

Discussion Paper No. 02-03

**Public Sector Centralization and
Productivity Growth:
Reviewing the German Experience**

Alexej Behnisch, Thies Büttner, and Dan Stegarescu

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Nontechnical Summary

Centralization in the public sector is often regarded as an unfavorable and hard-to-avoid tendency in the course of economic development associated with inefficient government expansion. Nevertheless, restraining the federal level comes at a cost, if federal government activities are important for a country's ability to coordinate public sector activities. This seems particularly relevant within the context of economic integration among local and state jurisdictions as, for instance, in the case of European integration. As emphasized in the literature on fiscal federalism, there are certain government functions where the effect of a government's policy decision is not confined to its own jurisdiction. Instead, in presence of high mobility of goods and factors, local policy decisions might exert external effects on other jurisdictions and the efficient supply of public services requires coordination among local and state governments. Possibly, but not necessarily, coordination of policies is achieved by the assignment of responsibilities to a central institution. From this perspective, it seems reasonable to argue that public sector centralization could be an important precondition and a driving force of economic growth. In order to empirically explore the role of (de-)centralization for growth this study focuses on the historical record of Germany from its foundation as a federal country in the 19th century to the present day.

The hypothesis of a stimulating impact of centralization on growth is laid out in a theoretical model emphasizing the role of benefit spillovers from public inputs between lower level governments. It turns out that as compared to a setting without coordination among governments, a central planner's solution would imply an increase in spending on federal public goods which benefits productivity and, under certain conditions, the rate of productivity growth.

To explore the link between economic growth and the vertical structure of the public sector empirically, two related, but distinct, approaches are employed. First, to assess the quantitative development over the long range, the analysis hypothetically assumes that at the time of its foundation, Germany displayed an inefficient, decentral structure of the public sector. With this presumption the analysis asks whether the development is consistent with a beneficial role of centralization. This is done by comparing the development of the public sector in terms of size and vertical structure with the development of productivity growth. A review of the development of the public sector, and, in particular, of the share of federal government expenditures, as an indicator of the share of federal goods supplied, in fact documents a significant secular – although stepwise – process of centralization from Germany's foundation until the 1970's. At the same time a significant increase in total factor productivity growth is indicated from growth accounting. A co-movement of productivity growth and centralization is also suggested by an inspection of specific policy areas, which are commonly regarded as playing a particularly important role for productivity growth. Whereas in

the area of science and education the federal expenditure share still remained small, until the 1970's public expenditures on transport and communication have been incurred increasingly by the federal level. Hence, although the descriptive evidence is not revealing the direction of causation, it can be stated that the pattern in the development of the public sector and of productivity is consistent with a stimulating impact of centralization on economic growth.

A second, more analytical approach, then, explores whether in fact the development of the federal system over the course of time has led to an efficient vertical structure with regard to productivity growth. More specifically, it asks whether in modern, post-war Germany a different vertical structure would have contributed to higher growth. The results of the regression analysis confirm a significant positive impact of the federal expenditure share on productivity growth after World War II. This suggests that a higher share of federal expenditures or, respectively, a smaller share of the state level, would have led to even higher rates of productivity growth.

Since fiscal federalism in Germany after World War II is characterized by complex connections between governments at all fiscal tiers, a higher share of federal public goods supplied may not only be brought about by higher federal expenditures but also by means of coordination among jurisdictions. As the analysis nonetheless shows a positive significance of federal government expenditures or, respectively, a negative significance of state government expenditures, it, therefore, indicates that the coordination of policies among state level governments as part of the cooperative federalism is not efficient with regard to productivity growth. Indeed, the negative impact found for the state level expenditures might be interpreted as an indication that the role of the state level in the German system of fiscal federalism is inefficient.

Of course, by focusing on efficiency with regard to productivity the current study has excluded many other possible government objectives. If state governments as compared to the federal government are more involved with the provision of public services other than public inputs, the current vertical division of responsibilities might well be efficient with respect to other objectives. However, given frequent criticism about disincentives of the German system of fiscal federalism, it seems nevertheless important to state that, whatever the objectives are, according to the empirical results the current structure of the public sector entails cost in the sense of foregone productivity growth.

Public Sector Centralization and Productivity Growth: Reviewing the German Experience[†]

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Abstract

The paper examines the role of the vertical structure of the public sector for economic growth in Germany in a long-term perspective. A theoretical model shows that, due to spillover effects of public service provision across lower level governments, federal government activities could have substantially contributed to productivity growth. A review of the German experience starting in the last quarter of the 19th century shows that the overall development is consistent with a stimulating role of the federal government in general and in specific areas like, for instance, transport and communication. However, a further empirical analysis of the period after World War II raises doubts about the efficiency of the vertical structure of the public sector with regard to productivity growth, since the results indicate that a smaller budget share of the state level would have benefited growth.

Keywords : Public sector centralization, public inputs, economic growth, fiscal federalism

JEL Classification : H72, H77, O11

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1 Introduction

Centralization in the public sector is often regarded as an unfavorable and hardly avoidable tendency in the course of economic development associated with the rise of the Leviathan or, less dramatically, with the increase in the overall inefficiency of the decision-making process in the public sector. The federalism literature emphasizes the importance of enforcing a more decentralized public sector, where several policy decisions are taken by local or state jurisdictions. By fostering learning processes, competition, and variety among the individual states decentralization will certainly have its merits, and the decentralization of the public sector might help to limit inefficient government expansion (Brennan and Buchanan, 1980). Nevertheless, restraining the federal level comes at a cost, if federal government activities are important for a country's ability to coordinate public sector activities.

This seems particularly relevant within the context of economic integration among local and state jurisdictions as, for instance, in the case of European integration. As emphasized in the literature on fiscal federalism (e.g., Oates, 1972), there are certain government functions where the effect of a government's policy decision is not confined to its own jurisdiction. Instead, in presence of high mobility of goods and factors, local policy decisions might exert external effects on other jurisdictions and the efficient supply of public services requires coordination among local and state governments. Possibly, but not necessarily, coordination of policies is achieved by the assignment of responsibilities to a central institution.

From this perspective, it seems reasonable to argue that public sector centralization could be an important precondition and a driving force of economic growth in the context of the European integration. Since, if the provision of public services exerts positive impacts on productivity and productivity growth (e.g., Aschauer 1989, Barro, 1990), one could think of an optimal vertical structure of the public sector which maximizes growth (e.g., Davoodi and Zou, 1998, and Xie et al., 1999). Of course, even an ideal public sector may have objectives other than raising productivity, and other considerations as for example to restrain the Leviathan will be important for the design of a federal system. But, if it could be shown that a different vertical structure of the public sector would yield higher productivity growth, it seems nevertheless legitimate to acknowledge foregone productivity growth.

In order to empirically explore the role of (de-)centralization for growth this paper focuses on the German experience. Despite substantial difficulties due to historical discontinuities and lack of data, it takes a long-term perspective from the formation of Germany as a federal state to the present day. The basic reason to include the early period into the analysis is to put the hypothesis of a beneficial role of centralization on productivity and growth in a historical con-

text. Especially, the comparison with the observed long-run development will help to point out the explanatory content and the limits of the theoretical argument of an impact of the vertical structure of the government on productivity and growth. Moreover, in the early period, Germany evolved from a collection of loosely connected states to an integrated economy where a significant role of centralized policies seems particularly likely. As the early Germany experienced significant growth at least in its industrial production, it is tempting to assume that the government has played an important role in economic development (Bowen, 1950). There are also striking fiscal parallels between the ongoing process of European integration and the integration process that formed Germany as a unified country. Like in 19th century Germany, tax authority in the EU remains largely with the states. Only tariff revenues belong to the EU as the central level, as was the case in pre-1914 Germany. Also, the struggle for the fiscal transfers of the member states to the EU budget has its historical antecedents in the early times of unified Germany, with its debate over the "*Matrikularbeiträge*". Although there are notable political differences, the economic parallels between the German and the European integration process suggest that a broad view on the German experience might contribute to the discussion of the role of central government activities for economic development and growth.

To explore the link between economic growth and the vertical structure of the public sector, the study employs two related, but distinct, approaches. To assess the quantitative development over the long range, the analysis hypothetically assumes that initially, i.e. at the time of its foundation, Germany displayed an inefficient, decentral structure of the public sector. With this presumption the analysis asks whether the development is consistent with a beneficial role of centralization. This is done by comparing the development of the public sector in terms of size and vertical structure with the development of productivity growth. In this regard, the analysis not only considers total expenditure but also the development in specific areas which are particularly concerned with the provision of public inputs, as for instance the public provision of transport and communication infrastructure. A second more analytical approach, then, explores whether in fact the development of the federal system over the course of time has led to an efficient vertical structure with regard to productivity growth. More specifically, it asks whether in modern, post-war Germany a different vertical structure would have contributed to higher growth. The results found are consistent with a positive role of centralization for productivity growth and suggest that a smaller budget share of the state level would actually have benefited overall growth in post-war Germany.

The paper proceeds as follows. The following section lays out the basic hypothesis of a stimulating impact of public sector coordination on growth. Section 3 provides a description of the public sector size and centralization in Germany beginning with its foundation in the 19th century and confronts this with the development of productivity growth. Moreover, subsections focus on the de-

velopment in the areas of transport and communication as well as science and education, functions of government which may be particularly relevant for productivity. Section 4 focuses on the period after World War II and relates centralization with productivity growth in a regression analysis. Finally, section 5 provides the conclusions.

2 Public inputs, coordination, and productivity growth

This section puts forward the argument that policy coordination may help to foster productivity and productivity growth in a highly stylized theoretical model of two jurisdictions. Following standard practice in the literature productivity is described using a macroeconomic production function relating output to factor input. Assuming a function of Cobb-Douglas type per capita output y at location i is

$$y_i = P_i k_i^\alpha, \quad (1)$$

where k_i denotes the capital intensity and P_i denotes total factor productivity (TFP). It reflects “the current state of technology used in producing the goods and services of an economy” (Griliches, 1998) and is in the following assumed to be affected by the supply of public services.

2.1 A local public good

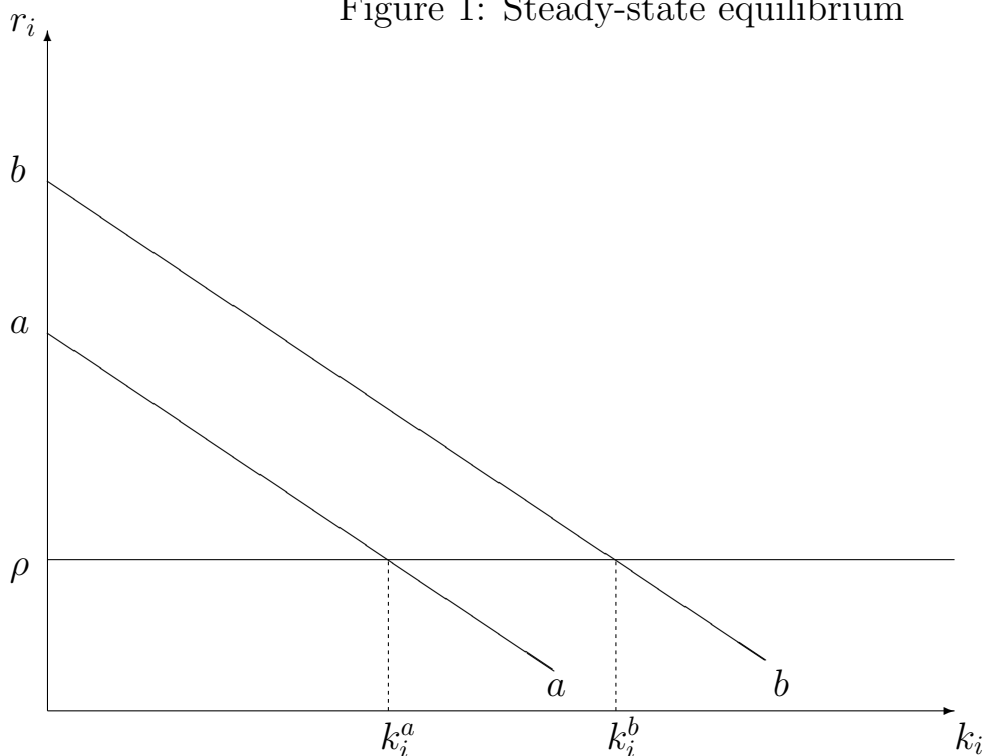
Consider the case of a local public good, which affects local productivity in a factor-augmenting fashion (Barro, 1990)

$$P_i = A g_i^\gamma, \quad (2)$$

where A denotes total factor productivity irrespective of public spending and g_i denotes per capita spending on the local public good. In a general setting we would have to take account of an impact of current as well as past government spending on current productivity pointing to a role of the accumulated stock of public capital. But whereas this would complicate the analysis it would not alter the results, qualitatively, as long as the productivity effect of public expenditures is limited and public capital depreciates over time. Hence, we assume that the level of public input supply is determined by current expenditures. If public expenditures are financed by a tax on value added, in the absence of debt, the budget constraint relates spending to tax revenue

$$\tau_i y_i = g_i, \quad (3)$$

Figure 1: Steady-state equilibrium



where τ_i is the tax rate. Assuming that firms treat the productivity impact of public inputs parametrically, i.e. that they do not take into account the global productivity impact of their decisions via the public budget, the after tax rate of return on capital is equal to its marginal product net of taxes and depreciation

$$r_i = \alpha (1 - \tau_i) P_i k_i^{\alpha-1} - \delta, \quad (4)$$

where δ denotes the rate of depreciation. Solving equations (1),(2), and (3) for the supply of public inputs and inserting into (4) we obtain

$$r_i = (1 - \tau_i) \alpha A^{\frac{1}{1-\gamma}} k_i^{\frac{\alpha+\gamma-1}{1-\gamma}} \tau_i^{\frac{\gamma}{1-\gamma}} - \delta. \quad (5)$$

Accordingly, the rate of return varies with the capital intensity and the tax rate depending on the parameters of the production function. If the productivity impact of public inputs is small, $\gamma < 1 - \alpha$, the rate of return declines with capital intensity. Capital accumulation of the economy then contributes to a decline in the rate of return and, consequently, saving and investment become less attractive over time. In the end, the economy approaches a steady state with a constant capital intensity where the rate of return just equals the rate of time preference.

The determination of the long-run conditions of the economy is depicted in Figure 1. The horizontal axis indicates the value of capital intensity. The negatively sloped line ($a - a$) represents the value of the rate of return corresponding to

a given capital intensity. The long-run equilibrium is determined by the intersection with the horizontal line reflecting the rate of time preference ρ . The long-run capital intensity is k_i^a .

An upward shift of the rate of return ($b - b$) results in a higher steady-state level of the capital intensity k_i^b . And, although the net rate of return is unchanged, the overall capital income is increased. Hence, a policy which aims at maximizing capital income will shift out the locus of the rate of return to the largest possible extent. Of course, it seems questionable to assume that the government maximizes capital income. But, in the current setting with a Cobb-Douglas production function, this is equivalent to maximizing overall income and consumption.¹ Therefore, a policy aimed at maximizing income or consumption will set the tax rate at a level which shifts out the locus of the rate of return as far as possible. Formally, we can derive the optimal policy by differentiation of equation (5) with respect to the tax rate. As in the analysis of Barro (1990) the optimal policy consists of a choice of the tax rate equal to the elasticity of output with respect to public inputs

$$\tau_i \stackrel{!}{=} \gamma. \quad (8)$$

Accordingly, the tax rate is set higher, if the impact of public spending on productivity is stronger. Without this impact, the tax rate would be zero.

2.2 A federal public good

Consider a case with two different public goods, a local and a “federal” public good. The former affects productivity only locally whereas the latter exerts significant benefit spillovers across local jurisdictions, formally

$$P_i = A g_i^\gamma f_i^{\mu\varphi} f_j^{(1-\mu)\varphi}, \quad 0 \leq \mu \leq 1, \quad (9)$$

where g_i captures spending on the local public good as above, and f_i is local spending on the federal public good. f_j denotes spending on the federal good by jurisdiction j . With the overall productivity effect of the federal public good denoted by φ , the contribution of the individual jurisdiction’s supply is deter-

¹Note that (per-capita) consumption c_i is given by net income exclusive of depreciation

$$c_i = (1 - \tau_i) P_i k_i^\alpha - \delta k_i. \quad (6)$$

Solving for P_i , inserting into equation (4), and setting the rate of interest to ρ we obtain

$$\left(\frac{\rho + \delta}{\alpha} - \delta \right) = c_i. \quad (7)$$

Accordingly, in the steady state consumption is proportional to the stock of capital.

mined by μ . As is shown in the following the existence of benefit spillovers gives rise to inefficient government policies.²

In case of uncoordinated policies, local policy at jurisdiction i determines the level of spending as well as the budget share of its own supply of the federal public good

$$\theta_i \tau_i y_i = f_i, \quad (10)$$

$$(1 - \theta_i) \tau_i y_i = g_i, \quad (11)$$

where τ_i is the local tax rate and θ_i is the budget share of the federal public good. The after tax rate of return on capital is

$$r_i = \alpha (1 - \tau_i) A g_i^\gamma f_i^{\mu\varphi} f_j^{(1-\mu)\varphi} k_i^{\alpha-1} - \delta. \quad (12)$$

Replacing f_i and g_i using (10), (11), (1), and (9) the rate of return can be expressed as a function of the capital intensity (k_i), the tax rate (τ_i), the budget share (θ_i) of the federal good, as well as of the spending on the federal good (f_j) by the other jurisdiction.

$$r_i = \alpha (1 - \tau_i) \left[A^{(1+\gamma+\mu\varphi)} k_i^{-(1-\alpha-\gamma-\mu\varphi)} f_j^{(1-\mu)\varphi} \tau_i^{(\gamma+\mu\varphi)} (1 - \theta_i)^\gamma \theta_i^{\mu\varphi} \right]^{\frac{1}{1-\gamma-\mu\varphi}} - \delta. \quad (13)$$

Without policy coordination the local government is assumed to choose its policy conditional on the spending decision of the other jurisdiction.³ Keeping the assumption that each jurisdiction aims at maximizing the steady state level of income generated at its location, the policy of a local jurisdiction can be derived by differentiation of the rate of return r_i with respect to τ_i and the spending share θ_i

$$\tau_i \stackrel{!}{=} \mu\varphi + \gamma, \quad (14)$$

$$\theta_i \stackrel{!}{=} \frac{\mu\varphi}{\mu\varphi + \gamma}. \quad (15)$$

As above, spending on the local good (g_i) is at the efficient level of γy_i . With $\mu\varphi > 0$ the tax rate is set higher than γ in order to finance spending on the federal good as well. The lower is μ the stronger are spillover effects from the federal public good, and, consequently, the lower is spending, despite of the fact that the overall productivity effect is fixed at φ . This reflects the basic inefficiency from

²Note that in difference to tax and expenditure competition models with local public inputs (e.g., Zodrow and Mieszkowski, 1986, and Seitz, 1994) the inefficiency arises from benefit spillovers not from the mobility of the tax base.

³As in the case of interjurisdictional competition (Seitz, 1994: 80ff.) local governments could alternatively be assumed to decide upon their policy conditional on the chosen policy parameters of jurisdiction j (τ_j, θ_j). Nevertheless, even with this alternative specification the decentralized setting with benefit spillovers would remain inefficient.

local provision of the federal good: each local government neglects the beneficial impact on the other jurisdiction's productivity.

In this situation the jurisdictions would benefit from policy coordination. An efficient outcome is achieved by a central planner who simultaneously determines the per capita amount of federal and local public goods supplied in each of the two identical jurisdictions. Given the symmetry of the model, the supply of public inputs now is determined by a uniform tax rate and a uniform share of local public inputs

$$\theta \tau y_i = f_i, \quad (16)$$

$$(1 - \theta) \tau y_i = g_i. \quad (17)$$

With the same tax rate and the same share of local public inputs also the value of the capital stock $k_i = k_j$ and the overall productivity $P_i = P_j$ are identical across jurisdictions. Consequently, the central planner maximizes r_i (and simultaneously r_j) at a given stock of capital by choosing τ and θ in the function

$$r_i = \alpha (1 - \tau) \left[A^{(1+\gamma+\varphi)} k_i^{-(1-\alpha-\gamma-\varphi)} \tau^{(\gamma+\varphi)} (1 - \theta)^\gamma \theta^\varphi \right]^{\frac{1}{1-\gamma-\varphi}} - \delta. \quad (18)$$

The first order conditions for a maximum rate of return are

$$\theta \stackrel{!}{=} \frac{\varphi}{\varphi + \gamma}, \quad (19)$$

$$\tau \stackrel{!}{=} \varphi + \gamma. \quad (20)$$

Again, the income share of spending on the local good is at a level of γ . But, the tax rate and also the share of spending on the federal public good are higher than in the decentral setting. Note that the policy parameters chosen are no longer affected by the benefit spillovers. As the intuition suggests, it can be shown that the rate of return is increased relative to the decentralized setting.⁴ In terms of Figure 1, this implies that the central planner's policy shifts out the locus of the rate of return relative to the policy of uncoordinated jurisdictions and thus brings about an increase in the steady state level of capital.

⁴The two solutions can be compared by inserting the corresponding policy parameters into equation (18). Denoting the rate of return in the central planner's and in the decentralized setting with r_i^c and r_i^d , respectively, at each value of the capital intensity the ratio of the (gross) rate of returns is given by

$$\frac{r_i^c + \delta}{r_i^d + \delta} = \left(\frac{1 - \gamma - \varphi}{1 - \gamma - \mu\varphi} \right) \mu^{\frac{-\varphi}{1-\gamma-\varphi}}.$$

This expression equals unity at $\mu = 1$, and is decreasing in μ . Consequently, with significant benefit spillovers $\mu < 1$ the central planner's solution yields a higher rate of return.

2.3 Steady state growth

The preceding analysis has assumed that in the long-run accumulation of capital comes to an end, as the rate of return declines in the value of capital. However, Barro (1990) uses the model of section 2.1 to show that, provided the productivity of public inputs is strong enough, public sector activity may generate sustained growth in the economy. In the model with the federal good this would be the case, if

$$\alpha + \gamma + \varphi = 1. \tag{21}$$

Then, as can be seen from equation (18) the rate of return is no longer decreasing in capital. In fact, the rate of return becomes independent of the stock of capital. And, if the rate of return is higher than the rate of time preference ρ , it would always be beneficial to increase the stock of capital in order to increase future earnings.

The optimal policy will be the same, irrespective of whether there is unlimited growth. The only difference is that the policy is not maximizing the level of consumption in the steady state but its rate of growth. Formally, with the parameter restriction (21) the rate of growth is obtained from the familiar Ramsey rule (e.g., Barro and Sala-i-Martin, 1995)

$$\hat{c}_i = (1/\eta) (r_i - \rho),$$

where \hat{c}_i denotes the rate of change of (per capita) consumption and η denotes the elasticity of the marginal utility of consumption. Assuming that η is constant,⁵ the above reasoning to determine policies, by assuming that the local governments or the central planner maximize the rate of return, can be directly applied as well to the maximization of the rate of growth of consumption. Consequently, we can state that the rate of growth in the decentralized setting is smaller than that achieved by the central planner.

However, the possibility of sustained growth has sort of a knife-edge character (Solow, 1994), since a small deviation from the above parameter condition yields a petering out of the growth process, or, to the contrary, an explosion of growth. Although, one might think of an evolutionary process which over the course of history leads to a selection in the sense that less efficient federal designs are given up or disappear, possibly no such mechanism is available to prevent parameter constellations which are explosive. Nevertheless, despite of the strong assumption about the production elasticities of public and private inputs, growth models of this type actually form the basis of empirical studies aimed at assessing the efficiency of the composition of the public sector with respect to productivity growth. Deverajan et al. (1996) consider the role of the composition of the public

⁵This is equivalent to assuming a constant intertemporal elasticity of consumption.

sector with respect to different functions of government. Davoudi and Zou focus on the vertical composition, i.e. on the role of (de)-centralization using data for several countries. Finally, Xie et al. (1999) analyze the role of centralization among the US. states. Also, note that with limited time periods available for empirical analysis the issue of whether an observed secular increase in productivity should be regarded as an adjustment towards a new, higher, steady state level of productivity, or, alternatively, as evidence for a continuous process of productivity increases cannot be finally resolved by means of an empirical analysis, anyway. Therefore, we follow the literature and focus on the relationship between productivity growth and centralization.

2.4 Empirical implications

The theoretical discussion suggests that centralization may contribute to productivity growth in the presence of public goods which have an impact on productivity and exert spillover effects between jurisdictions. As uncoordinated policies imply an inefficiently low supply of those “federal” public inputs, productivity gains are achieved by a central planner, who raises the supply of such public goods. Formally, the previous section gives rise to a relationship between productivity growth, the total public budget, and the overall spending share of the federal good

$$\widehat{P} = \widehat{A} + \beta_1 T + \beta_2 \Theta, \quad (22)$$

where \widehat{P} denotes the rate of productivity growth, \widehat{A} is the autonomous level of growth, T denotes the income share of total public spending, and Θ is the budget share of expenditures on the federal good. A positive coefficient β_2 indicates that a higher share of federal goods would stimulate productivity growth. A negative coefficient suggests that productivity growth would benefit from a reduction of the share of federal goods. In order to derive empirical implications it is essential to make a statement about the policy, as the sign of the two indicators of public sector activities depends on whether or not the size and structure of the public sector equals the central planner’s solution (indexed with C), formally

$$T \gtrless T_C \quad \Rightarrow \quad \beta_1 \lesseqgtr 0, \quad \text{and} \quad \Theta \gtrless \Theta_C \quad \Rightarrow \quad \beta_2 \lesseqgtr 0.$$

Suppose size and structure of the public sector are efficient, and there are only small perturbations. Then, there should be no significant relationship between both the level of expenditures and the degree of centralization on the one hand and productivity growth on the other hand, since there is no room for improvements. Thus, following Davoudi and Zou (1998) as well as Xie et al. (1999) an estimation of the relationship in equation (22) can be used to test for the efficiency of the vertical structure of the public sector with respect to produc-

tivity growth. A negative coefficient β_2 would be interpreted as an indication of a too high spending share for the federal good, whereas, conversely, a positive coefficient points to a too low share of spending on the federal good.

Two distinct, although related, empirical implications can be drawn depending on the initial situation. Assuming that the initial situation of Germany at the time of its foundation in the 19th century is characterized by an inefficient, decentralized setting ($T < T_C, \Theta < \Theta_C$), an expansion of the public sector together with centralization should be accompanied with an increase in the rate of productivity growth over time. Moreover, as not all public spending is equally important for productivity, specific policy areas, more closely related to the provision of public inputs, should play a particular prominent role in the process of centralization and government expansion.

This descriptive view on the relationship between productivity growth and the public sector is related to Popitz (1927) who argues that there is a clear tendency towards centralization of the public sector in the process of economic development. Among other factors which contribute to an increased role of the central government Popitz explicitly mentions economic integration.⁶ However, because Popitz mixes normative and positive perspectives on the development of the public sector, it is not obvious as to what extent he considers a centralization of the public sector as the source for increased productivity growth. But, at least, his discussion suggests that insufficient centralization in the public sector would harm the economic development.

In the later stages of the German federation, it seems difficult to still assume that the initial situation is characterized by a decentralized setting. Instead, the second approach explores whether the development of the federal system over the course of time has led to an efficient vertical structure with regard to productivity growth. More specifically, it uses an empirical estimate of the parameters of equation (22) to infer whether in modern, post-war Germany a different vertical structure would have yielded higher growth.

As the supply of federal goods is difficult to measure, the budget share of the federal government – for simplicity denoted as the “degree of centralization” – is used in the following as a proxy variable for the share of federal goods supplied. There are of course many limitations of this approach. First, as evident already from the theoretical model, federal public goods need not necessarily be supplied by the federal level. And, second, the federal level need not necessarily confine itself to the supply of federal goods. In fact, as argued by Popitz (1927), in a process of economic development and integration the division line between local and federal public goods will become less clear-cut. Moreover, in the presence of intergovernmental grants and revenue sharing, the vertical structure in terms

⁶“Die Entwicklung des Deutschen Reiches [...] zeigt, [...] daß eine einheitliche Wirtschaft auf dem Gebiete des Rechts und der Gewerbeförderung zum mindesten gemeinsame Gesetzgebung voraussetzt [...]” (Popitz, 1927: 347).

of expenditures is not always indicative of the vertical structure in the decision making process behind public expenditures (Blankart, 1999a). And, finally, expenditure figures fail to capture the extent of legislative and regulatory activities of governments (e.g., Zimmermann, 1973). However, using the share of federal government expenditures as a measure of the provision of federal goods has the definite advantage of being operational. As we do not see a reasonable alternative we will use the budget share in the following, keeping in mind that this indicator can be misleading and needs to be complemented in some cases with a discussion of legislative activities and specific features of the federal decision making process.

3 Public sector development and productivity growth

In order to discuss the underlying development of public sector growth and centralization from the formation of Germany as a unified state in the 19th century to the present day, this section examines the development of the public sector in general as well as differentiated with regard to fiscal tiers and contrasts this development with the rate of productivity growth. To provide a quantitative picture of the development of the public sector, we assembled data from a variety of sources. In particular for the pre-World War II period, we draw from existing studies by Andic and Veverka (1963), Hoffmann (1965), Weitzel (1968), and Recktenwald (1962, 1975). A detailed description of sources is provided in the appendix.

3.1 Overall development of the public sector

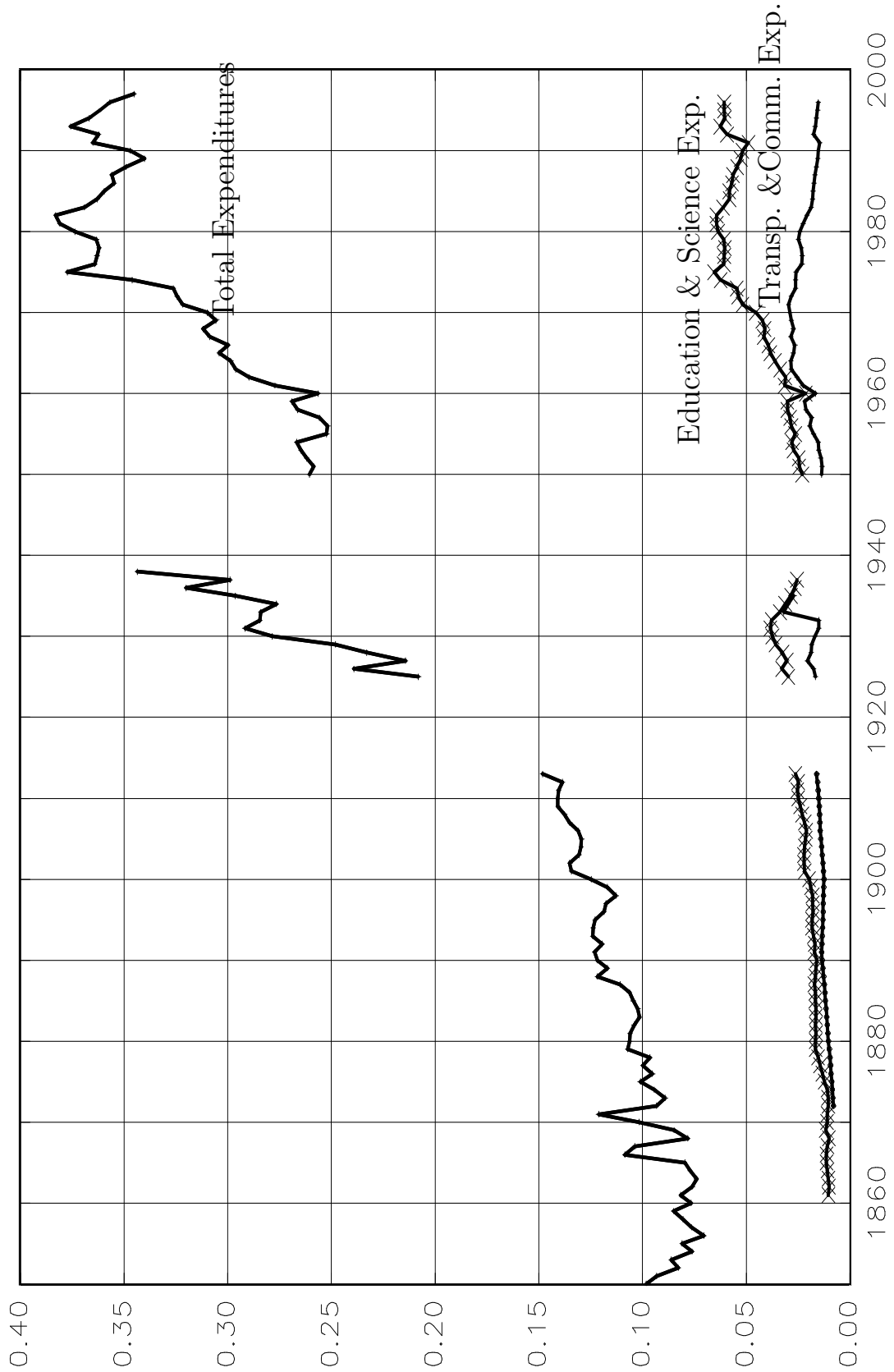
Figure 2 plots the ratio of total public expenditures without social insurance as percentage of net national product at market prices (NNP).⁷ As there are no data available for the periods around World War I and II the development is decomposed in three periods: pre-1914, interwar, and post-1950. With regard to the first period, the development of the public sector is characterized by a stagnation in the 1850's and early 1860's. During the struggle for German unification until 1871 we see some significant fluctuations, but after unification, there is a relatively steady, if not rapid, expansion. From a minimum at 7.1% in 1856, the share of total public expenditures as a percentage of NNP more than doubled to 14.8% in 1913.

The second period after World War I takes off with significantly higher public spending, which demonstrates the “displacement effect” of wars (Peacock and

⁷The data for total public expenditures are based on calculations from Hoffmann (1965), Statistisches Bundesamt (1991b), and Sachverständigenrat (1998), see appendix.

Figure 2: Public sector growth in Germany, 1850-1997

Public expenditures relative to net national product at market prices



Wiseman, 1961). By far the biggest and most rapid increase of the public sector's share occurred during the short inter-war period from 1925 to 1938. The share of total public expenditures as percentage of NNP rose within only 13 years from 20.8% in 1925 to 34.4% in 1938. Including social insurance, Andic and Veverka (1963) even report an increase of the public sector's share to 42.5% in 1938. In order to explain this extraordinary expansion of the public sector, three factors seem to play a crucial role. First, there is a remarkable *regular* rise in public expenditures regarding education, housing, and social affairs (even without social insurance) due to the formation of a comprehensive welfare system during the Weimar Republic. Second, then, war-related expenditures are responsible for a second, *irregular* increase of public expenditures. At the beginning of the Weimar Republic war damage compensation in accordance with the treaty of Versailles amounted to more than 10% of total public expenditures (Statistisches Bundesamt, 1972). Later on, Nazi Germany started its remilitarization and military expenditures are a major driving force of public spending (Andic and Veverka, 1963). Third, finally, the business cycle partly explains this pattern of public sector growth. Whereas, in consequence of the Great Depression from 1929 to 1932, the national product actually declined, public expenditures remained mostly at their high levels, or even increased as, for example, in the case of welfare expenditures.

In the immediate post-World War II period, in difference to the displacement effect of World War I, the ratio of public expenditures to NNP started with a level of 26.1% in 1950 which is slightly lower than the pre-Nazi level (1933: 28.4%). The sixties are characterized by significant growth up to 31.0% in 1970, and, corresponding to the change towards a Social and Liberal Democratic government in 1969, there is another sharp increase of public expenditures to a peak of 38.3% in 1982. Following the change of government in 1982 there is a small decline in the public sector's share to 34.0% in 1989. However, after German re-unification in 1990, additional public spending concerning the reconstruction of East Germany led again to an increase of the public sector size to 37.6% in 1993 and a modest decline thereafter.⁸

In conclusion, the general trend from the middle of the nineteenth century to the present day indicates an increase of the public sector share by almost five times during the past 150 years: from an average of 8% for 1850-65 to an average of nearly 38% in 1992-97.

3.2 Allocation of expenditures by fiscal tiers

A quantitative examination of the development in the vertical structure of the public sector faces serious difficulties, in particular regarding the period until

⁸Due to the inclusion of the debt of the East German economy in the public sector the figure for 1995 is suppressed.

1913.⁹ Figure 3 only reports five observations in the early period (see also the corresponding Table 1). With this qualification, the federal level's share seems to have remained rather stable with 29.3% in 1881 and 27.8% in 1913. But, as depicted in Table 1, there is a significant increase of the spending at the local level, i.e. of the municipalities. Tilly (1997) notes that municipal government expenditures, especially driven by investment activity, grew clearly faster than the national product during this period. Legler et al. (1988) find a similar increase of local spending towards the end of the 19th century in the U.S., arguing that this gain in local spending reflects the process of urbanization. Nevertheless, this period shows a gradual gain in importance of the federal relative to the state level, as there is a strong decline of the state level's share of total public expenditures (without social insurance) from 44.4% in 1881 to 35.5% in 1913, whereas the federal share more or less remained constant.

After World War I, the federal level starts with a much higher budget share, which, again, is related to the displacement effect of wars (Peacock and Wiseman, 1961). The Weimar Constitution transferred a number of expenditure functions from the state to the federal level, and it also introduced new expenditures on social assistance and education which were previously assigned to the local level (Laufer and Münch, 1997). Nevertheless, in the Weimar period the increase in the relative size of the local level continued, as its expenditure share increased from 36.9% in 1925 to 41.1% in 1932. The development of the budget share of the other fiscal tiers shows no clear pattern: the state level's share of total public expenditures first declined from 27.8% in 1925 to 24.0% in 1930, and then rose again to 26.8% in 1932. The federal level expanded from 35.3% in 1925 to 38.3% in 1930, and afterwards fell to 32.0% in 1932. With the beginning of the Nazi period in 1933, Germany ceased to be a federal system. With remilitarization and the consolidation of the Länder (*"Gleichschaltung"*), increasingly crucial public expenditures were allocated to the central level. As Andic and Veverka (1963) suggest, the federal government's share of total public expenditures made up as much as 75.9% in 1938.

The third period from 1950 to 1997 starts with a substantially higher share of federal expenditures as compared to the pre-Nazi period. In addition, we see a significant positive jump in the scale and share of state level expenditures (see Table 1). Moreover, the state level share also shows a continuous increase during the whole period until 1990. In contrast to the inter-war and pre-1914 periods, this points to a decentralization trend in expenditures, indicative of a fiscal re-emergence of the state level in this later stage of German federalism.¹⁰

⁹Although the Reichsschatzamt (1908) provides in its *"Denkschriftenband"* data for some single years, it is important to note that these figures are only of limited use and reliability, since the local level is not adequately taken into account. In order to give a rough indication, we use the estimates of Andic and Veverka (1963). For the post-World War II period, data according to the *Finanzstatistik* from the Statistisches Bundesamt (1972, 1998b) are employed. For more details, see appendix.

¹⁰Note that the apparent degree of centralization on the expenditure side does not take account of the low fiscal autonomy at the revenue side of the states' budget, see below.

Figure 3: Centralization in the public sector in Germany, 1881-1997
 Share of federal government expenditures

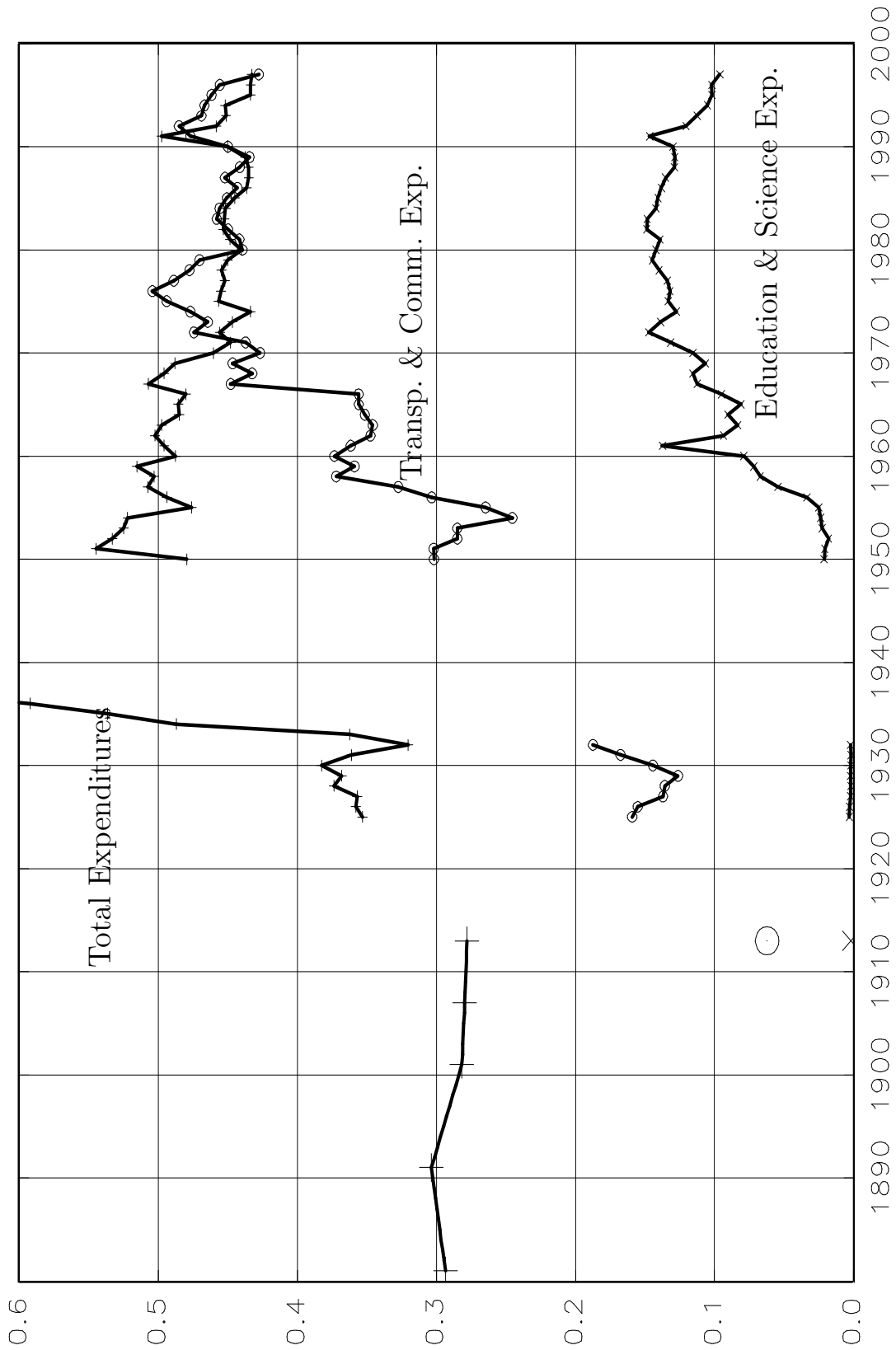


Table 1: Allocation of public expenditures by fiscal tiers in Germany, 1881-1997

Period	Federal gov.		State gov.		Local gov.		Sum ^d
	% NNP ^a	share ^b	% NNP	share	% NNP	share	
1881	3.09	29.34	4.68	44.39	2.77	26.27	10.54
1891	3.91	30.37	5.52	42.86	3.45	26.77	12.88
1901	3.94	28.16	5.53	39.52	4.53	32.32	14.01
1907	4.19	27.95	5.35	35.68	5.45	36.37	14.99
1913	4.60	27.81	5.88	35.53	6.07	36.66	16.55
1881-1913	3.58 ^c	28.73	5.39	39.60	4.45	31.68	13.79
1925-1932	8.41	35.92	6.02	25.73	9.01	38.36	23.44
1933-1937	13.21	52.84	4.60	18.42	7.17	28.73	24.98
1925-1937	10.26	42.43	5.47	22.92	8.30	34.65	24.03
1950-1973	16.42	49.32	10.18	30.61	6.67	20.07	33.27
1974-1990	16.50	44.63	12.84	34.75	7.62	20.61	36.96
1950-1990	16.46	47.38	11.28	32.33	7.06	20.30	34.80
1992-1997	17.01	44.36	13.37	34.89	7.96	20.75	38.34

Note: ^a) Net national product at market prices. ^b) As percentage of total public expenditure without social insurance and payments to the EU. ^c) The calculation of the average uses continuous data. ^d) Because of differences between national and financial accounts not equivalent to the total expenditure series in section 3.1 and in Table 2.

Whereas the federal level's share of total public expenditures decreased from its peak of 54.5% in 1951 to 45.0% in 1990 and 43.3% in 1997, the state level's share rose from 27.8% in 1951 to 34.1% in 1990 and 36.6 % in 1997. The local level, too, increased its share from 17.8% in 1951 to 20.9% in 1990 and 20.1% in 1997. Nonetheless, in comparison to its pre-World War II share, the local level remained relatively weak (cf. Blankart, 1999b).

Altogether, the figures indicate a secular increase of the federal expenditure share in Germany. Rather than showing a monotonous pattern, the development is characterized by stepwise increases corresponding to changes in the political system (Recktenwald, 1975: 745ff). However, the sequence of increases in the federal expenditure share has come to an end in the post-World War II period, more specifically in the 1970's.

3.3 Expenditures on transport and communication

As public expenditures on transport and communication may help to encourage mobility and interaction between jurisdictions, this area is particularly important

Table 2: Public expenditures for education, science, transport and communication in Germany, 1881-1997

Period	Transport & Communication			Education & Science			Total Exp.		
	Exp. lev. % NNP ^a	State gov. share ^b	Fed. gov. share	Exp. lev. % NNP	State gov. share	Fed. gov. share	Exp. lev. % NNP	State gov. share	Fed. gov. share
1881	1.06	-	-	1.64	-	-	10.59	44.39	29.34
1891	1.36	-	-	1.72	-	-	12.31	42.86	30.37
1901	1.28 ^c	-	-	2.18	-	-	13.43	39.52	28.16
1907	1.45 ^c	-	-	2.17	-	-	13.51	35.68	27.95
1913	1.60	29.78	6.21	2.63	37.47	0.17	14.81	35.53	27.81
1881-1913	1.35	-	-	1.96 ^e	-	-	12.34 ^e	39.60	28.73
1925-1932	1.73	17.97	15.15	3.44	55.11	0.22	24.97	25.73	35.92
1933-1937	2.96 ^d	-	-	2.91	-	-	29.52	18.42	52.84
1925-1937	2.07 ^d	-	-	3.24	-	-	26.72	22.92	42.43
1950-1973	2.26	30.07	36.11	3.47	63.38	7.84	28.50	30.61	49.32
1974-1990	2.06	29.34	46.06	5.96	69.71	13.72	36.19	34.75	44.63
1950-1990	2.18	29.77	40.24	4.50	66.01	10.28	31.69	32.33	47.38
1992-1997	1.59	28.35	46.11	6.05	70.07	10.63	37.55	34.89	44.36

Note: ^a) Net national product at market prices. ^b) As percentage of total public expenditure without social insurance and payments to the EU. ^c) Interpolations based on Weitzel (1968). ^d) Data are only available for 1925-35. ^e) The calculation of the average uses continuous data.

for exploring the relationship between centralization and productivity growth.

Whereas the overall pattern of development is depicted in the Figures 2 and 3, Table 2 lists numbers on the level of spending as well as the share of the state and federal levels.¹¹ Total public expenditures on transport and communication as a percentage of NNP amounted only to 1.1% in 1881, and increased to 1.6% in 1913. After World War I, the level of transport expenditures relative to NNP increased slightly to 2.1% in 1927, and declined in consequence of the Great Depression to 1.5% in 1932. Despite a lack of reliable data for the Nazi period, one might speculate about a rise in transport expenditures after 1933.¹² Starting from a level as low as 1.4% in 1950 transport and communication expenditures more than doubled in 20 years to a peak of 3.0% in 1971. Afterwards, they

¹¹The data are taken from Weitzel (1968) and Statistisches Bundesamt (1972, 1998b). For more details, see the appendix. More historical details on the role of the public sector in the area of transport and communication and further bibliographical references are provided by Tilly (1976) and Borhardt (1976).

¹²Indeed, Hoffmann's (1965) figures on net investments on roads also suggest such an increase for the post-1933 period. This is consistent with the enforced expansion of the road network as part of the Nazi's war preparations.

declined to just 1.4% in 1997 – a level as low as in the 1950s, and even lower than during the inter-war period. This relative decline of public expenditure in the area of transport and communication is probably due to the fact that the large-scale construction of basic infrastructure had been accomplished by this time, as well as to privatizations of large parts of the transport and communication infrastructure, and, finally, it might be caused by the EU's new role in these infrastructure projects.¹³

With regard to the allocation of transport and communication expenditures by fiscal tiers the data exhibit a significant centralization process (cf. Albers, 1964). The federal level's share of total transport and communication expenditures rose from 6.2% in 1913 to 16.0% in 1925. After a short decline to 12.6% in 1929, it increased again to 18.7% in 1932. During the post-World War II period, the federal level's share expanded rapidly from 30.2% in 1950 to a peak of 50.4% in 1976. Although the federal level's share subsequently decreased to 42.8% in 1997, it remained still fairly high. As depicted in Table 2, the state level's share, in contrast, declined from 29.8% in 1913 to 20.5% in 1925, and even only 16.8% in 1932. After World War II, the state level's share rose again to its pre-World War I level of 32.8% in 1950. Afterwards, however, it witnessed a minor decline to 29.3% in 1997. With a share of 64.0%, the local level was by far the most important fiscal tier regarding transport spending in 1913. Local authorities thus played a significant role during the process of industrialization, especially from 1897 to 1912, by providing public infrastructure (Tilly, 1997). This role was then quickly taken over by the state and, in particular, the federal level. After rising to its absolute peak of 69.7% in 1929, the local level's share thus declined to 64.5% in 1932, and just 37.0% in 1950. Subsequently, it even dropped to 21.3% in 1975, remaining more or less at this low level until reaching 27.9% in 1997.

But beyond this leading role of the federal level in transport and communication expenditures after World War II, policy coordination could have further contributed to an increase in federal public goods and thereby stimulated productivity growth. Particularly with regard to transport, joint public activities (*“Gemeinschaftsaufgaben”*), formally defined in Article 91 of the *Grundgesetz*, represent an important aspect of policy coordination.¹⁴ In addition, the regulative powers of the federal level might have a dominant position in the transport and communication sector. Likewise, the EU exercises now significant regulative powers in this area (Majone, 1994).

¹³For the Europeanization of public expenditures, see Schmidt (1999).

¹⁴For more details, see Laufer and Münch 1997.

3.4 Expenditures on education and science

Although there might be possible substitution effects with private education, the level and vertical structure of government activities in the area of education and science might be important for economic growth as well. With factor mobility public efforts to improve education will exert benefit spillovers across jurisdictions and, hence, coordination could benefit policy effectiveness. Similarly, with significant economic integration productivity effects of science and research activities will not be confined to individual states. However, it should be noted that as the benefit from learning processes, competition, and variety among institutions might be particularly strong in this field, central planning and egalitarian policies which are often related to centralization could lead to serious inefficiencies.

With regard to the overall development, total public expenditures on science and education as a percentage of NNP grew steadily during the pre-1914 period from 1.0% in 1861 to 2.6% in 1913.¹⁵ Together with the expenditure increase this period saw a modernization and extension of the public school system, and, particularly in the last two decades until 1914 universities and newly founded technical schools and other publicly supported research institutes experienced an upswing. With the further extension of compulsory education and the public school system and with the introduction of public financial aid schemes for education in the Weimar Republic, the ratio of science and education expenditures rose to 3.8% in 1931. After the Nazis came to power, however, this expansion was followed by a sharp decline to 2.6% in 1937.¹⁶

In the post-World War II period, science and education expenditures started from a lower level as compared to the Weimar Republic. With only 2.3% in 1950, the ratio of science and education expenditures as a percentage of NNP was thus as low as in 1908. From this low starting point, then, science and education expenditures almost tripled in 25 years and grew to 6.6% in 1975, reflecting governmental initiatives to promote secondary and tertiary education. Yet, after reaching a second peak of 6.4% in 1981, the ratio of science and education expenditures again declined to 4.9% in 1991. Only due to additional spending in relation to German reunification in 1990, finally, the share of public expenditures on science and education increased again to 6.0% in 1997. This general pattern of development is found also for the relative share within the total public budget. The area of education and science thus more than doubled its share within the public budget from 7.3% in 1950 to 17.3% in 1974. Afterwards, this share declined steadily to 13.8% in 1991. After a short post-reunification

¹⁵The data are taken from Hoffmann (1965) and Statistisches Bundesamt (1972, 1998b). For more details, see the appendix. An alternative data source on research and science expenditures is provided by Pfetsch (1974, 1982). Despite of some unresolved interpretation problems, these data broadly fit with the figures present here.

¹⁶For a detailed historical perspective on public sector activities in the area of education and science, see Conze (1976) and Pfetsch (1974).

increase of education expenditures, it is reported with 16.4% in 1997.

The federal expenditure share in the area of education and science is difficult to capture before 1913. From 1913 to 1932 the federal level's share of education and science expenditures remained at a low level of about 0.2%. After World War II, there is a centralization process, as the federal level's share reached a first peak of 13.7% in 1961. Growing subsequently only slowly to 14.7% in 1991, it declined again to 9.6% in 1997. Thus, in purely quantitative expenditure terms, the federal level remained quite weak in the area of education and science. A more rapid growth pattern can be observed for the state level's share. Starting from 37.5% in 1913, it increased to 58.3% in 1932. For the post-World War II period, the state level's share increased even further from 61.0% in 1950 to 71.6% in 1997. In contrast, local education and science expenditures declined dramatically. From 62.5% in 1913, the local level's share of total education and science expenditures decreased to 41.5% in 1932. Afterwards, the local level's involvement in education and science was furthermore reduced from 36.9% in 1950 to just 15.3% in 1991, increasing only slightly to 18.8% in 1997.

In accordance with the constitutional assignment (*"Kulturhoheit der Länder"*), the state level clearly emerged as the most important fiscal tier in charge of education and science expenditures. After 1871, education policy in Germany continued to be the domain of the states. However, this state level responsibility has always been counterbalanced by policy coordination. First attempts of coordinating university policies were established at a common university conference at ministerial level as early as 1898. Today, there exists with the *"Kultusministerkonferenz"* (KMK) a powerful body of all state governments aiming to coordinate numerous matters of education policy. Moreover, with the aim of coordinating education policy between the federal and the state level, the *"Bund-Länder-Kommission für Bildungsplanung und gemeinsame Forschungsförderung"* (BLK) establishes another means of policy coordination and joint legislation, regulation and financing in the area of education and science.¹⁷

3.5 Centralization and productivity growth

To contrast the development of the public sector with productivity growth, this subsection reports figures obtained from a standard growth accounting procedure which measures the rate of change of total factor productivity (TFP). Leaving a discussion of the method and the data sources to the appendix, the results are summarized in Table 3.

Accordingly, the average growth of the net domestic product in constant prices¹⁸

¹⁷For more details, see Laufer and Münch (1997).

¹⁸For the period 1850-1937 the net domestic product is employed, since only this is available in constant prices. After 1950 the growth accounting uses the net national product. See the appendix, for more details.

Table 3: Growth accounting for Germany, 1850-1997

Source	Production ^a	Capital	Labor	TFP
1850-1870	2.09 (100)	0.49 (23.3)	0.43 (20.9)	1.17 (55.8)
1871-1913	2.92 (100)	0.77 (26.4)	0.78 (26.7)	1.37 (46.9)
1925-1937	3.12 (100)	1.14 ^b (36.5)	-0.02 (-0.7)	2.01 (64.2)
1950-1973	6.14 (100)	2.12 (34.6)	0.84 (13.7)	3.17 (51.7)
1974-1990	2.14 (100)	0.81 (37.9)	-0.20 (-9.6)	1.53 (71.6)
1992-1997	0.94 (100)	0.72 (76.8)	-1.24 (-131.7)	1.46 (154.9)

Note: Percentage points in growth rate (per cent of production growth rate). *a*) Net domestic product or net national product at factor costs, see the appendix. *b*) The rate of capacity utilization of capital, as calculated by Mester (1961), is taken into account.

before the unification of 1871 is distributed among capital with 0.5%, labor with 0.4% (decomposed in employment 0.5%, and working hours -0.1%) and TFP with 1.2%. Between 1871 and 1913 TFP growth increased and amounted to 1.4% on average. With regard to the inter-war period, due to its shortness, large fluctuations, and economic crisis, it seems particularly difficult to distinguish a clear trend in productivity and to compare the growth record with preceding or following periods. Nonetheless, there is some indication of high productivity growth on average. Taking the utilization rate of capital into account TFP growth is calculated at 2.0%. The post-World War II period is characterized by unprecedented high economic and productivity growth, which especially in the immediate post-war period is related to the “catching-up” effect (e.g., Abramovitz, 1986, Maddison, 1996, van Ark and Crafts, 1996). Following standard practice¹⁹ the total period until reunification is decomposed into the years before and after the first oil price shock in 1973/74. The growth accounting yields high productivity growth of 3.2% until 1973, followed by a period of much weaker growth with only 1.5% on average. The period after reunification, considered separately, reports again a growth rate of TFP at 1.5%.

Although there are differences in methodology and data, the overall picture of the development of productivity growth is largely consistent with other studies (e.g., Hoffmann, 1965, Hesse and Gahlen, 1965, and Andre, 1971, for the pre-1914 time, and Christensen et al., 1980, Dougherty, 1991, and Maddison, 1995, for the post-1950 time). However, because of the general methodological problems the present results should be regarded as upper limits for the rate of technical

¹⁹See the studies on economic growth, as, e.g., Maddison (1995, 1996), or Christensen et al. (1980).

progress (see appendix).

All in all, with the exception of the period after the Oil Crisis, the figures show an average increase in the rates of productivity growth across the different periods: after Germany's foundation productivity growth increased. Moreover, in comparison with the pre-1914 Germany, the subsequent inter-war period showed even higher growth rates and the first two decades after World War II report the strongest growth. At the same time, the earlier inspection of the public sector development has revealed a significant expansion of the public sector together with a stepwise increase in the federal expenditure share. However, the centralization process has come to an end and has even been reversed in the 1970's, seemingly coinciding with the decrease in productivity growth. Although one should be cautious not to interpret this coincidence as causality, it should be noted that it is consistent with a significant role of the vertical structure of the public sector for economic growth, especially since the quantitative differences in the structure of the public sector are of significant magnitude.

The development in the two specific policy areas partly supports the conformity between centralization and productivity growth. In particular the area of transport and communication fits well into the picture of federally provided public inputs stimulating economic development and growth in a historical perspective whereas the federal expenditure share in the area of science and education showed only a small increase after World War II.

However, as already pointed out, budget or expenditure shares are imperfect indicators of the share of federal goods supplied, especially, since federal legislation and regulation activities as well as policy coordination among levels of government are not captured. In particular the pre-1914 period shows important legislative federal government activities, which are only weakly related to public expenditures. Even if first attempts to unify currencies, to harmonize legislations and standards, and to coordinate politics have been undertaken before, the unification of 1871 certainly marked the most important step. The monetary reform and the introduction of the Mark as a single currency in 1871/76, the complete unification of the different weights and measures, the introduction of a common patent law in 1877 and the protection of intellectual property played undoubtedly a significant role for the economic development. Moreover, the introduction of the Civil Right (*"Bürgerliches Gesetzbuch"*) and the Commercial Right (*"Handelsgesetzbuch"*) in 1900 marked a milestone in establishing legal support of commerce and trade. In addition, competition control was legally established in 1909. However, even though the pre-1914 period witnesses a series of important achievements of federal institutions, most of these institutions still exist, albeit with modifications, and it seems difficult to assign their productivity impact to individual periods. One might speculate, whether those federal institutions have contributed to a higher productivity growth as compared with the period before Germany's foundation. But, afterwards the continuance of these federal institutions might have caused an upward shift of productivity growth

across all subperiods. Nevertheless, differences in productivity growth across subperiods were still attributable to the development of public expenditures.

As for policy coordination, especially with regard to the post-World War II period, the Federal Republic of Germany is, in contrast to American federalism, characterized by complex connections between governments at all levels, which is frequently referred to as “*Politikverflechtung*” (Scharpf et al., 1976). Given this type of cooperative federalism, it can be argued that the close interrelationship between governments at the federal, state, and local levels establish a “unitary federation” (Hesse, 1962) which, in effect, operates like a single, albeit complex polity. Blankart (1999a) identifies a “hidden centralization” process in Germany resulting from the attempt of the *Länder* to use their power on most legislative issues in the upper chamber of parliament, the *Bundesrat*, to create a revenue cartel, mitigating horizontal competition. However, it should be noted that this specific kind of horizontal cooperation is not equivalent to a centralization of policies resulting in a higher share of federal public goods. Although the states may use their constitutional position at the federal level to elicit funds and to escape from the constraints of fiscal competition, it is not obvious why the states should use their funds to actually supply federal public goods. Rather, one should expect state governments to use their funds in their own interest, even if the general legal framework for their policies is laid down centrally and uniformly. In terms of the above model, states would use the funds to provide local public goods, rather than federal public goods. In fact, as we will see in the following section, the empirical analysis of the situation in the period after 1950 provides some support for the view that a reduction of the expenditure share of the state level might actually have benefited growth.

4 Centralization and productivity growth after World War II

This section examines whether in fact the vertical structure of the public sector in today’s Germany is efficient with respect to overall productivity growth. The years after 1990 are not included as they suffer from the structural break related to re-unification.

The regression relates current productivity growth to lagged values of growth, public spending and centralization. Formally, the basic estimation equation is

$$\widehat{P}_t = \beta_0 + \beta_1 \widehat{P}_{t-1} + \beta_2 T_{t-1} + \beta_3 \Theta_{t-1} + \beta_4 t + u_t. \quad (23)$$

\widehat{P}_t denotes the rate of total factor productivity growth in period t , T_{t-1} the ratio of total public expenditures (exclusive of social insurance) as percentage of NNP, and Θ_{t-1} the share of federal government expenditures in total public expendi-

Table 4: Estimated coefficients of the effects on productivity growth, 1950-1990

Specification	Dep. Variable: TFP growth rate						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	-0.250 (2.19)	-0.191 (1.48)	-0.471 (2.90)	-0.320 (2.38)	-0.239 (2.08)	-0.363 (2.72)	-0.215 (1.71)
TFP growth t_{-1}	0.167 (0.99)	0.124 (0.71)	0.169 (1.04)	0.060 (0.34)	0.016 (0.08)	-0.000 (0.00)	0.118 (0.66)
Expenditures t_{-1}	-0.043 (0.26)	-0.091 (0.52)	0.034 (0.21)	-0.456 (1.50)	-0.121 (0.65)	-0.430 (1.51)	-0.119 (0.61)
Federal exp. share t_{-1}	0.557 (2.83)	0.461 (2.10)		0.832 (2.98)	0.521 (2.61)	0.883 (3.15)	0.512 (2.42)
Ratio fed. to state exp. t_{-1}			0.756 (3.31)				
Educ. exp. t_{-1}				0.713 (1.65)		0.766 (1.81)	
Federal educ. exp. share t_{-1}					-0.325 (1.57)	-0.270 (1.65)	
Transp. exp. t_{-1}				-0.290 (1.34)			-0.217 (0.93)
Federal transp. exp. share t_{-1}					0.153 (1.39)		0.080 (0.84)
Trend	0.001 (1.31)	0.001 (1.38)	0.015 (1.89)	0.001 (1.22)	0.001 (1.69)	0.002 (2.10)	0.001 (0.78)
Catching-up dummy		0.012 (0.99)					
R^2	0.344	0.363	0.388	0.401	0.394	0.417	0.364
$R^2_{adj.}$	0.267	0.267	0.216	0.289	0.280	0.308	0.245
$BG(1)$	1.26	1.01	1.90	0.27	0.02	0.01	1.25
$BG(2)$	1.36	1.73	1.78	4.33	1.60	4.26	1.70

Note: absolute value of t-statistics in brackets.

tures. If we allow for interactions between expenditures, centralization, and productivity growth, corresponding equations could be stated for expenditure and centralization pointing to an analysis along the lines of a vector autoregression framework. Thus, for example, productivity growth could have led to rising income and, as a consequence, to higher public expenditures in response to increasing demand for public goods and rising tax revenues. However, since our focus is on the impact on productivity growth, we refrain from doing so here and focus on the single aspect of Granger causality in one direction.²⁰

Column (1) in Table 4 shows results from a basic regression including a lin-

²⁰In this regard, the equation is a reduced form which neglects the contemporaneous relationship between the variables. But, if we assume that the contemporaneous correlation between T_t , Θ_t , and \hat{P}_t is limited, the sign of the effect of centralization on TFP can be interpreted as revealing the sign of the relationship in the structural equation.

ear trend. The estimation takes account of just one lag, since the inclusion of higher order lags was rejected on grounds of the Akaike criterion. Note that the Breusch/Godfrey (BG) tests allowing for 1 or 2 lags do not indicate the presence of residual autocorrelation. Moreover, checks for influential observations following Davidson and MacKinnon (1993) did not detect any outliers. For a given level of public expenditures, which turns out to be insignificant, the results indicate a statistically significant positive effect of overall centralization on TFP growth during this period, even though a trend is included. The estimation in column (2) indicates that the effect of centralization is also robust against the inclusion of a dummy for the post-war period (1950-55) capturing the catching-up in the immediate post-war years. But, note that the dummy is not significant and that the adjusted R^2 is not increased. Note also that the inclusion of a cubic trend (results not shown) did not alter the results for the level of expenditures and centralization.

In light of the previous sections' descriptive analysis, we should expect the positive impact of centralization to be related with the fiscal re-emergence of the state level after the World War II. Therefore, column (3) replaces the federal level's expenditure share with an alternative indicator measuring the ratio of federal to state spending leaving aside the spending of municipalities. As expected, the significant effect is still obtained. This suggests that a reduction of the expenditure share of the state level would actually have benefited growth.

As the above discussion shed some light on specific policy areas, further regressions use, in addition, the level and degree of centralization of spending on education and science and on transport and communication (columns (4)-(7)). The level of expenditures on education and science shows a weak significant positive effect. It is interesting to see that centralization has more likely a negative sign: the negative effect of the federal expenditure share indicates that growth might have been stronger with less rather than with more centralization. With regard to the area of transport and communication the effects proved to be insignificant. At best, the level of expenditures tends to have a negative effect, whereas the impact of centralization is positive. Nevertheless, the share of consolidated federal expenditures shows a significant effect across all specifications, indicating that productivity growth would have been larger with more federal and less state level expenditures.

5 Summary and conclusion

The motivation of the paper has been to discuss whether public sector centralization might not only be a hard-to-avoid consequence but also a major force of economic growth. This hypothesis has been laid out in a theoretical model emphasizing the role of benefit spillovers from public inputs between lower level

governments. It turned out that as compared to a setting without coordination among governments, a central planner's solution would imply an increase in spending on federal public goods which benefits total factor productivity and also productivity growth, if the steady state supports ongoing economic growth.

The hypothesis of a stimulating role of centralization on productivity and productivity growth has then been confronted with the historical record in Germany from its foundation as a federal country in the 19th century until today. A review of the development of the public sector, and, in particular, of the share of federal government expenditures, as an indicator of the share of federal goods supplied, in fact documents a significant secular process of centralization from Germany's foundation until the 1970's. At the same time a significant increase in productivity growth is indicated from growth accounting. Moreover, the slight reduction of the federal expenditure share since the 1970's is accompanied with a significant lower rate of productivity growth. A co-movement of productivity growth and centralization is also suggested by an inspection of specific policy areas, which are commonly regarded as playing a particularly important role for productivity growth. Whereas in the area of science and education the federal expenditure share still remained small, until the 1970's public expenditures on transport and communication have been incurred increasingly by the federal level.

However, there are undoubtedly serious shortcomings of using the federal level's expenditure share as an indicator of the supply of federal goods. In particular, budgetary statistics will tend to underestimate the scope of legal and regulative government activities. There is some indication that especially in the early periods of the German federation significant coordination was achieved by new federal legislation and regulation. But, as many of those federal institutions still exist, they might simply have caused an upward shift of productivity growth across all subperiods, and, consequently, differences in productivity growth across subperiods are still attributable to the development of public expenditures.

In addition, as the figures on productivity growth are obtained from growth accounting they should be used with considerable caution, all the more so, as the historical data material is far from incontestable. Therefore, the small difference in productivity growth before and after the foundation of Germany as a federal state of about 0.2 % is too small to justify recommendations for policies in the context of European integration. But, the co-movement of productivity growth and centralization is not confined to the early periods and, although only in a stepwise fashion, extends over a long period until the mid of the 1970's. Hence, although the descriptive evidence is not revealing the direction of causation, it can be stated that the pattern in the development of the public sector and of productivity is consistent with a stimulating impact of centralization on economic growth. However, with the strongest increase in the federal share of the public sector taking place in the Nazi period, the data are also revealing the drawback of centralization: in presence of a non-benevolent central planner centralization

can yield immense welfare losses.

In a second step of the analysis the relationship between centralization and productivity growth in Germany after World War II has been empirically investigated by means of regression analysis. This approach allows us to distinguish effects of the size of the public sector from effects of its vertical structure and from the general trend in productivity growth. The results confirm a significant impact of the federal expenditure share on productivity growth after World War II. This suggests that a higher share of federal expenditures or, respectively, a smaller share of the state level, would have led to even higher rates of productivity growth. This finding is, however, not related to the federal expenditure share in education and science or in transport and communication. Whereas centralization in the latter area showed a weak positive effect on growth and a weak negative effect in the case of education and science, the overall degree of centralization proved significant throughout all specifications.

Since fiscal federalism in Germany after World War II is characterized by complex connections between governments at all fiscal tiers, a higher share of federal public goods supplied may not only be brought about by higher federal expenditures but also by means of coordination among jurisdictions. As the analysis nonetheless shows a positive significance of federal government expenditures or, respectively, a negative significance of state government expenditures, it, therefore, indicates that the coordination of policies among state level governments as part of the cooperative federalism is not efficient with regard to productivity growth. Indeed, the negative impact found for the state level expenditures might be interpreted as an indication that the current role of the state level in the German system of fiscal federalism is inefficient. If state level governments are forming a revenue cartel (Blankart, 1999a) one might even argue that a step towards higher fiscal autonomy is beneficial for growth if it reduces an oversupply of local public goods resulting from a swelled state level budget.

Of course, by focusing on efficiency with regard to productivity the current study has excluded many other possible government objectives. If state governments as compared to the federal government are more involved with the provision of public services other than public inputs, the current vertical division of responsibilities might well be efficient with respect to other objectives. However, given frequent criticism about disincentives of the German system of fiscal federalism, it seems nevertheless important to state that, whatever the objectives are, according to the empirical results the current structure of the public sector entails cost in the sense of foregone productivity growth.

Quantification of productivity growth

A standard macroeconomic approach to quantify productivity growth is provided by the technique of growth accounting. TFP growth is measured by the residual difference between the rate of change in real output (net national product at factor costs)²¹ and a weighted average of the growth rates of the total volume of worked hours as well as of capital input, where the weights are the income shares of labor and capital (for an overview see Barro and Sala-i-Martin, 1995).

Like other studies (Hesse and Gahlen, 1965, Andre, 1971), the analysis of the period up to World War II draws heavily on the work of Hoffmann (1965) which, despite of some statistical deficiencies, comprises the most consistent and detailed compendium of historical data for the case of Germany.²² Even if alternative statistics are available for the inter-war period, e.g. from the Statistisches Bundesamt (1972), the growth accounting is continued with Hoffmann's more complete data. Only specific figures are taken from more recent sources, see data sources below. For the inter-war period, where the capacity utilization of capital fluctuated considerably the utilization rate as calculated by Mester (1961) is taken into account. For the period after World War II the analysis relies mainly on the official publications of the Statistisches Bundesamt. Although in principle a disaggregation of capital and labor might be possible for this period, we refrain from doing so here because, then, the consistency with regard to previous periods would no longer be ensured. However, due to the residual approach the measure of TFP growth might overestimate productivity growth.²³ Nevertheless, since the aim of this study is not to quantify exactly the level of productivity growth, but to relate its development with developments in public sector activity, it seems justified to use this measure, especially since no reasonable alternative is available.

Data sources and definitions

Territory

1850-1913 – Germany, frontiers of 1913 (until 1870 without Elsass-Lothringen)

1925-1938 – Germany, frontiers of 1925 (without Austria and Sudetenland, since 1934 with Saarland)

1950-1997 – FRG, until 1990 without GDR (until 1959 also without Saarland and West Berlin)

Net domestic product, net national product

1850-1938 – Hoffmann (1965), NNP at market prices and at factor costs, in current prices, NDP at factor costs in current and constant prices as of 1913.

1950-1997 – Stat. Bundesamt (1991a, 1998a), NNP at market prices and at factor costs, in current and constant prices as of 1985, GNP deflator.

Capital stock

1850-1913 – Hoffmann (1965), constant prices as of 1913.

²¹For reasons of comparability, the net product is employed for the entire period until today, since no direct statistics on gross product are available before 1913, but only different estimations, such as Ritschl and Spoerer (1997), or Andic and Veverka (1963). Furthermore, for the period 1850-1938 only data on the net domestic product at factor costs are available in constant prices.

²²For a critical discussion of Hoffmann and other German national accounts of this time see Holtfrerich (1983), Fremdling (1988), Kuczynski (1967), Meihsl (1967), Lampert (1968) and Stolper (1969).

²³For a detailed discussion of the growth accounting methodology and the problems encountered in measuring TFP, see e.g. Solow (1957), Denison (1962, 1967), Christensen et al. (1980), Griliches (1998), Barro (1998), Barro and Sala-i-Martin (1995), and Jorgenson and Griliches (1967, 1995).

1925-1938 – Hoffmann (1965), in constant prices as of 1913. Capital utilization rate, Mester (1961).
1950-1997 – Statistisches Bundesamt (1991c, 1997), in constant prices as of 1985.

Capital income share

1850-1913 – Hoffmann (1965), capital income share in NDP.
1925-1938 – Petzina et al. (1978), capital income share in NNP.
1950-1997 – Statistisches Bundesamt (1991a, 1998a), share of gross income from entrepreneurship and property in NNP.

Population

1850-1913 – Hoffmann (1965).
1925-1938 – Hoffmann (1965).
1950-1997 – Statistisches Bundesamt (1991a, 1998a).

Employment

1850-1913 – Hoffmann (1965), employed persons.
1925-1938 – Gattinger (1961), employed persons.
1950-1997 – Statistisches Bundesamt (1991a, 1998a), employed persons.

Working hours (annual average per employed person)

1850-1913 – Hoffmann (1965), interpolated figures.
1925-1938 – Maddison (1995), interpolated figures.
1950-1997 – IAB (1992, 1997) and Statistisches Bundesamt (1998c), until 1960 extrapolated.

Labor income share

1850-1913 – Hoffmann (1965), labor income share in NDP (incl. income of self-employed).
1925-1938 – Petzina et al. (1978), labor income share in NNP (income of employees).
1950-1997 – Stat. Bundesamt (1991a, 1998a), labor income share in NNP (income of employees).

Total public expenditures as percentage of net national product (at market prices)

1850-1938 – Hoffmann (1965), total public expenditures without social insurance: public consumption, current transfers and interest payments, net public investment (without railways and postal services).
1950-1997 – Statistisches Bundesamt (1991b) and Sachverständigenrat (1998), total public expenditures without social insurance, “Volkswirtschaftliche Gesamtrechnung” (VGR).

Allocation of total public expenditures by fiscal tiers

1881-1938 – Andic and Veverka (1963), public expenditures without social insurance, incomplete series.
1950-1997 – Stat. Bundesamt (1972, 1998b), net public expenditures without social insurance and payments to the EU, incl. special funds LAF and ERP, “Finanzstatistik“.

Public expenditures for transport and communication

1881-1935 – level: Weitzel (1968), Recktenwald (1962, 1975); by fiscal tiers: Statistisches Bundesamt (1972); incomplete series.
1950-1997 – Statistisches Bundesamt (1972, 1998b), net expenditures, “Finanzstatistik”.

Public expenditures for education and science

1881-1937 – level: Hoffmann (1965); by fiscal tiers: Statistisches Bundesamt (1972); incomplete series.
1950-1997 – Statistisches Bundesamt (1972, 1998b), net expenditures, “Finanzstatistik”.

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