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Paper

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1. Introduction

According to a common assumption in the traditional theory of public finance, political decision makers, when deciding changes in the intertemporal flow of government revenues and expenditures, take into account the long-run budget constraint of the public sector. The risk of government failure is therefore excluded from the analysis, as is the possibility of financing public expenditures through a permanently increasing debt ratio of the public sector. Revenues and expenditures are assumed to be equilibrated over the long run.

This assumption about the long-run co-ordination between spending and taxes does not per se say anything about the specific nature this mechanism may take in practice. Governments may follow either of three logically possible ways. First, they can fix expenditures at a given value and try to adjust revenues to this level. Second, revenues may be taken as given and expenditures adjusted accordingly. Third, a mixture of the above two strategies, might be adopted with revenues and expenditures changing their role as target and instrument values over time.

The question, which of these three adjustment mechanisms prevails in practice, has been met with increasing interest in the economic profession over the last years. Various attempts have been undertaken to discriminate empirically between them (see e.g. *von Furstenberg et.al.* 1986, *Miller - Russek* 1990, *Bohn* 1991). The main reason for this new interest lies in the fact that, in recent years, the governments of several leading industrialized countries have made clear statements regarding these mechanisms.

In line with (meanwhile) standard supply-side reasoning they argue that an improvement in long-run growth perspectives and in overall economic efficiency can only be brought about by significantly reducing government activities, as measured by their share in GDP. Moreover, they claim that:[1]

1) A reduction of the share of government activities in GDP can only be achieved by tax cuts, since only hard budget constraints can improve productivity in public sector administrations; any attempt to cut spending without previously cutting receipts is doomed to failure.

2) While tax cuts and deficit reduction are mutually compatible targets, tax increases are inconsistent with a lasting reduction of budget deficits. Higher revenues would quickly stimulate additional demands from administrations and thus leave any previous budgetary imbalance unchanged.

The present coalition government of Social Democrats and Christian Democrats in Austria seems to subscribe also to the views expressed in the above-mentioned propositions. This can at least be inferred from what official documents (*Bundesregierung* 1987, 1991) and leading government representatives (*Ditz* 1992, *Lacina* 1992) say.

In this paper we investigate to which extent the historical development of the public sector in Austria can be explained by the above-mentioned propositions. To this effect we analyse the causal relationship between taxes and spending by estimating a tri-variate VAR model. Thereby propositions 1 and 2 will be confirmed if we can find a causal dependency of expenditures on taxes and if changes in deficits can be explained by shocks in revenues, rather than by shocks in expenditures. To put in comparative terms, we will consider propositions 1 and 2 the better confirmed, the stronger the causal

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[1] See for the USA for instance *Government Printing Office* 1984, 1985, for the United Kingdom *OECD* 1981, *HMSO* 1986, for Germany *BMfF 1985*, *Sachverständigenrat* 1985, were at least parts of these propositions are expressed.

dependency of expenditures on taxes and the better changes in deficits can be explained by shocks in taxes.

Section two of this paper develops some arguments in line with standard public choice theory which will be useful for the interpretation of our empirical findings. Sections 3 and 4 describe the database and present in some detail the methodology used for our empirical analysis respectively. In section 5, the empirical results will be presented and their correspondence with propositions 1 and 2 be examined. Section 5 summarizes the main findings an draws some conclusions.

2. Revenues or Expenditures: Which Side Dominates the Budget ?

Unfortunately, public choice theory does not unambiguously discriminate between the three logically possible mechanisms of equilibrating government revenues with outlays, as described above. On the contrary, highly plausible explanations for each of these three possibilities are offered.

Traditional public finance theory, for instance, interprets the process of political decision making as the action of a benevolent dictator. Outlays and revenues are thought to be determined simultaneously, so as to maximize long-run social welfare (*Musgrave* 1985). Simultaneity does not mean that the budget must be permanently in balance. Differing time profiles of welfare maximizing expenditure and revenue flows (*Barro* 1979), or unanticipated demand or supply shocks could easily bring government budgets in transitory deficits or surpluses. But no exclusive or one-sided causal relationship between revenues and expenditures should prevail. Furthermore, we should not expect the development of the budget deficit to be exclusively dominated by either revenue shocks or expenditure shocks. The relationship is most likely characterized by a high degree of coincidence.

The second, and without doubt more popular view of the political decision making process is that the expenditure side dominates the development of the budget. Implicitly we find this assumption embodied in nearly all economic models. This is true for Keynesian-type stabilization models, as well as for neoclassical growth models. The emphasis is always put on the effects which discretionary changes in outlays have on income, employment, or long-run growth. Far less attention is paid to revenues; they are expected to adjust endogenously and/or to be changed ex post so as to guarantee the long run budget constraint, even after the development of government spending has been changed discretionary.

No doubt, this assumption about the relative importance of spending and taxing is not constitutive for the respective theory. But it seems to reflect a wide-spread prejudice regarding the mechanism which drives the process of political decision making in our society. It was Adam Smith who had expressed this view already two centuries ago, when he criticized that the availability of credit facilities to the government would often induce a lasting increase of public sector spending above the level that would prevail in a world where outlays have to be financed out of current revenues (*Smith 1776, V*). Imperfect information and too high a rate of time preference would lead to an underestimation of the future burden of current deficits and thus cause a suboptimal intertemporal allocation of resources. Note the similarity of this argumentation to that of the advocates of modern public choice theory (*Buchanan - Wagner* 1977, *Rowley* 1987), criticizing the practice of Keynesian stabilization policy. They also argue that additional outlays accepted during recessions would commonly not be reduced in the ensuing recovery. Budget balance would rather be restored by increasing taxes, leading to a permanently growing share of government activities in total GDP.

A causal relationship between government receipts and outlays as described here need not necessarily be interpreted as a consequence of some kind of *government failure*. It could be seen as well as the inevitable result of a higher long run income elasticity of public goods in comparison to private goods

(Wagners Law). An increase in the share of government activities as a percentage of GDP can then hardly be interpreted as a misallocation of resources.

We are thus offered even two different explanations, each of them highly plausible, that might establish a dominance of spending decisions in the course of the budget decision making process. In an empirical context this makes us expecting that the results from our time series estimates should detect a nearly exclusive dependency of government receipts from government outlays.

The third logically possible relation between government outlays and receipts is the one described by the two above-mentioned propositions, which have become increasingly popular during the last decade. Traditionally a causal dependency running from revenues to outlays as maintained therein has been seen as relevant only for those subordinate state and local governments, whose borrowing capacities are narrowly limited by constitution or by effective credit rationing. At the general government level it was sometimes also explained as the result of the various kinds of revenue appropriation. Whenever specific tax revenues are earmarked for specific outlay categories, the latter will most likely be determined by the former.

During the prosperity years of the 1960s, some authors supposed that the progressivity of the tax system would cause the built-in elasticity of government revenues to exceed the dynamics of government outlays permanently (see *Heller 1967)*.Since they assumed also that political decision makers were reluctant to run permanent budget surpluses and judged tax cuts to be not too popular, they were led to conclude that a restoration of budget balance would generally be brought about by increasing spending.[2] However, apart from the fact that most countrie's tax systems are rarely progressive (at least when including social security contributions), we have not experienced a tendency towards budgetary surpluses during the last two decades (*McKee - Visser - Saunders* 1986, *Genser* 1986). So, even if this explanation might be relevant for some periods of post war history, it can hardly be considered a general hypotheses of the dependency of government outlays from revenues.

The increased international feed-back effects of domestic budget policies offer a more general and, indeed a more convincing explanation for the reversed causality between government expenditures and taxes. In fact it is a common knowledge in traditional open economy macroeconomics, that repercussions from the balance of payments reduce the effects of domestic deficit spending on national income and employment. It is perhaps less well known that this also reduces the *political attractiveness* of debt financed demand management. In addition, international economic relations are not restricted to the exchange of a few tradable goods and services anymore. They comprise all forms of financial, physical and human capital. The direction of the resulting flows is, among other criteria, highly influenced by comparative tax advantages. National tax autonomy is therefore severely reduced (*Streissler* 1989) so that it becomes increasingly difficult for national authorities to finance current deficits out of higher future taxes.

We are also currently observing that especially large countries see themselves confronted with an increasing political pressure from the international community to correct any major budgetary imbalances. As other countries might feel themselves adversely effected, most likely because of the resulting deterioration in world capital market conditions, they will urgently ask for a restriction of budgetary deficits (*De Grauwe* 1989). The process of international integration therefore limits to an increasing extent national governments budget autonomy.

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2 It is not clear whether we should expect this direction of causality also to prevail with the built in dynamics of outlays exceeding those of revenues.

We are again offered even more than one plausible explanation for a specific dependency between the budget aggregates. In this case, however, we expect our empirical findings to detect a causal relationship running from receipts to spending flows. Revenue shocks are supposed to dominate the dynamics of the public sector deficit.

So, it turns impossible to discriminate between the three adjustment mechanisms that are logically possible by means of pure public choice reasoning. We therefore need a careful empirical examination of the causal relationship connecting government spending and taxes for the history of the decision making process in Austria.

3. The Data: Searching for the correct budget concept

To discriminate between the three cases distinguished above, we examine first of all the causal relationship between the development of taxes and of government spending. Since we assume that the government meets its intertemporal budget constraint, we also can investigate whether budgetary imbalances, which are deemed intolerable in the long run, have been reduced predominantly by expenditure restraints and/or by tax increases.

Impulse response functions of bi-variate VAR models can bee used to analyse such causality relations between economic time series. (*Bohn* 1991). Such a representation is however insufficient since the variables in question are highly dependent on the development of aggregate income. Neglecting this joint dependency might easily lead to biased results. We therefore estimated a tri-variate VAR model using nominal GDP as an additional explanatory variable. This approach allows us to distinguish between the *direct* causality relation between spending and taxes (and vice versa) and the *indirect* causality effects via GDP.[3]

In addition, we interpret the development of the net deficit as an error correction process. Any deviation of the development of the net deficit from its long-run constraint is thereby defined as an error that the government has to correct by adjusting revenues (increasing taxes) and/or outlays (reducing spending). We thus investigate which side of the budget carries the burden of adjustment in practice.

We confine our empirical research to the *federal level* of the Austrian government. Despite their quantitative importance, the budgets of state and local governments are not taken into account.[4] One might argue that due to the differences in the political decision making process between federal, state and local governments, which could, as mentioned above, shed some light upon the different dynamics of the respective budget developments, the inclusion of state and local governments might be important. On the other hand one can hardly overlook that the legislative power, especially with regard to fiscal policies, is nearly exclusively concentrated at the federal level in Austria. The central government also plays the role of a *lender of last resort,* explicitly or implicitly covering imbalances at subordinate administrative levels (*Lehner* 1992). Austria's state and local governments effective economic power is thus by far exaggerated judged from its share on general government budget (*Bös* -

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[3] Note that the often used *Granger causality* tests (*Miller, Russek* 1990), which are based on a predictability concept, do not permit such a distinction.

[4] The share of state and local governments in general government outlays and receipts is approximately 30 %. Its share in general government debt amounts to 20 %.

Genser - Holzmann 1983).[5] We leave a careful distinction of the different adjustment processes at various administrative levels for future research.

Tax revenues as defined in traditional public finance theory account only for approximately 60% of Austria's federal governments total receipts. The rest comes from (social security) contributions, fees and charges (15 %), proceeds of federal enterprises (15%) and a miscellaneous component (e.g. revenues from privatization). It is therefore necessary for our purposes to define *taxes* in a broader sense and identify them with *total government receipts*. Because of the substitutability between the different components of public sector revenues one can not expect a close relation between taxes, defined in a narrow sense, and total government outlays to prevail in the data. *Total outlays* have to be covered by *total receipts*, no matter what source the latter are from.[6]

During the last few years, the economic meaning and relevance of traditional administrative budgets concepts, especially with respect to the measurement of the size of the budget deficit, has been increasingly questioned. Many alternative and improved concepts have been suggested, ranging from rather minor adjustments of administrative budget figures, to far-reaching methodological changes, associated for instance with the proposal to take as indicator of budget imbalances public sector's comprehensive calculated net worth position (*Buiter* 1983, 1985), or the displacement effects of fiscal policy on private saving and investment (*Kottlikoff* 1984).

It may very well be that the economic assessment of the public sector's credit worthiness or of the overall economic effects of fiscal policy can in fact be improved by using such alternative budget indicators. But again it has to be recalled that our interest is in the political mechanisms that determine the coordination between government outlays and receipts, not in the overall economic effects of fiscal policy measures. Therefore we are primarily interested in a budget concept that dominates the public discussion as well as the process of political decision making. Without any doubt, this is the administrative budget. We used it therefore as the basis of our computations.

We are however aware that in recent years the discrepancies between the administrative net deficit and some of the adjusted indicators of the budget balance have significantly in creased (*Seidel* 1989). This results primarily from the growing amount of (investment) projects being financed off the budget, as well as the increasing proceeds from privatizations and the sharp cutbacks in the reserve position of various government agencies. We therefore extended our computations to the so called *Finanzierungssaldo* (see *PSK* 1991), an indicator that purges the revenue side of the administrative budget from most of the effects mentioned above. Additionally we include the outlays of the ASFINAG[7] in government spending.

The sample period ranges from 1962 to 1991. The significance of time series estimates improves significantly with the length of the sample period. Thirty observations are a minimum requirement in this respect. It does, on the other hand, not seem advisable to extend the period of observation further

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[5] For a more comprehensive discussion of the pros and cons of using a central vs. a general government concept in analyzing public sector developments see e.g. *Chouraqui et.al.* 1986.

[6] A long lasting discussion in public finance theory aims at analyzing the degree of perceptibility of various taxes, fees and contributions. This discussion provides in fact important contributions to the explanation of the long run development and composition of total government receipts (see e.g. the contributions in *Hansemeyer* 1983). But it hardly would justify a restriction of our research to taxes defined in a narrow sense.

[7] Autobahn- und Schnellstraßenfinanzierungs AG - ASFINAG - is an agency, that originally was founded to plan and prefinance the construction of the interstate road network. Meanwhile it has extended its agenda also to railroad and building constructions.

back into the 1950's. Too many singular events during the years of reconstruction after world war II might lead to structural breaks and thus distort our estimates.

4. The Methodology: Impulse response functions and error correction forms

As already mentioned, we analyze causal dependencies by estimating impulse response functions. However, point estimates of impulse response functions contain no information about the statistical *reliability* of the effects detected. In our case this is especially true for the effects of shocks in the expenditure ratio on the revenue ratio and vice versa. We therefore implemented Monte Carlo simulations to asses whether the impulse responses are statistical significant at a 90% confidential level.

VAR estimates also provide some insight into the properties of the relationships between the variables under investigation in the frequency domain. To analyse these properties we employed a somewhat modified version of a procedure originally proposed by *Geweke*, who defined linear feed back measures and their decomposition by frequency (*Geweke* 1982, 1984, 1986). Let, for illustrative purposes,

$$\mathbf{A}(L)\mathbf{x}_t = \mathbf{u}_t$$

be an AR-process with the covariance matrix of $\mathbf{u}$, Σ_{uu}, being a diagonal matrix. The interpretation of the components of $\mathbf{u}_t$ as primitive shocks requires further restrictions, for instance on A(0) which is in general not equal to the identity matrix (see *Bernanke* 1986). If $\mathbf{A}(\lambda)$ is invertible at all frequencies $\lambda \in [0,\pi]$, the following MA-representation exists.

$$\mathbf{x}_t = \mathbf{C}(L)\mathbf{u}_t$$

where

$$\mathbf{C}(L) = \begin{bmatrix} c_{11}(L) & c_{12}(L) & \cdots \\ c_{21}(L) & c_{22}(L) & \cdots \\ \cdots & \cdots & \ddots \end{bmatrix} = \mathbf{A}(L)^{-1}$$

The cross spectral density matrix of $\mathbf{x}$ is therefore:

$$\mathbf{S}_{xx}(\lambda) = \mathbf{C}(e^{-i\lambda})\Sigma_{uu}\mathbf{C}(e^{+i\lambda})$$

If we have a tri-variate system, the spectrum of the first variable x_1 is

$$S_{x_1}(\lambda) = \sigma_1^2\tilde{c}_{11}(\lambda) + \sigma_2^2\tilde{c}_{12}(\lambda) + \sigma_3^2\tilde{c}_{13}(\lambda)$$

where σ_1^2 is the variance of the u_1, σ_2^2 is the variance of the u_2, $\tilde{c}_{11}(\lambda)$ represents $c_{11}(e^{-i\lambda})c_{11}(e^{+i\lambda})$, and so on. The spectrum of x_1 is therefore decomposed into three independent sources, originating from independent shocks in the three variables. To determine the influence of say u_2 (innovations in x_2) on x_1 one can define the causality spectrum

$$S_{x_2 \to x_1}(\lambda) = \frac{\sigma_2^2\tilde{c}_{12}(\lambda)}{S_{x_1}(\lambda)},$$

which represents the portion of the spectrum of x_1 at frequency λ that can be attributed to the shocks in x_2.[8] The similarity of this measure with the coherence spectrum is evident, although only one direction of causality is taken into account here. In this sense the term causality spectrum seems justified despite the fact that a causal interpretation requires identifying restrictions. But this is essentially due to the impossibility to determine the direction of *instantaneous* causality by statistical means.[9]

If $\mathbf{A}(\lambda)$ is not invertible at λ=0 because of a unit-root in the vector $\mathbf{x}$, problems in deriving $\mathbf{S}_{\mathbf{xx}}(\lambda)$ can arise. Fortunately, this does not matter for the definition of $S_{x_2 \to x_1}(\lambda)$, as the non-stationary parts of the AR-polynomial cancel. If the variables are I(1) processes, the spectra of $\mathbf{x}$ and $\Delta\mathbf{x}$ differ by the terms $(1 - e^{\pm i\lambda})^{-1}$ only. And these terms obviously cancels out, taking the ratio in the definition of $S_{x_2 \to x_1}(\lambda)$ into account.

If the innovations of the VAR are identified as primitive shocks by suitable restrictions, the cumulated historical effects of the different shocks on the variables under consideration can be examined. We undertake such an examination for the net deficit ratio in order to get a better understanding to what extent government expenditures, revenues and/or simply the growth rate of nominal GDP, have determined the historical pattern of the deficit ratio.

As the VAR-technique is essentially a reduced form method, it is highly susceptible to structural breaks. For this reason we employed Chow tests as indicators for such breaks. VAR estimates are also of comparatively low precision in all those cases where only few observations are available. To tackle this problem one can try to give more structure to the model at hand, for instance by estimating an *error correction* form. As we assume that the public sector meets its budget constraint, so that the net deficit ratio cannot rise indefinitely, the idea of an error correction formulation occurs almost naturally (*Bohn* 1991). High deficit ratios must induce the administration to lower expenditures and/or to raise revenues. Since an error correction model requires the variables to be non stationary and further imposes a cointegration restriction upon the VAR, a pre-testing procedure is necessary to investigate the time series properties of the variables. The figures of government spending, tax revenues and the net deficit are expressed as GDP ratios. Among other reasons this proved useful to decrease their dependency on nominal income dynamics and to reduce their degree of integration. We employed the augmented Dickey-Fuller test (ADF) and the Phillips-Perron test (PHP) to investigate whether the four time series used in our model contain unit roots. The series are defined as:

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[8] For the bi-variate case, the definition of $S_{x_2 \to x_1}(\lambda)$ is equivalent to $f_{x_2 \to x_1}(\lambda)$ in *Geweke* 1982, considering *Pierces* 1982 comment on this contribution. For the multivariate case, this is an extension of *Geweke* 1982 which, compared to *Geweke* 1984, has the advantage that indirect causality chains are also taken into account.

[9] There is an interesting connection between $S_{x_2 \to x_1}(\lambda)$ and common forecast error variance decomposition techniques for VARs. The variance decomposition for $t \to \infty$ is equal to

$$\int_0^{\pi} S_{x_2 \to x_1}(\lambda) \frac{S_{x_1}(\lambda)}{\sigma_1^2} d\lambda,$$

which is a weighted average of $S_{x_2 \to x_1}(\lambda)$, given the spectrum of x_1 as the weighing function.

BIPN	log of nominal GDP
AUSGNQ	log of expenditure ratio = log of federal expenditures minus debt repayments minus *BIPN*
EINQ	log of revenue ratio = log of federal revenues minus *BIPN*
NDEFQ	net deficit ratio = *AUSGNQ* - *EINQ*

Table 1 contains the test statistics. To allow for the proper alternative the test variant with time trend has been used whenever the variable indicated a significant trend component in a regression on a constant and a time variable. In all cases an autoregressive correction factor of 1 was sufficient to render the Ljung-Box Q-statistic insignificant at least at 10%.

Table 1. Unit Root Tests

Variable	ADF	PHP	Probable order of Integration
BIPN	0.635	-1.958	I(2)
$\Delta BIPN$	-2.409	-15.489	
$\Delta^2 BIPN$	-6.147***	-36.821***	
AUSGNQ	-2.383	-9.079	I(1)
$\Delta AUSGNQ$	-5.174***	-29.155***	
EINQ	-1.173	-3.828	I(1)
$\Delta EINQ$	-4.789***	-32.467***	
NDEFQ	-3.137*	-14.488	I(0) or I(1)
$\Delta NDEFQ$	-4.713***	-28.850***	

ADF ... augmented Dickey-Fuller test statistic, PHP ... Phillips-Perron test statistic
* ... significant at 10% level, ** ... significant at 5% level, *** ... significant at 1% level.

Table 1 clearly indicates, that the expenditure ratio as well as the revenue ratio are likely to be integrated of degree one. According to both tests an I(2) property for nominal GDP cannot be ruled out. The net deficit ratio seems to be a borderline case. The ADF-Test suggests *NDEFQ* to be trend stationary, whereas the PHP-test does not preclude an I(1) property. The results of these unit root tests therefore suggest the following specification of a tri-variate error correction model.

$$\begin{bmatrix} \Delta^2 BIPN_t \\ \Delta AUSGNQ_t \\ \Delta EINQ_t \end{bmatrix} = f(\Delta^2 BIPN_{t-i}, \Delta AUSGNQ_{t-i}, \Delta EINQ_{t-i}, NDEFQ_{t-1})$$

As already mentioned above, this model specification presumes that high deficit ratios induce the government to reduce expenditures or to raise revenues. Because of the supposed I(2) property of nominal GDP, as well as simple plausibility considerations, it seems necessary to postulate that the expenditure and the revenue ratio are dependent on the growth rate, not on the absolute level, of nominal income.

The critical point of this error correction form rests on the implicit assumption of a trend stationary net deficit ratio. This implies a cointegration between the expenditure and the revenue ratio. If this

assumption is not fulfilled, the above model has to be estimated without imposing a cointegration restriction. Such a free VAR estimation can be easily accomplished by including $AUSGNQ_{t-1}$ (or $EINQ_{t-1}$) as additional variable.

It is hardly possible to discriminate between a unit root or a root of say 0,99% by statistical means. Model builder are therefore well prepared to express their personal views, at least sometimes, when specifying a model. But as soon as the estimations are carried out, it can be tested whether the postulated assumptions are compatible with the data, or not. In our case we can include $AUSGNQ_{t-1}$ as additional variable and test whether this variable has a significant effect on the estimation results. If this is not the case, the assumption of a trend stationary net deficit ratio is at least not in a sharp conflict with the data.

Before the estimation procedures can be implemented, identification of the model has to be assured. If this is not the case, impulse responses and causality spectra can not be interpreted unambiguously. Following *Bernake* 1986 and *Sims* 1986 it is sufficient in this regard to impose restrictions upon the contemporaneous correlations of the VAR innovations. In line with their reasoning we specify the following innovation model. (Note that lower case letters now indicate *innovations* of the error correction form whereas upper case letters specify the variables themselves):

$$\begin{bmatrix} \Delta^2 bipn_t \\ \Delta ausgnq_t \\ \Delta einq_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ \alpha & 1 & 0 \\ \beta & \gamma & 1 \end{bmatrix} \times \begin{bmatrix} u_t \\ v_t \\ w_t \end{bmatrix}$$

with $\mathrm{cov}(u_t, v_t) = \mathrm{cov}(u_t, w_t) = \mathrm{cov}(v_t, w_t) = 0$

This innovation model imposes three restrictions and is therefore just sufficient to identify the error correction model. These restrictions imply that innovations in the expenditure and in the revenue do not have any effect on the growth rate of nominal GDP within the same period. (The reverse is clearly possible). Furthermore, they assume that innovations in the revenue ratio do not have any direct effect on the expenditure ratio within the same period.[10]

Unfortunately, one must be content with plausibility arguments when formulating such identifying restrictions; they are not testable (*Cooley - LeRoy* 1986). But since they imply, on the other hand, a recursive structure of the model, they are at the same time, very easy to implement.

To estimate the above VAR model, it is necessary to specify the lag length. Since we chose the last thirty years as estimation period in a tri-variate model structure, a lag length of three seems to be the maximum. It turned out, however, that a lag length of two was sufficient to render the Q-statistics and the DW-test statistic insignificant.

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[10] As far as the restrictions one and two are concerned this implicitly assumes, that the direct - and per definition negative - effects of changes in nominal GDP on the budget ratios, are not outweighed by multiplier effects of fiscal policy measures, that would constitute a positive relationship. The third restriction on the other hand seems justifiable because of the fact, that most expenditure flows are predetermined by legislation. We therefore should not expect, that unanticipated changes in government revenues have a too direct and automatic effect on current expenditures. Besides we ascertained that even an inversion of this assumption does not alter our estimation results significantly.

5. Empirical Results

The key parameters of the estimated equations are reported in table 2. We included a dummy variable for the year 1975 in the equations, as the severe decline in the growth rate of nominal GDP and the rise in the expenditure ratio in 1975 cannot be explained endogenously by the model. The point estimates without a dummy are however very similar. The precision of the estimates, on the other hand, (with regard to the estimated standard errors) is markedly improved by the inclusion of the dummy.

Table 2. Key-Parameters of the Estimated VAR Equations

endogenous variable	t-value of $NDEFQ_{t-1}$	t-value of $DM75$	R^2	prob. value of Q-stat.	t-value of $AUSGNQ_{t-1}$
$\Delta^2 BIPN$	-0.36	-3.74***	0.58	0.56	0.36
$\Delta AUSGNQ$	1.46	-2.00**	0.77	0.96	-1.37
$\Delta EINQ$	3.63***	-0.61	0.71	0.46	-0.82

* ... significant at 10% level, ** ... significant at 5% level, *** ... significant at 1% level

The most important parameter of these equations is the t-value of $NDEFQ_{t-1}$ since this variable represents the error correction term. As one can see this term is only significant in the revenue equation (even at a 1% level). In the other two equations it is insignificant. The expenditure equation even shows the wrong sign for $NDEFQ_{t-1}$. *This clearly indicates, that it is almost exclusively the revenue ratio that has to carry the burden of adjustment to changes in the deficit ratio.* This is also true for the estimations without a dummy.

Alternatively we also estimated the model by including $AUSGNQ_{t-1}$ as additional variable, so that the estimations are equivalent to a free VAR without a cointegration restriction. The last column of table 2 exhibits the t-values of $AUSGNQ_{t-1}$ for all those equations. As $AUSGNQ_{t-1}$ is not significant in any of the equations we can assume that the cointegration restriction that has been used is not in sharp conflict with the data.[11] The results of the free VAR estimations are very similar to the one's reported, except for the estimated standard errors of the impulse responses which are slightly larger.

The estimated *impulse response functions* representing the dynamic properties of the various variables are reported in Fig. 1 together with their respective 90% confidence intervals which were obtained by Monte Carlo simulations.[12]

The columns of figure 1 show the dynamic reaction of the system if shocked by unit innovations in one of the variables. The first column for instance indicates the response of the nominal growth rate (Δ *BIPN*) on a unit shock in the growth rate itself (first row), a unit shock in the expenditure ratio (second row) or a unit shock in the revenue ratio (third row). The rows on the other hand illustrate the effects of unit shocks on the variables. The second row for instance displays the effects of a shock in the expenditure ratio to $\Delta BIPN$, $AUSGNQ$, $EINQ$ and $NDEFQ$.

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[11] Strictly speaking, one should not use the t-value of $AUSGNQ_{t-1}$ for testing significance since $AUSGNQ$ is non stationary and not cointegrated with $NDEFQ$ under H_0. The estimated coefficient follows therefore a so called non standard distribution. However the true 5% significance level is greater then two in any case, so that the argument in the text is even strengthened (for that argument see *Pagan-Wickens* 1989, p. 986 ff).

[12] We took 200 random draws of the estimated VAR coefficient according to their estimated posterior distribution and calculated the corresponding 200 impulse responses.

The results are however remarkable in several respects.

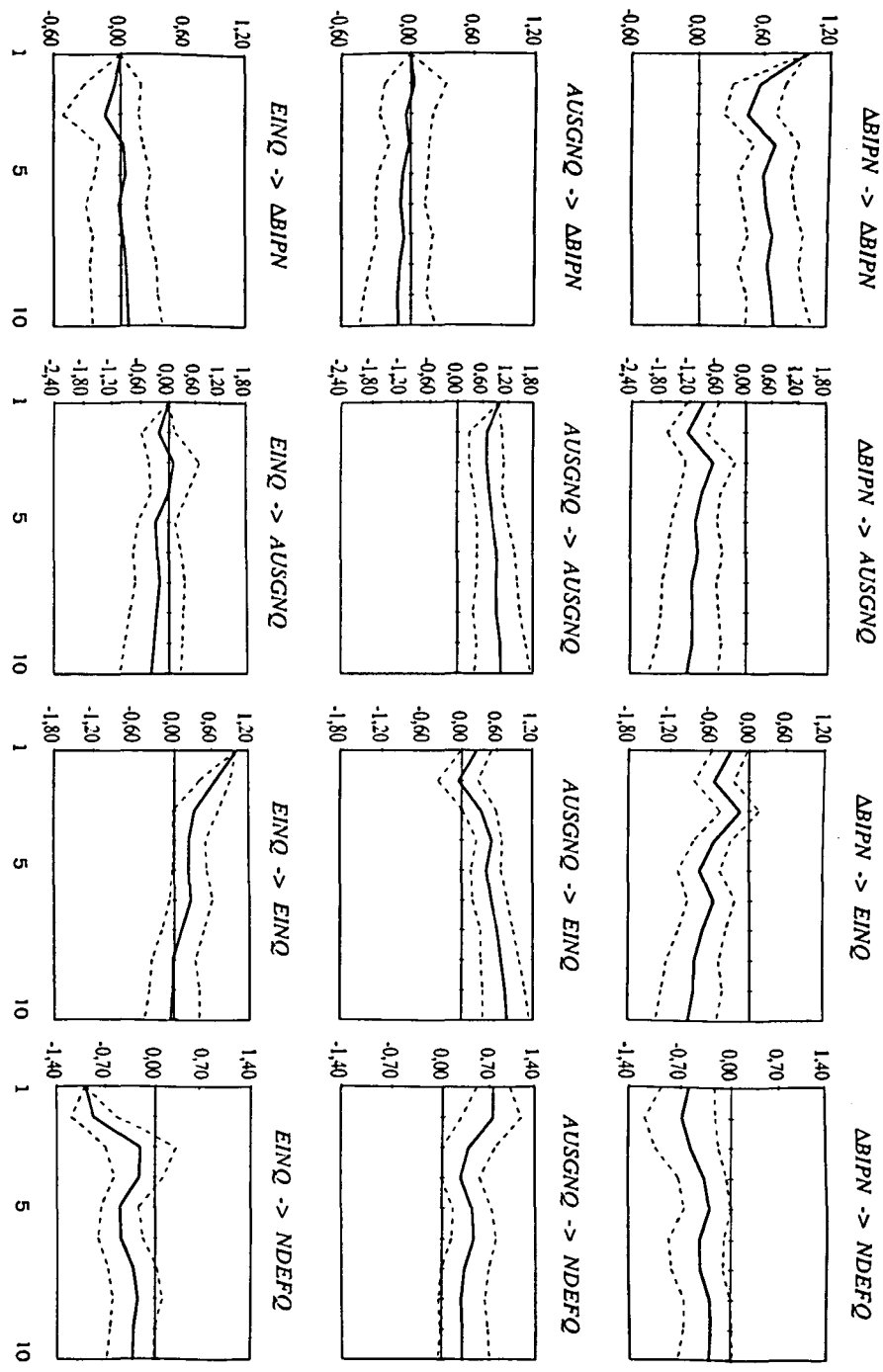

Fig. 1. Impulse Responses

1) Temporary shocks in the nominal growth rate of GDP have a permanent effect on the nominal growth rate of GDP itself, and on both, the expenditure and the revenue ratio. With the growth rate of GDP rising, both ratios decline. Although revenues and outlays increase with the growth of aggregate income initially, this increase is less than proportionate. However, the growth of expenditures and revenues adjusts to these higher growth rates of nominal GDP however gradually, so that a

stabilization of the corresponding ratios is attained at last, although at a lower level than at the outset. It is interesting to note that the speed of adjustment of the revenue ratio is significantly higher than that of the expenditure ratio. This indicates that tax revenues respond more quickly to GDP changes than expenditures. The fact that a higher nominal growth rate reduces the net deficit ratio can also be attributed to this delay.

2) Shocks in the expenditure ratio have a strong and statistical significant effect on the expenditure and the revenue ratio. The delay in the reaction of the revenue ratio, mentioned above leads to an equivalent effect on the net deficit ratio. A positive expenditure shock considerably increases the net deficit ratio. This effect is only gradually reduced by an increased revenue ratio in later periods.

3) There is no significant effect of shocks in the revenue ratio on both the nominal growth rate and the expenditure ratio, even in the short run. Positive shocks in the revenue ratio have only a short-lived influence on the revenue ratio. These shocks are therefore only temporarily effective. Permanent effects could not be detected.

We thus can see that shocks in the nominal growth rate of GDP have permanent effects on the expenditure as well as on the revenue ratio. The same is true for shocks in the expenditure ratio. Shocks in the revenue ratio on the other hand do not have significant effects on the expenditure ratio and the effects on the revenue ratio are only temporary. *This again indicates that expenditures dominate revenues.*

The results of the estimation of the *causality spectra* are reported in figure 2. Here the columns show the shares of the individual orthogonal shocks on the spectra of the variables, conditional on the frequency λ,which ranges from 0 to π, where π corresponds to a cycle of two years, $\pi/2$ to a cycle of four years and 0 to an infinite cycle (trend component).

The first column indicates that the variance of $\Delta BIPN$ is dominated nearly solely by own shocks (innovations in $\Delta BIPN$), along the whole frequency band. This raises serious doubts regarding the effectiveness of stabilization policies, that have so extensively been used in Austria during the last two decades.

The second column decomposes the spectrum of the expenditure ratio. In the long run ($\lambda=0$) innovations of $\Delta BIPN$ account for approximately 50% of the total variation of *AUSGNQ*, whereas in the short run ($\lambda=\pi$), nearly 100% of its variance can be attributed to own innovations. Shocks in the revenue ratio do not have any effect on the expenditure ratio along the whole frequency band.

The third column decomposes the spectrum of *EINQ*. In the short run ($\lambda=\pi$) and also at some business cycle frequencies ($\lambda=\pi/3$), variations in the revenue ratio can largely be attributed to own innovations. At low frequencies, the importance of these own innovations is declining dramatically. In the long term, shocks in the nominal growth rate and in the expenditure ratio are the dominant source of fluctuations in *EINQ*.

The fourth column displays the decomposition of the spectrum of the net deficit ratio *NDEFQ*. At low frequencies, shocks in $\Delta BIPN$, *AUSGNQ*, and *EINQ* are of approximately equal importance, whereas at business cycle frequencies shocks in the revenue ratio predominate. Shocks in the nominal growth rate and shocks in the expenditure ratio apparently have offsetting effects on *NDEFQ*, especially at low frequencies, so that shocks in the revenue ratio are quite important for the development of the deficit in the long run.

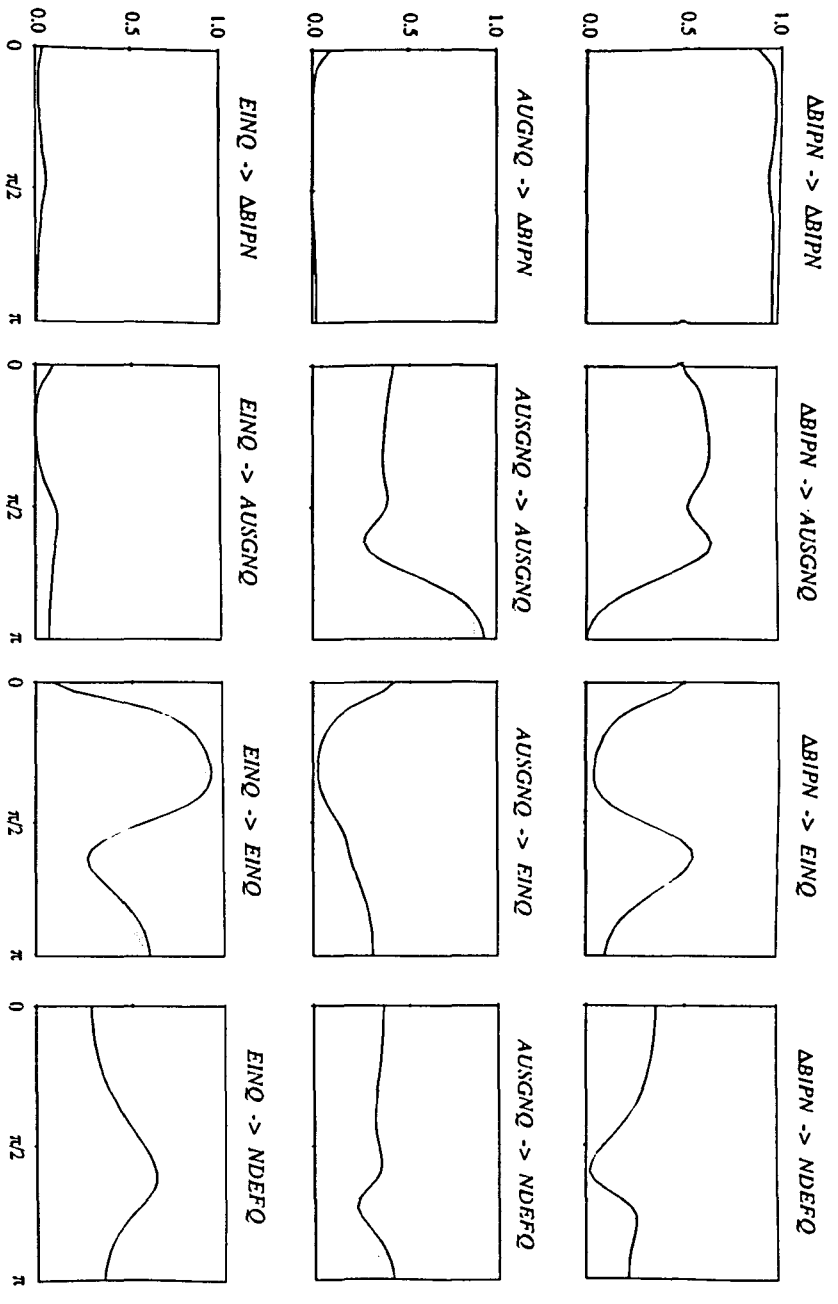

Fig. 2. Causality Spectra

Innovations in the revenue ratio thus turn out to be of practically no importance for the expenditure ratio. On the other hand, both shocks in the nominal growth rate and shocks in the expenditure ratio are the dominant source of fluctuations of the revenue ratio at low frequencies. At business cycle frequencies own innovations prevail.

As mentioned in section 3, one can also use the estimated VAR model to calculate the *accumulated effects of past innovations*, if these innovation are identified by appropriate restrictions. We used this

method to investigate the accumulated effects of past shocks on the net deficit. The results are reported in figure 3.[13]

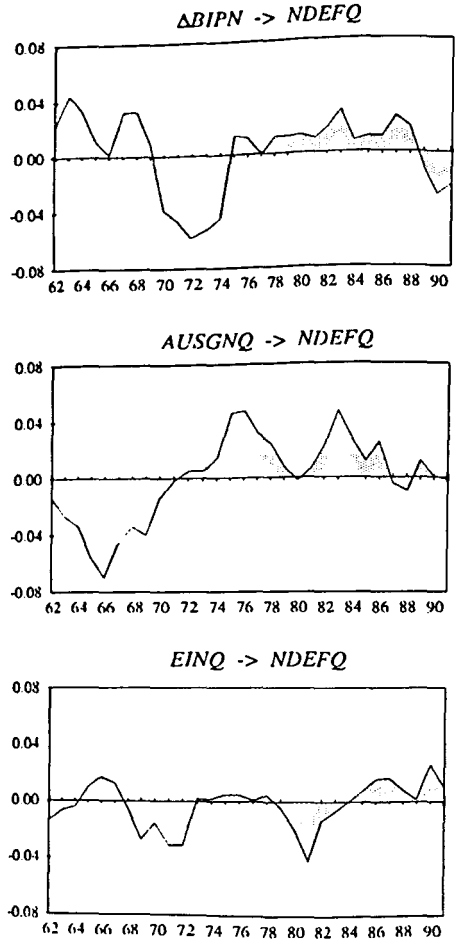

Fig. 3. Accumulated Effects of the Shocks on *NDEFQ*

The first part of figure 3 illustrates the cumulated effects of shocks in the nominal growth rate on the net deficit ratio, which can be interpreted in some way as the built-in stabilizers of Austria's federal budget. In line with some earlier findings (*Jaeger* 1990), our estimations indicate that the effects of these automatic stabilizers are significant. They were most marked during the extraordinary expansion period in the late sixties and early seventies. The following period from 1975 to the end of the eighties was characterized by mild but overall negative effects of the automatic stabilizers on the deficit, leading some analysts to conclude that their relevance is commonly exaggerated *(Lehner* 1991*)*. It deserves attention that the automatic stabilizer effects indicate a tendency towards a deficit reduction since 1988/89.

The second part of figure 3 displays the cumulated effects of innovations in the expenditure ratio on the net deficit ratio. As the GDP effects have already been filtered out, they can be interpreted as being dominated by discretionary political decisions regarding public spending plans. The data clearly detect a change in the political attitudes at the beginning of the seventies. While innovations in the expenditure ratio were consistently signed to reduce the deficit during the sixties, they indicate a

[13] As we are interested in the effects of the unanticipated shock of 1975, the results were generated without a dummy for 1975.

general tendency towards a deterioration of the budget balance since 1971. This tendency was interrupted only for two short-lived consolidation periods, the first one at the end of the seventies, the other one starting at the end of eighties.

The third part of figure 3 shows the cumulated effects of innovations in the revenue ratio on the net deficit ratio. They are somewhat smaller than those of the expenditure ratio and more erratic. Our findings thus detect the increased tax burden resulting from the *Paukenschlag* (1968) and the introduction of the *Luxussteuer* (1979), both measures clearly designed to restore budget balance. Tax relief measures were comparatively less pronounced. Besides the tax component of the *Wachstumsgesetze* (1966) and some relief measures during the year before the 1986 election, the *Große Steuerreform* of 1989 seems outstanding in this respect.

As the error correction estimates implemented in this section are interpreted as a model of government behavior, we would expect them to be highly susceptible to structural breaks. To examine for such breaks, an extensive testing procedure was applied. Every equation was estimated for various sub-periods. It then was tested whether the realizations of the endogenous variables for the remaining periods are compatible with the estimated equation. If they were not, they probably were generated by a different structure. The results of these Chow tests are reported in table 3.

The first column of table 3 displays the year of a hypothetical structural break. The second column of table 3 shows the prob-values of the Chow tests for the first equation ($\Delta^2 BIPN$), the third column for the second equation and so on. In all cases the null hypothesis (no structural break) cannot be rejected at conventional significance levels,[14] with the revenue ratio equation for the year 1990 (prob-value 0,123) being the only exception. This is probably due to the income tax reform 1989.

Table 3. Chow Tests

Year	$\Delta^2 BIPN$	$\Delta AUSGNQ$	$\Delta EINQ$
77	.777	.886	.867
78	.831	.812	.786
89	.874	.734	.715
80	.993	.850	.637
81	.987	.772	.561
82	.978	.655	.564
83	.964	.704	.754
84	.950	.660	.698
85	.934	.697	.602
86	.880	.638	.476
87	.780	.492	.433
88	.701	.890	.332
89	.534	.969	.232
90	.809	.887	.123
91	.953	.775	.418

To investigate the dependence of our results on the estimation period even further, we also reestimated the error correction model for the sub-periods 62 to 81 and 72 to 91. It again turned out that the estimated impulse responses as well as the causality spectra did not change in any significant way.

[14] We also carried out CUSUM and CUSUM^2 tests. These tests, too, did not indicate any structural breaks.

Only the estimated standard errors of the impulse response were slightly larger. But this is what one would expect when the estimation period is shortened.[15]

To analyze the consequences of the imposed cointegration restriction we also estimated the model as "free" VAR by including $AUSGNQ_{t-1}$ as additional variable. As already mentioned in section 3, this had no significant consequences on the point estimates of the impulse responses and the causality spectra.

At last we examined to what extent the use of an alternative budget concept would alter our results. As already mentioned, we made use of the *Finanzierungssaldo des Bundes* extended by the ASFINAG. We thus took account of the most important wealth-transactions and off-budget outlays to generate a deficit concept often considered as an economically superior indicator of government's long run budget constraint. One could expect, therefore, that the government would base its fiscal decisions on such corrected data rather than on the administrative budget concept. A reestimation of our model using the *Finanzierungssaldo* follows quite naturally.

It comes as surprise that the resulting point estimates do not differ significantly from those using the administrative budget concept as reported earlier. However, the Chow tests indicate a significant structural break in the revenue ratio, becoming effective in 1987/88. It is since then, that differences between the two concepts have become increasingly pronounced. For these two years the null hypotheses could be rejected at a significance level of 5,8 % resp. 6,4 %. This is in any case a strong indicator that the government does not base its budgetary decisions on data generated by this concept, but rather on the administrative figures. This might be due to the fact that the administrative concept dominates the discussion of fiscal policy in the media and the public nearly exclusively. But as any changes of the adjusted budget figures become effective for the administrative budget data too, although with some delay, this indicates that policy decision making processes are clearly short run oriented .

6. Summary and Conclusion

Our contribution was aiming to improve the understanding of the relationship between government spending and taxing decisions in Austria. Unfortunately, public choice theory does not provide a framework that would allow us to discriminate between the rivalling *spend and tax* and *tax and spend* hypotheses definitely. The relations between the budget aggregates had therefore to be investigated empirically.

We estimated a tri-variate VAR model including aggregate income as additional exploratory variable, implementing impulse-response functions and frequency domain techniques in order to identify the causal relation between government outlays and receipt. For that purpose we used time series of different (official and adjusted) budgetary concepts. Since we interpreted the budget making process as an error correction model we were allowed to estimate whether revenues or expenditures have to shoulder the burden of adjustment whenever the federal government sees its long run budget constraint hurt.

Our empirical estimations clearly indicate that the two propositions stated at the beginning of this paper, which clearly are in favor of the tax and spend hypotheses, can hardly claim any validity in the case of Austria. The development of the federal budget was driven dominantly by spending decisions

[15] The results of these estimations are available upon request.

not by the dynamics of government revenues. The traditional wide-spread view that spending decisions would cause taxes rather than the other way round seems strongly confirmed.

Although the political economic explanations for an inverse causality running from taxes to government outlays seem to be increasingly popular, we could not find any support for them in the data. Since one explanation for this proposition argues with the effects of an increasing international integration of national economic policies, we cannot exclude that it will considerable gain relevance in the future, as this integration process will - without doubt - become more important in the future. Historically it seems that the more traditional approach, viewing budget deficits as being dominated by outlays, is more in line with our observations. This does not mean, that any attempts to reduce budget deficits through revenue restraints are automatically condemned to failure. But we can definitely maintain that the budgetary developments of the past were not characterized by an excess of revenues, which induced political decision makers to search for ever new activities. It was rather the other way round, with governments facing new and costly obligations that had to be financed by additional revenues. As a consequence, if governments want to restrict activities and to reduce budget deficits by revenue constraints, this clearly entails a fundamental change in political attitudes. Whether this is under way remains to be seen.

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