Spoor A2:

Revenue equalization and stabilization in the Belgian federation.

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Revenue equalization and stabilisation in the Belgian federation

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Abstract

This paper presents an analysis of fiscal equalisation of regional household and government income in Belgium. We look at the extent to which it reduces long-term fiscal disparities across regions and the amount of smoothing it provides against asymmetric macroeconomic shocks. We discover that, although equalisation of household income through the fiscal system in Belgium can be motivated on grounds of both redistribution and to a lesser extent stabilization, this is not the case for the equalisation of regional government income. The funding system of regional governments is clearly based on equity considerations, rather than on concern for interregional stabilization.

1 Introduction

Throughout the public finance literature, *redistribution of income* is seen as a basic function of government. The rationale for equalisation of income is mainly the fact that a society's objectives for an equitable income are unlikely to be achieved in a system where markets are left free. In countries with multiple levels of governments, besides redistribution of household income from rich to poor, another form of redistributive activity is carried out, which is called *fiscal equalisation*. Fiscal equalisation relates to the transfer of fiscal resources across jurisdictions.

Most, and especially federal countries want to guarantee equal access to public services for all households in all regions, at the same cost. This *horizontal equity*-principle can be threatened if the tax raising capacity, or the public service cost, differs across regions. A transfer system of financial resources from relatively rich to relatively poor jurisdictions is then put in place. Fiscal equalisation can also be seen as a way to provide a level playing field for competition among jurisdictions. Another way of looking at fiscal equalisation of regional government income is seeing it as part of the transfer mechanism between secundary and tertiary income distribution w.r.t. local public goods and services. Tertiary income is then defined as disposable or secundary income, increased with imputed benefits from the subsi-

dized part of locally provided public goods and services [1].
However, the rationale for fiscal equalisation may not be as clear as the rationale for redistribution between rich and poor individuals, as Oates (2007) points out. After all, fiscal equalisation between regions can involve some perverse redistribution at the individual level, since wealthy agents in poor jurisdictions will be on the receiving end of transfers that may come from poor individuals in the relatively rich jurisdiction. Oates looks at fiscal equalisation as a transfer *on average* from rich to poor.
Fiscal equalisation is closely related to fiscal decentralization, since a crucial condition for disadvantaged regions to agree with decentralisation will be the installation of an explicit solidarity system that replaces the implied solidarity in former national systems. Mostly, the redistribution or solidarity system is laid down in the constitution as part of the financing system of the federated entities.

In Belgium, fiscal equalisation was also a condition for federalisation, and it was laid down in the Special Financing Act in 1989, as part of the financing system of regional governments. In Figure 1 and Figure 2 we present some stylized facts to illustrate the case for fiscal equalisation in Belgium. Figure 1 illustrates the differing tax raising capacity across Belgian regions for the personal income tax (PIT), which is the most important tax in terms of fiscal returns. The differing needs of regional governments are shown by the rather large discrepancies in per capita expenditures in Figure 2. Differences in "needs" can be explained by differing costs of providing public goods in different regions (e.g. because of area size, concentration of population), or by differences in demographic characteristics, in unemployment rates or in welfare of the inhabitants. Remark that fiscal equalisation itself can be an important driver of extra expenses, if moral hazard, soft budget constraints and/or common pool problems are present [2].

In this paper we will first take a look at interregional *redistribution of household income* through taxes, social security and other transfers to individuals. Secondly, we will concentrate on the implicit and explicit *equalisation of regional government income* through the financing system of regional governments.

Next to providing horizontal equity among the residents and governments of different jurisdictions, a second objective of fiscal equalisation may be *macroeconomic stabilization and insurance* of income against asymmetric shocks.
Risk-sharing emanating from region-specific shocks can come from free trade and mobility of capital and labour, from cross-ownership of productive assets in a developed capital market, from flexible exchange rates, or from lending and borrowing on national credit markets. The unavailability or (partially) failing of these market mechanisms provides rationale for income smoothing by means of the fiscal system.

[1] Remark that households only receive a small part of regional government revenues and that some of the benefits go to people outside the region (not only because of tourists, transients and commuters, but also because of network externalities and public good considerations)(Mélitz and Zumer, 2002)

[2] The idea of soft budget constraints is used to describe the situation where the central government cannot commit not to bail out regional governments when they are in financial trouble. The common pool problem refers to the fact that if regional governments' expenditures are financed out of general central taxation (=the commons), they all try to externalize the costs of their expenditures onto other jurisdictions.

Figure 1: Disparities in PIT-tax raising capacity: regional PIT contribution per capita relative to the national average

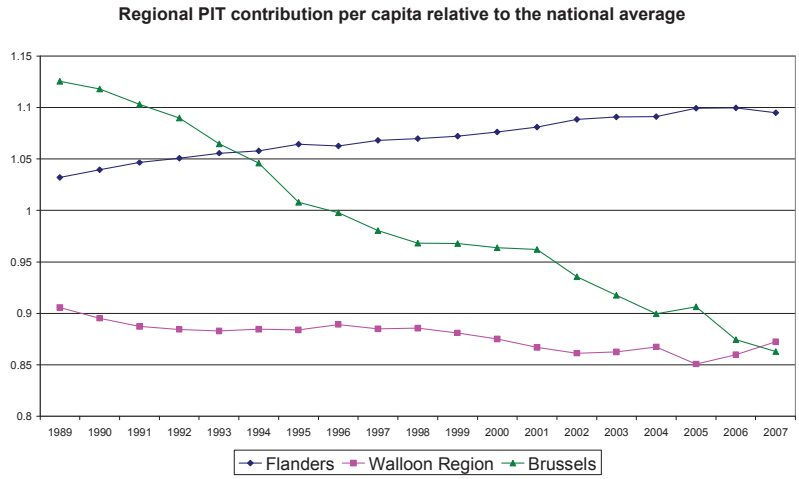


Figure 2: Disparities in "needs" of regional governments: regional government expenditures per capita relative to the national average

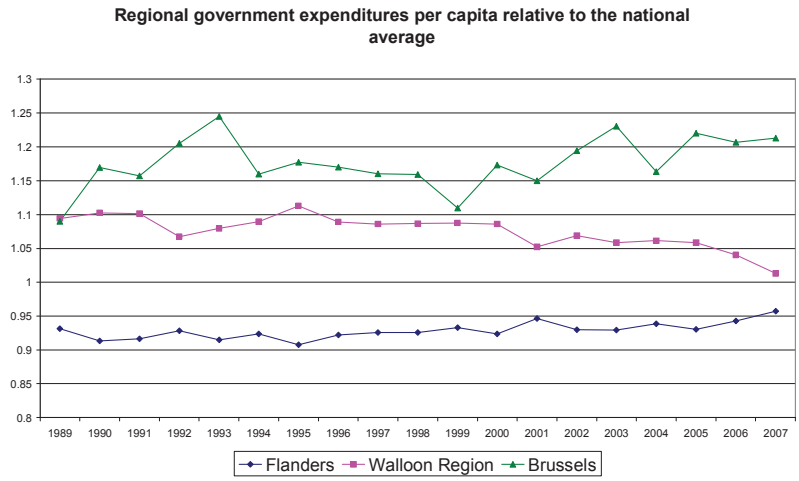


Table 1: Correlation coefficient between relative primary income per capita of households in different regions

Correlation coefficient between	
Flanders and Walloon Region	-0.66
Flanders and Brussels	-0.87
Walloon Region and Brussels	0.21

Table 2: Correlation coefficient between relative primary income per capita of governments in different regions

Correlation coefficient between	
Flanders and Walloon Region	-0.70
Flanders and Brussels	-0.95
Walloon Region and Brussels	0.46

For example, regional governments face higher borrowing costs on the credit market than federal governments do in terms of risk and liquidity premiums. Exchange rates were never an instrument of smoothing at the regional level. A second reason why mutual insurance of regional government income can be preferred to self-insurance by borrowing and lending on the credit market is that, if rational consumers anticipate future tax liabilities, and reduce their consumption accordingly, self-insurance against an adverse shock by borrowing on the credit market can not be effective. The demand effects of debt-financed transfers will be neutralized or overcompensated by the savings of consumers, which can exacerbate a recession (Von Hagen, 2007). So in other words, interregional redistribution is preferred to intertemporal transfers via the credit market. Thirdly, regional authorities also provide more public goods when insurance against adverse shocks allows for a steadier supply of these goods over time (Von Hagen and Hepp, 2000).
If asymmetric shocks are permanent instead of transitory, smoothing of regional government income will take the form of permanent redistribution between states, and this is mostly not desirable from a fiscal federalism point of view. Permanent asymmetric shocks ask for regional structural adaptations of taxes and expenses, or of the labour market.

In this paper we investigate to what extent regional households and governments are insured against asymmetric shocks. For the federal budget to be able to generate any amount of income smoothing, regional incomes must not be perfectly correlated, since aggregate risk cannot be insured by interregional transfers. The case for income smoothing is illustrated in Table 1 and Table 2, where the correlation coefficients of primary income per capita relative to the national average between regions are given for respectively household and regional government income.

The contribution of this paper is twofold.

First, we make an empirical investigation of the federal fiscal system regarding

redistribution and stabilization of regional household income per capita in the Belgian federation. We also decompose the overall effect of the fiscal system to capture the respective roles of taxes and the social security system. We compare the results to estimates for three European federal countries, namely Germany, Spain and Austria.

Second, the same analysis was applied to the income of regional governments to gain a better insight in the Belgian financing system of regional governments, as described in the Special Financing Act. We look at the separate effect of personal income tax and VAT transfers.

This paper is structured as follows: section 2 presents the state-of-the-art in literature w.r.t. the measurement of interregional redistribution and insurance. section 3 presents the model and estimation methods; the results of the empirical analysis are shown in section 4 and 5. Section 6 concludes.

2 Literature overview

Many researchers have estimated the extent to which interregional redistribution and insurance is present in countries.[3] Most of the empirical work has concentrated on the US and Canada, and only little evidence was provided for other federal countries. The Belgian case has not received much attention in the literature. Estimation methods, accounting principles and consequently estimates differ a lot across studies.

The first study for the US was performed by *Sala-i-Martin and Sachs (1991)*. They examined the effect of movements in regional personal income on respectively taxes and transfers. Variables were defined as ratios of the corresponding national per capita aggregates. Following their analysis, the US federal fiscal system provides substantial insurance against asymmetric regional shocks, with a combined effect of taxes and transfers of about 40 percent. The estimates are based on three-stage-least-squares regressions.

Von Hagen (1992) first noted that the estimations of Sala-i-Martin and Sachs are problematic, since they do not distinguish between permanent and transitory reduction of income disparities. Von Hagen's regression on first differences provides a measure of short-term insurance against asymmetric shocks. His estimate of short-term stabilization amounts to 10 percent, which is considerably lower than the estimate of Sala-i-Martin and Sachs. Remark that in this analysis, state gross product was used as the explanatory variable, as opposed to Sala-i-Martin and Sachs, who use primary income.

Bayoumi and Masson (1995) combine the effect of federal taxes and transfers in one regression, by taking disposable income as the dependent variable. By successively adding the effect of taxes and transfers to the dependent variable, they are able to estimate the incremental effect of both elements in the federal fiscal system in Canada and the US. Variables are defined in per capita terms relative to the national average and the estimation method for stabilization is three stage least squares. The stabilization estimate for the US amounst to 30 percent, when a broad

[3] Much of the interest in this field was sparked by the preparation of the European Monetary Union in the nineties. Concern was raised by the fact that countries, when joining the EMU, will lack sufficient tools to mitigate the effects of asymmetric shocks.

definition of net transfers is used[4] and amounts to 23 percent for narrower defined transfers. The estimate for long-term redistribution by a regression on long-term averages is 22 percent (broad definition of transfers) or 18 percent (narrow definition of transfers).

Asdrubali, Sorensen and Yosha (1996) provide estimates of overall market-based insurance between regions of the US federation. By decomposing the cross-sectional variance in gross state product, they are able to capture the effect of the different levels of smoothing. For the US, they find that 39 percent of shocks to gross state product are smoothed by capital markets, 13 percent by the federal government tax and transfer system, and 23 percent by credit markets. The authors use generalized least squares (GLS) regressions to correct for state-specific variances.

Fatas (1998) draws our attention to the fact that estimates of stabilization in earlier work overestimate the real insurance provided by the fiscal system. The reason is that, in measuring the effect of income fluctuations to disposable income, we ignore the effects of taxes and transfers on the overall budget balance. A fall in tax revenues in one state, generates an overall country deficit if this fall is not offset by a rise in tax revenues in another state. The deficit will have to be paid through future taxes by all states, including the depressed state. So, the amount of insurance the depressed state receives is less than what the change in this period's state disposable income indicates. Fatas also postulates that separating the effects of redistribution and stabilization is just an approximation. If an output shock is persistent, it reduces relative income forever. Are transfers insurance or redistribution in that case? Therefore, in theory, one should exclude permanent shocks from the analysis.

Mélitz and Zumer (2002) try to explain the considerable differences in estimates of earlier work and re-examine results of former studies in a general framework. They also provide new estimates for the US, Canada, France and the UK. They introduce consistent accounting, and argue that the choice between personal income and gross product accounting explains a large part of the dissimilarities in estimates. When asking about stabilization of personal income, the corresponding transfers to consider are those to persons. When focusing on the stabilization of gross product in a region, the right transfers should include those to lower-level governments and firms as well, since these affect local production. Mélitz and Zumer add panel data econometrics to the analysis and conclude that for long time series, their estimates do not differ from three-stage-least-squares estimates. For the shorter time series for France and the UK, panel data econometrics prove to be beneficial, since the lower efficiency of the 3SLS procedure delivers implausible results. The authors find that international differences in redistribution are substantially larger than those for stabilization of personal income. Redistribution varies from 38% in France, over 26% in the UK, to 16% in the US and Canada, but stabilization fluctuates around 20% for all countries. Redistribution turns out to be higher in the two non-federal European countries.

Von Hagen and Hepp (2000) look at the risk-sharing and redistributive properties of the German system of fiscal equalisation. First, they develop a theoretical model to deduce the optimal tax rate (or optimal transfer rate, the two are assumed to be

[4]This broad definition includes federal grants to state and local governments.

equal) to households (as a reaction to state income) and to state governments (as a reaction to state tax collections[5]). They find that the optimal tax rate to households consists of a redistributional and stabilizational part. The latter depends on the variance of regional per capita income relative to that of the aggregate, and on the correlation between region-specific and nation-wide income. So different regional characteristics ask for different stabilization arrangements, and regions must agree on a compromise[6]. The optimal tax and transfer rate between regional governments from the point of view of the representative consumer shows that there is a scope for horizontal transfers among regional governments even if these transfers are uncorrelated with regional income shocks and are not used to improve household consumption smoothing.
In the empirical part of their work, the authors use the transfers of the German *Finanzausgleich(FA)* in the different stages of equalisation as dependent variable and explore (1) the extent to which it serves as a buffer against regional GDP shocks and against shocks to local government tax collections, and (2) the redistributional properties w.r.t. regional income and tax contributions. They find that insurance and redistribution transfers are better characterized to offset differences and shocks to regional tax revenue than to regional gross product. The overall amount of insurance of the FA w.r.t. state GDP is only 3%, but w.r.t. state tax revenue it amounts to 56%. The supplementary vertical grants in the FA have a destabilizing effect. Marginal redistribution w.r.t. state GDP is found to be 8%, while it amounts to 111% w.r.t. tax revenues. The latter indicates that states may be better off in times of temporary tax revenue losses. Also permanent redistribution, which is captured by the state fixed effects, proves to be essential.

Baretti, Huber and Lichtblau (2002) try to capture the marginal redistribution between the German *Länder* by calculating marginal tax rates. They use a simulation model of Germany's fiscal equalisation. The marginal tax rate (MTR) is defined as the fraction of one additional unit of income tax collection in a state which flows out of the region. In rich states, the MTR reflects the increase of contributions to the interstate equalisation system if their tax collections go up. In poor states, the marginal tax rate reveals the reduction in received transfers through the fiscal equalisation system. MTRs tend to be lower for rich states, which provides evidence of a development trap in Germany. MTRs vary from 70% to 91% across states.

Padovano (2007) introduces a measure of interregional redistribution which basically ignores the insurance dimension of equalisation. His Index of Geographical Redistribution (IGR) is the estimate of the regression of a jurisdiction's *average* effective tax rate (measured as the difference between regional total and disposable income as a percentage of total income) on regional total income. The IGR represents the effective *marginal* geographical tax rate, since it estimates the change of the average tax rate to a change in per capita regional income. The larger the IGR,

[5]State income and tax collections are not necessarily perfectly correlated, because of taxes on other things than incomes, because of a small income elasticity of tax revenues, or because of lags between the generation of income and tax collection.

[6]The authors refer to Persson and Tabellini (1996), who point out that such a political compromise involves a trade-off between redistribution and stabilization, which may lead to underprovision of the latter. In another equilibrium, high-risk regions pay permanent unconditional transfers to low-risk regions for obtaining more insurance than low-risk regions would choose for themselves.

the higher the degree of progressivity of the tax system. Negative values point at a geographically regressive tax system. A geographically proportional tax system yield an IGR equal to zero. Padovano compares this index for Italy and the US over time. Although the highest value of progressivity has been reached in Italy, on average, the US reports higher values for the IGR, which leads to the conclusion that in this case the decentralized federal country redistributes more than the centralized country, while the latter was intuitively taught to be in a better position to transfer funds between regions.

3 Framework

The regression equations for the measurement of stabilization and redistribution are derived from the framework proposed in Mélitz and Zumer (2002). Two kinds of influences on regional disposable income can be distinguished: the average primary income over the entire period, and temporary deviations from the average.

$$DI_t^i = \alpha + \beta_r \overline{PI^i} + \beta_s (PI_t^i - \overline{PI^i}) + \varepsilon_t^i \tag{1}$$

with DI_t^i disposable income in region i at time t
PI_t^i primary income in region i at time t

The coefficient β_r of the permanent primary income $\overline{PI^i}$ is a measure of redistribution via the central budget, while the coefficient β_s of the transitory income $(PI_t^i - \overline{PI^i})$ captures the amount of stabilization via the center.

The decomposition of formula 1 to separate both effects yields two equations

$$\overline{DI^i} = \alpha + \beta_r \overline{PI^i} + \varepsilon^i \tag{2}$$

$$DI_t^i - \overline{DI^i} = \beta_s (PI_t^i - \overline{PI^i}) + \varepsilon_t^i \tag{3}$$

Rearranging equation 3 and taking first differences yields[7]

$$\Delta DI_t^i = \alpha^i + \beta_s \Delta PI_t^i + \varepsilon_t^i \tag{4}$$

Equation 2 makes use of the cross-sectional or *between* variation in the panel data to measure average risk-sharing over the entire period. While making abstraction from short-term cyclical factors, it provides a measure of long-term redistribution. Equation 4 makes use of the time series movements or *within* variation in the panel data regression to evaluate the impact of the fiscal system in response to temporary deviations in primary income. The regression on first differences thus provides a measure of stabilization.

When running the regressions, we use per capita values to correct for the different size of the regions. We divide the variables by their national average[8] to correct for differences in scale[9], to eliminate trend growth in the time series, and to exclude the

[7] Averages are absorbed by a constant term, which disappears when taking first differences. The first differences specification still contains a regional constant if the error term contains a drift element.

[8] This is the average of regional per capita values weighted by the population.

[9] For example, regional GDP has another order of magnitude as regional government revenues.

effect of country-wide symmetric shocks in the stabilization regression.
Following the methodology of Bayoumi and Masson (1995), we run intermediate regressions to estimate the incremental contribution of different elements in the fiscal system (analysis w.r.t. household income) or in fiscal equalisation through the regional financing system (analysis w.r.t. regional government income). In practise, we run regressions 5 and 6 to measure respectively redistribution and stabilization. Variables with superscript i denote regional per capita figures, while the index N stands for national per capita averages.

$$\overline{\left(\frac{PI^i - X^i + Y^i}{PI^N - X^N + Y^N}\right)} = \alpha + \beta_r \overline{\left(\frac{PI^i}{PI^N}\right)} + \varepsilon^i \tag{5}$$

$$\Delta\left(\frac{PI^i - X^i + Y^i}{PI^N - X^N + Y^N}\right)_t = \alpha^i + \beta_s \Delta\left(\frac{PI^i}{PI^N}\right)_t + \varepsilon^i_t \tag{6}$$

Equation 5 measures redistribution through the coefficient β_r, which should be interpreted as the amount of one unit of the initial difference in relative primary income that remains after fiscal transfers have been taken into account. The difference between β_r and unity reflects the size of the offset to primary income caused by the transfer flows. The elements X and Y in equation 5, which represent intermediate fiscal flows (f.e. personal income tax, or social security transfers, ...) are added successively and each time a new regression is performed. The difference between the resulting β_rs indicates the incremental effect of including the extra fiscal flow in the regression. In a similar way estimates equation 6 the relative stabilization effect of the diverse financial flows to yearly movements in primary income relative to the national average.

Econometrics

The cross-sectional regressions on long-term averages following equation 5 are performed by a panel data *between* regression. The between estimator is just the OLS estimator applied the regional means over time. In this way, all the time series information in the data is neglected.

For the stabilization regressions 6, a panel data feasible generalized least squares (GLS) regression was run. GLS corrects for region-specific variances (heteroscedasticity across panels) and for autocorrelation within panels. The GLS estimator is more efficient than the OLS estimator, since observations with a higher variance get a smaller weight in estimation (so more accurate observations get a higher weight). In panel data, the GLS estimator is the more efficient one because it combines the information from the *between* and *within* dimensions in an efficient way. Apart from the GLS regression, we estimated the same equation with OLS, fixed effects and random effects models. The estimates turn out to be quite robust across different estimation methods.

Unit root processes are eliminated from the time series by the definition of variables relative to the national averages, and by the time differenced specification of equation 6. We include state dummies to capture state-specific effects. Including year dummies is not necessary, since year-specific effects are eliminated by the

definition of variables relative to the yearly cross-sectional average. When the explanatory variable is measured with error, estimates could be biased towards zero, and the amount of smoothing in equation 6 could be overstated. As Asdrubali et al.(1996) point out, the problem is alleviated by weighting the regressions with the state-specific variance when using GLS. Measurement errors in the regressand don't effect estimates but could lead to increased standard errors, which inflate p-values.

4 Redistribution and stabilization of household income

4.1 Data

We collected data w.r.t. primary and secundary (disposable) household income from the regional accounts of the National Bank of Belgium (NBB). Time series are available from 1995 till 2006. In addition, the following intermediary flows were gathered from the same source. The content of the different variables can be found in Appendix A.

- Tax: taxes on income and property
- SC: social contributions
- SB: social benefits
- OC: other contributions
- OB: other benefits

We use regional population figures from the National Institute of Statistics (NIS) to calculate the per capita values in euro. To run the regressions, we divide all variables by the national average.

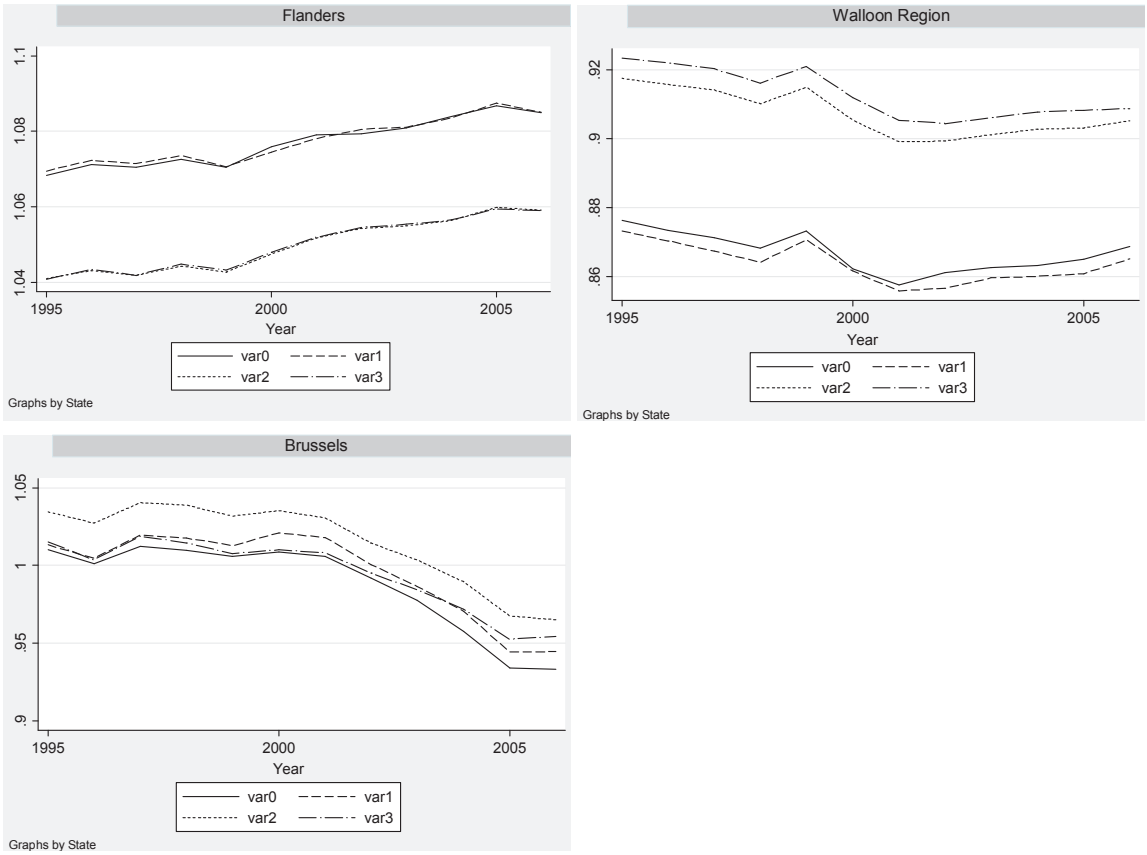
In the empirical analysis, intermediate regressions will be run to capture the effect of respectively income and property taxes, and the social security system. The relationship between primary and disposable income of households can be decomposed as follows:

$$PI^i - Tax^i - SC^i + SB^i - OC^i + OB^i = DI^i \tag{7}$$

We define the following variables, which will be used in the empirical analysis.

$$\begin{aligned} var0 &= \frac{PI^i}{PI^N} \\ var1 &= \frac{PI^i - Tax^i}{PI^N - Tax^N} \\ var2 &= \frac{PI^i - Tax^i - SC^i + SB^i}{PI^N - Tax^N - SC^N + SB^N} \end{aligned}$$

Figure 3: Evolution of defined variables in the three regions



$$var3 \quad = \quad \frac{PI^i - Tax^i - SC^i + SB^i - OC^i + OB^i}{PI^N - Tax^N - SC^N + SB^N - OC^N + OB^N} = \frac{DI^i}{DI^N}$$

Figure 3 illustrates the evolution of these variables over time for the three regions. Table 3 presents the summary statistics. In this Table, we now can explore the *within* (over time) and *between* (across regions) variation of the paneldata. The closer the variable gets to disposable income, the lower both types of variation, so we expect to find evidence of redistribution (reduction of cross-sectional disparities) and stabilization (reduction of variability of income over time) in the empirical analysis.

4.2 Redistribution results

To measure long-term redistribution of household income across regions, we run regression 5 on primary income. In the intermediate regressions, the dependent variable gradually takes more and more transfers into account, until total disposable income is reached. This is shown in the first column of Table 4, which reports the regressands to distinguish the different regressions. Performing panel data *between* regressions is equal to applying OLS on long-term averages. Table 5 gives an illustration of these averages. We first look at the regression results which are reported in the last row of Table 4, with disposable income as regressand. We ob-

Table 3: Summary statistics

Variable		Std. Dev.	Min	Max	Observations
var0	overall	0.089007	0.857654	1.086856	N = 36
	between	0.10541	0.866918	1.076989	n = 3
	within	0.01741	0.922827	1.002082	T = 12
var1	overall	0.090786	0.855875	1.087499	N = 36
	between	0.107782	0.863783	1.077313	n = 3
	within	0.016622	0.927065	1.003849	T = 12
var2	overall	0.063581	0.899129	1.05986	N = 36
	between	0.074215	0.907365	1.049726	n = 3
	within	0.0163	0.940694	1.016275	T = 12
var3	overall	0.058844	0.90441	1.059488	N = 36
	between	0.068913	0.912924	1.049897	n = 3
	within	0.014355	0.943671	1.010107	T = 12

serve that the coeffient on primary income is estimated at 0.65, which means that, on average, long-term relative income inequalities are reduced with 35 percent. In other words, the Belgium federal government redistributes on average 35 cents of every euro difference between states' incomes relative to the national average. The estimates in the second and third row of Table 4 specify the relative importance of respectively taxes, and the social security system. We see that, relative to the national average, their is no equalisation through income and property taxes, since the estimated β_r is significantly larger than unity. The reason of this counterintuitive result could be that income disparities within regions are different across regions. In Appendix B, we give an illustration of how large income disparities in a poorer region could bring along a higher effective tax rate in that region.
Redistribution of relative differences in individual income between the Belgian regions hinges almost entirely upon the fiscal flows through the social security system, which reduces inequalities with 34 cents in the euro. The R^2 statistics in Table 4 indicate the good fit of the different equations; the linear connection between primary and secundary income is very close.

Table 4: Estimates of long-term redistribution through the federal fiscal system

Adjustment to PI	β_r	1- β_r	s.d.	p-value	overall
var1=PI-Tax	1.02	-0.02	0.05	0.03	0.99
var2=PI-Tax- SC +SB	0.68	0.32	0.14	0.12	0.95
var3=Disposable income	0.65	0.35	0.01	0.01	0.99

Table 6 demonstrates the estimates for two subperiods, the first from 1995 till 2000, and the second from 2001 till 2006. We conclude that the redistribution of relative inequalities in household income per capita has decreased slightly over time, mainly by the reduced role of other contributions (OC) and benefits (OB).

Table 5: Long-term averages of variables in performed regressions

State	meanvar0	meanvar1	meanvar2	meanvar3
Flanders	1.0769	1.0773	1.0497	1.0498
Walloon Region	0.8669	0.8637	0.9073	0.9129
Brussels	0.9873	0.9961	1.0149	0.9946

Table 6: Estimates for the sub-periods 1995-2000 and 2001-2006

Adjustment to PI	β_r 95-00	β_r 01-06
PI-Tax	1.02	1.01
PI-Tax- SC +SB	0.68	0.69
Disposable income	0.62	0.68

4.3 Stabilization results

To estimate stabilization, we perform a panel data regression following equation 6 with the variables in the first column of Table 7 as dependent variables. The estimate of β_s on the bottom row of Table 7 gives an idea about the overall stabilization of household income in Belgium. Total fiscal flows in Belgium reduce short-term differences in relative income inequalities by 15 cents in the euro. By using variables with the national average in the denominator, we only capture stabilization of asymmetric shocks (which are idiosyncratic regional shocks) to regional primary income of households. When looking at the contribution of the different elements in the stabilization procedure, we first notice that personal income and property taxes provide no smoothing[10]. Each euro that relative pre-tax income goes up, relative post-tax incomes vary by 1.08 euro. Premiums to and transfers from the social security system account for a smoothing of 19 cents in the euro.

In Table 8 we present the estimates of the time series regressions for each region separately. We observe that the tax system does have a stabilization effect in Flanders and Wallonia, since the estimates are lower than unity. In total, more income smoothing is provided in Flanders and the Walloon Region than in Brussels. The estimated coefficients are all significant at the 1% level and the adjusted[11] R^2s indicate the good fit of the estimated equations.

Figure 4 illustrates the smoothing properties of the Belgian fiscal system visually by plotting the evolution of primary and disposable income in first differences.

[10]The same effect was found when property taxes were excluded from the tax variable. In that case, the estimated β_s amounted to 1.18, so the destabilizing effect relative to national averages was even higher when accounting for personal income taxes only.

[11]The adjusted R^2 makes -in contrast with the regular R^2- an adjustment for the number of variables that is included in the regression.

Table 7: Estimates of stabilization of household income per capita

Adjustment to PI	β_s	1-β_s	s.d.	p-value	R^2adj.
var1=PI-Tax	1.085	-0.08	0.04	0.00	0.94
var2=PI-Tax- SC +SB	0.89	0.11	0.04	0.00	0.92
var3=Disposable income	0.85	0.15	0.07	0.00	0.86

Table 8: Estimates of stabilization of household income per capita: time series regressions for the three regions

Flanders				
Adjustment to PI	β_s	s.d.	p-value	R^2adj.
PI-Tax	0.93	0.14	0.00	0.80
PI-Tax- SC +SB	0.80	0.14	0.00	0.74
Disposable income	0.78	0.14	0.00	0.72
Walloon Region				
Adjustment to PI	β_s	s.d.	p-value	R^2adj.
PI-Tax	0.94	0.10	0.00	0.89
PI-Tax- SC +SB	0.85	0.09	0.00	0.88
Disposable income	0.78	0.12	0.00	0.80
Brussels				
Adjustment to PI	β_s	s.d.	p-value	R^2adj.
PI-Tax	1.12	0.07	0.00	0.96
PI-Tax- SC +SB	0.90	0.08	0.00	0.92
Disposable income	0.87	0.09	0.00	0.88

4.4 International comparison

We repeated the analysis for three other federal countries in Europe. In Table 9 we can compare the obtained figures with estimates of β_r and β_s for Germany, Spain and Austria[12]. Regarding total redistribution and stabilization of regional household income per capita relative to the national average, the Belgian and Austrian fiscal system are very much alike. Germany and Spain provide respectively 1% and 13% less redistribution than Belgium, and the fiscal systems of both countries have no stabilization properties. The contribution of the German, Spanish and Austrian tax systems to redistribution is positive, although this effect was not found in Belgium. Belgium is the country with the largest long-term transfers from rich to poor individuals by the social security system.

In Table 10, we can compare the estimates to these provided by Bayoumi and Masson (1996). We see that Belgian redistribution in total, and especially by the social security system, is substantially higher than that of the US and Canada.

[12]The results in Table 9 are significant at the 1% level and the R^2s indicate a good linear relation between the variables.

Figure 4: Stabilization of regional income of households

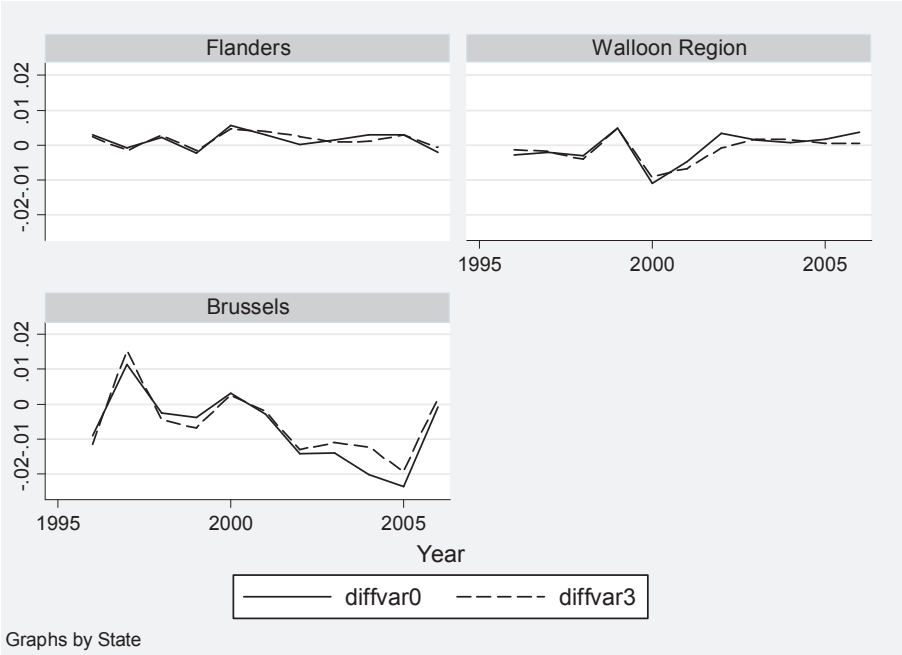


Table 9: Redistribution and stabilization in Germany, Spain and Austria

Germany		
Adjustment to PI	β_r	β_s
PI-Tax	0.90	1.07
PI-Tax- SC +SB	0.67	1.05
Disposable income	0.66	1.06
Spain		
PI-Tax	0.94	1.04
PI-Tax- SC +SB	0.79	1.02
Disposable income	0.78	0.98
Austria		
PI-Tax	0.84	1.02
PI-Tax- SC +SB	0.64	0.87
Disposable income	0.63	0.85

5 Redistribution and stabilization of regional government income

5.1 Data

In order to perform a similar analysis for redistribution and stabilization of regional government income, we need data w.r.t. primary and secundary (disposable) income of regional governments. Two problems arise. First, how do we define primary income of subnational governments? And second, what do we qualify as disposable

Table 10: Results for the US and Canada (Source: Bayoumi and Masson (1995))

US		
Adjustment to PI	β_r	β_s
PI-Tax	0.93	0.92
PI-Tax- SC +SB	0.92	0.91
Disposable income	0.82	0.77
Canada		
PI-Tax	0.97	0.96
Disposable income	0.82	0.85

income, and how do we assign receipts of the Belgian communities to the regions?

In theory, *primary income* could be defined as everything that would have been available for consumption by the regional government if there had been no fiscal intervention on the part of the federal government, or in other words, if states had full authority over taxes.

Except for the own regional taxes of the Flemish, Walloon and Brussels government, regional tax data are only available w.r.t. the personal income tax (PIT). Since regional governments receive also grants out of federal VAT revenues, we also want to include regional VAT contributions in the definition of primary income. Since regional VAT collection data are not available, we have to assign national data to the regions. To this purpose we use regional GDP adjusted for commuting[13] as a division key. Since no suitable division key for corporate taxes is available[14], we ignore these taxes. So we define primary income of regional governments as the sum of regional taxes, total PIT contributions and total VAT contributions[15].

The *disposable income* of regional governments consists of own regional taxes and of the financial resources they receive in accordance with the stipulations in the Special Financing Act (1989) and the Lambermont Agreement (2001). In what follows, we explain how we assign the receipts of the communities to the regions.

Time series are for 19 years, from 1989 till 2007. Variables are expressed in euros per capita relative to the national average. Per capita values correct for the different size of the three regions. Because of the division by the national average, no rescaling of variables of differing magnitude is required.

[13]This division key was also used in the ABAFIM study *Financiële transfers tussen de Belgische gewesten*(2004) w.r.t. interregional transfers in Belgium, but the usage of this key can be contested on several grounds. For example, a division based on regional disposable income or on household surveys could refine the results.

[14]In most Belgian regional studies corporate taxes are assigned to the regions on the basis of the regional share in the gross value added of corporations. Including this tax gives a distortion for the the region of Brussels since a disproportionate number of corporations are located in the neighbourhood of the capital.

[15]These three tax categories together represent about 87% of the total receipts of the consolidated government (apart from social security contributions).

Belgian regional government financing system

The Special Financing Act (1989) describes the financing of the three regions and the three communities[16] in Belgium. On the whole, receivings of regional governments make up about 38% of total government revenue (apart from social security contributions) in Belgium. In what follows we disregard the revenues of the German-speaking Community.
Algoed and Van den Bossche (2009) explain the working of the Special Financing Act and give an illustration of the determination of the revenues of regions and communities.

Three types of regional financial resources can be distinguished.

- First, about 20% of total subnational income (of regions and communities) comes from own-source taxes which solely accrue to the regions. The regions have full fiscal autonomy over these taxes since 2001. They include among other registration rights, inheritance taxes, property taxes and traffic taxes.

- Second, the greater part of regional government revenue comprises federal grants from the personal income tax to the regions and the communities, among which the solidarity grant, and grants out of the VAT tax to the communities.

- Third, about 8% of total regional revenues encompass other grants, such as the allocation for foreign students, radio and television license fees, and other funds given to the communities. The regions obtain extra grants for unemployment relief works, earmarked and other grants. Brussels obtains several extra grants linked to its special function as capital of Belgium.

Figure 5 illustrates the composition of regional government resources[17] in 2007.

We next take a brief look at how the PIT and VAT allowances are determined and how they are divided between the regions.

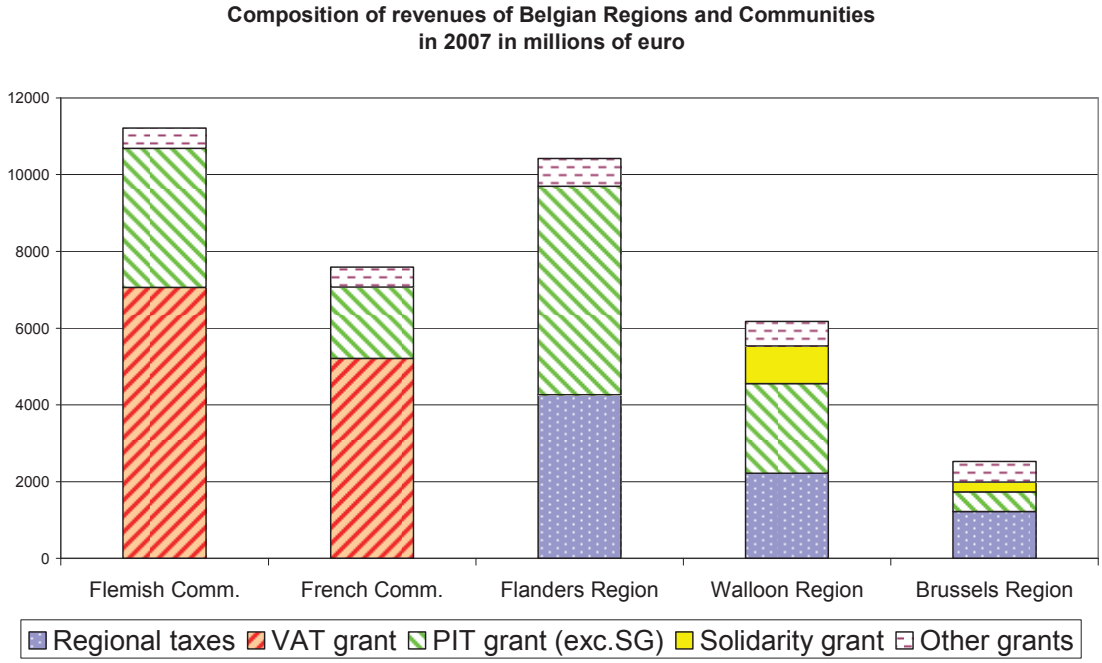
Both regions and communities are entitled to a fixed allocation from federal government PIT revenues. The historically determined amount is updated to CPI and economic growth on a yearly basis. The total grant is horizontally partitioned over the constituencies by the relative regional contribution to total government PIT revenues[18].
To make some correction for this horizontal division key, which clearly favours the economically more advantaged regions, the parties to the federalisation process agreed upon the installation of an explicit solidarity system between the three regions. The solidarity grant (SG) is a formula-based mechanism for fiscal equalisation of regional government receipts, that is based on the lagged deviation of regional

[16]These are respectively the Region of Flanders, the Walloon Region, the Region of Brussels, the Flemish Community, the French-speaking Community and the German-speaking Community.

[17]Remark that the Flemish Community and the Region of Flanders merged into one government in 1980.

[18]The regional PIT yields data are only available for the Regions. To calculate the division key needed to divide the fixed grant to the communities, 20% of the PIT contributions of Brussels is assigned to the Flemish Community, and 80% of the PIT contributions of Brussels is assigned to the French-speaking Community.

Figure 5: Composition of the revenues of the regions and the communities in Belgium



PIT contributions from the national average. In particular, when the average PIT-revenues per capita in a region are lower than the national average, the concerning region receives a fixed sum per inhabitant[19] times the number of inhabitants times the deviation in percentagepoints (of the average PIT revenues in the region in comparison with the national average). In the period from 1989 till 1999 the SG could be seen as a mutual insurance system between regions themselves, since the total PIB grant to the regions was reduced by this amount[20]. From 2000 on the federal government takes up the difference (positive or negative) in solidarity grant in comparison with 1999. So, the Belgian solidarity grant system is a combination of horizontal and vertical equalisation.

Only the communities are entitled to a grant out of federal VAT revenues. This is basically a fixed historical amount, which is yearly updated to the evolution of the CPI and of a defined "denatality factor", based on the yearly evolution of the number of children (<18 years). Since the Lambermont agreement in 2001, the communities are also entitled to "extra means" out of total federal VAT revenues. These extra means encompass a yearly fixed grant (cumulated and indexed to CPI and to the "denatality factor" from the next year on) in the years 2002 till 2011, and extra revenues due to the indexing of VAT grants to 91% of the real growth of national GDP.

The VAT grant is horizontally divided over the communities on the basis of two division keys. The original historical grant is partitioned by the number of pupils (aged 6 to 17). The extra Lambermont means are divided by a mixed division

[19] An amount of 11,6 euro, which is indexed with CPI from 1989 on.

[20] But in practise this is the same as lower PIT grants to the regions and a federally financed vertical solidarity grant.

key that depends on relative pupil amounts and relative PIT contributions. In this mixed division key, the weight of the second criterium grows steadily over time, resulting in a division key only based on the relative regional contribution to the PIT by 2012.

Assignment of the revenues of the communities to the regions

The federal government makes payments to the three regions and the two[21] communities. Since we make the analysis for the three regions, we need to divide the payments granted to the communities over these regions. The Flemish and the French-speaking Community revenues are assigned to the regions by applying formulas 8 tot 10, where P^i stands for population in region i.

$$REV_t^{FlanR} = REV_t^{FlemC} * \frac{P_t^{FlanR}}{P_t^{FlanR} + P_t^{BrR} * 0.2} \tag{8}$$

$$REV_t^{WalR} = REV_t^{FrenchC} * \frac{P_t^{WalR}}{P_t^{WalR} + P_t^{BrR} * 0.8} \tag{9}$$

$$\begin{aligned} REV_t^{BrR} &= REV_t^{FlemC} * \frac{P_t^{BrR} * 0.2}{P_t^{FlanR} + P_t^{BrR} * 0.2} \\ &\quad + REV_t^{FrenchC} * \frac{P_t^{BrR} * 0.8}{P_t^{WalR} + P_t^{BrR} * 0.8} \end{aligned} \tag{10}$$

We assume that 20 percent of the inhabitants of Brussels are part of the Flemish Community, and 80 percent are part of the French-speaking Community, which is the legal assignment key used for such calculations. The results of our calculations can be found in Figure 6.

Definition of variables

In the empirical analysis, we will run intermediate regressions to capture the incremental effect of the solidarity grant (SG), PIT[22] and VAT grants. The relationship between primary and disposable income for region i can be decomposed as follows:

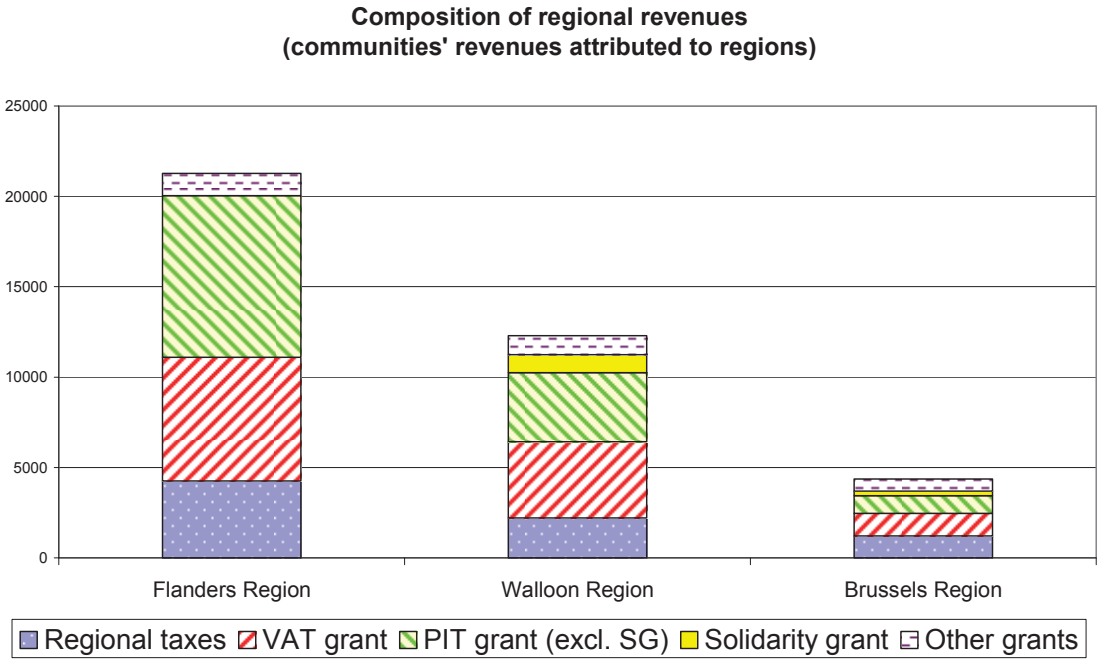
$$PI^i - PITcontr^i + PITrev^i + SG^i - VATcontr^i + VATrev^i + OtherGrants^i = DI^i \tag{11}$$

We define the following variables, which we will use in the regressions in the next

[21] We ignore the German-speaking Community.

[22] In what follows, revenues from the PIT (the variable $PITrev^i$) exclude the solidarity grant, which is reported separately.

Figure 6: Composition of assigned regional revenues in 2007 (in millions of euro)



two sections.

$$
\begin{aligned}
var0 &= \frac{PI^i}{PI^N} \\
var1 &= \frac{PI^i - PITcontr^i + PITrev^i}{PI^N - PITcontr^N + PITrev^N} \\
var2 &= \frac{PI^i - PITcontr^i + PITrev^i + SG^i}{PI^N - PITcontr^N + PITrev^N + SG^N} \\
var3 &= \frac{PI^i - PITcontr^i + PITrev^i + SG^i - VATcontr^i + VATrev^i}{PI^N - PITcontr^N + PITrev^N + SG^N - VATcontr^N + VATrev^N} \\
var4 &= \frac{PI^i - PITcontr^i + PITrev^i + SG^i - VATcontr^i + VATrev^i}{PI^N - PITcontr^N + PITrev^N + SG^N - VATcontr^N + VATrev^N} \\
& \frac{+ OtherGrants^i}{+ OtherGrants^N} = \frac{DI^i}{DI^N}
\end{aligned}
$$

Figure 7 gives a graphical illustration of the evolution of these variables over time for the three regions. Table 11 presents the summary statistics.

5.2 Redistribution results

We carry out regression 5 on the long-term averages that are reported in Table 13. The results w.r.t. the redistributional properties of the regional government

Figure 7: Total contributions versus total revenues and levels in-between

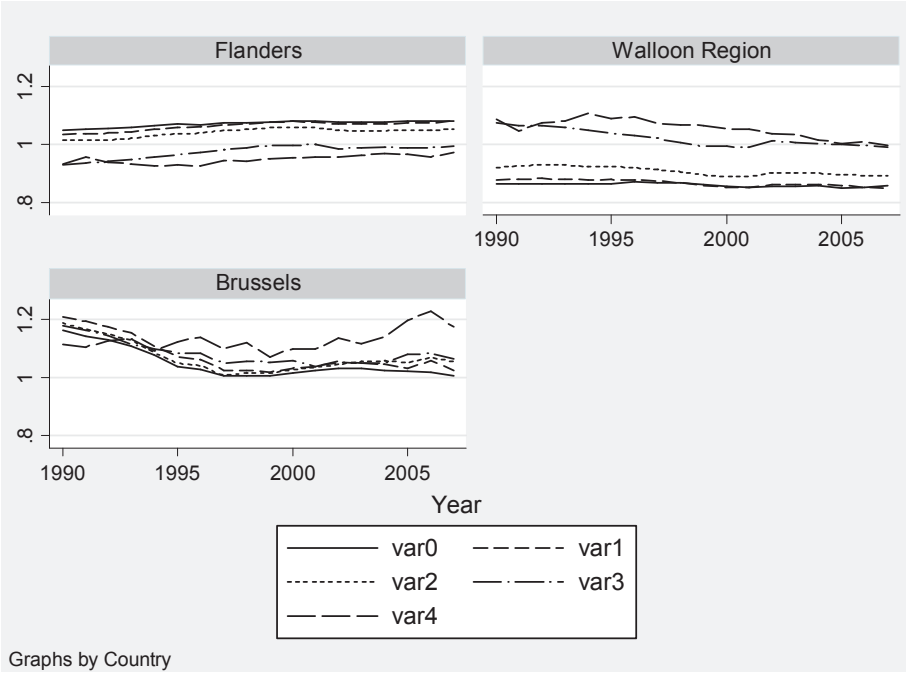


Table 11: Summary statistics

Variable		Std. Dev.	Min	Max	Observations
var0	overall	0.100618	0.849614	1.163514	N = 57
	between	0.115619	0.861346	1.069351	n = 3
	within	0.032448	0.945885	1.105189	T = 19
var1	overall	0.103528	0.849435	1.209368	N = 54
	between	0.117174	0.866456	1.075445	n = 3
	within	0.037314	0.944666	1.135481	T = 18
var2	overall	0.080333	0.88756	1.188584	N = 57
	between	0.087277	0.908653	1.07431	n = 3
	within	0.035841	0.939467	1.121637	T = 19
var3	overall	0.059794	0.920684	1.189971	N = 57
	between	0.058399	0.97145	1.088106	n = 3
	within	0.035511	0.976992	1.129977	T = 19
var4	overall	0.081145	0.910954	1.2263	N = 57
	between	0.091084	0.946231	1.126634	n = 3
	within	0.030902	0.983416	1.143401	T = 19

financing system are shown in Table 12. The estimate of β_r in the last row postulates that the initial differences in relative tax contributions per capita are not only completely equalised, but new relative inequalities are created by carrying on redistributing beyond equal incomes. For any euro difference between richer and poorer tax contributors relative to the national average, 1.16 euro is redistributed. 28 cents

is reallocated through the solidarity grant, 73 cents through the VAT grant[23], and 15 cents through other grants to regional governments. We conclude that not only the solidarity grant, but also VAT transfers and "other grants" can be classified as tools of implicit redistribution. In these results we find evidence of a development trap for regional governments. If, on average, a region's relative primary income goes up with one euro, his financial resources go down by more than one euro. We conclude that, on the basis of *long-term* averages, there is no accountability in the funding system of regional governments. For a region, it is better to be permanently poor.

However, the p-values and R^2 statistics indicate that the explanatory power of our model is not very good. The reason is that there is no good linear fit between the plots of long-term relative primary income versus secundary income for the three regions, as we can see in Figure 8. In Table 14 we take a look at the bilateral reduction in long-term income disparities through the funding system of regional governments[24]. We see that the reduction of relative income differences between Flanders and Wallonia amounts to 153% in this case. Also 65% of the relative disparities between Wallonia and Brussels is eliminated.

Table 12: Redistribution between regional governments

Adjustment to PI	β_r	1- β_r	s.d.	p-value	overall
PI-PITcontr+PITrev	1.00	0.00	0.15	0.09	0.97
PI-PITcontr+PITrev+SG	0.72	0.28	0.20	0.17	0.90
PI-PITcontr-VATcontr+PITrev+VATrev	-0.01	1.01	0.50	0.98	0.01
Disposable income	-0.16	1.16	0.77	0.86	0.03

Table 13: Long-term averages of variables in performed regressions

Region	meanvar0	meanvar1	meanvar2	meanvar3	meanvar4
Flanders	1.06935	1.06277	1.03912	0.97145	0.94623
Walloon Region	0.86134	0.86645	0.90865	1.02477	1.05834
Brussels	1.05283	1.07544	1.07431	1.08810	1.12663

We want to get an idea about how this redistribution evolved over time. Table 15 and Table 16 repeat the analysis for the sub-periods 1989-1995, 1996-2001 and 2002 till 2007 with and without the Region of Brussels. Especially when we ignore Brussels in Table 16, redistributing transfers seem to have declined over time. The reason could be the better relative performance of Flanders, which is reflected in

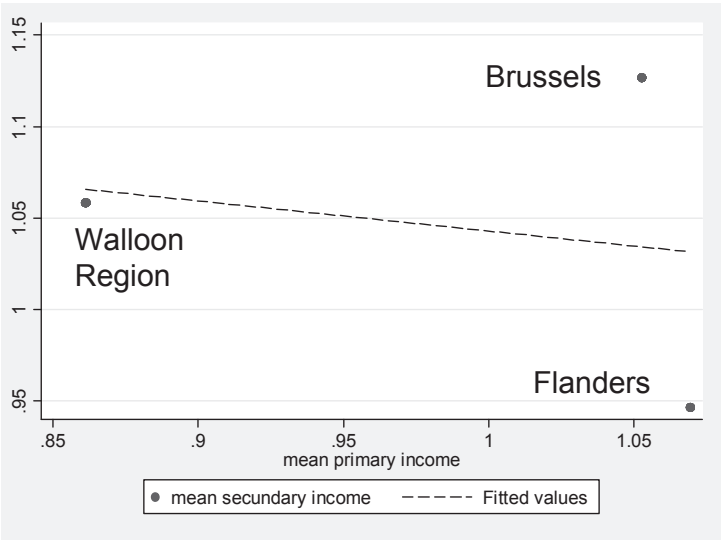
[23]Remark that this estimate of redistribution through VAT contributions and revenues is sensitive to the division key we use to assign national VAT contributions to the regions.

[24]The coefficients of β_r just indicate the slope of the connecting line between two regions in Figure 8.

Table 14: Bilateral redistribution in Belgium

Adjustment to PI	β_rFl-Wa	β_rWa-Br	β_rBr-Fl
PI-PITcontr+PITrev	0.94	1.09	-0.76
PI-PITcontr+PITrev+SG	0.62	0.86	-2.13
PI-PITcontr-VATcontr+PIT rev +VAT rev	-0.25	0.33	-7.06
Disposable income	-0.53	0.35	-10.92

Figure 8: Redistribution between regional governments: mean PI versus mean SI



receivings thanks to the horizontal division key of the PIT grant to the communities and to the regions (for the latter, the loosing regions are compensated by the federal solidarity grant). For the last period, the horizontal division of the extra Lambermont means since 2002, which takes gradually relative tax realisations into account[25], may also provide an explanation. The decreasing evolution over time is a reflection of the limited amount of short-term accountability build in into the system. However, the redistributional power of the financing system is still quite extensive.

5.3 Stabilization results

The β_ss in Table 17 give an indication of how year-by-year movements in relative tax contributions are reflected in the evolution of relative disposable income over the same period. Because the size of the PIT revenues is partially determined on the basis of the lagged relative regional fiscal contribution, we include the lag of primary income as a second explanatory variable. However, the p-values (not reported

[25]Cf. section 5.1.

Table 15: Redistribution between regional governments for the sub-periods 1989-1995, 1996-2001 and 2002-2007

Adjustment to primary income	β_{89-95}	β_{96-01}	β_{02-07}
PI-PITcontr+PITrev	1.03	1.00	1.00
PI-PITcontr+PITrev+SG	0.76	0.72	0.74
PI-PITcontr-VATcontr+PIT rev +VAT rev	0.07	-0.002	0.03
Disposable income	-0.11	-0.42	0.01

Table 16: Redistribution between Flemish and Walloon regional governments for the sub-periods 1989-1995, 1996-2001 and 2002-2007

Adjustment to PI	β_r 89-95	β_r 96-01	β_r 02-07
PI-PITcontr+PITrev	0.86	0.97	0.97
PI-PITcontr+PITrev+SG	0.49	0.7	0.68
PI-PITcontr-VATcontr +PIT rev+VAT rev	-0.62	-0.07	-0.05
Disposable income	-0.81	-0.57	-0.23

here) indicate that this variable has no explanatory power[26]. In Table 17 we notice that PIT contributions and grants provide no smoothing of income. Movements in primary income are fully reflected in PIT transfers. The solidarity grant is found to destabilize relative shocks to primary income. VAT grants provide smoothing, but only because they are quasi independent of regional economic evolution. The last row of Table 17 illustrates that there is no significant link between the movement in relative tax contributions and the evolution of relative disposable income over the same year. Theoretically, this independence could mean that total smoothing against macro-economic shocks is provided. However, other destabilizing factors make the receipts of regional governments rather unpredictable, as can be seen in Figure 9, which shows the evolution of yearly differences in primary and disposable income. We see that the latter is more variable over time. This is due to the unstable evolution of "other grants", as can be seen in Figure 10.

We conclude that the Belgian regional financing system reveals no stabilizational properties against asymmetric shocks in primary income of regional governments. The large variation in disposable income is the result of unstable financing of the regions, and not of a reaction to region-specific shocks. The R^2s indicate that the fit of the model is very low. The only insurance provided is the insurance against the risk of being a permanently poor region, as we saw in section 5.2.

[26]The lagged variable is expected to have an influence on PIT revenues, but the contemporaneous explanatory variable is expected to have a larger influence on the primary income- and PIT contributions-part of the regressand. Since the two explanatory variables move together, primary income takes over the effect of the lagged variable, which makes the latter insignificant.

Figure 9: Stabilization of regional government income

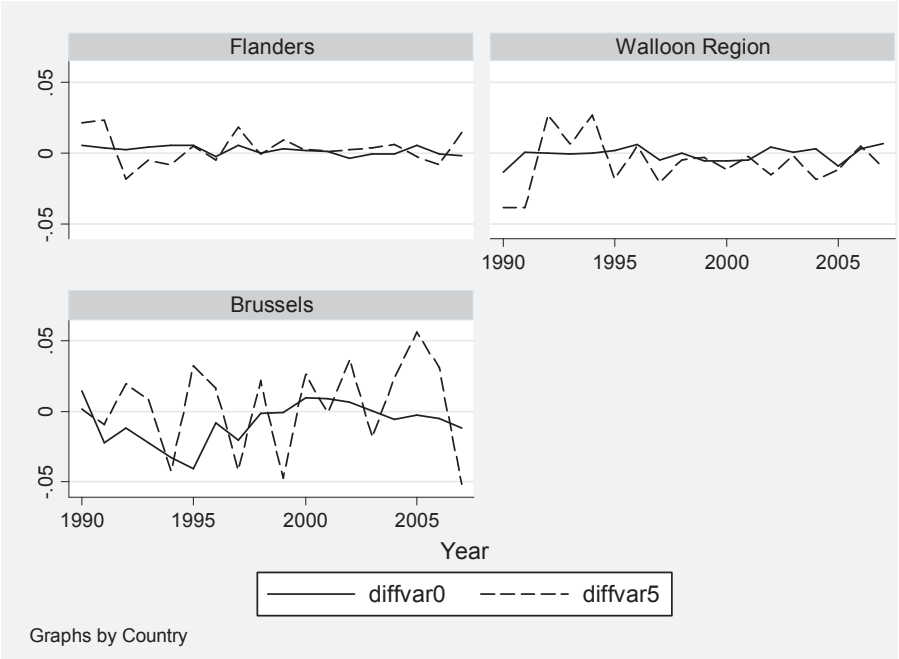


Figure 10: Evolution of "other income" relative to the national average over time: levels (first chart) and first differences (second chart)

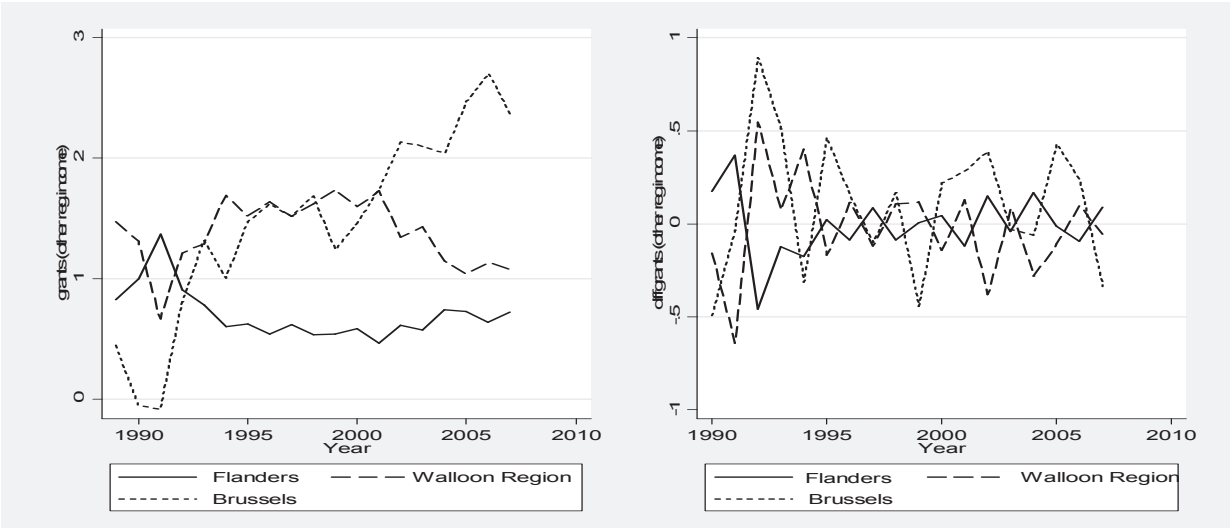


Table 17: Stabilization of regional government income: panel data analysis

Adjustment to PI	β_s	$\beta_{s,t-1}$	s.d. β_s	p-value β_s	adj.R^2
PI-PITcontr+PITrev	1.00	0.07	0.13	0.00	0.58
PI-PITcontr+PITrev+SG	1.09	0.007	0.14	0.00	0.64
PI-PITcontr-VATcontr+PITrev+VATrev	0.64	-0.15	0.17	0.00	0.12
Disposable income	0.67	-0.34	0.50	0.18	-0.25

6 Conclusions

This paper presents an analysis of fiscal equalisation among households and governments of the three regions in the Belgium federation. We look at the separate effect of two important aspects:

- First, the extent to which it reduces long-term fiscal disparities across regions
- Second, the amount of smoothing it provides against asymmetric macro-economic shocks

We look at the fiscal system to perform the analysis for household incomes, and at the funding system of subnational governments to carry out the examination w.r.t. regional government income. The overall effect of both devices is decomposed in the respective contributions of intermediate transfers.

The results show that, on average, long-term relative income inequalities between *households* of different regions are reduced with 35 percent. This redistribution hinges almost entirely upon the fiscal flows through the social security system, and it decreased slightly over time. Stabilization is only provided to a lesser extent, since short-term differences in relative income inequalities are only reduced by 15 cents in the euro. When running time series regressions for each region separately, we find that 9 percentpoints more stabilization is provided to Flanders and Wallonia than to Brussels. We compared the results to other federal countries in Europe, and found that the redistributional properties of the Belgian fiscal system are close to those of the German and Austrian system, but larger than those of Spain. Upon international comparison, Belgium manages quite well to stabilize regional household income per capita.

Concerning the income of *regional governments*, we find that the funding system overcompensates long term differences in the relative position of a region, which is measured by its tax capacity relative to the national average. The transfers through VAT contributions and -grants, the solidarity grant and "other grants" can be classified as tools of redistribution. We conclude that the largest part of permanent equalisation is not explicitly laid down in equalisation formulas, like that of the solidarity grant, but is more or less "hidden" in the practical implementation of the Special Financing Act and the Lambermont Agreement. The combination of funding and equalisation in a compound system does not really contributes to the

transparancy of the system, and it doesn't contribute to accountability. On the basis of long-term redistribution, the absence of accountability is reflected in the existence of a development trap for poorer regions. Since, on average, if a region's relative primary income goes up with one euro, his financial resources go down by more than one euro, we can say that for a region it is better to be permanently poor. Interregional equalisation can only to a low degree be justified on grounds of macroeconomic stabilisation against idiosyncratic shocks to primary income. PIT grants provide no relative smoothing. VAT grants provide smoothing, but this is due to their independence of regional economic performance. The absence of a significant link between movements in relative tax contributions and in relative disposable income, is explained by the unpredictable evolution of "other grants" to governments. We conclude that, as in most countries, the driving force for equalisation in Belgium is equity and not stabilization.

This study has a few shortcomings, which may be resolved in future research.

First, the data we used for the analysis w.r.t. redistribution and stabilization of regional government income, could be improved. The assignment of VAT collections to the regions and the division of community revenues over the regions could be refined.

Second, an important methodological criticism could be raised w.r.t. the fact that regions are compared on an equal base by using per capita values. Measurement and estimation methods should attribute a larger weight to larger regions. Otherwise, the results are affected by a certain leverage effect. For example, if a certain amount of income is redistributed from Flanders to Brussels, a small per capita reduction in the income of Flanders matches with a large increase in per capita income of Brussels.

Third, since the analysis of income equalisation between regional governments was not earlier performed in this exact way, we were not able to compare our findings to other countries.

Forth, other ways of fiscal equalisation between jurisdictions, like direct investment, public employment and public procurement, were left untouched in this paper.

Finally, it is interesting for further research to try to measure the effect of smoothing of regional government income, which is caused by the smoothing of household income, since also tax collections on social security benefits affect revenues of regional governments.

Appendix A: Definition of data

(source: Eurostat and Belgian regional accounts)

- **Primary income (PI)** is the balancing item between the resources and uses of the primary income account. It includes regional property income, compensation of employees, operating surplus (=surplus from housing services produced for own consumption by owner-occupiers) and mixed income (=surplus of households that operate in "sole proprietorships and partnerships without independent legal status"). It excludes paid interests.

- **Taxes on income and wealth (Tax)** cover all compulsory, unrequited payments in cash or in kind, levied periodically by general government and by the rest of the world on the income and wealth of institutional units, and some periodic taxes which are assessed neither on the income nor on the wealth in a specific region.

- **Social contributions (SC)** include actual social contributions and imputed social contributions in a specific region.

- **Social benefits (SB)** include social security benefits in cash (unemployment benefits, pensions, disability benefits, ...), private funded social insurance benefits, unfounded employee social insurance benefits and social assistance benefits in cash received by households resident in a specific region.

- **Other contributions (OC)** cover net non-life insurance premiums and miscellaneous current transfers paid by households resident in a specific region.

- **Other benefits (OB)** cover net non-life insurance claims and miscellaneous current transfers received by households resident in a specific region.

- **Disposable income (DI)** is the balancing item of the secondary distribution of income account. $DI = PI - Tax - SC + SB - OC + OB$

Appendix B: Explanation of increasing interregional disparities due to the tax system

In a progressive tax system, it is possible that the effective tax rate of a poorer region is higher, because of large income differencials within that region. This statement is illustrated with an example in Table 18. Suppose there are two regions, and each region has three inhabitants, with taxable income in the third column of Table 18. The tax rate system is progressive if we apply the formula $Tax = Max(PI * 0.47 - 7, 0)$. This formula approximates the results that we find when inserting the primary income figures in the tax calculator on the website of the Belgian federal government[27].

We notice that the region which is poorer on average, has a higher effective tax rate. Region 1's effective tax rate is 30% (13.1/43) while that for Region 2 is 35% (14.9/41). This phenomenon can be explained by the poor individual in Region 2, who should in theory pay negative taxes.

The variables we use in our cross-sectional estimation of redistribution in section 4.2 are the reported per capita values relative to the national average. We see that the cross-sectional difference between Region 1 and Region 2 is higher in terms of net disposable income than for primary income, which explains why the estimate of β_r could be larger than unity.

Table 18: Illustration of increasing interregional disparities via a progressive tax system

		PI	Tax	PI-Tax
Region 1	ind 1	50	16.3	33.7
	ind 2	44	13.5	30.5
	ind 3	35	9.6	25.4
Region 2	ind 1	100	39.7	60.3
	ind 2	25	5	20
	ind 3	0	0	0
Country	national avg	63.5	21.027	42.472
Region 1	per capita	43	13.136	29.863
	pc relative to nat. avg	0.6772	0.6247	0.7031
Region 2	per capita	41.666	14.9	26.7667
	pc relative to nat. avg	0.6562	0.7086	0.6302

[27] http://ccff02.minfin.fgov.be/taxcalc

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