
The Volatility of the Flemish Medium-term Budgetary Framework

Wouter van der Wielen*

Abstract – *The purpose of this paper is to determine the impact of shifts in macro-economic forecasts on the regional budget. In particular, this paper uses a probabilistic model for the Flemish budget to determine the probability distribution of future public revenues and expenditures. Its main findings are that the overall volatility of the Flemish budget has decreased as a result of the 6th State Reform. Specifically, the range of required cyclical corrections has narrowed after the reform. Nonetheless, with the decentralization of part of the personal income tax system came a higher volatility in regional tax revenues. Before the reform, this volatility was part of the volatility of the regional grants via a personal income tax grant for the regions. The increase in regional tax revenue volatility, is, however, compensated by a decrease in grant volatility, thereby limiting the overall volatility of the Flemish budget.*

Keywords: *medium-term budgets, stochastic projections, budget sensitivity, fiscal decentralization*

JEL Code: *C53, E61, E62, H72, H77*

1 INTRODUCTION

In the last two decades the majority of the world's nations have adopted laws instituting multiyear fiscal targets, known as Medium-Term Budgetary Frameworks (MTBFs). This trend also spilled over to regional governments. The directive of

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the EU Six-pack, for example, required member states to adjust their budgetary framework at all levels of government to that of the EU.

Similar to the case for borrowing constraints, the recent literature has emphasized the role of budget institutions in improving fiscal discipline. Specifically, the medium-term approach of the public budget is intended to overcome dynamic fiscal inefficiencies as argued for by, for example, Persson and Svensson (1989), Tabellini and Alesina (1990) and Velasco (2000). The empirical evidence on the impact of MTBFs on fiscal performance is broadly positive. For example, Gleich (2003) and Yläoutinen (2004) show that MTBFs were effective in raising public balances in Central and Eastern Europe in the second half of the 1990s. Similar results are found for Latin America and Eastern Europe using indexes of budget institutions including MTBFs (see e.g. Alesina *et al.* 1999; Fabrizio and Mody 2006). Nonetheless, the majority of this evidence follows from small regional samples and either cross-sectional or static panel models. Nerlich and Reuter (2013) and Vlaicu *et al.* (2014), however, present dynamic panel evidence supporting the disciplinary effect of MTBFs (both on aggregate and for sectoral measures) in the EU and worldwide, respectively.

Nonetheless, the MTBF is a forward-looking concept. Hence, to come to realistic medium-term targets, there is a requirement for the analysis of the volatility that can be expected. Moreover, multiyear fiscal targets are often defined in terms of both nominal and cyclically adjusted balances. An advanced and robust MTBF thus requires a measure of the impact of output on the regional budget to correct for output shocks as well as a more general assessment of the uncertainty in medium-term targets.

The contribution of this paper to the literature is therefore threefold. First, for the first time the stochastic analysis methods typically reserved for country-level analysis are translated to a lower-level of government. In particular, using the distribution of the unexpected shocks to Belgian growth, inflation and interest rates derived in van der Wielen (2015), a stochastic model of the Flemish medium-term budget is constructed. Second, this stochastic model allows a form of budgetary uncertainty analysis that is more advanced than the standard scenario analysis. Third, the model provides an alternative to the standard EU methodology for the determination of the regional cyclically adjusted budget balance and, consequently, the distribution of required fiscal adjustments in a federation.

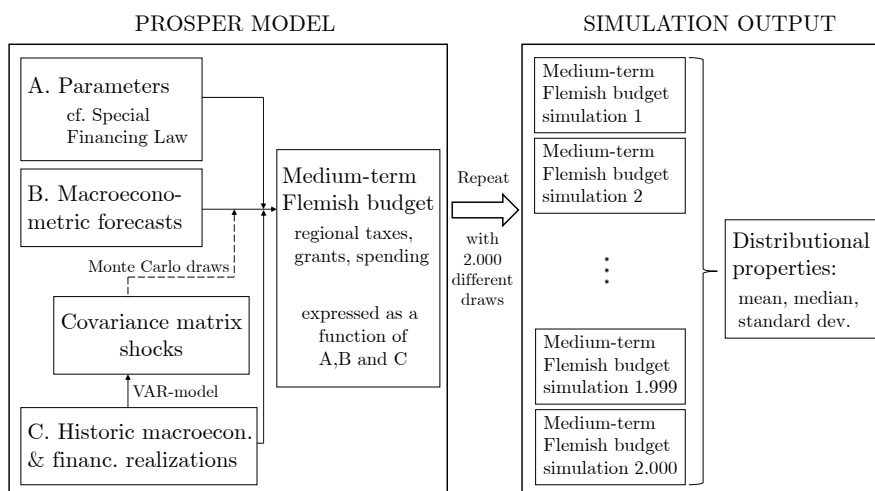
Using the model I find that the overall volatility of the Flemish budget has decreased as a result of the 6th State Reform. With the decentralization of a part of the personal income taxes (PIT), nonetheless, came a higher volatility in regional tax revenues. Overall the volatility of the Flemish budget has been limited. Consequently, the range of required cyclical corrections has narrowed after the reform.

The rest of this paper is structured as follows. Section 2 describes the model developed to make stochastic simulations of the Flemish budget over the medium-term. Section 3 highlights the stochastics of the Flemish medium-term budget. Next, section 4 applies the model to make inferences about the budget's sensitivity to macroeconomic shocks, before and after the most recent wave of decentralization. Section 5 concludes.

2 THE PROSPER MODEL

In order to illustrate stochastic simulation as a means to determine the impact of output on regional public finances I rely on data for the case of Flanders. Specifically, the 'PROjecting Stochastic Public Expenditures and Revenues' (PROSPER) model forecasts the Flemish grants, regional taxes and public spending over the medium-term horizon, while incorporating macroeconomic volatility through Monte Carlo simulation. The rest of this section summarizes the methodology, as illustrated in Figure 1. An earlier version of the PROSPER model was described in Decoster *et al.* (2015).

Figure 1. Flowchart of 2.000 Monte Carlo simulations of the PROSPER model



2.1 The Flemish Budget

2.1.a Grants

The majority of the regional revenues consists of regional grants expressed as a particular amount of various types of tax revenues collected by the federal government. In addition to their weight within the total revenues of the Flemish government, the grant system is important to analyze as the amounts of the grants typically exist of a sum determined for some base year which is subsequently adjusted yearly for, among other things, changes in GDP. Consequently, they are subject to output shocks as well. This susceptibility, however, has changed with the most recent State Reform.

A detailed account of how each grant is yearly indexed is included in tables 1 and 2. More extensive discussions of the Special Financing Law before the

6th State Reform were already provided by Decoster and Sas (2011) and Algoed and Van Den Bossche (2009). Alternatively, Decoster and Sas (2013) discuss the grant system after the reform. The allocation keys used to allocate the various grants over the different regions and communities were modelled, but not included in the tables as they are not the main focus of this paper.

Table 1. The Special Financing Law before the 6th State Reform

Grant	Article	Drivers
Regional share of personal income taxes	art 33 §4	HCPI, GDP growth, growth in number taxpayers, elasticity
National 'solidarity' mechanism	art 48	HCPI
Negative term:	art 33 bis	
– Radio and television license fees		HCPI
– Other		HCPI, 91% of GDP growth
Drawing rights	art 35 §1	n.a.
Additional resources for decentralization:	art 35 octies	
– Agriculture	art 35 ter	HCPI, GDP growth
– Agriculture and offshore fishing	art 35 quater	HCPI, GDP growth
– Scientific research on agriculture	art 35 quinquies	HCPI, GDP growth
– Foreign trade	art 35 sexies	HCPI, GDP growth
– Provinces and municipalities	art 35 septies	HCPI, GDP growth
Community grant personal income taxes ¹	art 47	HCPI, GDP growth
VAT revenues: ¹	art 38-40	
– Initial		HCPI, natality
– Lambermont		HCPI, 91% of GDP growth, natality
Radio and television license fees	art 47 bis	HCPI
Foreign students	art 62	HCPI
Profit sharing National Lottery	art 62 bis	n.a.
National botanical garden	art 62 ter	n.a.

¹ The communities' funds were based on the indexation of several base grant, i.e. the grants from personal income taxes and VAT are not simply intragovernmental payments of actual revenues. Except for the distinction in what follows, the link to these sources was only relevant at the setup of the original base.

Negotiators agreed to incorporate a transitional provision in the revised Special Financing Law. At the start of the new financing system the difference between the old and the new grants will be compensated. This compensatory amount remains part of the grant scheme for 10 years. The amount, however, is expressed in nominal terms and will thus erode in real terms. After those 10 years the amounts are reduced linearly to disappear after a second term of 10 years.

Table 2. The Special Financing Law after the 6th State Reform

Grant	Article	Drivers 2016	Drivers 2017-...
National 'solidarity' mechanism	art 48	HCPI, GDP growth	HCPI, GDP growth
Original resources for decentralization	art 35 octies	HCPI, GDP growth	55% of capped GDP growth ¹
New resources for decentralization:			
– Labor market policy	art 35 nonies	HCPI, 75% of GDP growth	55% of capped GDP growth ¹
– Fiscal expenditures	art 35 decies	HCPI, 75% of GDP growth	55% of capped GDP growth ¹
Compensation commuting losses	art 64 quater	n.a.	n.a.
Community grant personal income taxes minus pensions public servants ²	art 47/2	HCPI, 75% of GDP growth	55% of capped GDP growth ¹
Re-calibrated VAT revenues	art 40 quinquies	HCPI, 91% of GDP growth, natality	HCPI, 91% of GDP growth, natality
New resources for decentralization:			
– Child benefits	art 47/5	HCPI, 25% of growth GDP/capita, growth pop. 0-18y.o.	HCPI, 25% of growth GDP/capita, growth pop. 0-18y.o.
– Geriatric care	art 47/7	HCPI, 82.5% of growth GDP/capita, growth pop. >80y.o.	HCPI, 65% of capped growth GDP/capita ¹ , growth pop. >80y.o.
– Hospital infrastructure and medical-technical services	art 47/8-47/11	HCPI, GDP growth	HCPI, 65% of growth GDP/capita
– Health care	art 47/8-47/11	HCPI, 82.5% of GDP growth, pop. growth	HCPI, 65% of growth GDP/capita, pop. growth
– Other	art 47/8-47/11	HCPI, GDP growth	HCPI, GDP growth
Foreign students	art 62	HCPI	HCPI
Profit sharing National Lottery	art 62 bis	n.a.	n.a.
National botanical garden	art 62 ter	n.a.	n.a.

¹ To provide a balanced division of the advantages of future economic growth over the different levels of government the adjustment for GDP growth is limited if the real GDP growth exceeds 2.25%. Specifically, the grant is only adjusted by a prespecified percentage of the GDP growth up to 2.25%.

² The responsibility contribution for the pensions of public servants gradually increases until 2020. From 2021 onward it is linked to a proportion of the total salaries paid to statutory servants at the regional level.

2.1.b Regional Taxes

The 6th State Reform created the possibility for regions to set a piggyback tax for personal income revenues. In order to model the Flemish public revenues after the State Reform a model for personal income tax revenues is required. To this purpose Decoster and De Swerdt (2012) developed a microsimulation model using the IPCAL dataset, a representative sample of Belgian tax returns drawn up by the Federal Public Service (FPS) Finance. I use the regional elasticities of personal income taxes of their 'FANTASI' microsimulation model to relate the regional personal income tax revenues to GDP. The assumptions used to allow me to do so were already documented by Decoster and Sas (2013).

In addition to the new regional piggyback tax, the Flemish government has been entitled to levy inheritance taxes and registration fees for longer. The main types of registration fees (e.g. capital transfer taxes) have been modelled already by Hoebeeck and Smolders (2012), Hoebeeck *et al.* (2013) and Smolders and Stieperaere (2011, 2012). Capital transfer taxes are found to be a function of economic growth, the average house price and privately held financial assets (i.e. stocks). Moreover, Smolders and Stieperaere (2011, 2012) also do this for the inheritance taxes. Inheritance taxes are found to be a function of house prices in Flanders, the magnitude of private savings and private portfolios of stocks not quoted on the stock exchange. Since their applications are specific for the Flemish regional tax revenues and result in a satisfactory goodness-of-fit, I incorporate their estimated equations.

Other taxes levied by the Flemish government are property taxes and circulation (or road) taxes, but are only a minor fraction of all revenues. Although their omission from the model would thus have little impact on the volatility results presented below, they are incorporated using basic specifications regressing the tax revenue on its lag and the business cycle.

2.1.c Regional Public Spending

For the spending side of the budget, the Flemish administration works with a bottom-up principle. Each of the different agencies is required to make up their spending budgets, which – after inspection and revision – are combined into an overall medium-term spending budget. Except for inflation, macroeconomic evolutions and shocks only play a minor role in this process. For example, economic growth is assumed to only influence the evolution of a very limited number of spending categories. In particular, the directions of the coalition agreement and demographic evolutions are the main drivers.

In the model, all spending is indexed for inflation. The evolution of the social spending categories is subject to the evolution of the underlying section of the population as well. For example, child allowances are a function of the population under the age of 18. The costs of geriatric care are a function of the population older than 80 years old. Operating costs and public investments, on the other hand, are only indexed by inflation. Wage costs, in their turn, are also a function of the number of public servants and the wage drift. The model does leave the

option open to adjust the evolution of these last three categories based on political preferences, e.g. additional growth in investment.

Finally, the interest burden is computed as a percentage of the outstanding debt. Nevertheless, for this the structure of the debt stock is taken into account. A large proportion of the debt stock is fixed. Shocks in the interest rate will therefore have no effect on this part.

2.2 Macroeconomic Volatility

Given their close relationship (see e.g. Table 2), the PROSPER model models the budget components as functions of the aforementioned macroeconomic variables. For example, capital transfer taxes will depend on, among other things, economic growth and house prices. Therefore, the volatility in the regional budget is mainly driven by shocks to those macro drivers. In particular, in the simulations of the model, the volatility comes from shocks to Belgian GDP growth, inflation and interest rates. To do so the model relies on the endogenous macroeconomic forecasts and their structural shocks as derived using a structural vector autoregression model in van der Wielen (2015).¹

For simulation purposes, the uncertainty observed in historical data is employed to generate shocks to economic growth, inflation and the interest rate. In particular, the estimated variance-covariance matrix ($\hat{\Omega}$) of the VAR-model is decomposed as follows: $\hat{\Omega} = A^{-1}A^{-t}$, where A^{-1} is a 3×3 lower triangular matrix with the standard deviations of the structural shocks on its main diagonal. Then, quarterly shocks for the simulations ($\tilde{\epsilon}$) are obtained by multiplying A^{-1} by a 3×1 vector of random draws from a standard normal distribution: $\tilde{\epsilon} = A^{-1}\zeta_t$ where $\zeta_t \sim N(0,1)$. Repeating this simulation algorithm N times for a time horizon of T years results in NT vectors of $\tilde{\epsilon}$. In the application that follows, 2.000 simulations are performed over a period of 5 years.

While the shocks in the model at hand result from macroeconomic determinants, the shocks in earlier studies on regional budget volatility (see e.g. Albuquerque 2011) were defined as the deviation of the series from its trend or, similarly restrictive, the part of the budget series not explained by its own lag and institutional controls (i.e. the residual of a regression). Alternatively, standard sensitivity tests generally simulate shocks to each of the determinants one at a time, implying that correlations between shocks (as a result of correlations between determinants) are neglected. This is also the case when ad hoc combinations of shocks are considered, as in the traditional deterministic debt sustainability analysis (DSA). In a stochastic framework, such as the one at hand, uncertainty in macroeconomic conditions is accounted for in a much more satisfactory way,

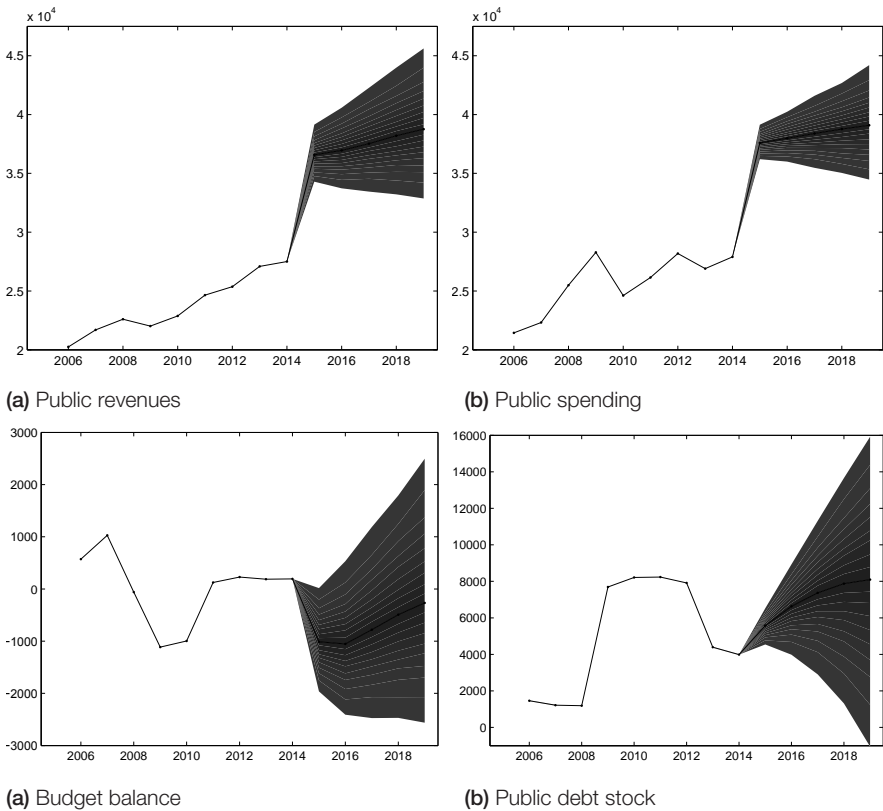
1. Nonetheless, the model also allows the use of exogenous forecasts. For instance, the projections by the Federal Planning Bureau can be used as the benchmark forecasts for real GDP, inflation and interest rates. This can be interesting for policy makers. For example, because they are the macroeconomic forecasts used by the government in making up the budget and referenced by the European Commission.

thanks to the explicit recognition of correlation and the probabilistic nature of the outcomes.

3 THE STOCHASTIC MEDIUM-TERM BUDGET

The overall uncertainty in the Flemish medium-term budget is illustrated in Figure 2. The figure shows the uncertainty for public revenues, public expenditures, the budget balance and the Flemish debt stock. In particular, each subfigure shows the results for 2.000 period-by-period Monte Carlo simulations of the PROSPER model. Shaded areas portray the deciles of the projections, with different shades delineating different deciles. As expected the uncertainty increases as the horizon lengthens. The jump in expenditures and revenues between 2014 and 2015 is the result of the 6th State Reform (see below).

Figure 2. Stochastic simulations of the Flemish medium-term budget (in million euro)



For a more detailed overview of the budget's uncertainty, I illustrate the uncertainty in each budget component in Table 3 using its standard deviation for the 2015 results. Specifically, using the N simulations for the i th budget component in period t the standard deviation is computed as:

$$\sigma_{x_{i,t}} = \sqrt{\frac{1}{N-1} \sum_{n=1}^N |x_{n,i,t} - \mu_{i,t}|^2} \text{ where } \mu_{i,t} = \frac{1}{N} \sum_{n=1}^N x_{n,i,t}$$

Note that the standard deviations of the subcategories do not necessarily need to add up to the standard deviation of the total. In contrast with the first moment, the second moment is not linear.

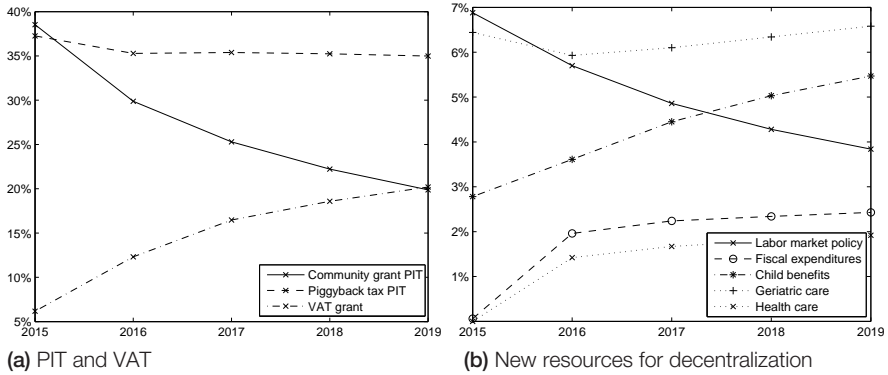
For any years after 2015 the standard deviations only increase as uncertainty about the possible outcomes grows. Moreover, uncertainty increases as some of the new grants following from the 6th State Reform (e.g. hospital infrastructure) were still fixed in 2015 but will get indexed from 2016 onward. The first column shows the nominal values of the standard deviations of each budget component, i.e. expressed in million euro. To ease comparison columns two and three express the standard deviations as percentages. The second column shows the budget components as percentages of the total revenues or expenditures. The third column shows them as percentages of their mean value over the 2.000 simulations.

As expected the standard deviation of the revenues reported in Table 3 exceeds that of total expenditures. In fact, spending volatility is about 60% of the magnitude of revenue volatility. After all, a large part of the automatic stabilizers on the spending side (e.g. unemployment benefits) are still federal competences. Nonetheless, the spending volatility is expected to increase to approximately 75% of revenue volatility by 2019 as a result of the step-wise introduction of new expenditures, as foreseen by the State Reform.

The revenue uncertainty is mainly the result of the uncertainty surrounding personal income tax revenues (cf. the community grant and piggyback tax from personal income taxes). Next in line are the revenues from the grant for labor market policy, that for geriatric care and that from VAT revenues. The importance of the volatility in revenues from capital transfer taxes is not negligible either, therefore supporting the need for advanced forecasting models.

Overall the uncertainty increases as the horizon lengthens. Additionally, the shares of the different components in the budget's overall uncertainty (as expressed in column two of Table 3) changes as time proceeds. As illustrated in panel (a) of figure 3, the share of the volatility of the community grant from personal income taxes is expected to decrease in the medium-term, while the importance of the volatility of the VAT grant is expected to increase. The influence of the decentralization of part of the personal income taxes through the piggyback system remains relatively constant at about 35% of the total revenue uncertainty.

Figure 3. Shares in the revenue uncertainty of the Flemish medium-term budget



As the implementation of the most recent State Reform proceeds some other additional resources come into play. Panel (b) of figure 3, for example, illustrates the rising importance of the grants for child benefits, fiscal expenditures and health care in the medium-term. As a result of their growing share, the share of the volatility in the grant for labor market policy in the total revenue volatility decreases.

Finally, as the Flemish debt stock remains limited and its interest rate is largely fixed in the long run, the impact of uncertainty via the interest burden is limited. As indicated by the third column it is, however, one of the most volatile components. Nevertheless, its small share in the budget hedges against this.

Table 3. Standard deviations of the 2015 Flemish budget by component

	Standard Deviations (σ)		
	million	% of total	% of mean
Total revenues	1 470.10	100.00	4.02
<i>Grants:</i>	<i>818.06</i>	<i>55.65</i>	<i>2.58</i>
National 'solidarity' mechanism	0.00	0.00	0.00
Original resources for decentralization	0.00	0.00	0.00
<i>New resources for decentralization:</i>			
– Labor market policy	101.21	6.88	6.13
– Fiscal expenditures	0.89	0.06	0.05
Compensation commuting losses			
Community grant personal income taxes	566.45	38.53	9.38
Re-calibrated VAT revenues	90.77	6.17	1.12

New resources for decentralization:			
– Child benefits	40.80	2.78	1.13
– Geriatric care	94.73	6.44	4.34
– Health care	0.00	0.00	0.00
– Other	0.00	0.00	0.00
Foreign students	0.42	0.03	1.13
Profit sharing National Lottery	0.09	0.01	0.26
National botanical garden	0.21	0.01	4.34
<i>Regional taxes:</i> ¹	<i>669.55</i>	<i>45.54</i>	<i>5.35</i>
Piggyback personal income taxes	547.78	37.26	7.18
Capital transfer taxes	70.21	4.78	3.48
Road taxes	49.45	3.36	4.00
Property taxes	10.95	0.74	9.56
Other	8.12	0.55	35.24
Total spending	895.63	100.00	2.38
<i>Primary spending:</i>	<i>886.55</i>	<i>98.99</i>	<i>2.36</i>
Functioning and investment:			
– Wages & social contributions	39.67	4.43	1.13
– Intermediary usages	28.30	3.16	1.13
– Investment	13.25	1.48	1.13
Social transfers	131.05	14.63	1.38
Non-social transfers	148.21	16.55	4.34
Intragovernmental transfers	540.45	60.34	3.10
Other	26.81	2.99	0.54
<i>Interest burden</i>	<i>13.18</i>	<i>1.47</i>	<i>16.52</i>
Budget balance	607.23	100.00	-59.67
<i>Primary balance</i>	<i>614.54</i>	<i>101.20</i>	<i>-65.52</i>

¹ Inheritance taxes were not found to be a significant function of GDP fluctuations, interest rates or inflation.

4 THE IMPACT OF THE 6TH STATE REFORM

Here I illustrate the impact the 6th State Reform has had on the Flemish budget. Earlier comparative analyses were performed by Decoster and Sas (2013), Algoed and Van Den Bossche (2013) and Mathot (2013). They do, however, leave aside volatility issues.

Table 4 presents the standard deviations of the 2015 Flemish budget if no state reform would have taken place. In other words, it illustrates the original financing scheme and is directly comparable to the results from Table 3. It immediately becomes clear that the standard deviation of total revenues was considerably larger before the 6th State Reform. The decrease since the reform is present both in nominal terms and percentage wise.

Table 4. Standard deviations of the 2015 Flemish budget if no state reform

	Standard Deviations (σ)		
	million	% of total	% of mean
Total revenues	1 572.10	100.00	6.00
<i>Grants:</i>	<i>915.28</i>	<i>58.22</i>	<i>4.29</i>
Regional share of personal income taxes	410.49	26.11	4.29
National 'solidarity' mechanism	0.00	0.00	0.00
Negative term	103.16	6.56	-3.35
Additional resources for decentralization	6.95	0.44	4.35
Community grant personal income taxes	189.40	12.05	4.29
VAT revenues			
– Initial	84.85	5.40	1.13
– Lambermont	376.80	23.97	20.61
Radio and television license fees	6.64	0.42	1.13
Foreign students	0.42	0.03	1.13
Profit sharing National Lottery	0.08	0.01	0.24
National botanical garden	0.21	0.01	4.34
<i>Regional taxes:¹</i>	<i>122.15</i>	<i>7.77</i>	<i>2.50</i>
Capital transfer taxes	70.21	4.47	3.48
Road taxes	49.45	3.15	4.00
Property taxes	10.95	0.70	9.56
Other	8.12	0.52	35.24
Total spending	895.63	100.00	2.88
<i>Primary spending:</i>	<i>886.55</i>	<i>98.99</i>	<i>2.86</i>
Functioning and investment:			
– Wages & social contributions	39.67	4.43	1.13
– Intermediary usages	28.30	3.16	1.13
– Investment	13.25	1.48	1.13
Social transfers	131.05	14.63	4.34
Non-social transfers	148.21	16.55	4.34

Intragovernmental transfers	540.45	60.34	3.10
Other	26.81	2.99	0.54
<i>Interest burden</i>	<i>13.18</i>	<i>1.47</i>	<i>16.52</i>
Budget balance	714.12	100.00	25.93
<i>Primary balance</i>	<i>721.38</i>	<i>101.02</i>	<i>25.46</i>

¹ Inheritance taxes were not found to be a significant function of GDP fluctuations, interest rates or inflation.

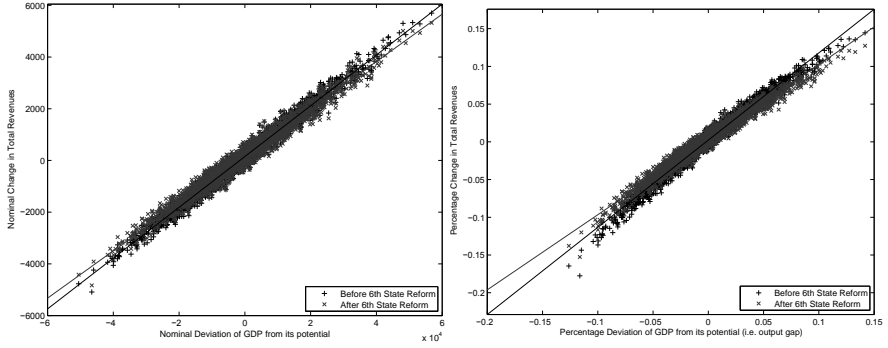
The higher percentage wise volatility of total revenues before the most recent reform is partly due to the higher standard deviation of total revenues themselves (i.e. more volatility in nominal terms), but it is also the result of a denominator effect. Before the State Reform the Flemish revenues were considerably lower. For instance, significant new resources for child benefits and geriatric care were added. Finally, there is also an element of correlation at play. As with portfolio analysis, combining revenue sources with negative correlations reduces the overall uncertainty, while more positively correlated revenue sources increases revenue uncertainty.

While the volatility of regional taxes was lower before the reform, the initially higher volatility in the grants more than compensated for this. With the decentralization of part of the PIT revenues came increased uncertainty in regional tax revenues. Hence, regions will now not only benefit more from the upswings of the cycle, but will also be confronted more by lower revenues in case of downswings. Nevertheless, as a result of other measures, the overall volatility of the Flemish revenues has decreased. For example, the rather volatile 'negative term' was abolished. Moreover, the indexation for output growth has been restricted after the reform. To provide a balanced division of the advantages of future economic growth over the different levels of government the adjustment for GDP growth is limited if the real GDP growth exceeds 2.25%. Specifically, the grant is only adjusted by a prespecified percentage of the GDP growth up to 2.25% (cf. Table 2).

To illustrate the impact of output shocks Figure 4 shows the changes in total revenues in relation to the corresponding changes in output vis-à-vis its potential, both in nominal terms as in percentages. Moreover, panels (c) to (f) further divide the total revenues into the revenues from regional taxes and those via grant schemes. Although the distribution of the possible outcomes for regional taxes has widened since the reform, that for the grants has shrunk. Overall, the sensitivity of the Flemish revenues has diminished.

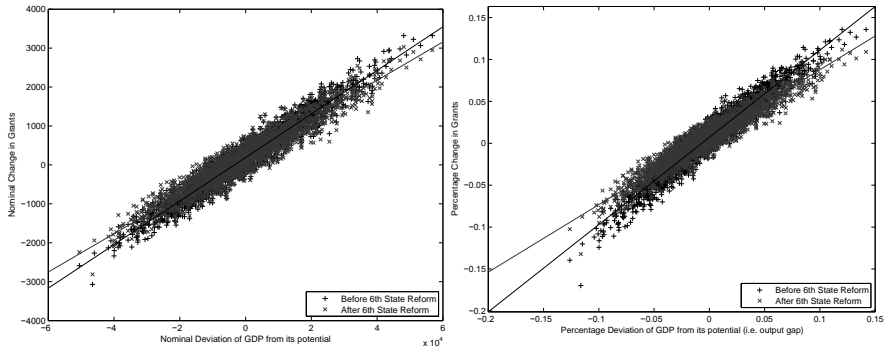
Furthermore, a linear least squares equation is fitted in each of the scatter plots to ease comparison. In fact, given the specification of the axes, the slope of the fitted curve is the sensitivity and the elasticity for the figures in nominal and percentage terms, respectively. Nonetheless, the output effect on regional taxes is clearly non-linear percentage wise. While there is a diminishing impact on tax revenues as the output gap becomes larger, tax revenues decrease more than proportionally as the output gap becomes smaller.

Figure 4. Changes in Flemish revenues *versus* the corresponding deviations of real GDP from its potential in 2015



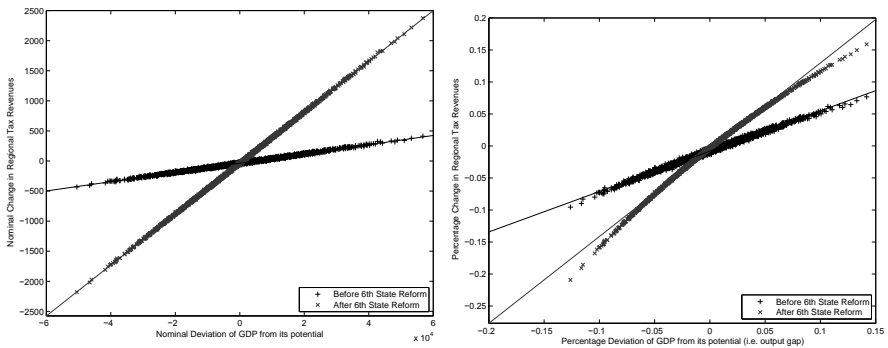
(a) Total revenues: nominal change

(b) Total revenues: percentage change



(a) Regional grants: nominal change

(b) Regional grants: percentage change



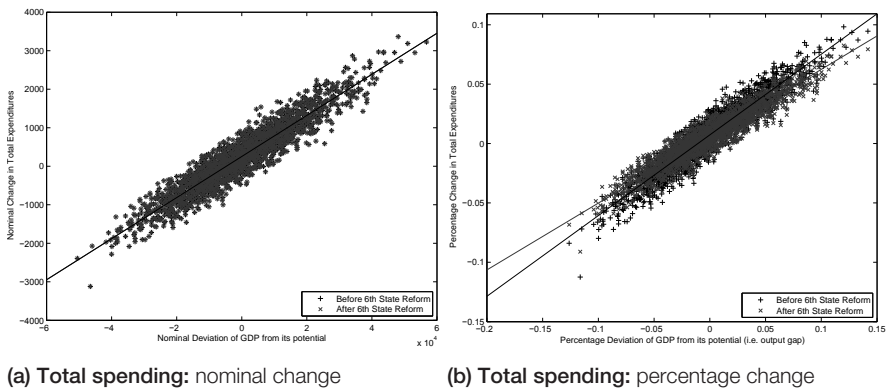
(a) Regional tax revenues: nominal change

(b) Regional tax revenues: percentage change

On the spending side, the standard deviations in 2015 are nominally the same under both scenarios. Expressed as percentages of the mean the uncertainty is higher under the original system. This is purely a denominator effect since the State Reform resulted in additional expenditures on social transfers. Nonetheless, in line with the political negotiations, these additional expenditures are modelled to be fixed amounts in 2015. Afterward, however, they do result in additional volatility. In particular, by 2019 the standard deviation of total spending expressed as a percentage of its mean in the new system increases to 7.56%, while it would only increase to 6.89% in case of no reform. Nonetheless, due to the limited output elasticity of this additional channel of uncertainty the medium-term output elasticity of total spending after the reform is smaller.

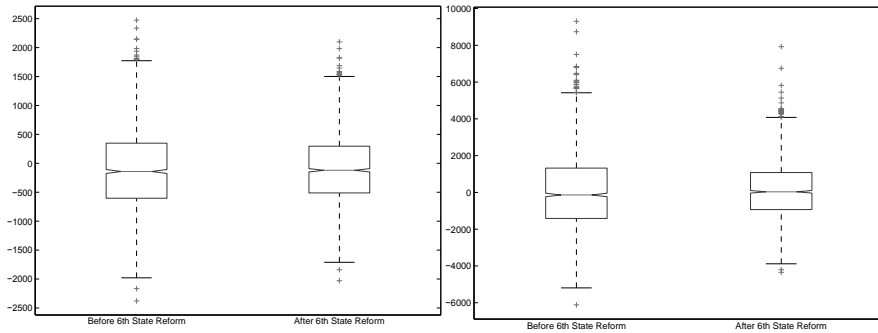
This can also be observed from Figure 5. The nominal changes before and after the reform coincide in 2015. Similar plots for successive years would show more volatile nominal spending as a result of the new expenditures on social transfers no longer being fixed. Panel (b), however, illustrates that expenditures have become less volatile percentage wise.

Figure 5. Changes in Flemish spending *versus* the corresponding deviations of real GDP from its potential in 2015



Taken together, the budget balance has become less volatile under the new financing scheme. Specifically, the possible range of required cyclical corrections simulated using the model has been restricted after the reform. This can be inferred from the box plots in Figure 6, which show the properties of the cyclical corrections in 2015 and 2019 with and without the reform. Even though policy makers will always be confronted by more uncertainty the longer the horizon, the reform has thus reduced the volatility of the Flemish budget.

Figure 6. The cyclical correction of the Flemish budget balance (in million euro) before and after the 6th State Reform



(a) 2015

(b) 2019

5 CONCLUSION

By now the majority of the world's nations have adopted laws instituting MTBFs. With the increased decentralization of fiscal policy, this trend also spilled over to regional governments. The empirical evidence on the impact of MTBFs on fiscal performance is broadly positive. Nonetheless to be effective, medium-term frameworks need to allow for uncertainty about underlying economic prospects. Several approaches for measuring and simulating volatility are available.

This paper summarizes a stochastic framework developed to analyze the volatility of Flemish grants, regional taxes and public spending over the medium-term. Due to the explicit recognition of the probabilistic nature of the outcomes the model accounts for uncertainty in macroeconomic conditions in a much more satisfactory way than previous models of the regional budget.

Using the model for the Flemish medium-term budget I find that the overall volatility of the Flemish budget has decreased as a result of the 6th State Reform. With the decentralization of a considerable part of personal income taxes, nonetheless, came a higher volatility in regional tax revenues. Before the reform this volatility was part of the volatility of the regional grants via a personal income tax grant for the regions. The increase in regional tax revenue volatility, is, however, compensated by a decrease in grant volatility and a decreased output elasticity on the spending side, thereby limiting the overall volatility of the Flemish budget. Consequently, the range of required cyclical corrections has narrowed after the reform.

REFERENCES

- ALBUQUERQUE, Bruno (2011). Fiscal institutions and public spending volatility in Europe. *Economic Modelling*, 28(6), 2544-2559.
- ALESINA, Alberto, HAUSMANN, Ricardo, HOMMES, Rudolf, & STEIN, Ernesto (1999). Budget institutions and fiscal performance in Latin America. *Journal of Development Economics*, 59(2), 253-273.
- ALGOED, Koen & VAN DEN BOSSCHE, Wim (2009). Bijzondere Financieringswet in een notendop (met illustratie voor het jaar 2009). *Documentatieblad SDD FOD Financiën*, 69(2), 63-90.
- ALGOED, Koen & VAN DEN BOSSCHE, Wim (2013). De hervorming van de Bijzondere Financieringswet: wat zijn de gevolgen voor de houdbaarheid van de federale en gewestelijke overheidsfinanciën? *Documentatieblad SDD FOD Financiën*, 73(2), 205-236.
- DECOSTER, André & DE SWERDT, Kris (2012). FANTASI: een microsimulatiemodel voor personenbelasting op IPCAL-data (Rapport Spoor A3b1 Steunpunt Fiscaliteit en Begroting II).
- DECOSTER, André, PROOST, Stef, & VAN DER WIELEN, Wouter (2015). PROSPER: Een begrotingsmodel voor een onzekere toekomst (Rapport Spoor A4 Steunpunt Fiscaliteit en Begroting II).
- DECOSTER, André & SAS, Willem (2011). De Bijzondere Financieringswet voor dummies (FLEMOSI Discussion Paper 4).
- DECOSTER, André & SAS, Willem (2013). De nieuwe Bijzondere Financieringswet van de 6de staatshervorming: werden de beloften ingelost? (FLEMOSI Discussion Paper 28).
- FABRIZIO, Stefania & MODY, Ashoka (2006). Can budget institutions counteract political indiscipline? *Economic Policy*, 21(48), 689-739.
- GLEICH, Holger (2003). Budget Institutions and Fiscal Performance in Central and Eastern European Countries (ECB Working Paper 215).
- HOEBEECK, Annelies & SMOLDERS, Carine (2012). Modellen ter voorspelling van de ontvangsten van de registratierechten (Rapport Spoor A1 Steunpunt Fiscaliteit en Begroting II).
- HOEBEECK, Annelies, STIEPERAERE, Hannes, SMOLDERS, Carine, INGHELBRECHT, Koen, & EVERAERT, Gerdie (2013). Elasticiteitsmodellen en combination forecasts ter voorspelling van de ontvangsten van de registratierechten (Rapport Spoor A1 Steunpunt Fiscaliteit en Begroting II).
- MATHOT, Axel (2013). Actief arbeidsmarktbeleid voor en na de staatshervorming. *Documentatieblad SDD FOD Financiën*, 73(2), 15-46.
- NERLICH, Carolin & REUTER, Wolf Heinrich (2013). The Design of National Fiscal Frameworks and their Budgetary Impact (ECB Working Paper 1588)
- PERSSON, Torsten & SVENSSON, Lars (1989). Why a Stubborn Conservative would Run a Deficit: Policy with Time-Inconsistent Preferences. *The Quarterly Journal of Economics*, 104(2), 325-345.

- SMOLDERS, Carine & STIEPERAERE, Hannes (2011). Modellen ter voorspelling van de ontvangsten uit de successie- en schenkingsrechten (Rapport Spoor A1 Steunpunt Fiscaliteit en Begroting II).
- SMOLDERS, Carine & STIEPERAERE, Hannes (2012). Evaluatie voorspellingsmodellen (Rapport Spoor A1 Steunpunt Fiscaliteit en Begroting II).
- TABELLINI, Guido & ALESINA, Alberto (1988). Voting on the Budget Deficit. *American Economic Review*, 80(1), 37-49.
- VAN DER WIELEN, Wouter (2015). Fiscal Rule Infringement Risks: A Stochastic Characterization of EMU Budgets and Their Discipline (CES Discussion Paper 15.12).
- VELASCO, Andres (2000). Debts and deficits with fragmented fiscal policymaking. *Journal of Public Economics*, 76(1), 105-125.
- VLAICU, Razvan, VERHOEVEN, Marijn, GRIGOLI, Francesco, & MILLS, Zachary (2014). Multiyear budgets and fiscal performance: Panel data evidence. *Journal of Public Economics*, 111(1), 79-95.
- YLÄOUTINEN, Sami (2004). Fiscal Frameworks in Central and Eastern European Countries (Finnish Ministry of Finance Discussion Paper 72).