Matti Virén

Fiscal policy in the 1920s and 1930s How much different it is from the post war period's policies?

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Suomen Pankki
Bank of Finland
P.O.Box 160
FI-00101 HELSINKI
Finland
☎ + 358 10 8311

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Matti Virén
Monetary Policy and Research Department

Abstract

This paper deals with the fiscal behaviour of governments in the 1920s and 1930s. The intention is to see whether there were the same features in government behaviour as in the post-World War II era. In particular, attention is paid to asymmetric fiscal policies, ie the question of whether government deficits react differently to income growth and inflation during depressions and booms. The analysis is carried out using data primarily from the League of Nations. The data come from 32 countries and covers the period 1925–1938. Estimation results suggest the in pre-war period deficits were much less sensitive to output and did not show as many asymmetric features as in post-war period. Otherwise, the same regularities apply to the empirical results. In particular, this is true with the disciplinary role of government debt in terms of budget deficits.

Key words: fiscal policy, deficit, asymmetric behaviour

JEL classification numbers: E62, H62

Finanssipolitiikka 1920- ja 1930-luvulla: Miten paljon se poikkesi sotien jälkeisen ajanjakson politiikasta?

Suomen Pankin tutkimus Keskustelualoitteita 15/2005

Matti Virén
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä tutkimuksessa tarkastellaan 1920- ja 1930-luvun finanssipolitiikkaa. Tarkoitus on selvittää, missä määrin valtioiden toiminta oli samanlaista kuin toisen maailmansodan jälkeisenä aikana. Erityisen mielenkiinnon kohteena on mahdollinen finanssipolitiikan epäsymmetrisyys eli kysymys siitä, reagoivatko ali- ja ylijäämät eri tavalla tulojen kasvuun laman aikana ja korkeasuhdanteissa. Analyysit tehdään käyttäen lähinnä Kansainliiton tilastoja. Aikasarja-aineistoa on 32 maasta, ja se kattaa ajanjakson 1925–1938. Estimointitulokset viittaavat siihen, että toista maailmansotaa edeltävänä ajanjaksona alijäämät olivat vähemmän sensitiivisiä tuotannon suhteen, eivätkä yhtä voimakkaasti epäsymmetrisiä kuin sotien jälkeisenä akanjaksona. Muutoin tuloksiin pätevät samat lainalaisuudet, ja tämä koskee erityisesti velkaantuneisuuden rajoittavaa vaikutusta alijäämiin.

Avainsanat: finanssipolitiikka, alijäämä, ei-symmetrinen käyttäytyminen

JEL-luokittelu: E62, H62

Contents

1 Introduction

Very little is known of fiscal policy in the 1920s and 1930s. Empirical analyses have typically focussed on monetary policy – more precisely, monetary policy failures during the Great Depression. The fact that less attention has been paid to fiscal policy can be explained by the fact that during the per war period governments were much smaller and the importance of fiscal variables was consequently much smaller.

Moreover, fiscal policies cannot so easily be characterized by any systematic policy rules or behavioural patterns which complicates all efforts to model and measure policy behaviour. Finally, there are severe data problems. At that time, there were no national accounts and even now one may only get data from central governments only. Even then, there can be severe data problems due to complicated budgetary practices in terms of different intra-governmental income transfers and unconsolidated funds. In the 1920s and 1930 there was no OECD or IMF to collect comparable data from different countries: only the League of Nations collected some data and published them in the Yearbook of League of Nations. That is also the main data source in this paper.

We do not intend to carry out any extensive analysis on fiscal polices for this period. Instead, we only want to make a preliminary assessment on the main features of polices compared to post World War 2 experiences. Thus, we want to see whether polices were strongly sensitive to cyclical movements. In addition we want to see whether the behaviour of government finances (deficits) showed any asymmetric features which seem to be present in the post-war period (see eg Virén (2000) and Melitz (1997)).

In order to be able to interpret the results we also focus on government revenues (Rev) and expenditures (EXP) separately. The purpose is simply to see to what extent the cyclical behaviour of these variables is different and whether the difference can be explained by any rule.

The economic analysis boils down in estimating the following simple 'deficit equation'

$$Def / Y = \alpha_0 + \alpha_1 \Delta y + \alpha_2 Def / Y_{-1} + u \qquad (1.1)$$

where Def denotes central government surplus (negative values deficit), Y* trend Gross Domestic product at current market prices, Δy output growth, Δp inflation, Def/Y_{-1} lagged surplus/DDP ratio and u the error term.

This commonly estimates equation can be rationalized by the following simple set of revenue and expenditure equations: $Rev = \gamma Y$, $Exp = \theta Y$, $Y = Y^* + Z$, where Z is the (nominal) output gap. Then $(Rev-Exp)/Y^* = Def/Y^* = (\gamma Y^* + \gamma Z - \theta Y^* - \theta Z)/Y^* = \pi_0 + \pi_1(Z/Y^*) = \pi_0 + \pi_1 z$. Clearly, this specification assumes

linear tax rates and linear government expenditure income relationships. If, however, the relationships were more complicated (for instance, with nonzero origins) the conventional formula $Def/Y^* = a + bz \approx a + b\Delta y$ could not be derived. If the revenue and expenditure equations were nonlinear, the same conclusion would obviously hold. The simplest alternative is perhaps a log linear model of the type $Rev/P = (Y/P)^{\gamma}$ and $Exp/P = (Y/P)^{\theta}$. Here one could assume that (at least in the medium run) $\gamma > 1$ and $\theta < 1$, that is, due to progressive taxation government returns increase with increasing income while government expenditures may fail to follow income growth (at least, in the short and medium run). With the deficit variable we cannot use this kind model in estimation simply because nonnegative deficit values do not allow for log transformation. With separate revenue and expenditure equations (Tables 4 and 5) this is possible, however, and the respective results can be interpreted from this point of view.

With the deficit variable we can, however, estimate a non-linear model to account for cyclical asymmetries but with kind of model we cannot trace back the different revenue and expenditure effects (parameters of the underlying model). The model which we use here is a nonlinear threshold model form which can be expressed in the following way (for earlier applications, see eg Virén (2001) and Mayes and Virén (2005))

$$Def/Y = \alpha_0 + \alpha_{11}\Delta y|z < 0 + \alpha_{12}\Delta y|z > 0 + \alpha_2 Def/Y_{-1} + u \qquad (1.2)$$

In the model, output gap (in terms of real GDP) is used as the threshold variable and zero as the threshold. Obviously that does not need to be the case. In this study the value can be defended by the following arguments: First of all, the sample period for individual countries is very short which does not really allow for a genuine search for more precise threshold parameter value. The second reason is a need for comparison: the value of zero makes cross-country comparisons quite straightforward. Finally, the value of zero has an intuitively obvious interpretation.

In addition to (1.1) and (1.2) we estimate an extended deficit equation which takes the following form

$$Def/Y^* = b_0 + b_1\Delta y + b_2\Delta p + b_3 Debt/Y^*_{-1} + b_4 Def/Y^*_{-1} + u \qquad (1.3)$$

where Δp denotes inflation and Debt/Y the debt/GDP ratio. The basic idea in estimating (1.3) is to see whether the debt level has any disciplinary (or, 'error-correction') effect on current deficits. The role of inflation is obvious from the seigniorage point of view but it is not clear how it shows up in the estimated deficit equations. That in turn depends on the way the seigniorage revenue is reported in the revenue statistics (ie, how the profits of the Central Banks are

transferred to the government). Our deficit measures are quite crude and we cannot really properly control the seigniorage proceedings and thus exactly anticipate the sign of the inflation effect.

The role of inflation is not, of course, limited to seigniorage. Obviously inflation may affect both revenues and expenditure via various indexation schemes. Or even more it may affect these things via the absence of indexation. A typical example is progressive taxation. In the absence of proper indexation, higher inflation implies higher effective tax rates and higher tax revenues. It is only that in the 1920s and 1930s the tax rates were so low that this tax progression effect was probably of minor importance. Moreover, the average inflation (deflation) rate for the 1920s and 1930s was just zero (see Table 1) which means that the role of inflation completely different from, say, the 1970s.

All models are estimated using panel data and the reported values correspond to cases in which all parameters (except for the fixed time and country effects) are constrained to be equal. The panel is incomplete to such extent that in the case of fixed effects only the LS or the GLS estimators are feasible. Before presenting the estimations results we briefly review the data and scrutinize some descriptive statistics and graphs (in section 2).

2 The data and some descriptive statistics

The analyses are based on cross country data on 26 countries that are listed in Table 2. In addition, we have six countries with somewhat deficient data (Czechoslovakia, Estonia, India, Latvia, Poland and Romania) that are analysed separately (see Table 5). The full sample period is 1920–1944 which obviously include World War II years for most countries[1]. War years are not the only abnormal times for the 1920s and 1930s. In the early 1920s there were still some unrest, or even war, in Eastern Europe and after 1933, a build-up for the following war began. There was a civil war in Spain for 1936–1939, war between Italy and Abyssinia in 1936 and war between Japan and China from 1935 on, just to mention the biggest crises during that period. In the early 1920s also data compilation was quite deficient so that for instance the League of Nations' Yearbook starts to have complete data first from 1925 on. Because of all these problems, we have used in addition to the long sample period 1920–1944 a short sample period 1925–1938 for which have derived a more or less complete data. This period is also the main sample period in empirical analyses.

[1] The League of Nations continued publishing the Yearbook until 1944 although many countries which were involved in the war stopped providing the data. Thus, the data for 1939–1944 is quite deficient already in terms of the country coverage. The quality of the data is then another problem.

Some comments of the main variables merit note. Take the deficit variables first. We use two measures Cdef and Gdef. Cdef denotes the current deficit and it is derived from the League of Nations Statistical Yearbooks as the difference between current revenues and current expenditures. Thus, the measure does not include capital expenditures, nor does it include capital revenues (nor, of course, borrowing and amortizations). Thus, the measure roughly corresponds to some 'current (cash) deficit'. The Gross deficit concept Gdef is simply the difference between total expenditures and tax revenues is it is derived from Mitchell (2003,ac,c). Roughly, the measure corresponds to 'net lending' but because we do not know the exact details of expenditures, we cannot really say how close to this concept we come.

As for output, we have three variables. GDP at constant market prices, gdp, (and the corresponding change rate, g), output gap, z, and industrial production, ip. Output gap is constructed using the Hodrick-Prescott filter with conventional weight parameters.

Some descriptive data for individual countries are presented in Table 1 while Figures 1–10 illustrate the median values of different time-series over 1920–1944. The corresponding median deficit and debt ratios are illustrated in Figure 2 and 3, the corresponding GDP growth relationships in Figures 3 and 4, the output measures in figures 5–6, revenues and expenditure in figure 7, and finally, interest rates, the price level and inflation in figures 8–10.

Looking at Table 1 and Figures 1–10 one may argue that during the pre-war period country differences were much larger that what they are now. Thus, we have some very indebted countries (France, UK), some countries which had wiped out almost all debt (Finland, Germany) and a miscellaneous set of 'reasonably' indebted countries. Deficit rate show even more variability – especially if the time pattern of deficits is taken into account. For some countries deficits are inherited from the early 1920, for some countries they reflect the Great Depression but there are also countries which have financed their pre-war armament programs by having growing government deficits.

Differences in growth rates and inflation look much larger than for the most post-war periods. These differences reflect many different facts such as initial situation in the early 1920s, different economic polices (exchange rate arrangements, in particular), pre-war (World War II) militarization and so on. The nature of differences also reflect the fact that international trade was much smaller than nowadays so that spill-over effects of growth were much smaller making the cyclical behaviour of output and inflation less coordinated.

3 Interpretation of results

Turn now to the estimation results. These are reported in Tables 2–6. Table 2 contains the basic estimates of the deficit equations (2) and (3) while Table 3 contains some a bit more sophisticated estimates for equation (3). Finally, the estimates for government revenue and expenditure equations are presented in Tables 4 and 5. A brief comparison of pre-war and post-war estimates is presented in Table 6. In Table 7 we present a set of estimates for the small sub-sample of countries. Finally, Table 8 contains just one set of estimates for a simple Fisher equation and a (New Keynesian 'hybrid') Phillips curve. These estimates are produced just to illustrate the basic features of the other relevant macroeconomic variables.

As for the deficit behaviour, we may summarize the finding in the following way:

- Deficits are sensitive to output but much less than during the post-war period in general or just the last decades (Table 2 & 3 & 7)
- Deficits are only weakly sensitive to inflation. (Table 2)
- There are asymmetric features in output responses; they are of the same nature as more recently but in statistical sense they are much weaker (Table 2).
- Thus the cyclical output (growth) effect on deficits is stronger in good times than in bad times (Table 2).
- Deficits respond 'correctly' to increased debt (higher debt levels tend to prevent excessive deficits; (Table 3)
- The deficits measures which we have do not allow for distinguishing a significant interest rate effect.
- The results see to be quite robust in terms of different estimators (Table 2) and even for the sample periods. In fact, it is somewhat surprising that the results for the long sample period (including the war years) come so close to the results for the 'normal years'.[2]

As for revenues and expenditure, the following comments merit note:

- The income elasticity of government expenditures is less than one while the elasticity of revenues is above one. Similarly, the expenditure/GDP ratio is not sensitive to income growth while the revue/GDP ratio is clearly (positively) related to income growth. (Table 4 & 5)

[2] Perhaps the only abnormal feature in the result deals the expenditure/GDP and revenue/GDP ratio equations in which the coefficient of the lagged terms goes to unity.

– The results can also be interpreted as suggesting that government expenditures behave in contra-cyclical manner while the behaviour of revenues is pro-cyclical (Table 5)
– In bad times, the negative cyclical (output growth) effect is somewhat more important in good (increasing output) times (Table 5)

The fact that deficits were much less sensitive to output than during the last two or three decades is really no surprise. The size of government was much smaller. The share of taxes of GDP was just a bit above ten percent (see Figure 7). Therefore it is no surprise that the output growth coefficient remains at the level which varies between 0.05 and 0.10. It is much less that the current estimates for which a representative number is something like 0.25 (see eg Virén (2001) and Tujula (2004)).[3]

Even if the sensitiveness has decreased, the basic features of expenditures, revenues and deficits have remained the same. That can be seen by comparing some basic parameter values for the periods of 1925–1938 and 1971–2004 (table 6). Thus, the income elasticity of expenditures is in both cases clearly smaller than the income elasticity of revenues (with the post-war data, the latter elasticity does not exceed one).

Although there are signs of asymmetries in all equations, it is not all clear how these asymmetries can be explained. The cyclical movements of the government revenues and expenditures are different. That is clear and that can explain why there are asymmetric features in cyclical movements in government deficits. The movements seem to be more sensitive output in depressions than in booms but the difference is not enormously clear and robust over all measures and estimations methods. Government expenditures and revenues seem also react output growth somewhat differently over the business cycle. Thus in good times, in particular, acceleration of growth seems to lead to reductions in both expenditures and revenues. The two effects largely net out but still the effect on government surplus is positive because changes in expenditures dominate the outcome[4].

Why the estimation of the inflation effect is so difficult was already discussed in the introduction. The results in Table 3 suggest the inflation effect is indeed quite sensitive to the deficit measure. Thus, the gross deficit it appears to negative (although very weak) while with the current deficit the effect is positive. Another explanation for the sensitivity of results becomes obvious when we scrutinize the

[3] The low value of the government size variables is partly due to the fact the out numbers just cover the central, government.
[4] When comparing the cyclical sensitiveness very much depends on whether we focus on the absolute levels of expenditures or the corresponding GDP ratios. Similarly, it makes a lot of difference whether we analyze the effects of a change of the level of output or a change in the rate of change of output (take for instance, the seemingly different results in Tables 4 and 5).

time series of output and inflation (see eg Figure 9 and the Phillips curve estimates in Table 8). Inflation (or rather deflation) and output growth seem to follow each other very closely and it then very difficult to distinguish the income and inflation effects.

Several other caveats remain with the results due to the data problems[5]. Take for instance, the problem of interest expenses. Increase in government debt level generates more interest expenses and that automatically increase deficits offsetting partly or totally the possible 'disciplinary effects' of higher government indebtedness. If we had precise data on primary deficits we could distinguish both effects and assess their relative importance. Unfortunately, that is not the case and hence we can only make some very preliminary conclusions.

The analyses just focus on the GDP effects on government deficits. Obviously, this not the whole story: deficits (government revenues and expenditures) affect output and other macro variables. Thus it is a bit dangerous to interpret the values of the estimated automatic stabilisers only as reflections of the size of the tax and expenditure parameters.[6]

Anyway, see again signs of nonlinear cyclical response in the sense that deficits are much more sensitive in depressions than in booms. In the 1920s and 1930s that can be simply explained by the growth unemployment related expenditures during the repression years.

Notice that there seems to be some evidence that interest rates in the 1920s and 1930s have behaved somewhat differently from the post-war (WW2) period (see eg Figure 8 and estimates of a Fisher equation in Table 7). The main difference deals with the role inflation. The effect of inflation on interest rates is even negative and definitely different from unity. This is basically no surprise because the price level has been almost stationary. Even so, interest rates have increased along with higher deficits while better performance (higher GDP) of the economy has in fact lowered the rates.

The interest rates deficit relationships for the 1920s and 1930s can be interpreted in many ways but one has to keep mind that on the level of short rates interest rate movements were dictated by exchange rate considerations and (later) by the Great Depression. The idea that that there had been some monetary policy reactions to the fiscal situation (or vice versa), as proposed by Melitz (1997) for

[5] The fact that the parameter estimates are often relative unprecise makes all assessments a bit tedious especially because almost all models suffer from autocorrelation and heteroskedasticity. Even if the standard errors have been corrected, one cannot really be sure on the exact magnitude of the confidence bounds.

[6] An alternative explanation for seemingly weak deficit output relationship is successful policy. If policy makers had pursued an effective and successful countercyclical fiscal policy it might well look that there is not relationship between output and deficits. See Blinder and Solow (1973) for details of this well-known old result.

the pre Maastricht period, is not consistent with any narrative evidence, nor does the data support the idea.[7]

Although the 'Fisher equation' results suggest that it has been difficult to predict future inflation we find that the New Keynesian 'hybrid' Phillips curve performs reasonable well. There is a positive relationship between output and inflation and the coefficient of the right-hand-side inflation terms comes close to unity. We may therefore conclude that the basic macroeconomic data behave equally 'well' as they behave in the post-war period.

4 Concluding remarks

All in all, we may conclude that the 1920s and 1930s does not represent an extraordinary episode in term of the fiscal behaviour of governments. Many of the basic features are just the same as in the post-war period. Thus we see that deficits are sensitive to cyclical movements of output; the size of the (automatic stabilisers) effect is roughly comparable to the size of government. Cyclical relations appear to be to some extent asymmetric reflecting the basic differences between revenues and expenditures. The same features seem to works also the most recent data. One way to interpret these results is to say that fiscal policies in the 1920s and 1930s were not profoundly different from policies that have been pursued later on. More affirmative conclusions would, however, require analysis of individual countries.

[7] For further evidence on interest rate behaviour, see Virén (1994)

References

Blinder, A – Solow, R (1973) **Does Fiscal Policy Matter?** Journal of Public Economics.

League of Nations (1927–1944) **Statistical Yearbook of the League of Nations.** 1927–1942/44. Geneva.

Maddison, A (1964) **Economic Growth in the West.** Allen and Unwin, London.

Mayes, D – Virén, M (2005) **Monetary Policy Problems for Currency Unions: Asymmetry and Problem of Aggregation in the Euro Area.** Economic Modelling, 22, 219–251.

Melitz, J (1997) **Some Cross-country Evidence about Debt, Deficits and the Behaviour of Monetary and Fiscal Authorities.** CEPR Discussion Paper 1653.

Mitchell, B (2003a) **International Historical Statistics: Europe 1750–2000.** Palgrave Macmillan, Basingstoke UK.

Mitchell, B (2003b) **International Historical Statistics: Africa, Asia & Oceania 1750–2000.** Palgrave Macmillan, Basingstoke UK.

Mitchell, B (2003c) **International Historical Statistics: The Americas 1750–2000.** Palgrave Macmillan, Basingstoke UK.

Tujula, M – Wolswijk, G (2004) **What Determines Fiscal Balances. An Empirical Investigation in Determinants of Changes in OECD Budget Balances.** ECB Working Paper 422.

Virén, M (1994) **A Note on Interest Rate Policy during Great Depression.** Journal of European Economic History, 115–129.

Virén, M (2001) **Fiscal Policy, Automatic stabilisers and Coordination.** In The Stability and Growth Pact (edited by Brunila, A – Buti, M and Franco, M), Palgrave, 259–286.

Table 1 **Sample average values of key variables for 1925–1938**

Country	Cdef/Y	Gdef/Y	Debt/Y	Δy	Δp:c	Δp:y
Argentina	-0.03	-1.98	..	2.61	-1.64	-0.28
Australia	-3.48	-0.58	85.6	1.65	-1.16	-0.52
Austria	-0.73	-6.57	27.2	0.20	-1.84	0.25
Belgium	0.01	-3.50	99.5	1.08	0.67	3.38
Brazil	-0.73	-1.57	..	3.26	2.88	2.52
Bulgaria	-1.80	-1.95	44.3	4.23	-2.22	-3.18
Canada	0.03	-1.49	62.5	1.34	-1.67	-1.14
Denmark	-1.11	2.50	21.7	2.50	-2.26	-1.58
Finland	0.06	-2.40	16.7	4.22	0.52	0.42
France	-1.02	-2.78	177.6	0.72	2.06	3.85
Germany	-0.78	-1.41	15.3	4.23	-1.87	-1.35
Greece	-1.53	-1.58	85.3	2.07	1.68	1.75
Hungary	0.10	-1.60	30.0	2.93	-1.95	-2.04
Indonesia	..	-2.72	..	1.42	-4.57	-5.12
Italy	-0.26	-7.47	78.8	1.92	-1.92	-0.18
Japan	-0.51	3.25	41.1	4.10	-0.61	0.49
Mexico	1.04	0.01	28.3	1.78	1.93	1.07
Netherlands	-1.99	-5.88	60.2	1.45	-3.28	-1.65
New Zealand	-0.88	-2.98	..	2.56	-0.46	..
Norway	-0.27	-0.88	35.2	3.68	-3.12	-3.36
Spain	-0.51	-0.44	62.7	2.41	1.08	-0.85
Sweden	-0.14	-1.57	22.4	3.43	-1.69	-0.57
Switzerland	-0.24	0.00	27.0	0.51	-3.40	-1.85
UK	-0.17	0.74	186.0	2.00	-3.25	-0.41
USA	-0.76	-1.69	29.7	1.00	-1.62	-4.65
Yugoslavia	0.42	-5.76	74.4	2.03	-2.09	-0.95
Mean	-0.61	-1.99	57.0	2.28	-1.15	-0.64

Cdef/Y denotes the ratio of (central) government current surplus (Cdef) to GDP at current market prices (Y). Gdef/Y in turn denotes the ratio of (central) government gross surplus (Gdef) to GDP at current market prices. Debt denotes the ratio of (central) government debt to GDP at current market prices. Δy denotes the average growth rate of GDP (at constant market prices) and Δp average inflation in terms the CPI or the GDP deflator (denoted by Δp:c and Δp:y). Data sources: League of Nations 1927–1944, Maddison (1964) and Mitchell (2003).

Table 2 **Estimation results of a simple deficit equation**

Definition of y,def	y	y|z<0	y|z>0	ρ	lagged Def/Y	R^2 SEE	DW (Wald)	Sample
Analyses with gross deficit/GDP ratio								
g	.014				.710	0.702	1.86	20-44
	(1.77)				(17.01)	0.047		
g	.029				.286	0.700	1.50	25-38
	(3.22)				(3.47)	0.027		
g		.018	.011		.726	0.697	1.85	20-44
		(1.63)	(0.98)		(16.88)	0.048	(0.27)	
g		.011	.053		.288	0.710	1.52	25-38
		(1.03)	(3.90)		(7.98)	0.027	(5.51)	
ip		.045	.012		.756	0.783	1.62	20-44
		(3.25)	(1.30)		(16.40)	0.041	(2.51)	
ip		.015	.028		.566	0.792	2.17	25-38
		(3.43)	(3.61)		(12.24)	0.024	(2.22)	
z		.-.005	-.028		.708	0.707	1.79	20.44
		(0.40)	(1.47)		(15.17)	0.052	(0.66)	
z		.013	-.001		.323	0.584	1.73	25-38
		(1.13)	(0.10)		(2.54)	0.036	(0.61)	
z		.024	-.007	.701		0.707	1.82	20-44
		(1.83)	(0.44)	(16.25)		0.050	(1.73)	
z		.022	.047	.262		0.810	1.66	25-38
		(1.51)	(2.47)	(3.54)		(0.028)	(0.82)	
ip, RE		.036	-.008		.906	0.636	2.03	20-44
		(0.97)	(0.36)		(10.95)	0.035	(1.29)	
ip, RE		.042	.046		.661	0.471	2.45	25-38
		(4.26)	(2.32)		(8.92)	0.027	0.04	
Analyses with current deficit/GDP ratio								
g	.011				.559	0.436	1.36	20-44
	(1.79)				(8.73)	0.042		
g	0.31				.277	0.262	1.82	25-38
	(2.91)				(3.08)	0.026		
ip	.017				.615	0.485	1.87	20-44
	(2.77)				(10.33)	0.039		
ip	.026				.502	0.402	2.59	25-38
	(4.54)				(8.68)	0.029		
ip		.019	.008		.585	0.475	1.85	20-44
		(2.82)	(0.98)		(9.51)	0.037	(5.01)	
ip		.035	.018		.507	0.485	2.29	25-38
		(5.80)	(1.92)		(10.27)	0.030	(2.39)	

Heteroskedasticity adjusted t-ratios are inside parentheses. Wald denotes the Wald F test statistic for the hypothesis that in the threshold model (2) output coefficients are equal. The number of observations is 487 for the full sample period 1920–1944 and 338 for the short sample period 1925–1938. All estimates (except for the row RE) are GLS panel data fixed effects estimates. The estimates on row 'RE' are derived from a random effects model. ρ denotes the estimated AR(1) parameter which is used quasi-filtering the panel data.

Table 3 **Alternative estimates of the deficit equation**

Sample Estimator	y	x	Def/Y lagged	SEE	DW/J	Def, y, x
1920–1944	.017		.615	0.039	1.87	Cdef, ip
OLS	(2.77)		(10.33)			
1925–1938	.026		.502	0.029	2.59	Cdef, ip
OLS	(4.54)		(8.69)			
1920–1944	.023		.920			Gdef, ip
Huber	(5.05)		(90.36)			
1920–1944	.013	-.002	.905			Gdef, ip,
Huber	(2.47)	(1.75)	(79.99)			Debt/Y
1924–1938	.028	-.001	.889			Gdef, ip,
Huber	(4.02)	(0.84)	(47.38)			Debt/Y
1924–1938	.013	-.001	.830			Gdef, g,
Huber	(1.11)	(0.45)	(45.55)			Debt/Y
1924–1938	.014	.005	.299	0.032	J=20.31	Gdef, ip,
GMM/AB	(11.07)	(3.35)	(14.96)			Debt/Y
1920–1944	.019	.007	.826	0.041	1.89	Gdef, ip,
GLS	(2.45)	(1.00)	(18.23)			Debt/Y
1924–1938	.025	.010	.619	0.027	2.61	Gdef, ip,
GLS	(5.10)	(1.92)	(13.62)			Debt/Y
1925–1938	.042	.017	.435	0.028	2.25	Gdef, ip,
OLS	(3.69)	(1.22)	(4.50)			Debt/Y
1925–1938	.016	.010	.435	0.027	2.28	Gdef, z,
OLS	(0.75)	(0.89)	(4.50)			Debt/Y
1925–1938	.005	.013	.420	0.027	2.31	Gdef, g,
OLS	(2.10)	(1.32)	(4.20)			Debt/Y
1925–1938	.040	-.009	.345	0.026	1.72	Gdef, g, Δp
GLS	(3.22)	(1.57)	(3.22)			
1925–1938	.026	.046	.193	0.022	1.59	Cdef, g, Δp
GLS	(2.28)	(4.45)	(2.23)			
1925–1938	.028	-.009	.581	0.025	2.34	Gdef, ip, Δp
GLS	(5.44)	(1.49)	(11.90)			
1925–1938	.021	.025	.456	0.027	2.49	Cdef, ip, Δp
GLS	(4.44)	(2.38)	(7.72)			

x is the additional regressor that is either the rate of inflation Δp or the (lagged) debt/GDP level, Debt/Y. y denotes here either the growth rate of GDP, g, or industrial production, ip, or the output gap in terms of real GDP, z. Huber denotes Huber's robust M estimator, GG/AB denotes the GMM Arellano-Bond estimator (with first differences) and GLS the fixed effects panel estimator. With the GMM/AB estimation, the instrument rank is 11.

Table 4 **Comparison of revenue and expenditure elasticities**

Dep. variable	y	y|z<0	y|z>0	Lagged dep.var.	R2 SEE	DW (Wald)
Def/Y	.023			.805	0.733	1.61
1920–1944	(3.00)			(17.37)	0.041	
Def/Y	.023			.574	0.520	2.49
1925–1938	(4.90)			(12.50)	0.026	
Exp/Y	-.061			1.000	0.875	1.36
1920–1944	(0.74)			(23.62)	0.052	
Exp/Y	-004.			.684	0.903	2.40
1925–1938	(0.67)			(16.71)	0.029	
Exp/Y		-.003	-.001	0.682	0.907	1.98
1925–1938		(0.55)	(0.09)	(16.78)	0.028	(0.06)
Rev/Y	.026			1.022	0.960	1.00
1920–1944	(5.05)			(34.34)	0.024	
Rev/Y	.032			0.866	0.973	1.71
1925–1938	(7.90)			(26.33)	0.016	
Rev/Y		.027	.041	0.871	0.976	1.70
1925–1938		(6.73)	(5.38)	(24.81)	0.015	(3.93)

All estimates are GLS estimates with fixed (cross-section) effects. Output y is in all cases measured by the growth rate of industrial production, ip. Wald indicates the F(1,264) test statistic for the coefficient restriction: $\alpha_{11} = \alpha_{12}$. The number of data points for the full sample is 426 and for the shorter time period 288.

Table 5 **Comparison of revenue and expenditure elasticities: level form equations**

Dep. variable	y	Δy	Δy|z<0	Δy|z>0	Lagged dep.	R2 SEE	DW (Wald)
Ex	.896					0.992	0.54
25-38	(15.08)					0.208	
Ex	.975	-.724				0.993	0.55
25-38	(16.21)	(5.52)				0.204	
Ex, OLS	.988	-.650				0.993	0.55
25-38	(8.24)	(2.75)				0.204	
Ex	1.414	-.638				0.986	0.38
20-44	(22.33)	(4.54)				0.289	
ex	.984		-.226	-1.401		0.993	0.85
25-38	(18.21)		(1.65)	(2.32)		0.202	(34.37)
ex	.327	-.001			.748	0.997	2.22
25-38	(6.38)	(1.04)			(28.69)	0.134	
re	1.130					0.997	0.69
25-38	(22.87)					0.146	
re	1.161	-.111				0.997	0.70
25-38	(22.05)	(1.02)				0.144	
re, OLS	1.230	-.086				0.997	0.71
25-38	(13.70)	(0.55)				0.144	
re	1.336	-.199				0.994	0.57
20-44	(12.49)	(2.89)				0.189	
re	1.172		-.131	-.425		0.997	0.76
25-38	(21.54)		(0.92)	(2.63)		0.144	(7.31)
re	.258	.004			.773	0.998	2.16
25-38	(5.07)	(4.56)			(23.22)	0.107	
Cdef	.077	.018				0.426	1.37
25-38	(10.25)	(1.36)				1973	
Gdef	.009	.011				0.630	0.94
25-38	(2.40)	(2.08)				3185	

y is the log(Gross Domestic Product), with the deficit variable it is, however, just GDP (not log GDP). ex = log(EXP/P), re = log(Rev/P) and def = Def/P. The number of observations for the long sample is 513 and for the short 360. Estimates (expect for the two indicated by OLS) are GLS fixed effects panel data estimates.

Table 6 **Comparison of pre-war and post-war parameter estimates**

Parameter	1926–1938	1971–2004
Income elasticity of expenditures (a)	.896	.773
Income elasticity of revenues (b)	1.132	.984
Income change effect on deficit (c)	.061	.340

(a) estimate of θ_1 from equation $\log(Exp/P) = \theta_0 + \theta_1 \log(Y/P)$. (b) estimate of γ_1 from equation $\log(Rev/P) = \gamma_0 + \gamma_1 \log(Y/P)^{\gamma}$ (c) estimate of φ_1 from equation $Def/Y = \varphi_0 + \varphi_1 \Delta \log(GDP)$. The post-war estimates are derived from EU data (and apply to 15 EU countries only) and the sample consists of 261 observations. All values are GLS estimates.

Table 7 **Estimates for the rest of countries**

Estimates for small panel with deficit data countries

$$\underset{}{\text{Cdef}/\text{p}} = \underset{(1.70)}{.266}\,\text{ip} + \underset{(0.66)}{.062}\,\text{Cdef}/\text{p}-1 + \text{country dummies}$$

R2 = 0.12, SEE = 17.92, DW = 2.21, n = 55
Countries: Czechoslovakia, Estonia, India, Latvia, Poland and Romania

Table 8 **Estimates for the Phillip curve and the Fisher equation**

Phillips curve estimates

$$\Delta\log(p_t) = \underset{(2.82)}{.101}\,\Delta\log(y_t) + \underset{(5.80)}{.583}\,\Delta\log(p_{t+1}) + \underset{(6.14)}{.365}\,\Delta\log(p_{t-1})$$

$$R^2 = .564,\ \text{SEE} = .040,\ \text{DW} = 2.60,\ \text{J} = 14{,}50$$

Interest rate equation estimates

$$r_t = \underset{(9.45)}{34.475} - \underset{(3.03)}{.032}\,\Delta\log(p_{t+1}) - \underset{(8.45)}{.034}\log(y_t) - \underset{(2.40)}{.065}\,\text{Def}_t/Y_t$$

$$R^2 = .854,\ \text{SEE} = 1.87,\ \text{DW} = 1.52,\ \text{J} = 6.28$$

r denotes government bond yield and p the CPI. Both equations are estimated by GMM to account for expected inflation. Lagged inflation, deficit and debt variables are used as instruments.

Figure 1 **Deficit and Debt/GDP -ratios 1920–1943**

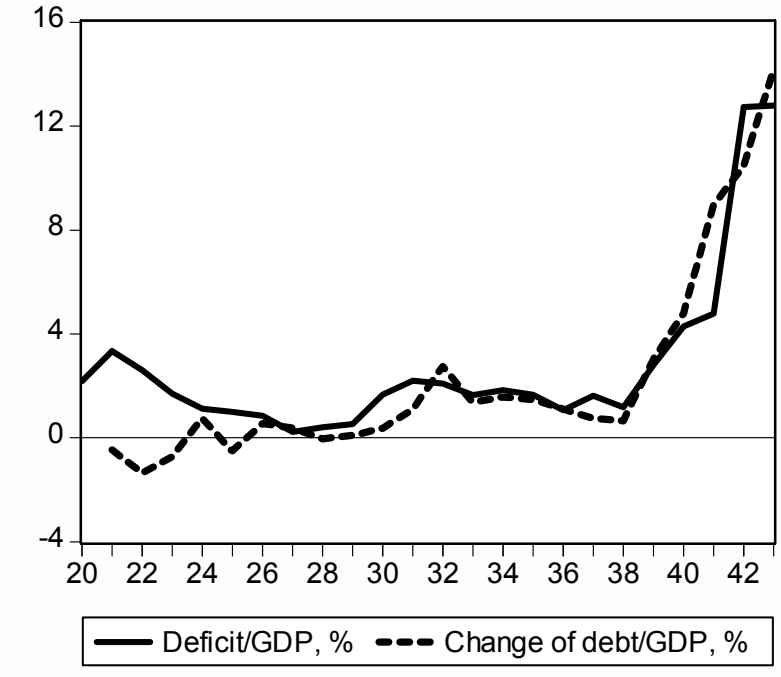


Figure 2 **Deficits 1920–1944**

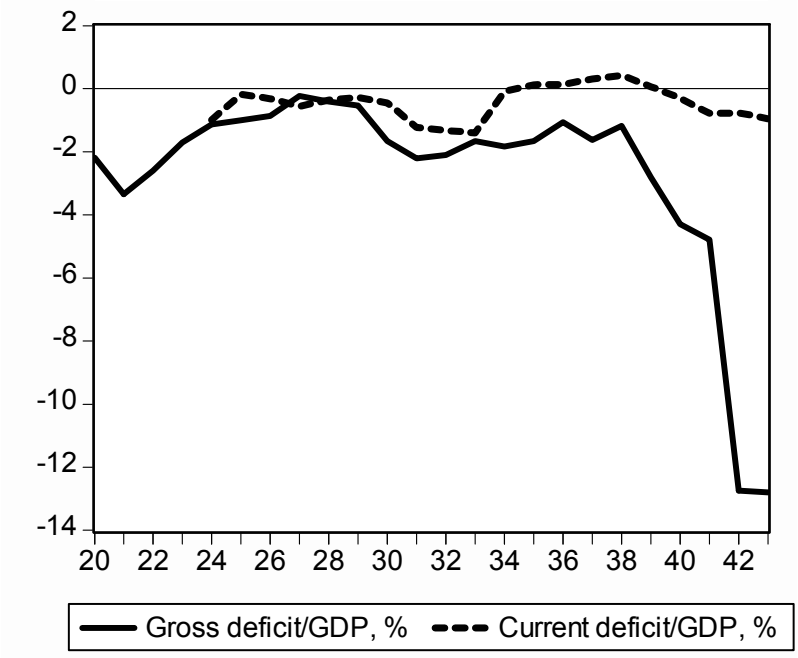


Figure 3 **Deficits and GDP growth 1920–1943**

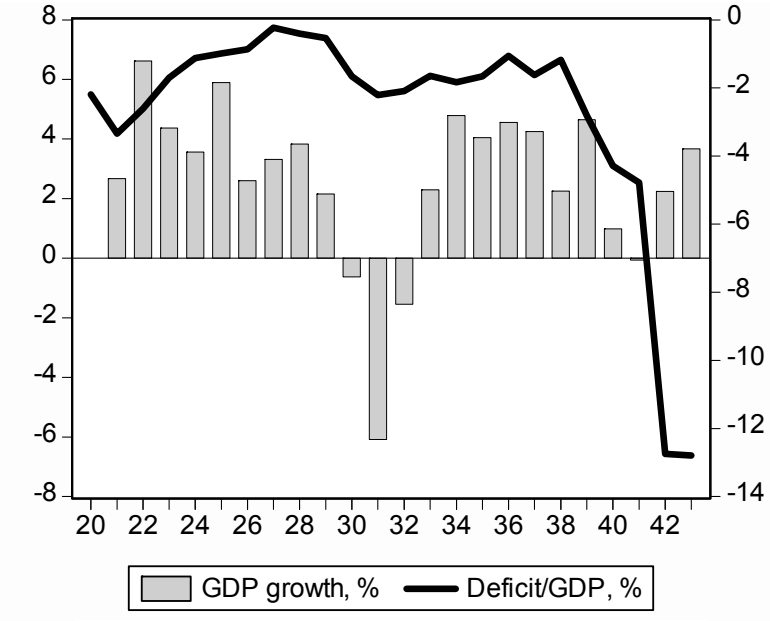


Figure 4 **Debt and GDP growth 1920–1944**

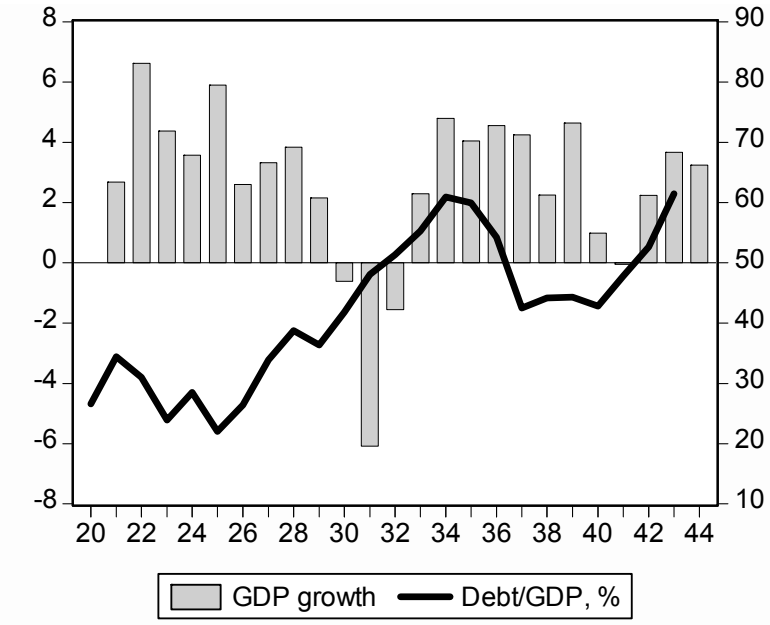


Figure 5 **GDP growth and output gap 1920–1944**

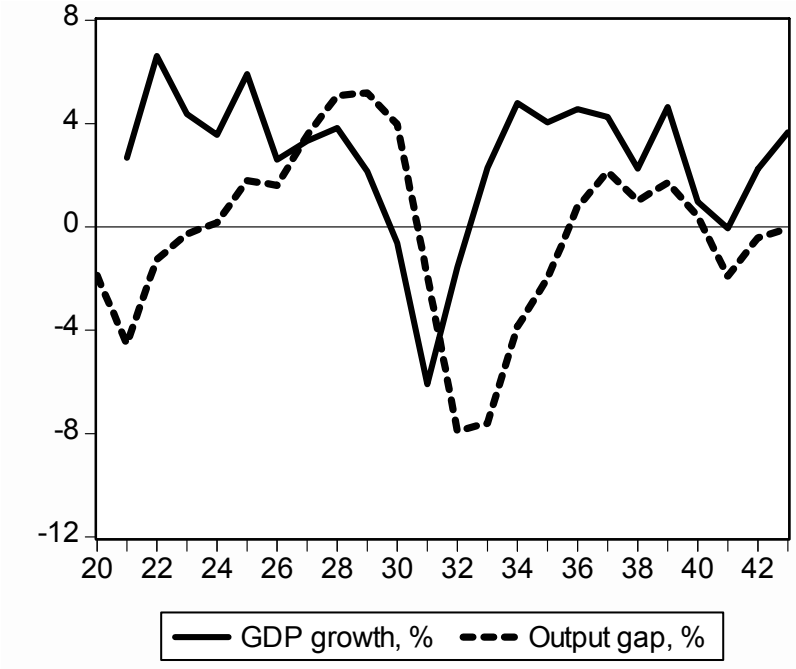


Figure 6 **GDP and industrial production 1920–1944**

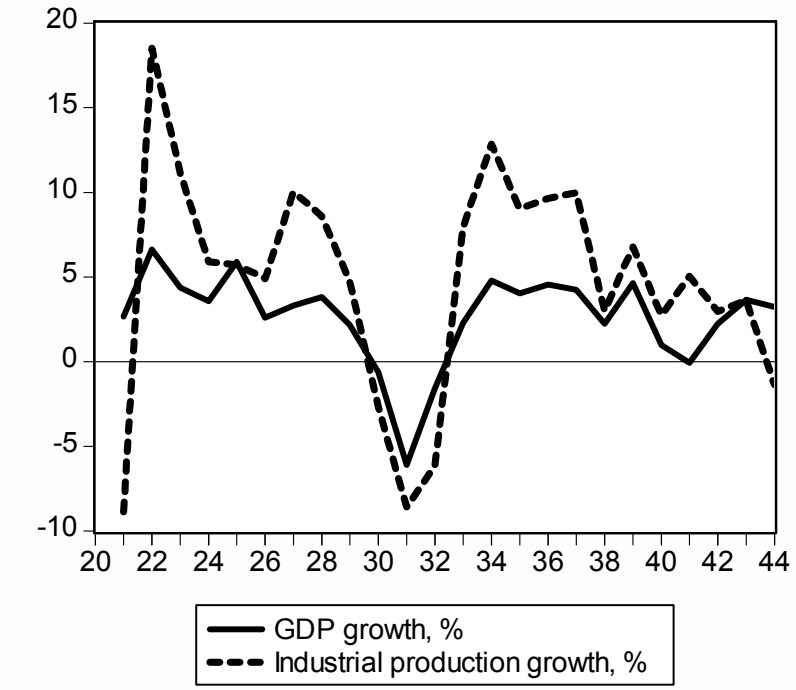


Figure 7 **Revenues and expenditures 1920–1944**

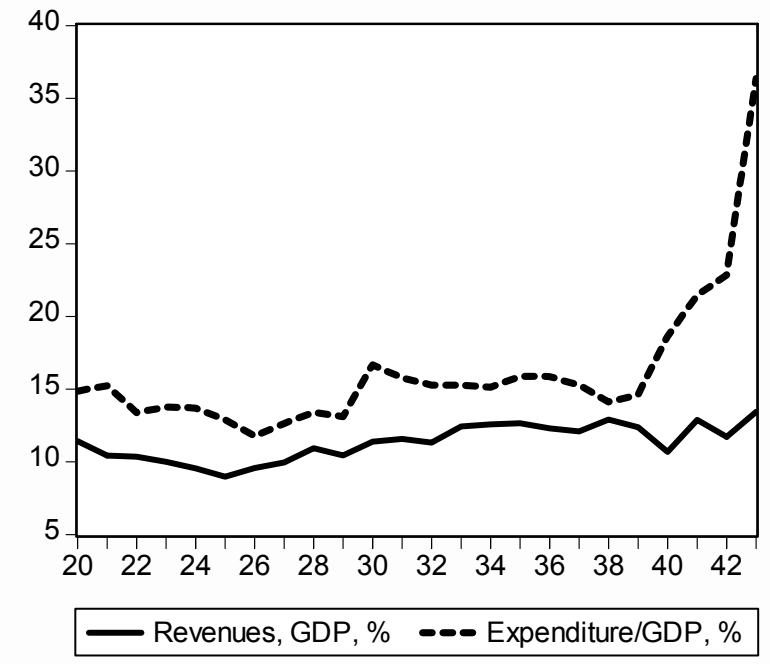


Figure 8 **Interest rates and prices 1920–1944**

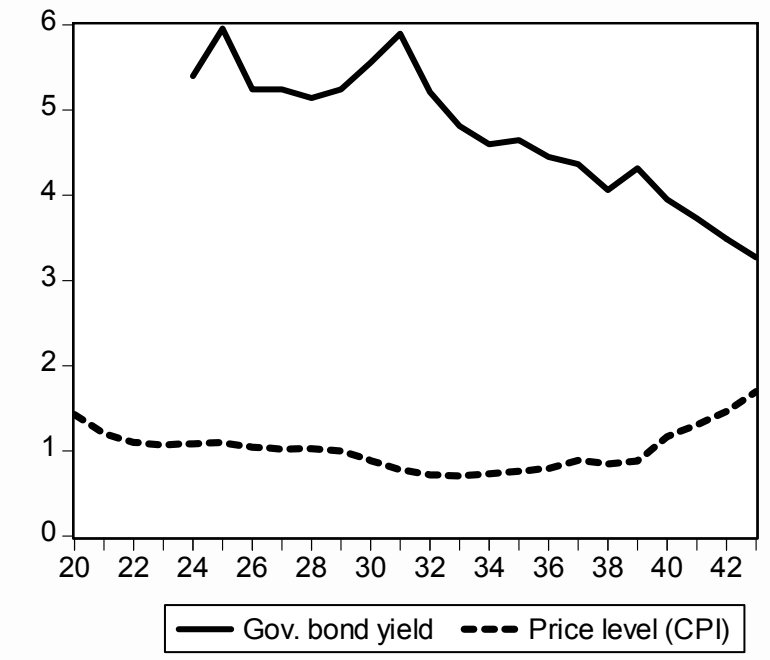


Figure 9 **Interest rates and prices 1920–1944**

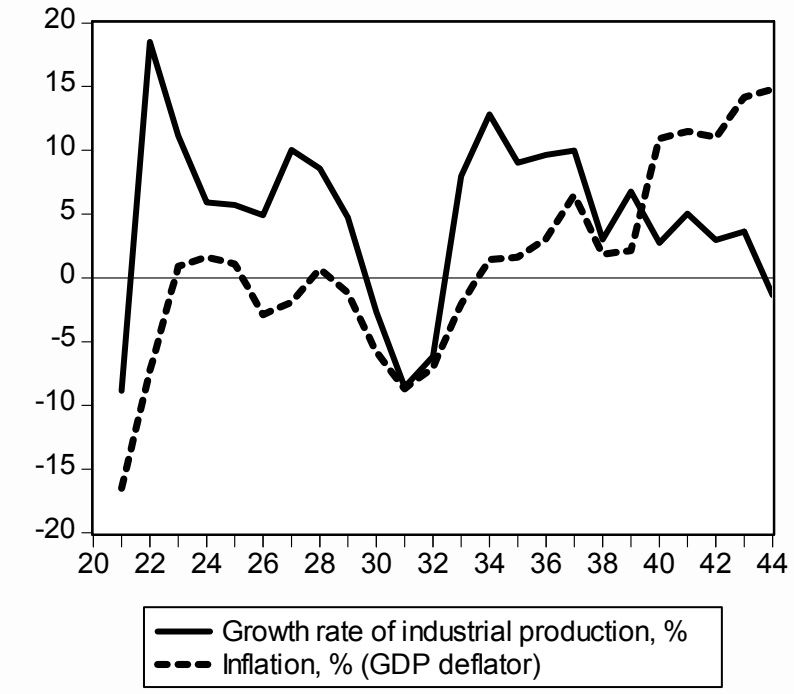
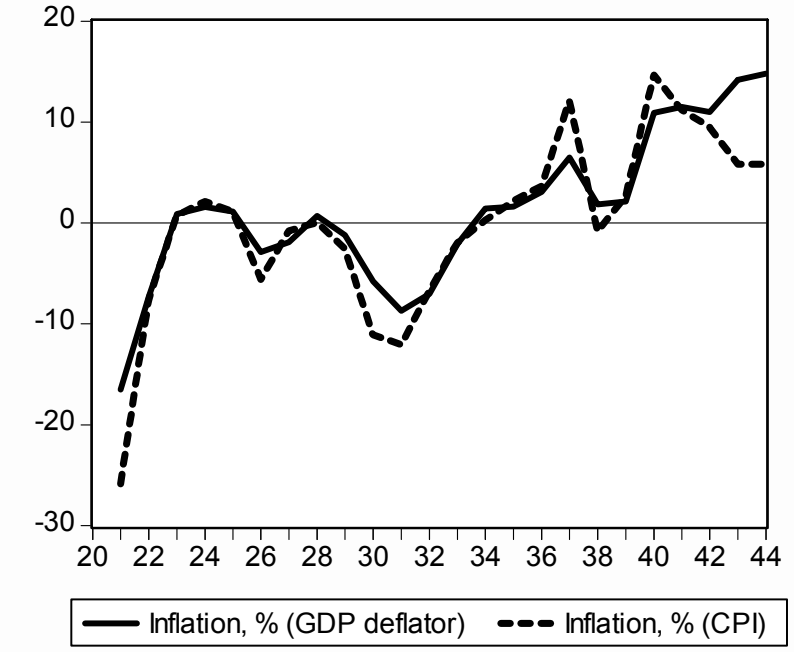


Figure 10 **Inflation 1920–1944**



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Suomen Pankki
Bank of Finland
P.O.Box 160
FI-00101 HELSINKI
Finland