	8.4
of which,				
(1) Health expenditure	12.6	2.4	5.8	0.9
(2) Total social security spending	29.5	4.5	14.0	3.7
Key Components of Social Security Spending:				
(2a) Pension related cash benefits	15.1	5.3	7.1	2.7
(2b) Incapacity related cash benefits	3.0	1.4	1.4	0.8
(2c) Unemployment compensation	2.9	1.7	1.4	0.9
(2d) Sickness pay	1.3	1.0	0.7	0.6
(3) Subsidies	3.5	2.2	1.7	1.1

Source: OECD Economic Outlook and Social Expenditure databases and authors' calculations.

The table distinguishes three key categories of government social spending based on the published statistics: health expenditures, social security spending and subsidies. A further sub-division of social security spending is made between retirement (old age cash benefits including early retirement pension and survivors cash benefits), incapacity benefits (related to disability, occupational injury and disease but excluding temporary paid sick leave), paid sick leave, and unemployment compensation. It is important to keep in mind that the health expenditures represent a class of direct government spending on goods and services and only the rest of social expenditures are transfer payments, either to persons in the case of social security, or to firms in the case of subsidies. We shall essentially limit our interest to the social benefits paid to households and exclusive of subsidies.

As can be seen, retirement cash benefits are by far the largest component of social expenditure, averaging 15% of government spending in the aggregate; health is next, averaging almost 13%. Unemployment compensation is much lower, at 3%. Interestingly, incapacity benefits are of the same level as unemployment compensation. Besides being larger than the other forms of social spending, spending on retirement and on health is more uniform than the rest, including unemployment compensation. Health spending is by far the most uniform of all. Taken as a percentage of total government spending, it is five times larger than its standard deviation. By contrast, incapacity related cash benefits, unemployment compensation, and government subsidies to firms (relative to total government spending) are on average only roughly one and three-tenths to twice as large as their standard deviations. Of these last three rubrics, spending on incapacity benefits is the most uniform. Paid sick leave is the least uniform social spending category of all as well as the smallest. These differences in uniformity persist almost unchanged if we compare the 21 country averages over the study period (either in levels or per capita) and thereby abstract from movements over time. The differences are therefore essentially international. The impression can then arise that if there is any cyclical responsiveness in government spending on health, retirement, incapacity, sickness, unemployment, and government subsidies in the cross-sectional evidence, it would be reflected more clearly in the individual-country estimates for health and retirement than for the other social spending groupings. Though this impression will not be confirmed, nothing markedly contradictory will appear either.

3.2. Estimating the automatic response of the budget surplus

Let us begin discussing the estimates of equations (1) without any disaggregation at all, that is with the dependent variable defined as the ratio of the net government surplus to output. Table 2, which contains these estimates, omits all coefficients except those for $\Delta(Y/Y^*)$. The omitted ones for $\Delta\pi$ and r_L are insignificant. The table shows four sets of estimates: (1) those from the least possible sophisticated statistical method of analysis, ordinary least squares, OLS; (2) those from the main statistical

Table 2. Aggregate estimates – dependent variable: net government surplus

21 countries 1982–2003, $n = 383$	OLS (1)	3SLS (2)	Excluding lagged change in gap OLS (3)	 3SLS (4)
Change in output gap, $\Delta(Y/Y^*)$	0.258*** (0.063)	–0.0107 (0.14)	0.306*** (0.062)	0.267*** (0.11)
R^2	0.48	0.46	0.47	0.47

Notes: Variables are expressed in current prices. Where relevant, estimated coefficients are followed by ***, ** and * to denote statistical significance at 1%, 5% and 10% significance levels respectively. Standard errors are reported in parentheses. In case of the 3SLS results pseudo R^2s are reported. In principle, both sets of 3SLS estimates should be below the corresponding OLS ones, since the failure to consider the reciprocal influence of fiscal policy on current performance in the OLS estimates should lead to overestimation not underestimation of the extent of automatic fiscal policy. This condition is not met. To explain the logic, suppose that a cyclical rise in the output gap Y/Y^* raises the net government surplus relative to output. In principle, this rise should limit the increase in output. If it does, then the correction for the reciprocal influence means raising the swings in $\Delta(Y/Y^*)$ above observed levels: that is, substituting higher positive values of $\Delta(Y/Y^*)$ in expansions and higher negative values of it in contractions. On the other hand, following the cyclical corrections, the series for the net government surplus relative to output – the dependent variable – stays the same. Thus, regressing the latter series on the corrected (larger absolute) values for $\Delta(Y/Y^*)$ should yield lower coefficients.
Source: Authors' own calculations.

method we shall use, three stage least squares, 3SLS; and in both cases, (3) and (4), those omitting the lagged change in the output gap as a control variable.[7]

As we can see, the OLS estimate for the impact of the output gap on the net government surplus is 0.26 and highly significant while the corresponding 3SLS one is nil. The estimates without the lagged change in the output gap serve to indicate that this control is the one responsible for the poor performance of the 3SLS estimate. When the variable is ignored, the 3SLS estimate is significant and quite close to either of the OLS ones. However, this sensitivity to lagged output gap in 3SLS will essentially disappear in our basic model where we disaggregate.

3.3. Estimating the automatic responses of individual taxes and expenditures

We turn next to estimates of our full system of 18 equations after the decomposition of the net government surplus into 15 different rubrics. The decomposition rests on the following balance sheet identity in the OECD accounts: net government surplus = (1) direct household taxes + (2) other direct taxes, primarily levied on business + (3) social security taxes + (4) indirect taxes – (5) current (wage and non-wage) spending

[7] In the case of the 3SLS estimates, the R^2 from the instrumenting equations indicate a reasonable fit. These R^2 are 0.60, 0.71 and 0.95 for the change in the output gap in ratios, the change in inflation and the long-term interest rate, respectively. In addition, the F tests for the deletion of the non-deterministic variables in the instrumenting equations confirm the significance of the explanatory power of the instruments in all three cases. The results always show a probability greater than $F = 0.0000$ (with $F(7, 334) = 25.05$, $F(8, 333) = 97.75$, $F(4, 335) = 110.08$ in the same order as before).

plus capital spending exclusive of social health expenditures (listed as current spending n.h., or net of health, in the tables) – (6) social health expenditures – (7) other government consumption – (8) pension-related cash benefits – (9) social spending on incapacity related cash benefits – (10) social spending on sickness benefits – (11) unemployment compensation – (12) other social expenditures – (13) government subsidies to firms – (14) other government transfer payments – (15) net interest payments. In reporting the results, we shall ignore four of these accounts: the three residual ones, (7), (12) and (14) and net interest (15). Of these, the three residual ones are difficult to interpret and net interest payments are often excluded from the start by focusing on the primary surplus. (Net interest always responds significantly to the output gap with the expected negative sign.) In addition, we will base our estimates of the aggregate response of the net government surplus on the statistically significant values of the 11 other accounts – or those that we do report – at the 0.95 confidence level. In this respect, we follow official practice. The official method of calculating total automatic stabilization is to add up the estimates for the five rubrics that are deemed significant from the start. We do the same except that we admit the potential significance of 11 rubrics and only retain those rubrics that prove statistically significant.

Table 3 contains the results. Once again, we show only the coefficients of $\Delta(Y/Y^*)$. The instrumenting equations for the reciprocal effects of the dependent variable on $\Delta(Y/Y^*)$, $\Delta\pi$ and r_L are the same as before and perform identically. As can be seen, the results are as indicated in the introduction. First, taxes are destabilizing. Household direct taxes go down in response to a positive output gap, as do social security contributions. Only other direct taxes, mainly ones on business income, move in a stabilizing direction. Based on all of these tax responses, there is a net destabilizing

Table 3. Disaggregate estimates

21 countries, 1982–2003, $n = 383$	$\Delta(Y/Y^*)$	
Revenues:		
Household direct taxes	–0.117***	(0.040)
Other direct taxes	0.0809**	(0.032)
Social security contributions	–0.0891***	(0.030)
Indirect taxes	–0.00860	(0.031)
Expenditure:		
Current spending n.h.	–0.164**	(0.065)
Health expenditure	–0.0918***	(0.014)
Pension related cash benefits	–0.149***	(0.021)
Incapacity related cash benefits	–0.0328***	(0.0064)
Unemployment compensation	–0.0590***	(0.013)
Sickness pay	–0.0295***	(0.0063)
Subsidies	–0.0290**	(0.014)

Notes: Variables are expressed in current prices. Where relevant, estimated coefficients are followed by ***, ** and * to denote statistical significance at 1%, 5% and 10% significance levels respectively. Robust standard errors are reported in parentheses. In case of the 3SLS results pseudo R^2s are reported.
Source: Authors' own calculations.

effect of 12 percent of a percentage-point. On the other hand, government spending on goods and services exclusive of spending on health is highly stabilizing. This is possibly a result of inertia or, more generally, a failure to keep up with the cycle. Social spending is also highly stabilizing, pensions the most so; they contribute 0.15 of a percentage-point to stabilization. Health spending is next, adding another 0.09 of a percentage-point to stabilization. Then unemployment compensation is third in line with a 0.06 contribution. Invalidity and sickness benefits contribute least to stabilization (and both in equal amounts) but together add as much as unemployment compensation. Altogether stabilization from social expenditures sums up to 0.36 of a percentage point. Despite the destabilizing effect of taxes, total stabilization from all sources is then 0.44 of a percentage point.

Before proceeding, it is interesting to pause once more on the fact, noted in the introduction, that our results for incapacity and sickness benefits contradict a section of the literature claiming that both of these sorts of expenditures move pro-cyclically. As we also observed before, this interpretation is closely connected to the use of the rate of unemployment as the measure of the cycle. Simply in order to shed more light on this pending issue, we substituted the change in the rate of unemployment for $\Delta(Y/Y^*)$ in our 18-equation framework. In this case paid sick leave does not respond to the rate of unemployment at all, while incapacity pay moves positively with unemployment and significantly so. Thus, the results do not support the conflicting literature regarding sick pay and clearly contradict it concerning incapacity pay.[8]

However, even had the results conformed to the conflicting literature regarding sick pay, we would still contest any inference of a pro-cyclical movement in this social spending on the earlier ground that unemployment and sick pay are both jointly determined. We would especially insist on this joint determination in the context of business cycles. Imagine the existence of a negative relationship between unemployment and sick pay for the sort of reasons stressed in the pro-cyclical literature: higher costs of shirking when unemployment is higher in particular. Imagine too that movements in the recorded unemployment rate occur not only for cyclical reasons but also for secular ones related to demography and changes in benefit eligibility criteria and monitoring. During recessions, employers will not only tend to separate themselves from less reliable workers (thus leaving them without any ability to claim sick pay for temporary illness), just as this conflicting literature suggests, but they may also lay off some workers who are ill, or whom they believe to be eligible to claim sick benefits, that the employers wish to retain. This last tendency implies a positive association between sickness pay and unemployment in recessions. In regressions of the

[8] In fact, the contradiction regarding disability pay strictly relates to Boone and van Ours (2002), who find that reported work accidents – not exactly the same thing as disability pay though positively related – rise when unemployment goes down. On the other hand, Khan, Gerdtham and Jansson (2004), who use disability pay and sickness pay as the dependent variables as we do and who expect negative signs in both cases, find the same positive effect of unemployment on disability pay that we get, contrary to their expectations (while they do get the negative sign they expect for sickness pay). Other differences should be mentioned between us and the latter: they estimate in levels rather than ratios, do not use first differences, and add some additional demographic controls that we omit in Table 3 but with which we experimented as well.

change in sickness pay on the change in unemployment, the long-run movement in unemployment is a factor and the forces leading to a negative relationship between the two variables (the disciplining effect) might dominate. But in a regression like ours, identifying the cycle with impulses arising from the goods market without any trend (and therefore excluding the long-run forces working on unemployment), the positive association between movements in unemployment and sickness pay might dominate instead.

4. ROBUSTNESS CHECKS AND EXTENSIONS

In this section we investigate the robustness of our findings in a variety of ways. We check the sensitivity of the results to dropping countries one at a time; investigate behaviour within the EU sub-group in the sample; and examine panel estimates over the sub-samples 1982–92 and 1993–2003. We also check the sensitivity of our key results to an alternative measure of the cycle; test the null hypothesis of symmetry of effects against the alternative of asymmetric adjustment of fiscal variables to positive and negative output gaps; and test for non-linear effects of the cycle. Finally, we look at what happens if we introduce the real time business cycle as a reflection of contemporary discretionary fiscal policy.

4.1. Do the results depend critically on any single country?

In order to check whether our results depend critically on any single country, we re-estimated the model 20 times, sequentially dropping one country at a time. The results of the panel estimates dropping one country at a time appear in Table A3 of a separate appendix. All 21 alternative 20-country sub-samples are shown. The table repeats the parameter estimates for the full 21-country sample on the first row to facilitate comparison. It can be seen that both the size and significance of the parameter estimates are relatively insensitive to the exclusion of any one country from the sample.

4.2. Is automatic stabilization different within the EU?

Table 4 pursues the previous test by paring down the sample to a sub-sample consisting of the 13 members of the European Union in 2001. Once again we show the results for the full sample in the table to facilitate comparison. The similarity between the results for the EU members and the full sample is remarkable. All the impacts on the elements of social expenditure lie within (or nearly within) the 95% confidence interval around the full panel estimates. There are only two mentionable changes. Indirect taxes show up as destabilizing at the 90% confidence level for the EU members whereas they had been insignificant for the full sample, and current government expenditures net of health cease to be significantly stabilizing whereas they had been so before.

Table 4. Estimates for the European Union

3SLS estimates, 1982–2003	All, n = 383			EU, n = 251	
Revenues:					
Household direct taxes	−0.117***	(0.040)	[−0.20, −0.04]	−0.102*	(0.053)
Other direct taxes	0.081**	(0.032)	[0.02, 0.14]	0.056	(0.035)
Social security contributions	−0.090***	(0.030)	[−0.15, −0.03]	−0.099**	(0.042)
Indirect taxes	−0.009	(0.031)	[−0.07, 0.05]	−0.070*	(0.039)
Expenditure:					
Current spending n.h.	−0.164**	(0.065)	[−0.29, −0.04]	−0.106	(0.086)
Health expenditure	−0.092***	(0.014)	[−0.12, −0.06]	−0.109***	(0.017)
Pension related cash benefits	−0.149***	(0.021)	[−0.19. −0.11]	−0.183***	(0.029)
Incapacity related cash benefits	−0.033***	(0.006)	[−0.05, −0.02]	−0.042***	(0.009)
Unemployment compensation	−0.059***	(0.013)	[−0.09, −0.03]	−0.069***	(0.018)
Sickness pay	−0.030***	(0.006)	[−0.04, −0.02]	−0.043***	(0.009)
Subsidies	−0.029**	(0.014)	[−0.06. −0.002]	−0.065***	(0.019)

Notes: see Table 3. 95% confidence intervals for the full sample estimates are given in square brackets.
Source: Authors' own calculations.

4.3. Are contributions to automatic stabilization constant over time?

To investigate the possibility that the contributions of the various components of automatic stabilization have changed over time we conducted split sample estimates for 1982–92 and for 1993–2003. There are fewer observations available for the earlier period than the later one: 156 rather than 227; in fact some countries even fall out entirely from the 1982–92 sub-sample. Unfortunately, this means that apparent differences over time could reflect simply changes in the country composition across the two sub-samples. To control for this possibility, we also conducted estimates based on a balanced panel including only those 12 countries for which data permits estimation over the full 1982 to 2003 period (Belgium, Canada, Denmark, Finland, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the UK and the US). This limited us to a little over two-thirds of the observations. Of course, with so much loss of data, the resulting estimates are less precise, and this lower precision is reflected in larger standard errors. Therefore, we shall only use the panel data estimates from the smaller set of countries (which we do not report) to throw light on whether the split sample results in Table 5 truly reflect changes in automatic stabilizing behaviour over time rather than mere changes in the country composition of the sub-samples.

This test reveals a few interesting changes over time. The destabilizing behaviour of direct taxes and social security contributions disappears in the 1993–2003 sub-period, while the stabilizing behaviour of other direct taxes appears in neither sub-period. By contrast, the stabilizing behaviour of government spending on goods and services net of health ceases to hold in the more recent sub-period. Also on the

Table 5. Split sample estimates for 1982–1992 and 1993–2003

3SLS estimates, 21 countries	1982–1992, n = 156		1993–2003, n = 227		All, n = 383	
Revenues:						
Household direct taxes	−0.134***	(0.047)	−0.0378	(0.050)	−0.117***	(0.040)
Other direct taxes	0.0257	(0.027)	0.0193	(0.046)	0.081**	(0.032)
Social security contributions	−0.0787**	(0.033)	−0.0587	(0.037)	−0.090***	(0.030)
Indirect taxes	0.0541	(0.034)	0.0572	(0.038)	−0.009	(0.031)
Expenditure:						
Current spending n.h.	−0.217***	(0.083)	−0.0840	(0.066)	−0.164**	(0.065)
Health expenditure	−0.0289*	(0.016)	−0.0711***	(0.017)	−0.092***	(0.014)
Pension related cash benefits	−0.0552***	(0.020)	−0.0578**	(0.024)	−0.149***	(0.021)
Incapacity related cash benefits	−0.0143**	(0.007)	−0.0180**	(0.007)	−0.033***	(0.006)
Unemployment compensation	−0.111***	(0.019)	−0.025*	(0.013)	−0.059***	(0.013)
Sickness pay	−0.0175*	(0.009)	−0.009*	(0.005)	−0.030***	(0.006)
Subsidies	0.0032	(0.018)	0.0141	(0.015)	−0.029**	(0.014)

Notes: see Table 3.
Source: Authors' own calculation.

spending side, the stabilizing behaviour of health spending becomes more pronounced in the more recent 11-year period, and that of unemployment compensation appears to weaken. The comparison of these results with those from the 12-country balanced panel gives little reason to doubt that the changes reflect genuine movements over time.

4.4. Does the measure of the cycle matter?

In an additional experiment we replaced the OECD measure of the output gap with one obtained from HP filtered data. This only affects the dating of the cycles marginally although it does modify the steepness and the depth of the cycles. As can be seen from Table 6, the results are basically identical to those with the OECD measure.

4.5. Is stabilization symmetric across expansions and contractions?

Is it possible that the automatic stabilizing movements in expenditure and revenues occur to different degrees in contractions and expansions? If so, progressive movements of individual components of the government budget in one direction could affect the net budget surplus and the government debt as a whole over a series of cycles. Such asymmetries are then important. We test for such asymmetries with a dummy variable that takes the value 1 when output is below potential ($Y < Y^*$) and 0 otherwise. By taking the product of this dummy and the change in the output gap and introducing the product term as a separate explanatory variable, we can test for the significance of differences in responses to the cycle when output is below potential. Table 7 shows the outcomes. There is some sign of a greater stabilizing response of

Table 6. Alternative measures of the output gap

3SLS estimates, 1982–2003 n = 383	OECD gap $\Delta(Y/Y^*)$		HP Gap $\Delta(Y/Y^*)$	
Revenues:				
Household direct taxes	−0.117***	(0.040)	−0.0842**	(0.039)
Other direct taxes	0.081**	(0.032)	0.0770**	(0.031)
Social security contributions	−0.090***	(0.030)	−0.0944***	(0.029)
Indirect taxes	−0.009	(0.031)	−0.0339	(0.030)
Expenditure:				
Current spending n.h.	−0.164**	(0.065)	−0.183***	(0.062)
Health expenditure	−0.092***	(0.014)	−0.0826***	(0.014)
Pension related cash benefits	−0.149***	(0.021)	−0.156***	(0.020)
Incapacity related cash benefits	−0.033***	(0.006)	−0.0344***	(0.006)
Unemployment compensation	−0.059***	(0.013)	−0.0631***	(0.012)
Sickness pay	−0.030***	(0.006)	−0.0267***	(0.006)
Subsidies	−0.029**	(0.014)	−0.0294**	(0.013)

Notes: see Table 3.
Source: Authors' own calculations.

Table 7. Testing for symmetry versus asymmetry in cyclical responses

3SLS estimates, 1982–2003 n = 383	$\Delta(Y/Y^*)$		Additional impact when $Y < Y^*$	
Revenues:				
Household direct taxes	−0.175***	(0.040)	−0.0016*	(0.0009)
Other direct taxes	0.124***	(0.032)	0.0007	(0.0007)
Social security contributions	−0.061**	(0.030)	0.0008	(0.0006)
Indirect taxes	−0.017	(0.032)	0.0010	(0.0007)
Expenditure:				
Current spending n.h.	−0.176***	(0.066)	−0.0013	(0.0014)
Health expenditure	−0.091***	(0.014)	−0.0003	(0.0003)
Pension related cash benefits	−0.195***	(0.022)	−0.0003	(0.0005)
Incapacity related cash benefits	−0.041***	(0.006)	−0.0002*	(0.0001)
Unemployment compensation	−0.068***	(0.013)	0.0001	(0.0003)
Sickness pay	−0.030***	(0.006)	−0.0002*	(0.0001)
Subsidies	−0.047***	(0.014)	−0.0006*	(0.0003)

spending in recessions than expansions with regard to incapacity and sick pay. But in both cases, the effect is small and barely significant.

4.6. Testing for non-linear effects

The next test concerns the possible non-linearity of the responses. We tested for this non-linearity by adding squared values of $\Delta(Y/Y^*)$ to the standard specification. (It was necessary to assign the same signs to the squared terms as those of the initial values.) The results, in Table 8, identify significant non-linearities in the effects only

Table 8. Testing non-linearity

3SLS Estimates, 1982–2003 n = 383	$\Delta(Y/Y^*)$		Sign preserving square of $\Delta(Y/Y^*)$	
Revenues:				
Household direct taxes	−0.107	(0.070)	0.0030	(0.0078)
Other direct taxes	−0.022	(0.054)	0.0062	(0.0060)
Social security contributions	−0.126**	(0.050)	0.0038	(0.0056)
Indirect taxes	0.036	(0.053)	−0.0047	(0.0060)
Expenditure:				
Current spending n.h.	−0.209*	(0.110)	0.0087	(0.0120)
Health expenditure	−0.117***	(0.024)	0.0060**	(0.0026)
Pension related cash benefits	−0.241***	(0.036)	0.0161***	(0.0041)
Incapacity related cash benefits	−0.038***	(0.011)	0.0014	(0.0012)
Unemployment compensation	−0.040*	(0.021)	−0.0022	(0.0024)
Sickness pay	−0.036***	(0.011)	0.0018	(0.0012)
Subsidies	−0.017	(0.023)	−0.0012	(0.0026)

Notes: see Table 3.
Source: Authors' own calculations.

in two cases: health spending and pensions. In both examples, the interpretation of the non-linearity is that the stabilizing response of the expenditure category weakens as the size of change in the output gap increases. While both progressive attenuations are well defined, they are small.

4.7. Introducing the real time business cycle

The next robustness test relaxes the assumption of no contemporaneous response of discretionary fiscal policy to the business cycle. Thus far we have used final data for the change in the output gap. However, by adding 'real time' data, we can check for the separate effect of the contemporary state of knowledge about the output gap on the receipt and spending items. Any such effect would then probably reflect responses to discretionary policy decisions rather than the environment. Most important, the new data will permit us to check whether our main results about automatic stabilization hold up if we allow for contemporary discretionary fiscal policy. The test is narrower than we would wish since the requisite data is only available for the second half of our study period. Notwithstanding, the test is still considerable since it covers 204 observations. In addition, health expenditures, pensions, unemployment compensation and sick pay all remain statistically significantly stabilizing over the relevant sample in the test period prior to introduction of real time data.

Our source of the requisite series for the real time output gap is Jacopo Cimadomo, who constructed the series himself since 1993, when it first became possible to do so and made them available to us. Based on his series, we are able to measure the real time change in the output gap $\Delta(Y/Y^*)$ in a reasonable manner as the predicted value of Y/Y^* early in a year for the same year minus the concurrent prediction of the value of Y/Y^* for the preceding year (that is, as both values were recorded in the December issue of the OECD *Economic Outlook* for the preceding year). Given the significance of the revisions of early releases of GDP data and the associated measures of the output gap, both relevant predicted values (in constructing the change in Y/Y^*) notably differ on average from those that will be recorded after the passage of two or three years. The use of real time data in macroeconomic policy evaluation has become increasingly popular. See Cimadomo (2007) for a nice overview.

In presenting the test results with real time data in Table 9, we first repeat our earlier results for 1993–2003 in Table 5 without this data; next we show the estimate of the same specification for the same 1993–2003 period over the restricted sample of countries for which the real time data are available but without this data; and last we include the real time variable in the estimate. In the case of the last two estimates, we show the estimates of the effect of the lagged output gap and the real time business cycle in addition to those for the (final) output gap. Apart from general interest in the real time business cycle, it is useful to show the performance of the lagged output gap side by side if only as a reminder that we associate discretionary fiscal policy with both variables.[9] However, despite these two reflections of discretionary fiscal policy in Table 9, we centre our discussion of the table exclusively on automatic fiscal policy (the relevant numbers for which are shown in bold) and will not comment on discretionary policy (the other numbers).

The difference between the first and second estimate in the table, neither of which reflects real time data, is important. Even the drop from 227 to 204 observations because of the shortage of real time data for the same years evidently matters. This drop in observations comes from the lack of real time data for Switzerland and the restricted amount of it for Iceland and New Zealand. As seen from the first two columns, even prior to the introduction of the real time business cycle, pensions are already less important in the available smaller sample for the test than in our full sample for 1993–2003 while incapacity pay is no longer important in the smaller sample at all. Of note as well, the same lack of destabilizing behaviour of taxes that we had observed before for the entire 1993–2003 sample shows up in the smaller sample. Most important, though, are the results following the introduction of the real time business cycle.

As is clear, except possibly for indirect taxes, the variable makes little difference. In particular, all three categories of social spending on households that emerged as automatic stabilizers at the 5% significance level for the identical sample previously – namely, health spending, unemployment compensation, and sick pay – still show up as statistically significant with the inclusion of the variable. Even the sizes of the

[9] In this regard, note that the macroeconomic authorities are likely to consult more information than the real time series alone contain. Adam and Cobham (2006) provide an interesting demonstration of this point in a detailed treatment of the example of British monetary policy since the eighties. For recent applications of real time data to the analysis of fiscal policy, see Forni and Momigliano (2005), Beetsma and Giuliodori (2007), Bernoth, Hughes Hallett and Lewis (2007) and Kalckreuth and Wolff (2007).

Table 9. Real time estimates (1993–2003)

3SLS	(1) n = 227, 21 countries		(2) n = 204, 20 countries				(3) Including real time output gap, n = 204, 20 countries					
	$\Delta(Y/Y^*)$		$\Delta(Y/Y^*)$		lagged $\Delta(Y/Y^*)$		$\Delta(Y/Y^*)$		Lagged $\Delta(Y/Y^*)$		Real time $\Delta(Y/Y^*)$	
Revenues:												
Household direct	**–0.038**	**(0.050)**	**–0.011**	**(0.050)**	0.032	(0.036)	**–0.064**	**(0.053)**	0.049	(0.036)	–0.118*	(0.062)
Other direct taxes	**0.019**	**(0.046)**	**–0.037**	**(0.048)**	0.059*	(0.034)	**–0.047**	**(0.051)**	0.062*	(0.035)	–0.018	(0.060)
Social security	**–0.059**	**(0.037)**	**–0.044**	**(0.039)**	0.021	(0.028)	**–0.010**	**(0.042)**	0.011	(0.029)	0.071	(0.050)
Indirect taxes	**0.057**	**(0.038)**	**0.065***	**(0.037)**	–0.026	(0.027)	**–0.002**	**(0.038)**	–0.004	(0.026)	–0.138***	(0.044)
Expenditure:												
Current spending n.h.	**–0.0840**	**(0.066)**	**0.077**	**(0.064)**	–0.078*	(0.044)	**0.030**	**(0.067)**	–0.063	(0.045)	–0.086	(0.076)
Health expenditure	**–0.071*****	**(0.017)**	**–0.058*****	**(0.017)**	0.001	(0.012)	**–0.036****	**(0.018)**	–0.007	(0.013)	0.060***	(0.022)
Pension related	**–0.058*****	**(0.024)**	**–0.043***	**(0.025)**	–0.048***	(0.018)	**–0.038**	**(0.027)**	0.047**	(0.019)	0.012	(0.032)
Incapacity related	**–0.018****	**(0.007)**	**–0.004**	**(0.007)**	–0.003	(0.005)	**–0.003**	**(0.008)**	–0.004	(0.006)	0.001	(0.009)
Unemployment	**–0.025***	**(0.013)**	**–0.026****	**(0.013)**	–-0.014	(0.010)	**–0.026***	**(0.014)**	–0.014	(0.010)	–0.002	(0.016)
Sickness pay	**–0.009***	**(0.005)**	**–0.014****	**(0.006)**	–0.001	(0.004)	**–0.015****	**(0.006)**	–0.001	(0.004)	–0.003	(0.007)
Subsidies	**0.0141**	**(0.015)**	**0.009**	**(0.015)**	–0.001	(0.010)	**–0.011**	**(0.015)**	0.006	(0.010)	–0.044**	(0.017)

Notes: see Table 3. Columns (2) and (3) contain 21 fewer observations than column (1) because of the omission of Switzerland and fewer observations for Iceland and New Zealand.
Source: Authors' own calculations.

three coefficients do not undergo statistically significant changes. As regards pensions, note that this social spending variable barely remains stabilizing at the 10% significance level in the relevant 1993–2003 sub-sample prior to introduction of real time data. Thus, while the variable may drop in statistical significance afterwards, the drop is actually quite small.

5. INDIVIDUAL COUNTRY ESTIMATES

Of course, individual country tests are important. In deciding on policy actions, national authorities must rely on estimates of automatic stabilization at home and can only use panel results covering 20 other countries to shed additional light on such estimates. As regards individual country estimates, with a maximum of a mere 22 time series observations per country, our basic system of simultaneous estimation is no longer feasible. There are simply too few observations available to use estimation methods that allow for simultaneity, and in practice the theoretical gain from greater consistency would not compensate for the loss of precision of the estimates. Consequently, in generating single country results we will stick to the simplest method of estimation, ordinary least squares, while recognizing that the estimates may be subject to a degree of simultaneity bias. Even so, we limit estimation to those countries for which a minimum of 15 observations are available. Five countries then fall out (Australia, Austria, Iceland, Norway and Switzerland), leaving 16 countries. In discussing the results, we shall focus exclusively on the issue of the impact of the different components of social spending on automatic stabilization. For this reason, we show only the results for social benefits paid to households in Table 10.

A glance at the table will show a majority of significant coefficients for health spending, pensions and unemployment compensation. The significance of health spending and pensions comes out about as clearly as that of unemployment compensation. The performance of incapacity benefits is only slightly worse. Sick pay performs worst of all with only three significant signs. All of the signs of the statistically significant coefficients in the table are correct; there are generally few incorrect signs. The final row of the table indicates the number of the individual estimates that are inside the 95% confidence limits of our full basic panel estimate. Over 40% of them are, most of them concerning unemployment compensation and health. On the other hand, the weighted-average values for these two spending items are outside those 95% confidence limits. By contrast, those for the other spending items are inside those limits (or close). Admittedly, some of the significant coefficients are implausibly high. This is true for unemployment compensation and pensions in Germany, for sick pay in Finland, and arguably, for unemployment compensation in Spain.

These single-country estimates reinforce our previous conclusion that large mistakes can arise from dismissing all social expenditures besides unemployment compensation. Column (6) shows the sum of the individual coefficients of the five separate components of social spending in the earlier columns. Column (7) shows the corresponding

Table 10. Individual country estimates (OLS)

	n	(1) Unemployment compensation	(2) Health expenditure	(3) Pension related expenditure	(4) Incapacity related benefits	(5) Sickness pay	(6) Sum of separately estimated	(7) Estimates using aggregates	(8) Ratio column 6 to column 1
Belgium	22	−0.073***	−0.042	−0.076**	−0.025**	−0.019***	−0.235	−0.228***	3.225
Canada	22	−0.090***	−0.077***	−0.043***	−0.016***	−0.0003	−0.225	−0.229***	2.508
Denmark	22	−0.118***	−0.076**	0.038	0.005	−0.031	−0.181	−0.157*	1.534
Finland	22	−0.085**	−-0.081**	−0.144	−0.026	−0.333**	−0.670	−0.306	7.847
France	17	−0.054***	−0.069**	−0.137**	−0.012**	−0.004	−0.275	−0.247***	5.133
Germany	22	−0.638***	0.212	−0.625**	−0.070**	0.020	−1.101	−1.402	1.726
Ireland	17	−0.064*	−0.062**	−0.072	−0.009	−0.004	−0.210	−0.223**	3.301
Italy	22	−0.019	−0.062	−0.075	−0.003	−0.014*	−0.173	−0.168	9.372
Japan	22	−0.014	−0.072***	−0.060**	−0.001	−0.001***	−0.148	−0.161***	10.99
Netherlands	22	−0.037	−0.070**	−0.029	−0.040	−0.018	−0.194	−0.182	5.295
NewZealand	16	−0.024	−0.067**	−0.054	−0.012	−0.002	−0.159	−0.297**	6.532
Portugal	22	−0.025***	0.025	−0.072**	−0.033**	0.004	−0.125	−0.098*	5.058
Spain	22	−0.202**	−0.051	−0.080**	−0.010	−0.016	−0.359	−0.358***	1.778
Sweden	22	−0.081*	−0.007	−0.100***	−0.079***	0.029	−0.239	−0.227***	2.947
UK	22	−0.069*	−0.078	−0.109***	−0.031	−0.015	−0.302	−0.275**	4.382
USA	22	−0.023**	−0.045***	−0.087***	−0.006***	−0.002	−0.164	−0.176***	7.078
No. −ve estimates		16	14	15	15	13	16	16	
Weighted Av.		−0.104	−0.038	−0.109	−0.024	−0.027	−0.302	−0.298	4.912
Full Panel (3SLS)		−0.0590***	−0.0918***	−0.149***	−0.0328***	−0.0295***			
95% CI		[−0.09, −0.03]	[−0.12, −0.06]	[−0.19, −0.11]	[−0.05, −0.02]	[−0.04, −0.02]			
No. within CI		14	11	3	5	3			

Notes: see Table 3.
Source: Authors' own calculations.

estimate for the aggregate of those five components in a separate test. Except for Finland and New Zealand, the two totals are close. Next, column (8) gives the figure for the total social spending in column (6) divided by the one for unemployment compensation in column (1). The lowest value is around 1.5. This implies a minimum of a 50% error from basing the estimate of the contribution of social spending on households to automatic stabilization on unemployment compensation alone. But the ratio is mostly much higher: over 2 and on average near 5.

6. DISCUSSION

6.1. The implications for automatic versus discretionary policy

None of our estimates are easily comparable with the official ones since they are in percentage points rather than levels. More comparable estimates are in Appendix 1. Still, our analysis would clearly suggest that automatic stabilization has been underestimated thus far. Had the official estimates taken place in ratios, everything, including the results in Appendix 1, would indicate that they would be lower than ours. The policy implications are important. Two outstanding points of reference in the discussion of European fiscal policy both rely on the official figures for automatic stabilization: Buti and Sapir (1998) and Galí and Perotti (2003). Buti and Sapir (1998) do so in a large-scale study of fiscal policy behaviour by the Services of the European Commission shortly before entry into monetary union. In this study, the authors interpret the policy behaviour of the prospective EU membership in the preceding decades as destabilizing during episodes of moderate positive output gaps. However, if automatic stabilization was higher than they assumed, as our analysis would suggest, the expansionary destabilizing behaviour was even greater at these times, since it offset stronger forces that work automatically the opposite way.[10] Galí and Perotti (2003) for their part conclude that, if anything, discretionary fiscal policy in the EU became more stabilizing following the Maastricht Treaty. Our results water down this last conclusion since they offer good reason to think that there was less discretionary stabilization than they assumed.

6.2. The implications for the Stability and Growth Pact and reforms

Our results also call into question the Buti-Sapir assessment that the 3 percent ceiling on government deficits in the Stability and Growth Pact (SGP) would only bite significantly in Member States of the EU facing a sharp recession when they stood

[10] In an earlier study that focused on discretionary fiscal policy, Melitz (2000) found the destabilizing tendency of government expenditures to be so precisely defined that he interpreted the results as reflecting automatic rather than discretionary policy. Obviously neither author any longer accepts this view. Our basic inference is that it is impossible to draw inferences about automatic fiscal policy in a study of fiscal policy without modelling automatic fiscal policy separately.

close to the ceiling. If the contribution of automatic stabilization is higher on average than Buti and Sapir thought, the chances of exceeding the ceiling are higher too. This may explain some of the difficulty various Member States of the EU have encountered in meeting the ceiling thus far. It may also lend support to the 2005 SGP reforms.

Furthermore, as a part of the SGP, the European Commission has a mandate to survey the Medium Term Budgetary Forecasts of the member countries in order to check whether deficits have been accurately projected and the limits are likely to be breached. If our analysis is correct, the reports of the Commission to the European Council tend to downplay the automatic forces influencing the budget and to give discretionary fiscal policy too much credit for automatic movements in the net government surpluses. True, both the plans that are submitted to the Council by the Member States and the reports to the Council by the Commission pay increasing attention to other social payments and transfers besides unemployment compensation, particularly in the context of the discussions of pension reform. This is then reflected in the Council's assessments. However, the focus of this attention is strictly on sustainability or the long run. In our view, the implications for the short-run adjustment process are of crucial importance too. We would argue that the neglect of the cyclical implications of pensions, health expenditure and disability pay, especially in evaluating alternative reform packages, could be storing up problems for the control of budgets in the future.

6.3. Heterogeneity across countries

A fundamental issue that arises in the light of our study concerns possible differences in automatic stabilization across countries. The new mechanisms of automatic stabilization in our discussion are likely to differ between countries; they might even not operate everywhere. Notable differences in automatic stabilization between countries are already recognized on the basis of the existing conception of automatic stabilization as resting on taxes and unemployment compensation alone.[11] The differences could evidently be wider if more mechanisms of automatic stabilization are at work. On this fundamental issue, we can only be suggestive and more research needs to come.

6.3.1. Retirement benefits. As indicated in the earlier discussion of retirement benefits, the incentives of firms to encourage early retirement during recessions are likely to depend heavily on features of payroll taxes, compulsory contributions to pension plans, entitlement rules and social security payments (see Hutchens, 1999). These

[11] Chapter 9 of Buti and Sapir (1998) is a good source for the current view of the international differences in automatic stabilization in the EU based on current interpretations and estimates. The basic picture is one where the big member countries are fairly representative and cluster around an average level of 50% automatic stabilization, while the Netherlands and some of the Scandinavian countries are at the top of the ranking with closer to 80 or 90% stabilization. These differences narrow after taking into account the stabilizing impact of net government surpluses on output since the small countries are also more open and subject to bigger 'leakages' abroad. Of course, once again, these numbers depend on estimates in levels, not percentage-points.

features all differ across countries. Apart from such differences, firms may be better able to discriminate against older workers in deciding about layoffs in some countries than others because of differences in labour regulations and trade union power.

6.3.2. Health spending. Health expenditures, in turn, are disproportionately high for the elderly and there could be a link to pensions. Those who retire early during recessions may have poorer health (see Dwyer and Mitchell, 1999). With retirement, they also have more time for health care. Retirees generally may devote more attention to health care. Their health itself could be affected by retirement and not necessarily for the better. Thus, the cyclical behaviour of pensions and health spending may be correlated. Other factors may matter as well. The extent of public health insurance varies internationally. Furthermore, governments may differ in their ability to control their spending on health in the short run. While this ability is probably fairly modest everywhere, in some countries, such as France, errors in projections of total public spending repeatedly lead to modifications of the system of public health protection. Feeble public control over total health spending in the short run might be a contributing factor to the stabilizing behaviour of health spending.

6.3.3. Incapacity and sickness related benefits. The importance of national rules in determining the cyclical behaviour of incapacity benefits is particularly plain. Perhaps people with temporary health problems qualify for disability pay in some countries but not others. The financial incentives to return to work once receiving disability pay may also differ. Short spells of disability pay may not be equally possible everywhere. Autor and Duggan (2006) discuss in rich detail how the efforts by the Social Security Administration in the US to enforce strict medical criteria have been thwarted by the courts in litigations. Of course, in countries where tenuous applications for incapacity benefits may succeed, the benefits may be more closely linked to the cycle.

In the case of sickness pay, our individual country results are particularly divided. But some of the international differences that arise make sense. Portugal, Spain and Sweden belong to the majority of countries that do not show stabilizing behaviour of sick pay in Table 10. These three countries are also the subject of particular discussion of the disincentives to report sick in recessions for people holding temporary employment contracts.[12] All three feature heavily in the literature on the implications of increased use of temporary versus permanent contracts (see, for example Arai and Skogman Thoursie, 2005; Bentolila and Dolado, 1994; Bentolila and Saint-Paul, 1992; Bover *et al.*, 2000 and Jimeno and Toharia, 1996).

[12] In the third quarter of 2005, Eurostat Labour Force Survey data indicate that the share of employees with temporary contracts reached 14.7% in the EU15, ranging from 34.4% in Spain, 19.9% in Portugal and 17.3% in Sweden to under 10% in Austria, Belgium, Luxembourg and the UK; see Table 9 in Romans and Hardarson (2006).

6.3.4 General influences on stabilizing behaviour. There could also be some general factors affecting the stabilizing behaviour of social programmes apart from the detailed mechanisms at work, and these general factors might operate differently in different countries. For example, demography may enter as an influence from one cycle to the next in the case of pension spending. Demographic profiles differ between countries. Furthermore, political factors could play a role in the evolution of cyclical sensitivity. In particular, a political reluctance to rely more heavily on unemployment compensation could have something to do with the growing importance of invalidity pay. As another factor, the tier of government that is responsible for payment could matter. Budget constraints are generally tighter for sub-central tiers of governments than for central ones. Thus, if a lower tier pays, as happens in the US for unemployment compensation, for example, the cyclical responsiveness may be weaker.

These are all merely suggestions. The question of the possible differences in the cyclical sensitivity of some social spending programmes depending on the country has not been posed before, and while there are various international comparisons of social spending programmes, we have found none that bear on the issue of the differences in cyclical sensitivity.

7. CONCLUSION

In this paper we have exploited detailed data from the OECD Social Expenditure Database along with the national accounts aggregates from the OECD Economic Outlook Database in order to reassess the extent and composition of automatic stabilization. We found that automatic movements in health spending, pensions, incapacity benefits and sick pay are prominent along with unemployment compensation. This result was only to be expected in the case of pensions, and need not arouse surprise in the cases of health spending, incapacity benefits and sick pay. Perhaps the stabilizing nature of the cyclical movements of health spending, incapacity benefits and sick pay could not have been foreseen. However, the hypothesis that any of these three categories of social spending is a-cyclical goes contrary to a good deal of previous theory and evidence, particularly in the fields of labour and health. In conclusion, we firmly reject the conjectures in earlier macro studies, such as those we quoted from Auerbach and Feenberg (2000), Galí and Perotti (2003) and Perotti (2002), that unemployment benefits are the only current expenditures that contribute significantly to automatic stabilization.

We have already pointed to several directions of further research. But in closing, we would like to mention two more. Ours has been a Keynesian perspective. We have supposed aggregate desired spending to be the fundamental consideration in automatic stabilization. In addition, we have limited ourselves to estimates of the effects of the cycle on net government surpluses and have not gone on to explore the impact of these surpluses on aggregate demand. Clearly some important general equilibrium issues therefore are left pending. As Caselli observes in his discussion, the different spending responses to the cycle that we introduce could have varying effects on aggregate demand. More significantly, as he also proposes, there could be supply-side effects. The cyclical adjustments in retirement pay, invalidity pay and sick pay could mean wider cyclical movements in employment than would have occurred in the absence of the compensation, and if so, the stabilizing properties of the additional sources of spending would be weakened. We wish to add a separate ground for scepticism about the welfare benefits from a strict welfare perspective. Automatic stabilizers are generally conceived as a social benefit. But this ceases to be obvious if automatic stabilization depends largely on health care, retirement age and the propensity to claim incapacity for work.[13] From the standpoint of smoothing lifetime consumption, stable health care is a good. Institutional arrangements that result in variable health care over the business cycle are therefore questionable. It is also dubious policy to subject retirement income to the hazards of the business cycle. Even if the action should stabilize current output it may still not smooth individual lifetime consumption. Needless to say, inducing long-term exits from the labour force for temporary reasons can do harm. The sources of automatic stabilization that we found in our discussion could thus worsen social welfare. To our mind, this heightens the significance of our results.

Discussion

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The issues of automatic fiscal stabilization and efficiency of discretionary fiscal measures have always attracted the attention of academics and policy-makers. Fiscal rules embedded in the Maastricht Treaty and Growth and Stability Pact put these issues to the centre of economic policy debate accompanying the process of European monetary unification. With this paper the authors contribute to this debate in a number of ways. The most important is the analysis of cyclical responsiveness of fiscal expenditure items other than unemployment benefits. Classic macroeconomic literature documents only scarce evidence on the topic. By providing the first analysis of such detail and depth, the authors make an important contribution. Namely, the analysis of cyclical properties of fiscal items such as spending on health, retirement benefits and paid sick leave, has been discussed in labour and health economics, but not directly in relation to issue of automatic fiscal stabilization. With their analysis

[13] Perhaps it was never obvious. For a couple of different reservations about the welfare benefits, see Farina and Tamborini (2004) and Buti *et al.* (2003). We should also emphasize that we are by no means the first to raise welfare questions about the social spending programmes we discuss.

the authors bridged the two strands of literature. Moreover, the evidence that these expenditure items contribute importantly to automatic stabilization questions some of the commonly accepted conjectures about the potential adverse macroeconomic consequences of the fiscal constraints imposed by the Maastricht Treaty on EU member states. The results presented in the Darby and Melitz paper may also lead researchers to rethink the methodologies international organizations use to calculate the cyclically adjusted budget balances. Last but not least, the empirical analysis presented in this paper is very valuable for all researchers working on theoretical models with embedded fiscal policy reaction functions as it considerably increases our knowledge about the channels through which fiscal policy affects the cyclical dynamics of an economy.

There are, however, some issues about the specification of the empirical model in the paper that deserve the merit of a more detailed discussion. In what follows we shall also see how addressing these issues influences estimation results and what are the challenges these issues pose for future research.[14]

Note, that the baseline empirical model used by the authors is:

$$\begin{aligned}\Delta(x_i/Y)_{ct} &= \alpha_0 + \alpha_{1i}t + \alpha_{ti} + \alpha_{ci} + \beta_{1i}\Delta(Y/Y^*)_{ct} + \beta_{2i}\Delta\pi_{ct} + \beta_{3i}r^L_{ct} \\ &\quad + \beta_{4i}(x_i/Y)_{c,t-1} + \beta_{5i}\Delta(x_i/Y)_{c,t-1} + \lambda_i c_{ct} + \varepsilon_{ict}.\end{aligned} \tag{1}$$

This is the same as equation (1) in the paper, with country index c added for completeness and explicitly spelled out inclusion of lagged endogenous variables. Since the right-hand side of the equation contains the lagged level of dependent variable we can rewrite the previous equation as

$$\begin{aligned}x_i/Y_{ct} &= \alpha_0 + \alpha_{1i}t + \alpha_{ti} + \alpha_{ci} + \beta_{1i}\Delta(Y/Y^*)_{ct} + \beta_{2i}\Delta\pi_{ct} + \beta_{3i}r^L_{ct} \\ &\quad + (1 + \beta_{4i} + \beta_{5i})(x_i/Y)_{c,t-1} - \beta_{5i}(x_i/Y)_{c,t-2} + \lambda_i c_{ct} + \varepsilon_{ict}.\end{aligned} \tag{2}$$

We can thus observe that what is actually being estimated is not a proper model in differences but a model in levels of the left-hand-side variable with implicit restrictions on model parameters. The difficulty with such an approach lies in the fact that it is from a theoretical point of view very hard to justify a relation between the change in the output gap $\Delta(Y/Y^*)$ and the level of x_i/Y_{ct}. This implicit twist of the model has important empirical consequences. For comparison I report below the estimates of the model without the level term on the right-hand side:[15]

$$\begin{aligned}\Delta(x_i/Y)_{ct} &= \alpha_0 + \alpha_{ti} + \alpha_{ci} + \beta_{1i}\Delta(Y/Y^*)_{ct} + \beta_{2i}\Delta\pi_{ct} + \beta_{3i}r^L_{ct} \\ &\quad + \beta_{4i}\Delta(x_i/Y)_{c,t-1} + \lambda_i c_{ct} + \varepsilon_{ict}.\end{aligned} \tag{3}$$

[14] At this point I wish to thank the authors for sharing their data.

[15] The linear trend term is also omitted. In a model specified in differences a linear term trend implies a diverging rate of change of revenue/expenditure fiscal items. Such a feature of the model is clearly inconsistent with the data.

Table 11. Automatic stabilization in a revised model

$(Y/Y^*)_t$	Darby & Melitz		Model (3)	
	Aggregate estimates			
Aggregate deficit	−0.0107	(0.14)	0.54***	(0.166)
Disaggregate estimates				
Revenues				
Hous. dir. taxes	−0.117***	(0.040)	0.0329	(0.081)
Other dir. taxes	0.0809**	(0.032)	0.5332***	(0.065)
Soc. sec. contr.	−0.0891***	(0.030)	−0.0228	(0.062)
Ind. taxes	−0.0086	(0.031)	−0.1921***	(0.064)
Expenditure:				
Curr. spending	−0.164**	(0.065)	−0.6329***	(0.142)
Health exp.	−0.0918***	(0.014)	−0.1311***	(0.030)
Pensions	−0.149***	(0.021)	−0.1991***	(0.043)
Incapacity	−0.0328***	(0.0064)	−0.0529***	(0.012)
Unemployment	−0.0590***	(0.013)	−0.2377***	(0.026)
Sickness	−0.0295***	(0.0063)	−0.0711***	(0.014)
Subsidies	−0.0290**	(0.014)	−0.1294***	(0.029)

Note: Lagged change in output gap included in both models.

As we can observe from Table 11, some important differences emerge. Turning our attention first to the upper part of Table 11 – corresponding to Table 2 in the Darby and Melitz paper – we see that their finding of no automatic response of overall budget balance, which they attribute to inclusion of lagged change in the output gap as a control for potential discretionary responses, no longer appears to be there in a model properly specified in differences. Automatic responses are quantitatively large and highly significant.

Moreover, the estimate of aggregate deficit response of roughly 0.5 is very much in line with the OECD's estimates of automatic responses in developed countries. More insight on the sources of the differences in estimates can be obtained by looking at disaggregate estimates reported in the bottom panel of Table 1. The left part of the table replicates the entries from Table 3 in Darby and Melitz. On the right are the estimates of model (3). In the modified model household direct taxes and social security contributions are no longer destabilizing as Darby and Melitz argue. Other direct taxes respond automatically in a stabilizing manner but significantly more strongly so. What appears to have a destabilizing effect are indirect taxes. On the expenditure side all signs and significances of coefficients are preserved. Moreover, in a modified model all coefficients result to be significantly larger.

Results of model (3) thus confirm the basic message Darby and Melitz want to convey about the cyclical responses of social spending. Whatever model we look at tells us that social spending has been unjustly omitted from the literature on automatic fiscal stabilization. However, in their case the results have been obtained in a model with some dubious statistical properties. This may also be the reason why in the model containing aggregate budget balance, total stabilizing response of budget balance appears to be unrealistically low and insignificant. A modified model specification, however, yields more plausible results.

There are two final econometric aspects of the analysis of Darby and Melitz that raise some important questions about such an analysis in general. First, their main estimation is performed in a system using 3SLS. In principle, the main advantage of such an estimation approach is that it enables us to identify all reciprocal responses between endogenous variables. Entire discussion in the paper is devoted to automatic responses of fiscal revenues and expenditure to the output gap. But this is only a necessary condition for automatic stabilization. For a sufficient condition of automatic stabilization we also need an estimate of the contemporaneous response of the output gap to the budget balance. Darby and Melitz decided to exclude current change in the budget balance from the output gap equation.[16] They argue: 'This would require a broader modelling of the cycle beyond what we need to capture the automatic effect of the cycle on the net government surplus – the parameter of interest to us.' Such a reasoning is rather superfluous. First, it seems that Darby and Melitz themselves contradict this view on the same page by arguing that the equations for the output gap, inflation rate and the interest rate are needed in a system 'in order to control for the reciprocal influences of the dependent variables (x_i/Y) on the output gap, inflation and the interest rate'. Second, parameter estimates in system 3SLS estimation are in the initial stages of estimation obtained by 2SLS, i.e. 2SLS regression of (x_i/Y) on the output gap and other control variables. Because output gap is endogenous, we need a first-stage 'model' of the output gap in terms of exogenous variables only. So, proper modelling of the output gap is not only required to obtain good estimates of the effect of the budget balance on the output gap, but equally importantly so also for the estimates of the output gap on budget balance (the first 15 equations of the system), which are of central interest in the Darby and Melitz paper. If the authors are satisfied with the statistical and economic properties of their core estimates, then what is needed to estimate the reciprocal effect of budget balance on the output gap of equally satisfying properties is only a fiscal balance identity to close the system.

If we do this in their baseline model presented in Table 3, a surprising outcome emerges: the contemporaneous effect of budget balance (revenues minus expenditure) on output gap is statistically insignificant and even with a wrong sign (point estimate of 0.063 and standard error 0.051). This would imply that identified automatic

[16] It follows from some theoretical arguments put forward by Darby and Melitz that also some revenue and expenditure fiscal items are in principle contemporaneously related. In a system it is possible to estimate these contemporaneous relations, but Darby and Melitz decided to exclude them from the model in the paper. Some of the exclusion restriction would surely be supported by the data, but all of them would also surely be rejected.

responses of fiscal variables are actually not stabilizing from the point of view of stabilizing the output gap. A necessary condition for automatic fiscal stabilization seems to be fulfilled, but the sufficient condition is not. This is clearly a controversial result, but obtained in the same system of equations as presented in the paper and without changing any of the results presented thus far. It is also a result that makes the whole analysis open more questions than it provides answers.

The second econometric issue that can be raised concerns the limitations of such an empirical exercise. What the empirical strategy employed by Darby and Melitz does not control for is the fact that the fiscal deficit may automatically change also when actual output moves in line with its potential. This happens because tax brackets in a progressive tax system and social (and other) spending are in general not perfectly indexed to the growth of nominal potential GDP. Any empirical model that is unable to control for this feature will produce biased estimates of automatic fiscal responses. The approach used by the OECD that is based on examination of national tax codes and social security systems (and not on estimates of the output gap) does not suffer from this problem. The results of Darby and Melitz therefore demonstrate that social spending has been most likely wrongly omitted from the analysis of automatic stabilizers. However, a more precise evaluation of their actual stabilizing role, that could form a firm basis for policy implications, necessarily requires an estimated structural model.

Panel discussion

The original and somewhat surprising results of the paper by Darby and Melitz were generally well received by the panel. Part of the discussion centred on the paper implications for the Stabilization and Growth Pact. For example, Kevin O'Rourke wondered whether, given the paper result that automatic stabilizers may actually be more important than previously thought, governments should actually be more careful with respect to the 3% limit on public deficit, or instead the rules should be relaxed. Some methodological aspects of the paper were also discussed: in particular there was some disagreement among panel members on whether the analysis should be done in levels or ratios. The merits of the alternative specifications suggested by the discussant Igor Masten were also discussed.

APPENDIX 1 – THE ESTIMATES IN LEVELS

There are several reasons to take an interest in our basic estimating equation when the issue is the impact of a euro of output gap on the number of cents of net government surplus. First and foremost, the question has been formulated this way in official estimates in the past. The estimates will then produce numbers for total automatic stabilization that are more directly comparable with the usual ones. In addition, any failure to respond at all to the output gap in the short run would contribute to the stabilizing effect of the social spending items in our discussion but may not do so when the issue is framed in levels. It is therefore interesting to check if the stabilizing influence of the social spending items we stress shows up if we require a stabilizing response in the spending level as such for automatic stabilization.

In this case, the basic equation takes the form:

$$\Delta x_{it} = \alpha_{oi} + \alpha_{1i}t + \alpha_{ti} + \alpha_{ci} + \beta_{1i}\Delta(Y - Y^*)_t + \beta_{2i}\Delta\pi_t + \beta_{3i}r_{Lt} + \beta_{4i}\Delta(Y - Y^*)_{t-1} + \beta_{5i}x_{it-1} + \beta_{6i}\Delta x_{it-1} + \varepsilon_{ti} \quad \text{(A1)}$$

for i = 1 . . . 15

where the variables have the same signification as before in equation (1) but β_1 signifies by how many cents a euro of output gap alters the respective tax and spending items x_i. If we estimate equation (A1), the results are strongly affected by Japan. This is a problem we have encountered throughout our study (much of which took place based on the preceding 2004 OECD release of the Social Expenditure database covering a shorter period): Japan has always had an excessive effect on the outcome in levels. Thus, we present the 20-country estimate of equation (A1) without Japan. The problem does not exist in ratios and therefore may have little to do with Japan as such but simply reflect the lower robustness of our estimates in levels (where among other things, the R^2 for the instrumenting equation for the change in the output gap is 0.48 instead of 0.60 in ratios).

Table A1. Disaggregate estimates in levels

20 countries, all except Japan, 1982–2003, n = 361	$\Delta(Y - Y^*)$	
Revenues:		
Household direct taxes	0.347***	(0.032)
Other direct taxes	0.157***	(0.016)
Social security contributions	0.042***	(0.012)
Indirect taxes	0.013	(0.013)
Expenditure:		
Current spending n.h.	0.012	(0.024)
Health expenditure	–0.030***	(0.006)
Pension related cash benefits	–0.032***	(0.005)
Incapacity related cash benefits	–0.010***	(0.002)
Unemployment compensation	–0.039***	(0.005)
Sickness pay	–0.005**	(0.002)
Subsidies	–0.019***	(0.005)

Notes: see Table 3.
Source: authors' own calculations.

Table A1, like Table 3 concerning equation (1), only shows the coefficients pertaining to the output gap. From this table, we see that a positive output gap produces 55 cents more tax collection. Direct household taxes (constituting 0.28 of total current receipts) are the most important, business taxes (constituting 0.07 of the total revenues) are

APPENDIX 2 – DATA

Table A2.

Code	Description	Source
GDP	Gross Domestic Product (Market prices),	Economic Outlook
GDPTR	Potential Output, Total Economy, Current Prices	Economic Outlook
PGDP	GDP Deflator	Economic Outlook
IRL	Interest Rate, Long Term	Economic Outlook
UNR	Unemployment Rate	Economic Outlook
YPGT	Total Disbursements Government	Economic Outlook
YPG	Current Disbursements, Government	Economic Outlook
CGAA	Government Consumption	Economic Outlook
SSPG	Social Benefits Paid by Government	Economic Outlook
PSE	Public Social Expenditure	SocX
PCB	Public cash benefits	SocX
PSE-PCB	Benefits in Kind	SocX
Residual	SSPG – PCB	
CAPOG	Net Capital Outlays	Economic Outlook
HLTH	Health Benefits in kind	SocX
YPEPG	Property Income Paid by Government	Economic Outlook
TOCP	Other Current Transfers Paid by Government	Economic Outlook
TSUB	Subsidies	Economic Outlook
YRG	Total Current Receipts	Economic Outlook
TYB	Direct Taxes, Business	Economic Outlook
TYH	Direct Taxes, Households	Economic Outlook
TIND	Indirect Taxes	Economic Outlook
SSRG	Social Security Contributions Received by Government	Economic Outlook
TOCR	Other Current Transfers Received by Government	Economic Outlook
YPERG	Property Income Received by Government	Economic Outlook
AGE	Pension Related Cash Benefits = Old Age Cash Benefits exc. early retirement pension [Code 100–Code 112] + Survivors Cash Benefits [Code 200] + Early Retirement pension [Code 112]	SocX
ICR	Incapacity Benefits (Disability, Occupational injury and Disease, exc. sickness [Code 300-Code 313-Code 314]	SocX
SIC	Paid Sick Leave (occupational injury and disease and other sickness daily allowances) [Code 313+Code 314]	SocX
UC	Unemployment Compensation/Severance Pay [Code 711]	SocX
OTH	Other Social Cash Benefits = Family + Housing + Other [Code 500 + Code 800 + Code 900]	SocX
DPR	$\text{Dependency Ratio} = \dfrac{100(\text{population aged 0–14 and 65+})}{\text{Population aged 15–64}}$	ILO
PAR	$\text{Prime Age Population Ratio} = \dfrac{\text{population aged 25–54}}{\text{total population}}$	ILO
FPR	Female Participation Rate	ILO

Notes: Economic Outlook = OECD Economic Outlook Database as provided on the OECD Compendium CD Rom 2007 release 2; SocX = OECD Social Expenditure Database 2007 release; ILO = International Labour Office Economically Active Population Estimates and Projections, 5th Edition, 2007; All values are in current prices.

APPENDIX 3 – SEQUENTIALLY DROPPING COUNTRIES

Table A3. Sequentially dropping each country in turn

1983–2003 Ratios	*n*	Revenues				Expenditure						
		Household direct taxes	Other direct taxes	Social security cont.	Indirect taxes	Expend n.e.s.	Health. expend	Pension related	Incapacy related	Unemp. comp.	Sick pay	Subsidies
All	383	–0.117***	0.081*	–0.089***	–0.009	–0.164**	–0.092***	–0.149***	–0.033***	–0.059***	–0.030***	–0.0290**
Australia	371	–0.112***	0.079**	–0.089***	–0.011	–0.161**	–0.091***	–0.151***	–0.033***	–0.057***	–0.031***	–0.0290**
Austria	371	–0.123***	0.073**	–0.088***	–0.007	–0.157**	–0.085***	–0.145***	–0.033***	–0.058***	–0.029***	–0.0336**
Belgium	361	–0.108***	0.092***	–0.098***	–0.006	–0.141**	–0.092***	–0.153***	–0.029***	–0.061***	–0.028***	–0.0325**
Canada	361	–0.037	0.096***	–0.051*	0.013	–0.197***	–0.069***	–0.120***	–0.030***	–0.073***	–0.022***	–0.0496***
Denmark	361	–0.119***	0.095***	–0.095***	0.001	–0.182***	–0.087***	–0.171***	–0.036***	–0.068***	–0.027***	–0.0175
Finland	361	–0.131***	0.043	–0.077**	0.010	–0.192***	–0.075***	–0.0932***	–0.025***	–0.056***	–0.030***	–0.00642
France	366	–0.122***	0.081**	–0.081***	–0.000	–0.168**	–0.092***	–0.144***	–0.034***	–0.063***	–0.030***	–0.0300**
Germany	361	–0.120***	0.087***	–0.075**	–0.022	–0.169**	–0.091***	–0.159***	–0.034***	–0.058***	–0.031***	–0.0252*
Iceland	371	–0.112***	0.063**	–0.070**	0.007	–0.113*	–0.088***	–0.142***	–0.030***	–0.063***	–0.030***	–0.0307**
Ireland	366	–0.097**	0.103***	–0.087***	–0.035	–0.153**	–0.086***	–0.136***	–0.029***	–0.053***	–0.023***	–0.0335***
Italy	361	–0.108***	0.061*	–0.101***	0.023	–0.164**	–0.102***	–0.142***	–0.033***	–0.059***	–0.029***	–0.0260*
Japan	361	–0.119***	0.060*	–0.106***	–0.014	–0.146**	–0.094***	–0.160***	–0.035***	–0.068***	–0.026***	–0.0286**
Netherlands	361	–0.103***	0.084**	–0.050*	–0.012	–0.157**	–0.085***	–0.141***	–0.025***	–0.049***	–0.026***	–0.0295**
New Zealand	367	–0.132***	0.074**	–0.100***	–0.031	–0.156**	–0.099***	–0.160***	–0.036***	–0.056***	–0.036***	–0.0320**
Norway	369	–0.104**	0.110***	–0.081***	–0.032	–0.193***	–0.083***	–0.151***	–0.032***	–0.061***	–0.027***	–0.0386***
Portugal	376	–0.112***	0.082**	–0.087***	–0.004	–0.170***	–0.093***	–0.148***	–0.034***	–0.059***	–0.030***	–0.0305**
Spain	361	–0.089**	0.071**	–0.087***	–0.020	–0.140**	–0.082***	–0.142***	–0.036***	–0.051***	–0.028***	–0.0197
Sweden	361	–0.129***	0.074**	–0.099***	–0.002	–0.152**	–0.092***	–0.140***	–0.029***	–0.065***	–0.030***	–0.0261*
Switzerland	371	–0.115***	0.078**	–0.088***	–0.012	–0.166**	–0.092***	–0.149***	–0.034***	–0.059***	–0.030***	–0.0305**
UK	361	–0.117***	0.090***	–0.081***	–0.024	–0.153**	–0.095***	–0.163***	–0.038***	–0.064***	–0.032***	–0.0319**
USA	361	–0.118***	0.090***	–0.088***	–0.008	–0.152**	–0.104***	–0.157***	–0.035***	–0.056***	–0.032***	–0.0326**

Notes: see Table 2.
Source: authors' own calculations.

much less but still notably so, social security taxes (0.23) far less still and indirect taxes (0.29) not at all. (Indirect taxes tend to be more dependent on consumption spending than output.) On the spending side, government purchases of goods and services net of health do not respond to the cycle. However, social expenditures fall by nearly 12 cents in response to a positive gap, of which the reduction in unemployment compensation accounts for a third. Both health expenditures and pensions contribute nearly as much to the reduction in social spending as unemployment compensation. Invalidity pay and sick pay contribute much less but still significantly. In sum, total automatic stabilization amounts to 0.68. This number compares with usual estimates of 0.50.

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