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SOLVENCY AND SUSTAINABILITY OF FISCAL POLICIES IN THE EU**

BY

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1 INTRODUCTION

The rise of public indebtedness of many industrial countries during the past two decades has caused increasing concern about its potentially unfavourable effects. More specifically, the question has been raised whether the fiscal policies (the pattern of public debt and deficits) pursued by some governments can be sustained in the future. In view of the budgetary criteria implied by the Maastricht Treaty, the sustainability aspect of the fiscal policies of some member states of the EU has increasingly drawn attention from economists. However, the fiscal discipline that is needed in the future EMU in order to avoid the negative externalities of excessive deficits goes far beyond the long-run requirement of sustainable fiscal policies since it puts precise upper limits on deficits and debt-to-GDP ratios as an entry condition in the pre-EMU stage.

This paper focuses on empirical tests for the sustainability and solvency of fiscal policies. The solvency criterion is derived from the intertemporal budget constraint of the government. Tests for solvency heavily rely on the time-series properties of the deficit inclusive of interest payments, particularly its stationarity. However, we argue that the stationarity of the deficit should only be seen as a weak criterion to evaluate the sustainability of fiscal policies, since the intertemporal budget constraint does not bound the debt-to-GDP ratio, which may continue to increase without violating solvency. A more realistic sustainability criterion should also take into account limits to the government's taxing capacity, so

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that only finite values of the debt-to-GDP ratio guarantee the marketability of public debt, *i.e.* level-stationarity of the debt-to-GDP time series is required.

The basic framework of the theoretical analysis draws on recent contributions, such as Hamilton and Flavin (1986), Spaventa (1987), Trehan and Walsh (1988), Hakkio and Rush (1991), Corsetti (1991), Kremers (1988, 1989), MacDonald (1992) and De Haan and Siermann (1993).

Solvency and sustainability are tested first for 8 ERM countries during the period 1970–1994, for which general government data are published by the European Commission. Subsequently, we will focus on historical evidence (from 1870 onwards) for the Belgian central government. A long-term view on its fiscal stance allows for testing the hypothesis that high and persistent deficits for some periods may not prevent a government from obeying both criteria, provided that the policy is changed eventually. This long-run analysis does not reveal any evidence in support of sustainability, as the debt ratio is found to be nonstationary, instead of level-stationary. However, the finding of a historically stationary deficit allows us to examine the revenue and expenditure adjustment mechanisms that bring about intertemporal budget balance (solvency) by means of an impulse-response analysis.

The paper is organized as follows. In section 2, the conditions for solvency and sustainability will be derived and assessed. Sections 3 and 4 present the empirical results. The main conclusions are summarized in section 5.

2 THE FRAMEWORK

2.1 *The Concepts of Solvency and Sustainability*

The sustainability of fiscal policy has become an important issue in public finance. In recent contributions, a key concept is the government's or present value budget constraint, according to which the present value of future primary surpluses must be equal to the actual public debt. This weak condition for sustainability (there are no limits to the levels of taxation that society is willing to accept) is denoted as solvency in the sequel.

A more pragmatic notion of sustainable fiscal policy is defined here as a trajectory of revenue and public expenditure that, given the initial stock of outstanding public debt, can be pursued indefinitely, considering constraints on the taxing capacity of the government. Defined in this way, a sustainable fiscal policy implies, in addition to solvency, a feasible tax policy that is limited by an upper bound on the tax rate.

The empirical approach that will be followed in this paper is backward-looking and analyses the past behaviour of the time series involved. The relevant question is then: does the fiscal trajectory that has been pursued in the past in a specific macroeconomic environment reflect solvency, or, judged from a more

operational point of view, is it sustainable in the future? If not, either changes in budgetary policies or in the relevant macroeconomic characteristics impinging on the evolution of public deficits are required for the government's fiscal policy to remain solvent in the future or to prevent a debt explosion (sustainability).

In the sequel, the conditions for a solvent and a sustainable fiscal policy will be derived in a formal way, starting from the government budget constraint that holds at the end of any period t:

$$B_t = G_t - T_t + (1 + i_{t-1})B_{t-1}. \tag{1}$$

The outstanding stock of public debt at the end of period t is denoted by B_t. G_t is primary public expenditure, *i.e.* exclusive of interest payments on the debt, T_t is tax revenue and i_t is the effective, nonnegative rate of interest paid on the public debt. All variables are in real terms. Seigniorage has not been taken into account in the calculation of government revenue for two reasons. On the one hand, different concepts are at hand in the literature (see *e.g.* Gros, 1989). Two alternative definitions of seigniorage can be used, *i.e.* a cash flow and an opportunity cost measure, leading to widely divergent results. On the other hand, we do not attempt to correct the public sector data. In line with Bohn (1991) we consider the official budget data as most informative about government behaviour. It is appropriate to assume that policymakers are primarily influenced by the widely available official numbers.

Solving (1) forward recursively from period t to n yields:

$$B_t = \sum_{j=1}^{n} I_{t,j} S_{t+j} + I_{t,n} B_{t+n} \tag{2a}$$

where: $I_{t,j} = \prod_{h=1}^{j} (1 + i_{t+h-1})^{-1}$
$S_{t+j} = T_{t+j} - G_{t+j}$ (*i.e.* the primary surplus).

The present value budget constraint (2a) should also hold for an infinite horizon:

$$B_t = \sum_{j=1}^{\infty} I_{t,j} S_{t+j} + \lim_{n \to \infty} I_{t,n} B_{t+n}. \tag{2b}$$

An infinite-lived government is considered to be solvent if its net worth is nonnegative. This implies that the second term on the r.h.s. of (2b) is nonpositive. A negative value of this term would mean that the government is, in the limit, a net creditor in present value terms. This case of supersolvency (Corsetti, 1991) can, for practical purposes, be ruled out. Hence, strict solvency requires:

$$\lim_{n \to \infty} I_{t,n} B_{t+n} = 0. \tag{2c}$$

Consequently, a solvent government should at any time equalize its outstanding debt with the present value of future surpluses. Furthermore, condition (2c) implies that the growth rate of public debt should in the limit be smaller than the asymptotic rate of interest. This requirement rules out Ponzi finance schemes, whereby in the absence of primary surpluses, interest payments on outstanding debt are financed systematically by additional borrowing.

The sustainability criterion introduces an additional constraint on fiscal policies since it refers to the boundedness of the debt-to-GDP ratio. The latter should eventually stabilise at a finite steady-state level. From the point of view of sustainable fiscal policies, condition (2c) is necessary but not sufficient. Indeed, solvency as defined above allows for an unbounded debt-to-GDP ratio as long as debt does not grow faster than the real interest rate. All that is required for (2b) and (2c) to hold, for a given finite stock of initial debt, is that the growth rate of future primary surpluses must, on average, be lower than the rate of interest (Kremers, 1989).

It is intuitively clear that for the government to be able to market a continuously growing debt, the growth rate of the latter should be smaller than the growth rate of the aggregate wealth of the buyers of public bonds, which can be approximated by the growth rate of GDP. The constraint on the marketability of public debt can be highlighted explicitly by introducing the government's collateral (Spaventa, 1987; Kremers, 1988 and 1989). From the point of view of the investors in public bonds, it is reasonable to assume that the accumulated debt should not exceed its collateral. A proxy for the latter is the government's future tax capacity, augmented with the net worth of public assets. In the sequel, only tax revenue will be considered as collateral.

To illustrate this stronger condition, assume for simplicity that – excluding seigniorage – the tax revenue is generated at a rate τ by GDP, Y_t. If τ^* is the maximum feasible 'permanent' tax rate, one then has:

$$\sum_{j=1}^{\infty} I_{t,j} T_{t+j} \leq \tau^* Y_t \cdot \sum_{j=1}^{\infty} Q_{t,j} \tag{3a}$$

where $Q_{t,j} = \prod_{h=1}^{j} (1 + \rho_{t+h-1})/(1 + i_{t+h-1})$. The one period growth rate of GDP is denoted by ρ_t. One may, however, doubt whether in reality total tax revenue qualifies as an appropriate collateral for servicing public debt. Some revenue needs to be reserved to finance essential public goods, such as public infrastructure, defence, the protection of property rights... that affect the growth potential of the economy in a positive way.[1]

Let γ^* be the lower bound on primary expenditure on these public goods, expressed as a ratio to GDP. The additional constraint on the government's col-

1 We are indebted to an anonymous referee for this suggestion.

lateral is then:

$$\sum_{j=1}^{\infty} I_{t,j} G_{t+j} \geq \gamma^* Y_t \cdot \sum_{j=1}^{\infty} Q_{t,j}. \tag{3b}$$

Since in the case of solvency:

$$B_t = \sum_{j=1}^{\infty} I_{t,j} T_{t+j} - \sum_{j=1}^{\infty} T_{t,j} G_{t+j} \tag{3c}$$

it follows that the stock of public debt is limited to the tax collateral minus primary expenditure on essential public goods, *i.e.* to $\tau^* - \gamma^*$ in terms of GDP ($\tau^* > \gamma^*$):

$$B_t \leq (\tau^* - \gamma^*) Y_t \cdot \sum_{j=1}^{\infty} Q_{t,j}. \tag{3d}$$

According to condition (3d), a finite collateral implies that ρ, the long-run real growth rate of GDP, is lower than the (asymptotic) rate of interest i. Furthermore, the long-run growth rate B^0 of real public debt should not exceed the real growth rate of the economy, since condition (3d) has to hold for all future periods.

To summarize, a sustainable fiscal policy, *i.e.* a policy that implies both solvency and the boundedness of the government's collateral, requires that:

$$B^0 \leq \rho < i. \tag{4}$$

It is clear that condition (4) is more restrictive than imposing solvency as implied by (2c) since in addition, the debt-to-GDP ratio must eventually stabilise at a steady-state level. Apparently, governments satisfy the solvency condition in a dynamically efficient economy, *i.e.* an economy that has not accumulated too much capital (Abel *et al.*, 1989). Indeed, dynamic efficiency requires that the real rate of interest asymptotically exceeds the real growth rate; it does, however, not guarantee a bounded public debt ratio or interest charges on public debt that fall short of GDP.

2.2 *Empirical Tests of Solvent and Sustainable Fiscal Policies*

As Fase and Wellink (1990) show, various approaches have been followed in the empirical tests of the solvency and the sustainability of fiscal policies. Hamilton and Flavin (1986) concentrated in a seminal paper on a stochastic version of the intertemporal budget constraint (2b), assuming different processes for the forma-

tion of expectations about future surpluses. For practical purposes, the rate of interest was assumed constant. In these tests, the stationarity of future surpluses implies the stationarity of government debt if the limit term (2c) turns out to be insignificantly different from zero. Using annual data for the US over the period 1962–1984, Hamilton and Flavin concluded that the Federal government did not violate its intertemporal budget constraint, *i.e.* that it proved to be solvent.

This conclusion has been seriously challenged by different authors. *E.g.* Wilcox (1989) detected significant parameter instability in the autoregressive process that generated US Federal debt in the sample period covered by Hamilton and Flavin. Moreover, he showed that nonstationarity of the (undiscounted) debt could not be rejected. A strong assumption embedded in the Hamilton–Flavin approach is the nonstochastic nature of the real rate of interest. Other authors, such as MacDonald and Speight (1986), who tested for a stable long-run relationship between debt and the primary surplus (*i.e.* their time series being cointegrated), rely on a constant rate of interest as well.

However, Trehan and Walsh (1988) convincingly demonstrated that the focus on the stationarity of the deficit exclusive of interest is misleading when testing for intertemporal budget balance. They showed that the *stationarity of the deficit inclusive of interest payments is both a necessary and sufficient condition for solvency.* The finding that public expenditures including interest payments are cointegrated with tax revenue (inclusive of seigniorage) is an equivalent test. An advantage of the Trehan–Walsh approach, as compared to the earlier studies, is that the real rate of interest need not be assumed constant.

The fiscal solvency implied by the stationarity of the deficits inclusive of interest can be explained intuitively as follows. Assume *e.g.* that primary expenditure is adversely affected by a random shock in some early period of the time horizon. The subsequent increase of debt will trigger a cumulative process of additional interest charges. Even if, following the initial shock, the deficit exclusive of interest remains stationary, public debt will be nonstationary. The discounted value of the stock of debt in some future period, *i.e.* the limit term (2c) above, will tend to zero only if sufficient primary surpluses (in present value terms) are realized in order to compensate for the additional interest charges induced by the initial shock. This condition will be fulfilled if the deficit inclusive of interest is stationary.

It should be noted that the Trehan–Walsh testing procedure only verifies whether observed government deficits support solvency or not. Since a *sustainable fiscal policy* requires, in addition to solvency, a steady-state bounded debt ratio, an adequate test for the *absence of a stochastic as well as a deterministic trend in the debt-to-GDP time series* (*i.e. mean-stationarity*) should be added as well (see *e.g.* Kremers, 1988 and Caporale, 1992).

3 SOLVENCY AND SUSTAINABILITY IN EIGHT ERM COUNTRIES

This section reports on the results of testing both criteria of fiscal behaviour for eight ERM countries from 1970 to 1994. The data are on an annual basis and have been obtained from the 'European Economy' publications of the Commission of the European Communities. They refer to the level of general government, including the federal government, social security and the local and state governments as the case may be. The choice of the general government is therefore motivated by the availability of comparable data.

Unfortunately, the limited availability of comparable data (debt-to-GDP are published from 1970 onwards; the range is even shorter for France and The Netherlands) contrasts with the large-sample theory of unit root tests and with the long-term feature of sustainability and solvency. Excessive deficits can indeed be maintained for long periods, but eventually government spending must be reduced and/or revenue must be increased. In this respect, stationarity tests may have little to say. However, it remains interesting to compare the performance of budgetary policies of different countries during a period that started with unfavourable macroeconomic conditions in the middle of the 1970s, followed by the economic recovery of the late 1980s. A typical feature is that some member countries' deficit ratios and, accordingly, their debt-to-GDP ratios have risen dramatically in the late 1970s and 1980s. These policies are likely to be adjusted in order not to jeopardize a smooth transition towards the EMU.

a. Solvency

First, the solvency of the fiscal policies pursued by the ERM countries under review will be tested according to the Trehan–Walsh procedure, *i.e.* by analyzing the statistical properties of the deficit inclusive of interest payments. More specifically, the stationarity of the deficit-to-GDP time series will be the maintained hypothesis. The presence of a unit root in these time series (*i.e.* the null is rejected) clearly reflects fiscal insolvency, implying that condition (2c) is violated.

The Augmented Dickey–Fuller (ADF) estimates are summarized in the upper left part of Table 1. However, as Kwiatkowski *et al.* (1992) argue, the way in which classical hypothesis testing is carried out ensures that the unit root is accepted unless there is strong evidence against it. Therefore, it can be useful to perform a complementary test in which the null would correspond to stationarity. Kwiatkowski *et al.* (1992) express a time series as the sum of three components: a deterministic trend, a random walk and a stationary component. Stationarity, either around a level or around a linear trend, corresponds to the case where the variance of the random walk is zero. The application of Kwiatkowski's test to our data is presented in the upper right part of Table 1.

Combining the results of ADF and Kwiatkowski, it is impossible to draw a clear-cut conclusion about solvency for 4 out of 8 countries. We cannot reject

TABLE 1 – TIME-SERIES PROPERTIES OF GENERAL GOVERNMENT DEBT AND DEFICIT RATIOS

	Unit root test (ADF)		Stationarity test (Kwiatkowski)	
	Excl. trend	Incl. trend	Excl. trend	Incl. trend
General government deficit-to-GDP, 1970–1994				
Belgium	−1.68	−1.31	0.19	0.14**
Denmark	−2.90**	−2.70	0.36**	0.11
France	−1.08	−3.77*	0.53*	0.09
Germany	−4.13*	−3.96*	0.19	0.11
Ireland	−1.25	−2.16	0.19	0.14**
Italy	−1.88	−0.75	0.41**	0.15*
Netherlands	−2.42	−0.94	0.32	0.14**
UK	−2.47	−3.09	0.18	0.10
General government debt-to-GDP, 1970–1993				
Belgium	−0.75	−3.75**	0.47*	0.09
Denmark	−1.47	−3.31**	0.44**	0.09
Germany	−0.46	−2.12	0.51*	0.12**
Ireland	−1.57	−1.61	0.44**	0.11
Italy	+2.86	−1.64	0.52*	0.13**
UK	−3.21*	−3.17	0.48*	0.10
Crit. values	MacKinnon (1991)		Kwiatkowski *et al.* (1992)	
at 5%	−3.01	−3.65	0.46	0.15
at 10%	−2.65	−3.26	0.35	0.12

Note: * and ** denote that the null hypothesis is rejected at 5% and 10%, respectively. Due to limited availability, French and Dutch debt-to-GDP data were omitted.

either the unit root hypothesis or the stationarity hypothesis for Belgium, Ireland, The Netherlands, and the UK. Denmark probably has a stationary deficit, as the evidence against the unit root hypothesis is only marginally significant. Strong evidence in favour of solvency is found for France and Germany, whereas Italian fiscal policies have undoubtedly been insolvent.

b. Sustainability

As pointed out above, sustainability is a more stringent condition as compared to solvency and requires, in addition, the mean-stationarity of the debt-to-GDP time series. Tests for the mean-stationarity of the debt-to-GDP series are pre-

sented in the lower part of Table 1. For all countries we can reject the null hypothesis of mean-stationarity. For Belgium and Denmark strong evidence is found for trend-stationarity. Combining ADF and Kwiatkowski, the conclusion is that, except for the UK, there is clear evidence against debt sustainability. For the UK, the data (or the tests) are not sufficiently informative to draw an unequivocal conclusion.

4 SOLVENCY AND SUSTAINABILITY OF BELGIUM'S FISCAL POLICIES IN A HISTORICAL PERSPECTIVE

4.1 *Time-series Properties*

As stated above, it is important to stress that the concepts of sustainability and solvency do not prevent the government from running high budget deficits or surpluses for long periods of time. The transversality condition of equation (2c) only restricts the asymptotic behaviour of government debt. Given the possibility of considerable inertia in public expenditure and/or revenue, it is appropriate to take a very long-term horizon. Moreover, keeping in mind the concern for sustainability (avoiding an excessive debt burden), it is very likely to find stationarity of the deficit inclusive of interest payments as well of te debt-to-GDP time series when the sample data include wars and severe recessions.

The data used are annual and scaled by nominal GDP, covering the period from 1870 on.[2] Figure 1 presents the central government's revenue and expenditure inclusive of interest payments as ratios to GDP, denoted by t_c and gg_c, respectively. Figure 2 depicts the long-run tendencies of the deficit ratio, denoted by d_c $(=gg_c - t_c)$, for the period 1870–1988. The debt-to-GDP ratio is graphed in Figure 3 for the period 1870–1993.

One clearly observes the impact of World War I and World War II, which led to considerable expenditure shocks and deficit peaks. Even when excluding the wartime shocks, the share of central government expenditure changed significantly over the sample period, from about 5% of GDP in 1870 to about 40% in the 1980s. The debt-to-GDP ratio has crossed any conceivable equilibrium level only infrequently during this period.

2 Early data on central government nominal expenditure and revenue were obtained from 'Tabel van de uitslagen van de Begrotingen der gesloten dienstjaren van 1830 tot en met 1959,' published in the 118th Book of the 'Rekenhof.' Recent data were obtained from 'Statistisch Jaarboek van België,' published by the 'Nationaal Instituut voor de Statistiek.' Nominal GDP is reconstructed on the basis of indices of real GDP and consumer prices (except for World War I), both available from 1870 on, tabulated in Maddison (1991). An approximation has been used for the World War I consumer prices by means of indices for Brussels, tabulated in Scholliers (1978). Nominal public debt from 1870 to 1913 is tabulated in van der Rest (1933). Debt data from 1919 onwards are from the National Bank of Belgium and the Ministry of Finance. World War I debt has been approximated by accumulating deficit data.

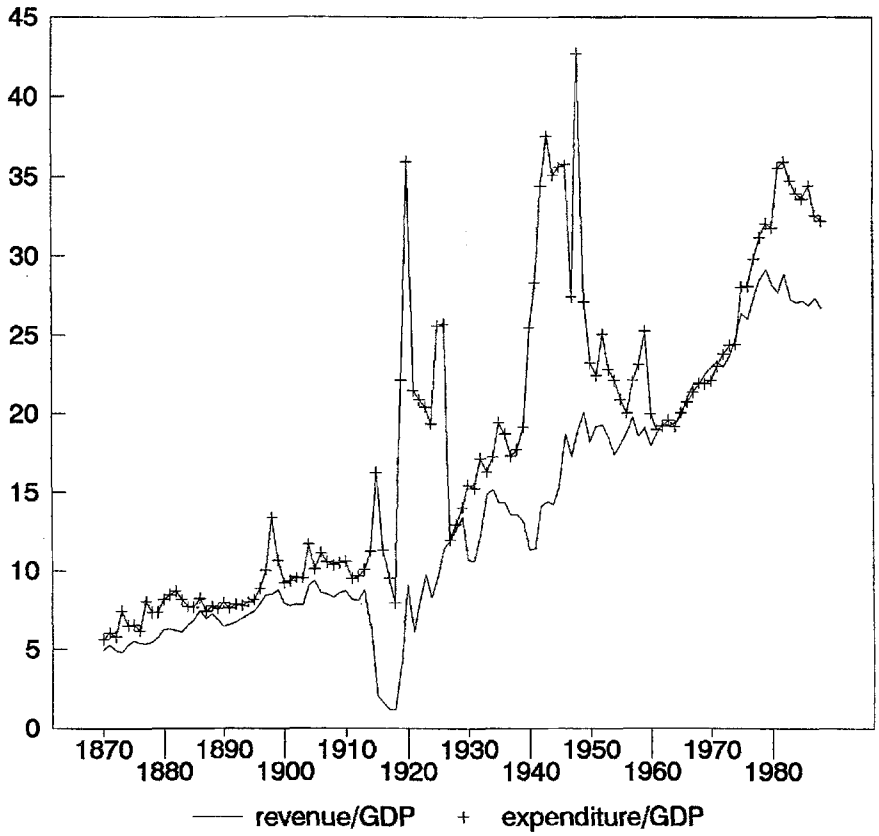


Figure 1 – Belgian central government revenue and expenditure inclusive of interest payments as fractions of GDP, 1870–1988

We examine the time-series properties of the historical data in Table 2. Regarding sustainability, there is no doubt about the presence of a unit root in the debt-to-GDP ratio over the sample period 1870–1993, as the Kwiatkowski test clearly rejects stationarity (lower part of Table 2). This means that Belgium's central government debt ratio does not reveal any tendency towards boundedness in the long run.

The apparent (trend-) stationarity of the deficit suggests that government behaviour has been consistent with the intertemporal budget constraint over the sample period 1870–1988 (upper part of Table 2). So, in contrast with the small sample estimated in section 3 that reject intertemporal budget balance, historical evidence confirms that the central government deficit does return to a long-run equilibrium level, even in Belgium.

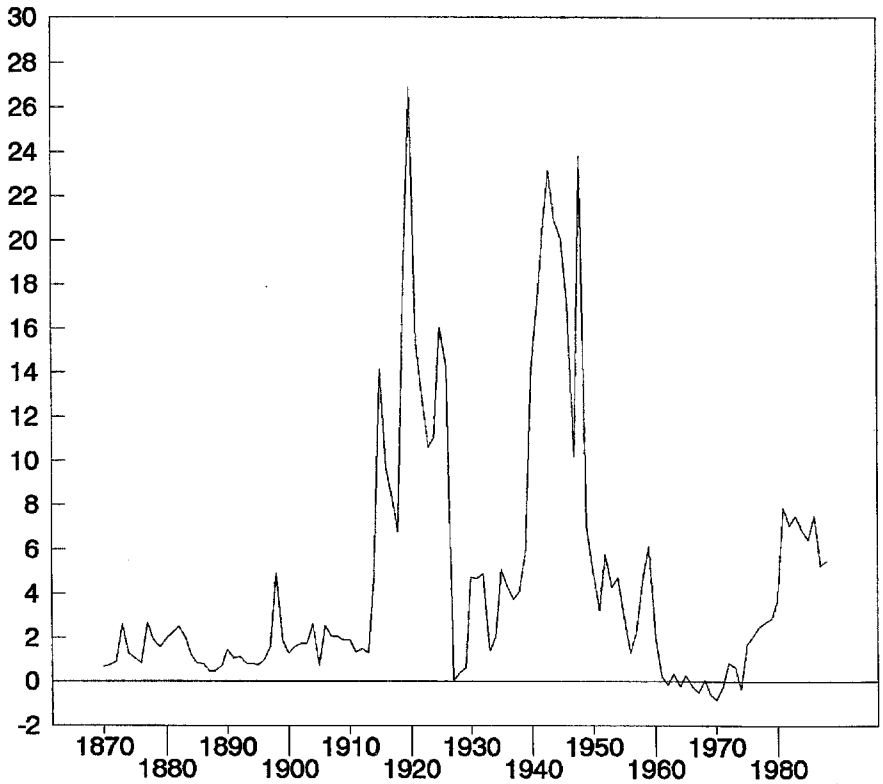


Figure 2 – The Belgian government deficit inclusive of interest payments as a fraction of GDP, 1870–1988

4.2 *Impulse-response Analysis*

In order to analyze the impact of expenditure and revenue shocks on gg_c and t_c, we estimate a vector autoregression (VAR) model. According to the VAR approach, both gg_c and t_c are endogenous and each can be written as a linear function of its own lagged values and of the lagged values of the other variable. However, a pure VAR process in differences will be misspecified if the variables are cointegrated, as this kind of specification omits the error-correction feature (Engle and Granger, 1987). If the relationship between expenditure and revenue is out of equilibrium, the next change in gg_c and/or t_c will be influenced by the size and sign of the current equilibrium error. In order to obtain an error-correction representation, the first lag of the deficit d_c, *i.e.* the cointegrating variable, is included.

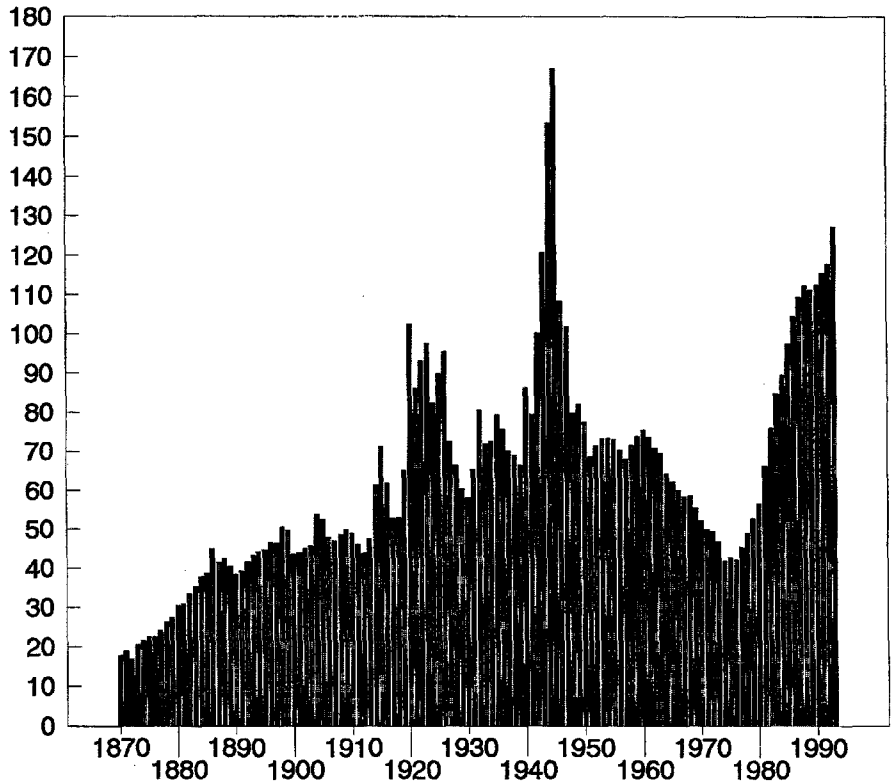


Figure 3 – The Belgian central government debt as a fraction of GDP, 1870–1993

A system of two equations is run to estimate the dynamic impact of a unit increase in gg_c and t_c, respectively (*i.e.* impulse-response analysis). The method of Seemingly Unrelated Regression (SUR) takes into account the covariance between the equation residuals to improve the efficiency of estimation. Table 3 displays the results.

One can observe that a unit increase in government revenue ($\Delta t_c = 1$) leads to a considerable spending reaction in the same period, which is partly reversed in the following periods. By contrast, the impact of a unit innovation in expenditure ($\Delta gg_c = 1$) on revenue is moderate. When looking at the lagged variables, spending and revenue still appear to influence each other.

The lagged deficit has a significantly negative effect on public expenditure and a positive (though weaker) effect on taxation. This result confirms the assumption that past deficits generate stabilizing long-term tax and spending adjustments. The

TABLE 2 – HISTORICAL TIME-SERIES PROPERTIES OF BELGIAN GOVERNMENT DEBT AND DEFICIT RATIOS

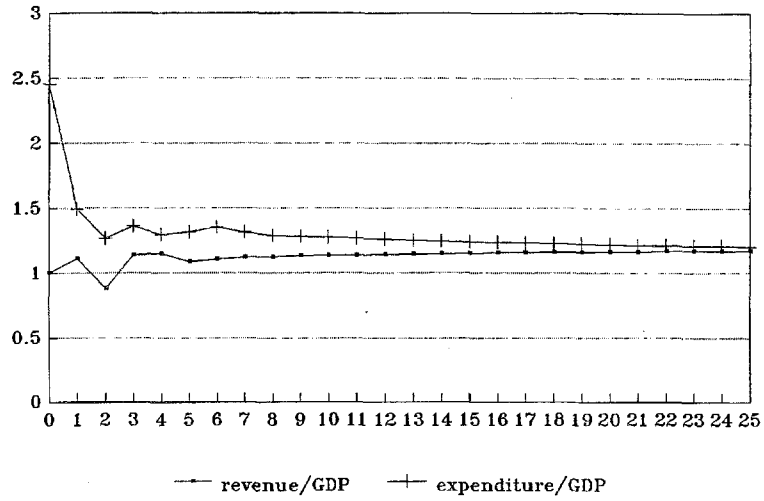
	Unit root test (ADF)		Stationarity test (Kwiatkowski)	
	Excl. trend	Incl. trend	Excl. trend	Incl. trend
General government deficit-to-GDP, 1870–1988				
	−4.04*	−4.49*	0.43**	0.09
General government deficit-to-GDP, 1870–1993				
	−1.86	−2.63	0.77*	0.15*
Crit. values	MacKinnon (1991)		Kwiatkowski *et al.* (1992)	
at 5%	−2.89	−3.45	0.46	0.15
at 10%	−2.58	−3.15	0.35	0.12

TABLE 3 – ERROR-CORRECTION ESTIMATES OF Δt_c AND Δgg_c BY MEANS OF SUR, 1870–1988

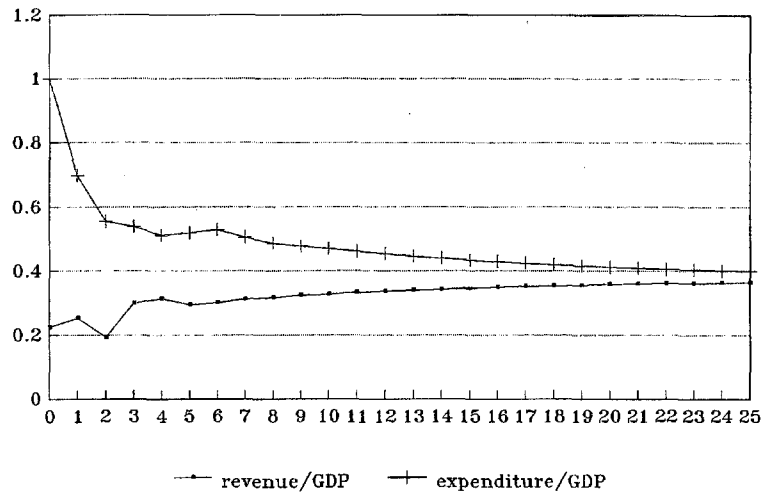
Regressor variable and lag	Dependent variable: Δt_c Coeff. (*t*-value)	Dependent variable: Δgg_c Coeff. (*t*-value)
Δt_c 0	...	2.452(9.69)
Δt_c 1	0.245(2.85)	−0.854(3.03)
Δt_c 2	−0.189(2.26)	0.529(1.88)
Δt_c 3	0.038(0.45)	−0.070(0.25)
Δgg_c 0	0.224(9.69)	...
Δgg_c 1	0.004(0.13)	−0.063(0.65)
Δgg_c 2	−0.015(0.51)	−0.038(0.39)
Δgg_c 3	0.100(3.65)	−0.292(3.13)
d_c 1	0.049(2.65)	−0.154(2.49)
Constant	−0.203(1.46)	0.888(1.95)
St. error	1.07	3.57
Adj R^2	0.21	0.15

fact that deficits signal future tax changes rejects the hypothesis of tax smoothing, according to which the ratio of revenue to GDP is a random walk.[3]

3 The random walk property implies that the best estimate of tomorrow's tax rate equals today's tax rate, given all the information that is available today.



Panel A: Unit shock in t_c



Panel B: Unit shock in gg_c

Figure 4 – Responses of central government revenue and expenditure to unit innovations in t_c and gg_c in period 0

Figure 4 visualizes the effects of unit innovations on the levels of revenue and spending on the basis of the parameter estimates. Panel A shows that an innovation in revenue t_c remains persistent in subsequent periods. The revenue level stabilizes even on a higher level than the baseline level plus one, as this innovation in revenue involves a strong spending reaction, which is only partially re-

versed. As for tax revenue, expenditures stay more than 1 point above their initial level. The fact that revenue and expenditures are mutually dependent variables supports the tax-and-spend, as well as the spend-and-tax hypothesis.

Panel B shows the spending and revenue increases following a unit innovation in gg_c, the expenditure rate. Most of the change in spending appears to have a transitory character, as only 40% of the increase seems persistent. The response of taxes is positive and accommodates to the persistent component of the additional expenditure (*i.e.* the random walk hypothesis is rejected). The increase in spending triggers a tax increase that stabilizes at a level of 0.40 above the base line tax rate.

Apparently, the way in which high deficits have typically been corrected in the period 1870–1988 depends on the source of the shock. The adjustments range between 60% and 120% on the spending side (approximately 120% for tax innovations and 60% for spending innovations) and between 20% and 40% on the revenue side. Only for an expenditure shock, a high deficit has typically been corrected by a 'political compromise' combination of spending cuts and tax increases.

5 CONCLUSIONS

This paper has focused first on the solvency and sustainability of 8 ERM countries' fiscal policies from 1970 onwards. Subsequently, the fiscal stance of Belgium, currently having the most heavily indebted sector of the sample, was analyzed from a historical perspective. The latter (very long-term) approach is undoubtedly more accurate, as the fiscal policies have been examined by means of unit root tests of government debt (sustainability) and deficits (solvency).

In the short-term comparison of the ERM countries, no support was found for the sustainability presumption. This finding suggests the need for a structural change of fiscal policies in order to achieve sustainability. Only France and Germany, and perhaps Denmark, seem to obey the solvency criterion (*i.e.* the stationarity of the budget deficit), whereas Italy's fiscal policy undoubtedly leads to insolvency. For other countries mixed results were obtained.

Regarding solvency, the results of the 'historical' approach contrast with the 'short-run' outcome for Belgium. Although the classification is not identical (general *vs.* central government data) this finding is not surprising. Running large deficits for substantial periods of time can be in line with the theoretical concept of intertemporal budget balance, provided the fiscal policy is changed eventually. The longer the sample period, the better are the chances of finding evidence that a government undertakes budget adjustments to achieve better balanced public finances. However, as regards debt sustainability, we could not find any historical tendency of the Belgian debt-to-GDP ratio to return to a constant long-run equilibrium level.

The concept of practical sustainability is most relevant in the framework of the budgetary preconditions of Maastricht. The Maastricht quantitative criteria for limiting public debt and deficits have the property to be unequivocal, which might be of crucial political advantage. Most policymakers perceive the fiscal rules established by the Treaty of Maastricht to be not only desirable but also necessary to ensure the smooth operation of a full European monetary union. They are convinced that wayward budgetary policies conducted by member countries will jeopardize the monetary union (see *e.g.* Vanhorebeek, 1994).

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Summary

SOLVENCY AND SUSTAINABILITY OF FISCAL POLICIES IN THE EU

This paper focuses on the sustainability and solvency issues of the public sector. Tests for sustainability heavily rely on the time-series properties of the debt-to-GDP ratio, whereas solvency test focus on the deficit inclusive of interest payments. Sustainability and solvency tests are applied first on 8 ERM countries during the period 1970–1994. Subsequently, we concentrate on historical evidence (from 1870 onwards) for the Belgian central government. This long-term view allows for a more accurate time-series analysis. On the one hand, we find historical support for the hypothesis that high and persistent deficits for some periods can be consistent with the present-value budget constraint (solvency), provided that policies are changed eventually. On the other hand, the much stronger requirement of sustainability is not fulfilled since we do not find a tendency of the debt ratio to return to a constant long-run equilibrium level.