Regional redistribution and stabilization by the center in Canada, France, the UK and the US: A reassessment and new tests*

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ABSTRACT

This paper re-examines earlier estimates of regional redistribution and stabilization through the central government budget in the US, and produces new estimates of this redistribution and stabilization in the US, Canada, France and the UK. The new estimates rest on panel data econometrics and an adherence to certain accounting principles that have occasionally been violated in the past. As a result of the accounting, the peak estimates for the US and Canada in the earlier literature are never attained. Regional stabilization of personal income through the central government budget emerges as close to 20% in the US, France and the UK, but only 10 to 14% in Canada. In case of gross product instead of personal income accounting, regional stabilization is closer to 10% in the US. As regards France and the UK, the use of panel data econometrics proves essential.

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In most member countries of the OECD, a region undergoing an adverse shock will receive net transfers from other regions through the central-government budget. The tax obligations of the afflicted section will fall, while the region will benefit from higher subsidies from the rest of the nation. The social expenditures from the center will also stay up. But a country member of the future EMU suffering a similar shock will not receive any corresponding transfers from the European Union through the central-government budget of the Union – or only negligibly so. In this respect, countries in the EMU will lack a stabilizing mechanism that regions in a national currency union possess.

With this issue in mind, a number of authors have tried to ascertain just how much stabilization the regions get today through the relevant mechanism when a shock hits one of them relative to all the rest without affecting the national aggregates. Most of this research has focused on the US – a country about as big as the seven or eight largest members of the European Union put together. But the estimates of regional stabilization for the US differ by an order of one to four. They go from a high of 40% attenuation of a regional shock by the central budget in Sala-i-Martin and Sachs (1991) to lows of under 10% in von Hagen (1992). Despite the attention that has been lavished on this work, especially in connection with EMU, those differences in estimates have never been satisfactorily explained. A primary object of this paper is to resolve the problem. In doing so, we shall study more national examples than the US. Specifically, we will also examine Canada, France and the UK. Canada has been analyzed before by Bayoumi and Masson (1995), and the UK as well as Canada by Goodhart and Smith (1993). But apart from a simulation study by Pisani-Ferry, Italianer, and Lescure (1993), ours is the first examination of France (except for Zumer (1996)). In addition, we will use a uniform statistical methodology. Our adopted estimation procedure will be simple and dynamic panel data econometrics. Finally, we will pay a lot of attention to the distinction between stabilization and redistribution, and will employ this distinction in the same form as it appeared in Bayoumi and Masson, and Obstfeld and Peri (1998).

The reason von Hagen originally proposed for his lower estimates of stabilization in the US than those of Sala-i-Martin and Sachs (SiM-S) was his use of first differences as opposed to theirs of levels. By employing levels, he maintained that SiM-S had really tested for redistribution rather than stabilization. But shortly after he wrote, Bayoumi and Masson (B-M) performed SiM-S's test in first differences, and got nearly the same estimates as SiM-S had. They also provided separate estimates of redistribution. More recently, Fatás (1998) offered another possible reason for von Hagen's lower estimate of stabilization than SiM-S's, which von Hagen (1998) has since embraced as well. According to Fatás, the problem lies in SiM-S and B-M's failure properly to distinguish between interregional transfers by the central government and aggregate deficit spending by this government. To Fatás' mind, von Hagen manages somehow to avoid the problem.

We take issue with both von Hagen and Fatás about the sources of the differences in the estimates of stabilization. Those differences rest strictly on the accounting. SiM-S use personal income concepts and a broad measure of net transfers, whereas von Hagen uses gross product concepts with a narrow measure of net transfers. If we repeat SiM-S's accounting, we get very similar results to theirs either in levels or first-differences, as B-M had shown before, and if we repeat von Hagen's accounting, we get very similar results to his either in levels or first-differences, as Goodhart and Smith (1993) had reported before.[1] In addition, and contrary to Fatás, correcting for changes in deficit spending by the federal government as SiM-S and B-M did, or doing so in von Hagen's manner makes no difference.

If accounting is so important, what is the right accounting? Our answer will be that personal income and gross product accounting are both correct, but relate to

[1] von Hagen's estimate of a coefficient of over 40% in levels (von Hagen (1991), quoted once more in von Hagen (1998)) has never been reproduced. Goodhart and Smith (1993) tried and failed (p. 426); so have we twice, once before in Mélitz and Zumer (1998) and here again.

different questions, and accordingly may require different measures of net transfers. When asking about stabilization of personal income, the focus is on the welfare of residents and accordingly, the right transfers to consider are those to persons. When asking about the stabilization of gross product in a region, the question pertains to activity in a region (the productivity of firms, employment, infra-structure, etc.) and the right transfers to consider are those that affect local production. These transfers will then include those to lower-level governments and firms as well as individuals, even though the affected property owners may reside elsewhere. It is the disregard of those principles that underlies the wide differences in the previous estimates for the US. If those accounting principles are observed, the estimates of regional stabilization by the central government in this country narrow down, and come within the range of 12 to 20%. We will begin by reviewing the literature. Then we shall propose a model largely nesting the earlier specifications of stabilization and redistribution. As concerns the theoretical specification as such, our only basic extension will be to allow for distributed lags in stabilizing effects. But we shall extend previous studies in two other major regards: first, by admitting both personal income and gross product accounting as appropriate; and second, by using panel data econometrics as a uniform research methodology. Following the treatment of theory and research methods, we shall proceed to the tests.

Our general results can be summarized as follows. We find substantially larger international differences in the redistribution than the stabilization of personal income. There is a 38% reduction in the regional dispersion in the income distribution through net transfers from the center in France, a 26% reduction in the UK, and approximately a 17% one in the two North American nations. With respect to stabilization of personal income, however, the numbers are fairly similar: close to 20% for the US, France, and the UK alike, and somewhat lower, around 10 to 14%, in Canada. In the case of the redistribution and stabilization of gross output, the study could only be carried out for the US and Canada, since the regional time series in France and the UK are too short.

The resulting estimates for those two North American countries are also contrasting. We find more redistribution and stabilization of gross product than personal income in Canada, but less redistribution and stabilization of gross product than personal income in the US. With respect to the US, our figures for stabilization are always notably lower than those of SiM-S, whose high estimates, as we shall show, depend essentially on their accounting (rather than any question of levels or first differences, as von Hagen maintained and has often been perceived).

II. Earlier work

Since one of our main concerns is to clarify the sources of the wide earlier differences in estimates for the US, we begin, in Table 1, with a summary of the outstanding results of five major preceding studies of regional stabilization through the federal budget in the US. The authors in question performed more tests than we report. The first on the list, Sala-i-Martin and Sachs (SiM-S), opened the discussion of regional stabilization via the central government budget in the US by examining the separate responses of taxes and transfers to regional personal income. Like the authors of the next four studies, they measured the basic flow variables in per capita real terms. They also defined regional taxes, transfers, and incomes as ratios of the corresponding national aggregates (per capita). Therefore, all of their regional figures at every date are centered around 1 (some above, some below, 1), and if individually weighted by the ratio of the regional population to the national one, they sum up exactly to 1. In performing their tests, SiM-S also kept their variables in levels, admitted regional fixed effects, and used instruments for personal income in order to correct for simultaneity. The estimates we report from them in the table obtain under the constraint of equal coefficients of stabilization in the nine different regions for taxes and transfers, respectively (or for their two systems of nine equations). Those estimates also rest on three-stage-least-squares.

The next important contributor to the discussion, von Hagen, turned to first differences and used series for gross state product instead of personal income. Further, he pooled the data over a six-year period (1981-86) for the 50 individual states. Finally, in order to abstract from movements in the national aggregates, he did not divide by national per capita values, but rather introduced a separate time dummy for each individual date. Von Hagen's formulation was essentially repeated by Goodhart and Smith (1993), on whose study (which concerned Canada and the UK as well) we do not report. Goodhart and Smith got nearly the same estimates of stabilization in first differences as von Hagen had for the US.

The next study presented in the table, by Bayoumi and Masson (B-M), followed von Hagen's use of first differences to analyze stabilization, but employed disposable income as the dependent variable and thereby combined taxes and transfers. (The authors also experimented with a separate treatment of the two.) In other respects, however, B-M adhered to SiM-S fairly closely: they employed similar accounting and the same estimation procedure. The table shows two of B-M's estimates: the one where they limit their measure of net transfers to those received by individuals; and the other where they repeat SiM-S's broader measure of net transfers, inclusive of grants to state governments.

The following study, by Asdrubali, Sørensen and Yosha (ASY), casts a wider net than any of the rest. Instead of focusing merely on central-government transfers to the regions, they jointly examine two other mechanisms of regional risk sharing: private insurance (through income claims of the residents of one region on the output of other regions) and private borrowing. As a result, ASY estimate regional stabilization by the central government as part of a system of four equations, in which two of the equations concern the two aforementioned mechanisms of risk sharing, and another regards unsmoothed consumption. But even though ASY use generalized least squares to estimate their system, their fitted equation for central-government insurance does not differ when estimated separately with one-stage-least-squares. This need not have been the case but happens to be so in the case of the US (see Mélitz and Zumer (1999)). Thus, the equation can be detached from the rest of their system. If this is done, the equation can be easily seen to be a straightforward application of von Hagen's estimation procedure. The growth rate of net transfers is on the lefthandside of the equation (in logs, as in von Hagen); the growth rate of gross state product is on the righthandside; all the variables are per capita real figures; and temporal fixed effects take into account common changes in the regional values. The only basic departure from von Hagen in ASY is that they define net transfers more broadly than he did – indeed, theirs is the broadest definition anywhere in the discussion, as it incorporates all net transfers to corporations, individuals and state governments, as well as all federal indirect taxes.

The last of the studies in the table, by Obstfeld and Peri (O-P) diverges from the rest by using a bivariate VAR to estimate stabilization, and thus allowing for some dynamic adjustment (in common with an earlier version of our work). In addition, the authors effectively employ the same accounting as SiM-S; that is, they combine personal income with a broad measure of net transfers.

Upon scrutiny, it becomes clear that the differences in the earlier estimates could stem from the accounting. Those studies that use personal income accounting yield much higher estimates of stabilization that those using gross state product accounting, and the more inclusive the definition of net transfers in the analysis, the higher the stabilization estimate they obtain. The exception to this generalization is O-P, who employ personal income accounting while using a broad measure of net transfers, and therefore, on our claim, should have come up with high estimates of stabilization but do not. One reason may be O-P's use of a bivariate VAR. Another factor may be their restriction of stabilization effects to two years. In our own application of dynamic panel data econometrics, we find significant effects that last longer. But we are not sure. Even in the case of the other four studies, of course, it is still to be shown that the differences in the estimates result strictly from the accounting, since other factors could be at work. As the table displays, the four studies differ in many other respects: the use of levels or first differences, instrumental variables, regional fixed effects, and pooling or three-stage-least-squares. Only an application of a consistent econometric methodology to the whole range of relevant hypotheses can justify the conclusion that accounting is the critical factor. We turn to such a consistent methodology next. We shall also apply the same methodology to three additional national data sets besides the US.[2]

III. Theory

Since we shall follow B-M's distinction between redistribution and stabilization, let us begin by repeating their equations for the two. However, in order to avoid any misunderstanding right at the start, it is important to observe that even though B-M's equation for redistribution is stated in levels, while their equation for stabilization is in first differences, that particular difference has nothing to do with the distinction between redistribution and stabilization. Rather, their distinction hinges on the fact that the equation for redistribution refers strictly to the cross-sectional evidence over the study period as a whole, whereas their equation for stabilization takes the regional time series into account. Here then are their two equations, stated in similar notation to theirs:

$$\frac{DI_i}{DI_N} = \alpha + \beta \frac{PI_i}{PI_N} + \varepsilon_i \qquad (1)$$

$$\Delta\left(\frac{DI_i}{DI_N}\right)_t = \alpha_i + \beta_i \, \Delta\left(\frac{PI_i}{PI_N}\right)_t + \varepsilon_{it} \qquad (2)$$

DI refers to per capita disposable income, PI to per capita personal income, i is a regional index, and N is a national index. Equation (1) contains no time subscripts, which is B-M’s way of signifying that the variables are averages over the entire study

[2] But even before doing so, we may pause to dismiss Fatás' suggestion that the different methods of control for aggregate influences have any role to play. First principles tell us that controlling for those influences by dividing all of the regional variables by the national aggregates or introducing dummy variables for the individual dates should come essentially to the same. In fact, we have used both methods to correct for aggregate changes and can report that they yield indistinguishable results. Empirical support will follow, partly in note 10 (where we make significant reference to Goodhart and Smith (1993)).

period, and that the equation refers strictly to cross-sections. $1-\beta$ in equation (1) is B-M's measure of redistribution, and $1-\beta_i$ in equation (2) is theirs of stabilization.

(a) *The proposed framework*

We propose to derive the same equations by starting from the more general hypothesis:

$$Y_{it} = \alpha_d + \beta_d \overline{X}_i + \beta_s (X_{it} - \overline{X}_i) + \varepsilon_{it} \quad (i = 1,2, ..., M;\ t = 1,2, ..., T) \qquad (3)$$

X_{it} stands for either $(PI_i/PI_N)_t$ or $(GP_i/GP_N)_t$, GP is gross product; Y_{it} is the disposable value of X_{it}, after adding net transfers (+ or –) from the central government; and $\overline{X}_i$ and $\overline{Y}_i$ are the averages of X_{it} and Y_{it} over the whole period T. We shall use "income" and "disposable income" as portmanteau terms for X and Y when we want the terms to refer indifferently either to *personal* income or *gross product*.

The model postulates two concurrent but separate influences on regional disposable income (as a percentage of the national disposable income) Y_{it}: one depending on the average income (prior to central-government taxes and transfers) over the entire period; the other on temporary deviations from the average. The average, $\overline{X}_i$, may be understood to reflect permanent income, while the deviations, $X_{it} - \overline{X}_i$, reflect transitory income instead. Accordingly, the coefficient β_d, relating to the response to the long run average income, concerns redistribution via the central budget (permanent changes in Y_i), while the coefficient β_s, concerning the response to transitory deviations from the previous long run average, regards smoothing or stabilization via the center instead (mere changes in the time profile of Y_i). Based on this conception, redistribution evidently may exist even when there is no movement in the time series, whereas stabilization hinges entirely upon such movement.

Suppose next we decompose equation (3) into two parts:

$$\overline{Y}_i = \alpha_d + \beta_d \overline{X}_i + \eta_i \qquad (4)$$

$$Y_{it} - \overline{Y}_i = \beta_s (X_{it} - \overline{X}_i) + \mu_{it} \qquad (5)$$

where η_i and μ_{it} are two new disturbance terms. Equations (4) and (5) obviously add up to (3) (with $\eta_i + \mu_{it} = \varepsilon_{it}$). Upon examination, equation (4) is perfectly identical to B-M's equation (1). But equation (5) deviates from their equation (2) in being stated in levels and having no constant term. This last equation can also be formulated as:

$$Y_{it} = \alpha_i + \beta_s X_{it} + \mu_{it} \qquad (6)$$

with α_i equal $\overline{Y}_i - \beta_s \overline{X}_i$. Equation (6) has the advantage of exhibiting the important fact that, contrary to possible first impressions, the specification does indeed harbor a regional fixed effect.

Suppose we consider this last equation in first differences. Then the fixed effect, α_i, disappears. However, should the disturbance term u_{it} contain a drift element (or one that continually grows or diminishes with time), the first difference of equation (6) will still contain a regional constant and be:

$$\Delta Y_{it} = d_i + \beta_s \Delta X_{it} + \nu_{it} \qquad (7)$$

where d_i is now the drift per period. Equation (7) now replicates B-M's equation (2) precisely, or does so once we set all the β_i coefficients equal in all regions, that is, in the case reported in Table 1. In our analysis of stabilization, we shall study β_s both with equations (6) – or identically (5) – and (7), if only to dispel the popular notion that the differences in the estimates have anything to do with the choice of formulation in levels or first differences.

Going back to equations (4) and (5) for a moment, it is important to note that the two also assume the canonical form in panel data econometrics. As is well known in panel data econometrics, estimates of equations (4) and (5) produce identical estimates of β_d and β_s to those that are gotten by estimating equation (3). Indeed, this fact underpins the usual estimation of equations (4) and (5) separately. The general practice in panel data econometrics is also to term β_d a "between" coefficient, β_s a "within" coefficient, and to interpret the two as different estimators of a single parameter β. But we will deviate from this last practice, and as a result, will eschew the entire "between-within" terminology but always refer to β_d and β_s as separate "redistribution" and "stabilization" parameters instead.

The reasons for admitting the possibility of separate parameters for redistribution and stabilization should be underlined, even though the matter has sometimes been treated as obvious. Tax and transfer systems are clearly designed, in part, to reduce income differentials, and in part, to provide collective insurance against individual accidents. Efforts to equalize are reflected in provisions for the progressivity of taxes, anti-poverty programs and features assuring each person certain social services (or their availability) largely independently of income. Efforts to stabilize are reflected, instead, in marginal tax rates (apart from any progressivity), temporary unemployment compensation and temporary tax breaks. In principle, we can easily imagine national contexts where taxes would only exist at high incomes, become very progressive at those incomes, redistributive spending would be high, and there would be no unemployment compensation, no temporary subsidies, no temporary tax breaks. Redistribution consequently would be strong and stabilization weak. Or we can imagine the opposite: strictly proportional taxation, lots of temporary aid in case of disasters but no permanent assistance to the poor. Evidently, then, strong redistributive measures do not imply strong stabilization or the converse. This possibility underlies our distinction between β_d and β_s.

The previous equations also assume strictly contemporary stabilizing effects. Suppose instead that there are lagged influences. In this case, rather than equation (5), a distributed-lag version is more fitting: namely,

$$Y_{it} - \overline{Y}_i = \sum_{j=0}^{L} \beta_{t-j} (X_{it-j} - \overline{X}_i) + \mu_{it} \qquad (8)$$

where L is the number of lags.

We shall estimate stabilization based the cumulative sum $\sum_{j=0}^{L} \beta_{t-j}$ of equation (8) as well as equations (5) and (7). We further propose to apply panel data econometrics as a uniform methodology in all three cases. The three equations can be estimated on this econometric basis either with OLS or by admitting a reciprocal influence of Y_{it} on X_{it}. We shall do both in dealing with equations (5) and (7), but only test equation (8) in the more sophisticated way, that is, with reciprocal effects. Quite specifically, in estimating equation (8), we will use the technique suggested by Arellano and Bond (1991) in order to take into account reciprocal influences in the framework of panel data econometrics. Their suggestion involves an application of the generalized method of moments (GMM), and requires moving to first differences in order to find appropriate instruments for X_{it} (in levels). Basically, the method exploits all the orthogonality conditions existing between the lagged values of the endogenous variables and the disturbances. Thus, while equation (8) may be stated in levels, the procedure that we will use to test it will mean converting to first differences at an initial stage.

(b) *The framework in relation to the literature*

Our basic reason for using equations (5), (7) and (8) in order to estimate stabilization is obviously our wish to explain the differences between the earlier studies of the subject. Let us be more explicit now about the relation of these three equations to the previous work. Equation (5) is very close to SiM-S's specification in the case we have cited in Table 1 where SiM-S constrain their stabilization parameters to be the same in all regions. This is particularly evident if we view our equation (5) in the form of (6). As may be seen, there is then the same specification as SiM-S's in levels and there are the same regional fixed effects. As already mentioned, equation (7) is a perfect replica of B-M's equation (2) once all of the stabilization parameters in equation (2) are equated across the regions. But since specifying the variables in ratios or adding temporal fixed effects comes to the same, equation (7) is also very close to von Hagen and ASY's common specification. The only difference of note between this last equation and their specification is the presence of a regional drift in equation (7), which von

Hagen and ASY exclude.[3] Thus, as long as we accept the possible interpretation of X_i as gross state product and are willing to admit the eventuality of a drift term, d_i, equation (7) can stand as well for von Hagen and ASY's common specification as for B-M's. Equation (8) takes us particularly close to O-P (1998), as they recognize themselves. In both cases, the stabilizing response to a shock assumes the form of a dynamic process, there are reciprocal effects (because of our use of Arellano-Bond), and the stabilization parameter can be interpreted as a cumulative influence over time.

As regards redistribution, or equation (4), let us note that B-M are not alone in choosing to estimate a redistribution parameter by regressing the long run average levels $\overline{Y}_i$ on $\overline{X}_i$, since O-P do as well. Admittedly, O-P perform the regression with estimated instead of observed values of $\overline{X}_i$ and $\overline{Y}_i$, and this can lead to wide differences in the estimates of β_d. But the basic conception of the distinction between stabilization and redistribution in B-M and O-P is the same.

(c) *The accounting choices*

The one fundamental issue remaining to be discussed concerns our claim that the interpretation of net transfers by the central government should differ depending on the choice of interpreting X_i as regional gross product or regional personal income.

We can think of regional income as the production in the region. However, in this case, the income belongs partly to the residents of other regions. Or else we can think of regional income as the income of the residents. But then some of the income stems from production in other regions. Both choices seem equally reasonable to us. We see no ground for dismissing one in favor of the other.[4] Yet, based on usual regional

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[3] Other differences are barely mentionable. The use of logs makes no difference at all, since the values are all centered around one. Defining Y_i as the disposable value of X_i (like B-M) instead of net transfers (like SiM-S and von Hagen) is also of little import. While B-M (1995) argue convincingly for their definition of Y_i, and we adopted this definition in the light of their reasoning, we have found the decision to have no notable influence on the estimates.

[4] In a related way, either GDP or GNP can serve to measure aggregate income, though GNP depends on nationality rather than residence.

statistics, the two choices give rise to significantly different orders of magnitude for X_i, since regional output figures add up to gross national product, while the regional figures for the residents' income add up only to national personal income, and the former aggregate is far larger than the latter.

Depending on which measure of X_i we use, we also ask a different question when we inquire about redistribution and/or stabilization of relative regional incomes by the central government. In one case, the question regards the changes in the regional composition of the disposable gross product after net transfers by the center, and in the other case, it relates to the changes in the regional composition of disposable personal income after the transfers. In either case, the relevant transfers include all the central-government net transfers to the residents. But should they also include the net transfers to lower-level governments and firms? It would seem that the answer is positive if the focus is on regional output, since these transfers plainly support local activity. But the issue is less clear if the focus is on the income of residents. Granted, the residents of a region derive benefits from central-government subsidies to their local governments just as they do from direct subsidies to themselves, since the former provide them with better services of transportation, recreation, education and so forth. Yet some of those benefits also go to people outside the region, not only because of tourists, transients and commuters, but also because of network externalities (as regards communications and transportation) and public good considerations (as regards education and research). Similarly, the central-government subsidies to local firms may help local employment, but they also provide income support to the owners of the firms who reside outside the region.

There is much more to the issue than that, however. If we are to include the net transfers to lower-level governments and firms in estimating the redistribution and stabilization of personal income, the question arises why we do not make other, similar imputations in measuring personal income, and accordingly, why we do not use a broader measure of personal income. Some of the undistributed income of local firms that does not receive any upper-government support also belongs to the residents; and some of the value-added of local government spending that does not receive any such support belongs to them too (aside from the portion of this local spending that the residents receive through wages and interest). This emphasis is essential since the numbers for redistribution and stabilization are affected. If any imputations are made in assessing how much is added to personal income by the central government budget, but no other similar imputations are made in calculating personal income, the figures for redistribution and stabilization will systematically be swelled. Therefore, our view is simply that the choice of a broad measure of net transfers requires a correspondingly broad measure of income, and inversely, that a narrow measure of one requires a narrow measure of the other. The concepts of income before and after net transfers must agree.

In any event, we shall show that such accounting choices are the key to the wide range of estimates in the US. As we shall see, combining a broad measure of net transfers with a narrow measure of regional income furnishes high numbers for redistribution and stabilization, while combining a narrow measure of net transfers with a broad measure of regional income furnishes low numbers for them.

As a further consideration, we will find that in the case of France and the UK but not the US and Canada, our choice of panel data econometrics is very important (and it is so because fewer data are available for France and the UK than the US and Canada rather than anything else).

IV. The results

Figures for regional personal income (PI_i) are easier to construct by official Statistical services and therefore more readily available than regional gross product (GP_i) ones. For that reason, we were only able to carry out the study for all four countries in regard to personal income. As concerns gross product, we were limited to the US and Canada. The French and British series for GP_i are too short. In the case of the UK, not only are the GP_i series available only for 1982-93, but we lack a regional decomposition of central government transfers to lower-level governments as well.

Matters are worst of all for France, where the GP_i series only cover seven years, 1982-88, or at least did so when our study began. In addition, experiments with the income approach (using PI_i) for UK and France taught us that estimates of β_s tend to be biased toward one when the study period covers only a decade or so. Even with respect to the US and Canada, there are problems. There exists a series for GP_i for the US going back to 1963, but Beemiller of the Bureau of Economic Analysis insists that the series was constructed on altogether different principles prior to 1977 (see Beemiller and Dunbar (1993)), and the BEA now refuses to diffuse the numbers before that date. Therefore, we begin the study of redistribution and stabilization of gross product for the US only in 1977. Similarly, as regards Canada, a change took place in the method of constructing the published data on GP_i in the early eighties. But we were fortunate enough to receive a coherent series directly from *Statistics Canada* for 1965-88, the same study period we use for personal income. All of our sources of variables are described in the Data Appendix and this data, along with our exact definitions of the variables, is available on the journal's website (or directly from us).

We begin with our results relating to personal income, and therefore concerning all four countries.

(a) *The redistribution and stabilization of personal income in all four countries*

At the start of our work, we duplicated B-M's results on personal income in the US and Canada. This proved possible because B-M were sufficiently kind to let us have their data and programs. We then went on to employ panel data econometrics, and once we did so switched to the use of the full sample of 48 states for the US rather than sticking to B-M's 8 regions.[5] None the less, we continued to follow B-M in dropping the sparsely populated provinces of Prince Edward Island, the Yukon and Northwest Territories in Canada. In reporting our work in Table 2, we disregard the early phase of

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[5] 48 instead of 51 because we still left out Hawaii, Alaska and the District of Columbia, as did B-M from their regions.

replication and only show the panel data results for all four countries. In addition, we report only on what we regard to be consistent accounting, or, in the example at hand (personal income), the cases where net transfers consist strictly of personal taxes and personal transfers. The standard errors, in parentheses, relate to β_d and β_s, or the estimated coefficients as such, rather than $1-\beta_d$ and $1-\beta_s$, redistribution and stabilization. Our estimates of β_d are also standard "between" ones of panel data econometrics, which means that all of the M regional observations (M as in equation 3) were repeated by the number of periods T (see Mátyas and Sevestre (1996)).

In the case of redistribution, the conclusions can be seen to be those mentioned in the introduction: 38% redistribution for France, 26% for the UK, and around 16% for the US and Canada. The implied differences between the four countries are therefore very wide. Essentially, efforts to narrow regional differences in personal income appear to be far greater in the two centrally organized European economies than in the two federally organized North American ones.

In estimating stabilization with equations (5) and (7), we experimented with instrumenting X_i the same way as B-M did, namely, by using the first lagged value of $\Delta(PI_i/PI_N)$, a constant, and time trend. We tried extra lags in $\Delta(PI_i/PI_N)$ as well. The instrumentation invariably did not affect the estimate of β_s but simply lowered the overall fit. As they lack interest, we do not report these experiments, and our only use of instrumentation shown in Table 2 is in the last column, which concerns Arellano-Bond. Our instrumentation there is also our most sophisticated (by far).

Comparing the estimates of β_s in equations (5) and (7), we see that employing levels or first differences makes no difference at all. But even the use of a dynamic model, or equation (8), makes only a mild difference. Based on this last equation, the estimates of stabilization are somewhat closer together internationally than those resting on simple panel data econometrics (equation 7). In the case of simple panel data econometrics, stabilization ranges from a high of 26% for the UK to a low of 10% for Canada, with the US and France standing close together in the middle. But when we turn to the dynamic panel data estimates instead, the degree of stabilization tends to converge toward 20% in the UK, France and the US; only Canada remains an outlier with 14% stabilization. However, even in the Canadian case, the estimate is closer to the other three than before.

Those Canadian and US estimates also do not differ much from the earlier ones by B-M based on 3SLS. However, when we applied their method of estimation for France and the UK (which required dividing France into 8 large regions rather than retaining 21 so as to preserve enough degrees of freedom, in light of the need to constrain the β_s coefficients to be equal across all the regions), we obtained estimates of stabilization diverging widely from the panel data ones in the table. Based on B-M's method, the estimates of β_s are about one, and therefore would imply no stabilization at all. Yet, as can be seen from Table 2, panel data econometrics yields estimates of around 20% stabilization for both countries – a bit over 20% for the UK, a bit under for France. These differences in estimates hinge entirely on the lower efficiency of the 3SLS procedure when a uniform β_s serves across all regions. The British and French series happen to be particularly short. Therefore, if we need to impose equal β_s coefficients for all the regions, as is true when using separate regional equations and 3SLS, the degrees of freedom are very low. Panel data econometrics avoids the problem entirely by supposing a single equation and a single β_s from the start.[6] Moreover, it would be difficult, if not impossible, to reconcile the implied absence of stabilization, based on B-M's estimation procedure, with the estimates of redistribution of 38% and 26% for France and the UK that rest on the same data. We assign no weight at all to those 3SLS estimates.[7]

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[6] To be sure, SiM-S's and B-M's use of 3SLS may be nevertheless justified as long as we look for a separate coefficient β_s for each region.

[7] Our earlier working paper, Mélitz and Zumer (1998), contains both those estimates and our general replication of B-M.

(b) *The redistribution and stabilization of both gross product and personal income in the US and Canada*

In the case of the US and Canada, it is possible to study the redistribution and stabilization of gross product as well as personal income. This then provides us a fitting opportunity to display the general importance of the issue of the accounting choices. In the process, we shall also shed light on the marginal contributions of different categories of net transfers to redistribution and stabilization (as B-M did before us). Our results regarding personal income are in Table 3, those concerning gross product in Table 4. The first two rows of both tables introduce new material into the discussion and serve to give an idea of the respective contributions of personal taxes (rows 1) and other taxes (rows 2), as such, to redistribution and stabilization. The subsequent rows, 3, add information about the marginal contributions of direct transfers (rather than taxes) to redistribution and stabilization. Of course, in the case of Table 3 (or personal income), these third rows also repeat the estimates in Table 2 for the US and Canada. The repetition is exact for Canada where the study period is the same. But for the US, where the relevant study period is shorter (1977-1992), the new pertinent estimates are shown. These new estimates also differ little from the old. The dynamic panel data estimates in both Tables 3 and 4 relate strictly to our preferred definitions of net transfers. Thus, they appear only in rows 3 of Table 3 and rows 4 of Table 4. In general, the estimates in Table 3 agree entirely with those of B-M when they applied the same decomposition of net transfers to personal income (which they never did in regard to gross product or Table 4).[8]

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[8] Two basic differences exist between the US and Canadian data in Tables 3 and 4. First, the tax contributions to social insurance in Canada cannot be separated from direct taxes. This explains why there are no separate numbers for Canada in rows 1 in both tables (compare B-M (1995), including the Appendix). Second, as regards Canada, an official decomposition of federal indirect taxes is available. These taxes are also about four times higher than in the US, averaging around 4.5% of GDP over the study period. Thus, in the Canadian case, the fourth rows add indirect taxes as well as grants.

Viewing both Tables 3 and 4 as a whole, it is clear that successively broader definitions of net transfers yield successively higher estimates of redistribution and stabilization.[9] Comparison of Tables 3 and 4 also permits seeing at a glance that the application of any given measure of net transfers to gross product rather than net income systematically lowers the estimates of redistribution and stabilization. This is not surprising since such application, or moving along any given row from Table 3 to Table 4, means associating the same net transfers with larger values of the independent variable, as regional gross output figures are far greater than personal income ones on the whole. The rest of our discussion of Tables 3 and 4 will focus strictly on rows 3 and 4, which had been our sole preoccupation before.

The rows 3 of Table 4 essentially amount to using von Hagen's accounting. As compared with the rows 3 of Table 3 (where personal income is the measure of X_i), the outcome is a notable reduction in the estimates of redistribution and stabilization in both countries. Interestingly enough, the drop is sharper for Canada than the US. But the choice of levels or first differences makes no mentionable difference. Either way, row 3 of Table 4 in the American case displays von Hagen's estimate of 10% stabilization in the US. Since we correct for changes in the aggregates using SiM-S's and B-M's method rather than von Hagen's, this difference is also manifestly irrelevant.[10]

Rows 4 of Tables 3 and 4 associate the broad measure of net transfers with gross product. Therefore, they basically concern ASY's accounting. Indeed, row 4 of Table 4

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[9] The one minor exception to this rule is that stabilization of gross product goes down in passing from line 1 to 2 in the test in first differences for the US in Table 4 – that is, when the taxes for social insurance are added. But the marginal contribution of these taxes to redistribution and stabilization is generally low for the US.

[10] We also tried estimating equation (5) – in levels – using von Hagen's accounting for his limited study period of 1981-86. The estimate of β_s is still 9%, exactly the one that Goodhart-Smith (1993) obtained (p. 426) when they too tested in levels for the same period with von Hagen's accounting (and also his use of time dummies). In addition, we are unable to account for von Hagen's report that he found little difference when he substituted personal income for gross product as the explanatory variable.

for the US essentially repeats ASY's estimate. The sole difference between this estimate and theirs for the US stems from their use of a still broader measure of net transfers, inclusive of federal excise taxes (which required a special regional decomposition of their own) and federal taxes on corporate income. As can be seen, their 13% estimate of stabilization for the US exactly matches ours in this row. The corresponding rows 4 of Table 3, concerning personal income, mainly replicate SiM-S's accounting, which B-M largely endorse (while examining narrower measures of net transfers as well). Since these estimates associate the widest possible measure of net transfers with the lower measure of income, the estimates of stabilization hit a peak. Figures close to 30% now appear reasonable for the US, while stabilization could be as high as 25% for Canada.

If we look back over rows 3 and 4 of Tables 3 and 4 as a whole, the figures for redistribution and stabilization go from lows of around 10% to highs of around 30% for the two countries. But, on our view of the right numbers to consider – namely, those excluding grants in Table 3 and including them in Table 4 – the differences narrow, and the estimates of stabilization and redistribution remain essentially in the 10 to 20% range in both countries. In addition, and quite significantly, the figures based on gross product in rows 4 in Table 4 are uniformly inferior to those based on personal income in rows 3 of Table 3 for the US, while the opposite is true for Canada. Therefore, there seems to be a tendency toward more redistribution and stabilization of personal income than gross product in the US, and an opposite one toward more redistribution and stabilization of gross product than personal income (which is clearer for redistribution than stabilization) in Canada. Data limitations do not permit us to say whether the situation in France and the UK resembles more that in the US or Canada in this last regard.

V. Conclusion

We have proposed a general framework for examining previous work on regional redistribution and stabilization, and we have introduced two basic changes in the analysis: first, consistent accounting; and second, panel data econometrics. The choice between personal income and gross product accounting plays a central role in the discussion. In our view, both sorts of accounting are correct. But the two deal with separate questions and require separate measures of net transfers. Based on consistent accounting, we have shown that the American figures for stabilization are not as widely apart as they often appear. The use of panel data econometrics, as opposed to some earlier methods, also proves particularly beneficial in examining France and the UK, where study would otherwise be nearly impossible.

Based on the combination of consistent accounting and panel data econometrics, the redistribution of personal income varies from 38% in France to 17% in the US and Canada, with UK in between at 26%. But stabilization of personal income is around 20% in all four cases – or at least all of them except Canada, where the figure is closer to 10-15%. As regards the redistribution and stabilization of gross product, however, where we could only study Canada and the US, estimates for Canada go up to around 15 to 20%, while those for the US go down to the 10 to 15% range. Further international applications would be all to the good.

DATA APPENDIX

As mentioned in the text, all of the data used in this paper is available on the journal’s website or from ourselves.

In the case of the US, the data come directly from the Bureau of Economic Analysis (BEA) of the US Department of Commerce, except for the federal grants in aid to state and local government, which come instead from US Department of Commerce, *Federal Expenditures by State for Fiscal year 19*-- (various years), or (equivalently) the *Statistical Abstract of the United States*. All the data are available from 1958 to 1994 except for GP_i, for which a consistent series goes only from 1977 to 1992, as explained in the text, and except for the federal grants, for which the series starts in 1969.

For Canada, all of the series come from an extract of the CANSIM database "Provincial Economic Accounts," that we obtained directly from *Statistics Canada*, and which was especially prepared for us. These figures rest on new methods of construction that were adopted in the early eighties. Though all the series are available for 1961-1994, we performed the tests strictly for 1965-88, B-M's sample period, because parts of the longer series reached us only very late.

The main source of French regional data is "Les comptes régionaux des ménages," *INSEE Résultats*, *Economie Générale* no. 65-66, février 1993. But this source contains numerous gaps, which needed to be filled in from the INSEE publications, *Annuaire statistique de la France* (various years), *Archives et Documents* no. 180, septembre 1986, and *Collections de l'INSEE série R* (various years). For the details, see Zumer (1996).

As regards the UK, the main source is the Central Statistical Office, *Regional Trends* (various years). But we obtained a print-out of the essential series directly from the CSO (which has since become the Office for National Statistics). All of the British series are available for 1971-1993 inclusively.

In closing, it is important to observe that while offical series for regional gross product can generally be directly identified with GP_i, those for regional personal income frequently cannot be identified with PI_i. The reason is that the data for "personal income" often includes some transfers from the central government and, as in the case of the US, may be defined net of social security taxes. Corrections are therefore necessary. In the course of handling the problem (which arose for all four countries except France), we had the benefit of disposing of the detailed series and definitions of Bayoumi and Masson (1995) for the US and Canada, and those of Asdrubali, Sørensen and Yosha (1996) for the US. Thus, we were able to compare with their choices. As regards these particular authors, therefore, we can virtually account for every last difference between our figures and others' for the US and Canada. A detailed explanation of all our choices is present in our data file.

REFERENCES CITED

Arellano, M., Bond, S., 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. Review of Economic Studies, 58, 277-297.

Asdrubali, P., Sørensen, B., Yosha, O., 1996. Channels of Interstate Risk-sharing: United States 1963-1990. Quarterly Journal of Economics, 111, 1081-1110.

Bayoumi, T., Masson, P., 1995. Fiscal Flows in the United States and Canada: Lessons for Monetary Union in Europe. European Economic Review, 39, 253-274.

Beemiller, R. M., Dunbar, A. E., 1993. Gross State Product, 1977-90. Survey of Current Business, December, 28-37.

Fatás, A., 1998. Does EMU Need a Fiscal Federation. Economic Policy, 26, April, 163-203.

Goodhart, C., Smith, S., 1993. Stabilisation. In: EC, The Economics of Community Public Finance. European Economy, Reports and Studies, 5, 417-455.

Mátyas, L., Sevestre, P., 1996. The Econometrics of Panel Data, second ed. Kluwer Academic Publishers, Netherlands.

Mélitz, J., Zumer, F., 1998. Regional Redistribution and Stabilization by the Center in Canada, France, the United Kingdom and the United States: New Estimates Based on Panel Data Econometrics. CEPR Discussion Paper, no. 1829.

Mélitz, J., Zumer, F., 1999. Interregional and International Risk Sharing and Lessons for EMU. Carnegie-Rochester Conference Series on Public Policy, 51, December, 149-188.

Obstfeld, M., Peri, G., 1998. Regional Nonadjustment and Fiscal Policy. Economic Policy, 26, April, 205-259.

Pisani-Ferry, J., Italianer, A., Lescure, R. 1993. Stabilisation Properties of Budgetary Systems: A Simulation Analysis. In: EC, "The Economics of Community Public Finance," European Economy, Reports and Studies, 5, 511-538.

Sala-i-Martin, X., Sachs, J., 1991. Fiscal Federalism and Optimum Currency Areas: Evidence for Europe from the United States, NBER Working Paper no. 3855; subsequently published In: Canzoneri, M., Grilli, V., Masson, P. (Eds), Establishing a Central Bank: Issues in Europe and Lessons from the U.S., Cambridge University Press, UK, 1992.

von Hagen, J., 1992. Fiscal Arrangements in a Monetary Union – Some Evidence from the US. In: Fair, D., de Boissieu, C. (Eds), Fiscal Policy, Taxes, and the Financial System in an Increasingly Integrated Europe, Kluwer Academic Publishers, Netherlands.

von Hagen, J., 1998. Fiscal Policy and Intranational Risk-sharing, ZEI working paper, B13, University of Bonn, forthcoming In: Hess, G., van Wincoop, E. (Eds), Intranational Macroeconomics, Cambridge University Press, UK.

Zumer, F., 1996. Fédéralisme Budgétaire et Stabilisation. Doctoral dissertation, Institut d'Etudes Politiques de Paris.

TABLE 1

EARLIER STUDIES OF STABILIZATION IN THE US

	Sala-i-Martin and Sachs (1991)	**von Hagen (1992)**	**Bayoumi and Masson (1995)**	**Asdrubali, Sørensen and Yosha (1996)**	**Obstfeld and Peri (1998)**
REGIONS	9	50	8	50	51
PERIODS	1970-88	1981-86	1. 1965-86 2. 1971-86	1964-90	1969-85
INDEPENDENT VARIABLE	$\ln\left(\frac{PI_i}{PI_N}\right)$	$\Delta \ln GP_i$	$\Delta\left(\frac{PI_i}{PI_N}\right)$	$\Delta \ln GP_i$	$\ln\left(\frac{PI_i}{PI_N}\right)$
DEPENDENT VARIABLE(S)	$\ln\left(\frac{T_i}{T_N}\right)$ $\ln\left(\frac{TR_i}{TR_N}\right)^*$	$\Delta \ln T_i$ $\Delta \ln TR_i$	1. $\Delta\left(\frac{DI_i}{DI_N}\right)$ 2. $\Delta\left(\frac{DI_i}{DI_N}\right)^*$	$\Delta \ln\left(\frac{PI_i}{DI_i}\right)^*$	$\ln\left(\frac{DI_i}{DI_N}\right)^*$
FIXED EFFECTS	REGION	PERIOD	REGION	PERIOD	REGION
OTHER INDEPENDENT VARIABLES	TREND, VARIETY OF INSTRUMENTS	OIL STATES	NO	NO	NO
RECIPROCAL EFFECTS	YES	NO	YES	NO	YES
NUMBER OF EQUATIONS	9 TAXES, 9 TRANSFERS	1 TAXES, 1 TRANSFERS	8 NET TRANSFERS NARROW, 8 NET TRANSFERS WIDE	4	1 PERSONAL INCOME, 1 DISPOSABLE INCOME
TEST METHOD	3SLS	POOLING : OLS	3SLS	POOLING : GLS	BIVARIATE VAR
SINGLE-VALUE ESTIMATE OF STABILIZATION	40%	10%	1. 23% (1) 2. 30% (2)	13%	12% (3)

PI = Personal Income   GP = Gross Product   T= Taxes
TR = Transfers   DI = Disposable Income
Index i refers to Region   Index N refers to Nation
Asterisk signifies broad definition of transfers or net transfers, as the case may be.

(1)The estimate pertains to Bayoumi-Masson's narrow definition of net transfers.
(2)The estimate pertains to Bayoumi-Masson's broad definition of net transfers.
(3)The estimate is the cumulative two-year effect rather than the current one-year effect (10%).

TABLE 2

REDISTRIBUTION AND STABILIZATION OF PERSONAL INCOME IN THE US, CANADA, FRANCE AND THE UK

	REDISTRIBUTION Eq. (4)		STABILIZATION					
			LEVEL Eq. (5)		FIRST DIFFERENCES Eq. (7)		DYNAMIC Eq. (8)	
	$1-\beta_d$	$\overline{R}^2$	$1-\beta_s$	$\overline{R}^2$	$1-\beta_s$	$\overline{R}^2$	$1-\beta_s$(1)	$\overline{R}^2$
USA (60-94) 48 Regions	0.158 (0.014)	0.987	0.174 (0.006)	0.923	0.155 (0.007)	0.894	0.203 (0.015)	0.978
CANADA (65-88) 9 Regions	0.164 (0.018)	0.996	0.095 (0.016)	0.936	0.104 (0.021)	0.903	0.144 (0.007)	0.994
FRANCE (73-89) 21 Regions	0.380 (0.031)	0.955	0.171 (0.029)	0.701	0.156 (0.028)	0.734	0.194 (0.040)	0.939
UK (71-93) 12 Regions	0.260 (0.033)	0.980	0.259 (0.028)	0.734	0.255 (0.043)	0.531	0.210 (0.001)	0.965

The standard errors in parentheses pertain to β_d or to β_s, respectively. Regional constants are omitted. The designated equations, to which β_d and β_s, refer are as follows:

Equations:

(4) $\overline{Y}_i = \alpha_d + \beta_d \overline{X}_i + \eta_i$

(5) $Y_{it} - \overline{Y}_i = \beta_s (X_{it} - \overline{X}_i) + \mu_{it}$

(7) $\Delta Y_{it} = d_i + \beta_s \Delta X_{it} + \nu_{it}$

(8) $Y_{it} - \overline{Y}_i = \sum_{j=0}^{L} \beta_{t-j} (X_{it-j} - \overline{X}_i) + \mu_{it}$

In the case of equation (8), β_s refers to $\sum_{j=0}^{L} \beta_{t-j}$.

(1) The respective estimates of the individual β_{t-j} terms for $\beta_s = \sum_{j=0}^{L} \beta_{t-j}$ are as follows:

US : $0.858\, x_t - 0.064\, x_{t-1} - 0.036\, x_{t-2} + 0.027\, x_{t-3} + 0.014\, x_{t-4}$
(0.012) (0.010) (0.011) (0.010) (0.0009)

CAN : $0.923\, x_t - 0.044\, x_{t-1} - 0.023\, x_{t-2} + 0.010\, x_{t-3} - 0.011\, x_{t-4}$
(0.002) (0.003) (0.005) (0.002) (0.001)

FR : $1.079\, x_t - 0.052\, x_{t-1} - 0.116\, x_{t-2} - 0.010\, x_{t-3} - 0.003\, x_{t-4} - 0.006\, x_{t-5} - 0.084\, x_{t-6}$
(0.047) (0.044) (0.042) (0.040) (0.034) (0.048) (0.029)

UK : $0.875\, x_t - 0.038\, x_{t-1} - 0.010\, x_{t-2} - 0.032\, x_{t-3} - 0.025\, x_{t-4} + 0.0007\, x_{t-5}$
(0.002) (0.002) (0.002) (0.003) (0.002) (0.003)

Instruments used in dynamic panel data estimations with GMM : **US** : lag-3-and-greater instruments. **CAN** : lag-1-and-greater instruments. **FR** : lag-4-and-greater instruments. **UK** : strong exogeneity.

Explanation : The list of potential instruments in the GMM estimation for the US is X60 to X94, where X60 is the vector of cross-section data for the year 1960. Since X_t to X_{t-4} were retained, a lag-0 instrument matrix means that the set of instruments used in the first GMM equation is X60 to X65. Correspondingly, the matrix will be X60 to X66 for the second GMM equation, and etc. A lag-1-and-greater instrument matrix means that the set of instruments used in the first GMM equation is X60 to X64, etc. Strong exogeneity means that all instruments are used for all equations. Otherwise, there is weak exogeneity. We tested for strong exogeneity of the X's, as well as for weak exogeneity of lag order 0-and-greater (the extreme case), 1, 2, 3, etc. with the appropriate Chi-squared statistics, and we report the resulting efficient estimation.

TABLE 3
REDISTRIBUTION AND STABILIZATION OF PERSONAL INCOME IN THE USA AND CANADA

NET TRANSFERS	REDISTRIBUTION Eq. (4)		STABILIZATION					
			LEVELS Eq. (5)		FIRST DIFFERENCES Eq. (7)		DYNAMIC Eq. (8)	
USA (77-92) 48 Regions	$1-\beta_d$	$\bar{R}^2$	$1-\beta_s$	$\bar{R}^2$	$1-\beta_s$	$\bar{R}^2$	$1-\beta_s^{(1)}$	$\bar{R}^2$
(1) DIRECT TAXES ONLY	0.0751 (0.008)	0.997	0.079 (0.006)	0.987	0.043 (0.008)	0.907		
(2) DIRECT TAXES AND SOCIAL INSURANCE	0.0863 (0.009)	0.996	0.086 (0.007)	0.977	0.063 (0.012)	0.898		
(3) DIRECT TAXES, SOCIAL INSURANCE AND TRANSFERS	0.181 (0.016)	0.982	0.234 (0.007)	0.941	0.149 (0.012)	0.878	0.203 (0.036)	0.981
(4) DIRECT TAXES, SOCIAL INSURANCE, TRANSFERS AND GRANTS	0.213 (0.019)	0.974	0.272 (0.008)	0.922	0.200 (0.012)	0.846	—	—
Canada (65-88) 9 Regions	$1-\beta_d$	$\bar{R}^2$	$1-\beta_s$	$\bar{R}^2$	$1-\beta_s$	$\bar{R}^2$	$1-\beta_s^{(1)}$	$\bar{R}^2$
(1) DIRECT TAXES ONLY	—	—	—	—	—	—		
(2) DIRECT TAXES AND SOCIAL INSURANCE	0.046 (0.021)	0.996	0.041 (0.006)	0.999	0.025 (0.008)	0.950		
(3) DIRECT TAXES, SOCIAL INSURANCE AND TRANSFERS	0.164 (0.018)	0.996	0.095 (0.016)	0.936	0.104 (0.021)	0.903	0.144 (0.007)	0.994
(4) TOTAL TAXES, SOCIAL INSURANCE, TRANSFERS AND GRANTS	0.299 (0.036)	0.959	0.244 (0.037)	0.901	0.209 (0.042)	0.837	—	—

The standard errors in parentheses pertain to β_d or to β_s, respectively. Regional constants are omitted. The designated equations, to which β_d and β_s, refer are as follows:

Equations:

$$(4)\ \bar{Y}_i = \alpha_d + \beta_d \bar{X}_i + \eta_i$$

$$(5)\ Y_{it} - \bar{Y}_i = \beta_s (X_{it} - \bar{X}_i) + \mu_{it}$$

$$(7)\ \Delta Y_{it} = d_i + \beta_s \Delta X_{it} + \nu_{it}$$

$$(8)\ Y_{it} - \bar{Y}_i = \sum_{j=0}^{L} \beta_{t-j} (X_{it-j} - \bar{X}_i) + \mu_{it}$$

In the case of equation (8), β_s refers to $\sum_{j=0}^{L} \beta_{t-j}$.

(1) The respective estimates of the individual β_{t-j} terms for $\beta_s = \sum_{j=0}^{L} \beta_{t-j}$ are as follows:

US: The lag structure is as follows :

$0.802\ x_t - 0.051\ x_{t-1} - 0.002\ x_{t-2} + 0.051\ x_{t-3} - 0.002\ x_{t-4}$

(0.029) (0.026) (0.021) (0.022) (0.017)

Instruments used in GMM : lag-3-and-greater instruments

CAN: See table 2.

The χ^2 test, in connection with GMM, led to the choice of the appropriate matrix of instruments (described by a lag order which, as can be seen, always corresponds to weak exogeneity of the instruments). See the explanatory note to Table 2.

TABLE 4

REDISTRIBUTION AND STABILIZATION OF GROSS PRODUCT IN THE USA AND CANADA

NET TRANSFERS	REDISTRIBUTION Eq. (4)		STABILIZATION					
			LEVELS Eq. (5)		FIRST DIFFERENCES Eq. (7)		DYNAMIC Eq. (8)	
USA (77-92) 48 Regions	**$1-\beta_d$**	$\bar{R}^2$	**$1-\beta_s$**	$\bar{R}^2$	**$1-\beta_s$**	$\bar{R}^2$	**$1-\beta_s^{(1)}$**	$\bar{R}^2$
(1) DIRECT TAXES ONLY	0.015 (0.016)	0.988	0.019 (0.003)	0.999	0.040 (0.005)	0.981		
(2) TAXES AND SOCIAL INSURANCE	0.040 (0.021)	0.980	0.030 (0.003)	0.998	0.031 (0.006)	0.979		
(3) TAXES, SOCIAL INSURANCE AND TRANSFERS	0.124 (0.016)	0.984	0.097 (0.003)	0.990	0.089 (0.006)	0.974		
(4) TAXES, SOCIAL INSURANCE, TRANSFERS AND GRANTS	0.136 (0.020)	0.976	0.130 (0.004)	0.985	0.118 (0.006)	0.968	0.118 (0.013)	0.980
Canada (65-88) 9 Regions	**$1-\beta_d$**	$\bar{R}^2$	**$1-\beta_s$**	$\bar{R}^2$	**$1-\beta_s$**	$\bar{R}^2$	**$1-\beta_s^{(1)}$**	$\bar{R}^2$
(1) DIRECT TAXES ONLY	—	—	—	—	—	—		
(2) DIRECT TAXES AND SOCIAL INSURANCE	0.012 (0.017)	0.998	0.027 (0.003)	0.999	0.009 (0.012)	0.944		
(3) DIRECT TAXES, SOCIAL INSURANCE AND TRANSFERS	0.087 (0.012)	0.999	0.039 (0.006)	0.991	0.025 (0.006)	0.951		
(4) TOTAL TAXES, SOCIAL INSURANCE, TRANSFERS AND GRANTS	0.226 (0.033)	0.985	0.143 (0.012)	0.961	0.126 (0.017)	0.928	0.146 (0.010)	0.985

The standard errors in parentheses pertain to β_d or to β_s, respectively. Regional constants are omitted. The designated equations, to which β_d and β_s, refer are as follows:

Equations:

(4) $\bar{Y}_i = \alpha_d + \beta_d \bar{X}_i + \eta_i$

(5) $Y_{it} - \bar{Y}_i = \beta_s (X_{it} - \bar{X}_i) + \mu_{it}$

(7) $\Delta Y_{it} = d_i + \beta_s \Delta X_{it} + \nu_{it}$

(8) $Y_{it} - \bar{Y}_i = \sum_{j=0}^{L} \beta_{t-j} (X_{it-j} - \bar{X}_i) + \mu_{it}$

In the case of equation (8), β_s refers to $\sum_{j=0}^{L} \beta_{t-j}$.

(1) The respective estimates of the individual β_{t-j} terms for $\beta_s = \sum_{j=0}^{L} \beta_{t-j}$ are as follows:

US: The lag structure is as follows :

$0.913x_t - 0.034x_{t-1} - 0.016x_{t-2} + 0.003x_{t-3} + 0.015\ x_{t-4}$
(0.012) (0.012) (0.008) (0.009) (0.007)

Instruments used in GMM : lag-0-and greater instruments (weak exogeneity in the extreme).

CAN: The lag structure is as follows :

$0.854x_t - 0.013x_{t-1} - 0.013x_{t-2} + 0.036x_{t-3} - 0.010\ x_{t-4}$
(0.003) (0.003) (0.002) (0.003) (0.002)

Instruments used in GMM : lag-2-and-greater instruments.

The χ^2 test, in connection with GMM, led to the choice of the appropriate matrix of instruments (described by a lag order which, as can be seen, always corresponds to weak exogeneity of the instruments). See the explanatory note to Table 2.