Building Capacity in the Public Administration
Evidence from German Reunification

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Abstract

An effective public administration is essential for state capacity and economic prosperity. We study one of the main means to build administrative capacity: seconding officials from high-capacity to low-capacity public administrations. Our context is the capacity-building in the East German tax administration after reunification. Each East German tax office was assigned a partner tax office in West Germany, which was responsible for the capacity-building measures. This unique feature of our setting generates variation in capacity-building that is exogenous to the situation and needs of the East German tax offices. Leveraging this variation, we provide the first causal estimates of the short- and long-term effects of secondments on tax office performance. We assess tax office performance along two dimensions: output quantity and output quality. Our findings show that secondments increased short-term output quantity and had positive effects on long-term output quality. Effect heterogeneity is consistent with successful knowledge transfer as main mechanism behind successful capacity building.

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1 Introduction

An effective state is key for economic prosperity (Besley and Persson, 2009). State effectiveness, in turn, relies on the capacity of the public administration, the engine behind successful policy implementation. Administrative capacity varies widely, both across and within countries. For example, the time that it takes to obtain a value added tax refund differs significantly, ranging from five weeks in Germany and seven weeks in the United Kingdom to 63 weeks in Italy, according to the World Bank's Doing Business Indicators. Significant variation also exists within countries, for instance in the time that it takes to assess a personal income tax declaration or the audit cycle for companies.

Addressing disparities in administrative capacity can enhance public service delivery to local businesses, ultimately spurring local economic activity, and increasing welfare. Correspondingly, there are many attempts to transfer capacity between administrative units. One of the main means of capacity transfer is to second officials from high-capacity units to lower-capacity units of the public administration.[1] Yet, to date, we understand neither the effectiveness of such initiatives nor the key determinants of their success.

This paper studies the capacity-building in the East German tax administration after German reunification. It makes three contributions. First, we provide causal evidence on the effectiveness of secondments for capacity building in the public administration. We exploit unique quasi-experimental features of the situation after reunification to identify causal effects. We show that the secondment of West German tax officials to East German tax offices improved both short and long term performance of the East German tax administration along the margins of output quantity and quality. Second, we explore the mechanisms behind successful capacity building. Finally, we identify key factors that determine the effectiveness of secondments and offer insights to inform the design of future capacity-building initiatives.

The establishment of the East German tax administration after reunification has three key features that make it ideally suited to study the causal effect of secondments as capacity-building

[1] To give a few examples, the European Union uses the Twinning instrument for capacity building in the public administration as part of the European Neighbourhood Policy. Resident Twinning Advisors are seconded to the partner institutions (European Commission, 2017). France sends officials on secondment as technical experts to improve the financial governance in countries receiving French development assistance (Chauvet et al., 2019; Raffinot et al., 2019). The Norwegian Tax Administration and the Revenue Authorities of Mozambique, Tanzania, and Zambia maintain a partnership for capacity building that comprises secondments of Norwegian tax officials as advisors (Fjeldstad and Heggstad, 2012).

measure. First, capacity-building took place on a large scale. As the former German Democratic Republic was a socialist state, there was virtually no tax administration before reunification. In contrast, in a market economy, the tax administration is a crucial part of the public administration, as taxes are the main source of government funding. With reunification, the West German tax law was transferred to East Germany, requiring the establishment of an entirely new tax administration. 113 new tax offices were set-up in the five new East German federal states during the process of reunification. We use these tax offices as units of our empirical analysis. The tax offices were staffed mainly with employees from the finance departments of the former East German public administration, who were not familiar with the West German tax system. Capacity-building therefore had to qualify these employees for their roles in the tax administration and to establish the organizational framework for well-functioning tax offices.

Second, there was no federal plan for capacity-building. Instead, capacity-building was implemented through partnerships between the West German federal states and the East German federal states, as the public administration is a state responsibility in Germany for historical reasons. Each East German federal state was assigned one or more West German partner federal states mainly based on geographical proximity. Importantly, within partner states, each East German tax office was assigned one or more West German partner tax offices. The West German partner tax office(s) had the primary responsibility for the capacity-building measures.

Third, the West German federal states adhered to the principle of voluntary participation of their staff in the capacity-building measures. To encourage their officials to participate in capacity building, the West German states provided tax-free financial incentives. From the perspective of a West German tax official, the attractiveness of a secondment varied with the local real value of those financial incentives at home as well as with the distance to the East German tax office. The scale of the capacity-building measures therefore did not only depend on the needs of the East German tax office, but also on the characteristics of the West German partner office. The West German variation allows us to identify the causal effects of the capacity-building measures on East German tax office performance.

The unique features of our institutional setting allow us to address the key econometric challenge associated with our research question, the possible endogeneity of capacity-building measures. In general, weaker administrations may demand more support and therefore receive more secondments. This biases the estimated coefficient towards zero. In our context, the principle

of voluntary participation may alternatively lead to an overestimation of the true effect insofar the West German tax officials preferred secondments to stronger tax offices that offered them a more rewarding experience. We identify effects by exploiting variation in the costs and benefits of being seconded across West German tax offices. Specifically, local differences in the real value of financial incentives for officials across West German partner tax offices captures variation in the benefit of secondments. Differences in the distance between West German and East German tax offices capture variation in secondment costs. Additionally, differences in the relative size of the partner offices reflect variation in the potential supply of West German tax officials. We document that systematic matching of East German tax offices with the most suitable West German tax offices, a process that would call into question our identification strategy, is highly unlikely, given both the rapid pace of events during reunification and based on quantitative analyses of partner similarity.

Our analysis is grounded in a major, novel data collection. We assembled a unique data set with detailed information on the secondments at the level of the East German tax offices. While the decentralized organization of the capacity-building measures provides the foundation of our identification strategy, it posed a major challenge for data collection. There was no systematic monitoring and recording of capacity-building at the federal level. Different institutions managed the record keeping of the capacity-building measures in the different states. We conducted more than 60 interviews with current and former politicians, public officials and formerly seconded officials to obtain an in-depth understanding of the specific situation in each state and to uncover the data.[2] Ultimately, we retrieved some information from the Federal Archives and the archives of the federal states. We obtained most of the data directly from the Ministries of Finance and the Higher Financial Directorates of the federal states. Some federal states even extracted information from the individual personnel files to support our data collection effort.

Most information was only available as hard copies. We digitized the information, cleaned the data, and conducted extensive quality, consistency and plausibility checks. Our final data set contains the number of workdays that West German officials spent at each East German tax office per year for the period 1990–1996 (until 2000 for some tax offices). For a subset of tax offices, we additionally have individual-level information on the rank of the West German officials, the start date and end date of their secondments and their tasks in the East German and the West German tax offices. This allows us to characterize the capacity building measures

[2] Appendix C documents our data sources in detail.

in a high level of detail.

We document that the characteristics of the West German partner tax office(s) indeed significantly determined the amount of the capacity-building measures. We measure capacity-building per employee as the number of workdays that West German tax officials spent in an East German tax office per East German tax office employee. A one-standard deviation increase of the local real value of the financial incentive, the distance between partners, and the relative tax office size lead to a 0.21-0.45 standard deviation increase of the number of days of West German presence per employee in the average East German tax office.

To understand the impact of capacity building on the East German tax offices, we study two dimensions of tax office performance: the quantity and the quality of tax office output. We conceptualize the capacity-building measures as on-the-job training, as the seconded West German tax officials supported and trained the East German personnel in their day-to-day tasks. To estimate the impact on output quantity, we adapt the framework used by Konings and Vanormelingen (2015) to estimate the effect of worker training on firm productivity, applying it to our setting. We specify a tax office production function where tax office output quantity is a function of the effective labor input that depends on the number of employees and the capacity-building measures received per employee. We study the effects of the capacity-building measures both in the short term, while capacity-building was still in progress, and in the long term, after the measures were completed. The short-term effect of capacity-building measures is ex-ante ambiguous, because intensive capacity-building may bind resources and thus lead to a decline in output quantity. In the long term, one would expect that successful capacity-building is reflected in a positive effect of measures on tax office output quantity. We focus on the number of cases assessed as our main output measure, because tax revenues may be more dependent on the local economic structure than on the efficiency of the tax office, in particular as the East German economy underwent major structural change after reunification.

A primary means of bureaucratic oversight are customer complaints (Prendergast, 2003). By law, taxpayers have the right to object to any decision taken by the tax administration. To assess the impact of capacity building on the quality of tax office output, we study its effect on the number of objections that taxpayers raised against tax office decisions. We also analyze whether objections were decided in favor of the taxpayer or the tax office. This helps us assess whether the decisions taken by the tax administration are correct. The combination of output

quantity and output quality allows us to assess whether there is a quantity-quality trade-off and whether capacity-building measures have a stronger effect on one of the two margins of tax office performance.

We use the variation in capacity-building measures per employee to estimate the tax office production functions. We find that the capacity-building measures have a positive short-term effect on tax office output. A one standard deviation increase of the number of days of West German presence per employee causes a 10% increase of the number of declarations assessed per employee. The effect is more pronounced for more complex tax types, suggesting that the effect is driven by successful knowledge transfer. We cannot detect a positive effect of the capacity-building measures even shortly after measures were completed. Further analyses show that the scope and speed of assessments became more and more similar across tax offices over time, suggesting that the capacity-building measures gave some tax offices a head start that the other offices caught up through learning-by-doing.

Unlike the absence of long-term effects on output quantity, we find that capacity-building measures have a lasting impact on the quality of tax office output. In the short term, capacity building has no effect on the number of objections raised per employee. This is notable given our finding that enhancing capacity boosts tax office output. In the long term, the number of objections declines significantly with the capacity-building measures: a one standard deviation increase in the number of days of West German presence per employee causes a decrease of the number of objections by a third of a standard deviation. We find that both the number of objections granted to the taxpayer and the number of objections rejected by the tax office decrease with capacity-building in the long term. We interpret the decline in the number of objections granted to the taxpayer as showing that the secondments of West German tax officials increased the quality of the tax office output. The decline in the number of objections rejected by the tax office suggests that higher tax office output quality helped build trust of taxpayers in the tax administration. Taxpayers therefore raise substantially fewer objections in the long term, in particular, fewer unjustified objections rejected by the tax office.

Finally, we exploit our data to inform the design of future capacity-building initiatives. Studying the length of secondments, we find that secondments of intermediate length are most effective. A plausible explanation for this finding is that an intermediate secondment length balances the problems related to a lack of coordination resulting from frequent turnover and the fact that

the transferable expertise even of the most knowledgeable seconded officials is limited.

Our paper contributes to four strands of the literature. The first strand seeks to understand how state capacity relates to the personnel economics of the state and the organization of the public administration (see Besley et al., 2022; Finan et al., 2017, for surveys). This literature documents that the selection of individuals into the public administration is crucial for administrative performance and studies how selection responds to financial incentives (e.g., Dal Bó et al., 2013; Deserranno, 2019) and political discretion (e.g., Colonnelli et al., 2020; Muñoz and Prem, 2022; Voth and Xu, 2022; Xu, 2018). Moreover, it investigates the effects of financial and non-financial incentives on bureaucratic effectiveness (e.g., Bandiera et al., 2021; Bertrand et al., 2019; Deserranno et al., forthcoming; Khan et al., 2016, 2019) and analyzes the role of managers and management practices for administrative performance (e.g., Englmaier et al., 2022; Fenizia, 2022; Rasul and Rogger, 2018). Finally, it shows that monitoring through audits increases performance (e.g., Olken, 2007), though it is crucial to design non-corruptible monitoring institutions (Vannutelli, 2022). We contribute a novel dimension to the literature by analyzing the impact of secondments, a common capacity-building tool in the public sector. We quantify the causal effect of secondments of officials from high-capacity administrations on both the quantity and quality of outputs in lower-capacity administrations. Although secondments are widely employed, we are not aware of any prior studies that have estimated their causal effect.

Second, our results contribute to a nascent empirical literature on the state's production function. Best et al. (2023) quantify the relative importance of individual bureaucrats and bureaucratic organizations for public sector output. We advance this literature by conceptualizing the production function of the tax administration–a key branch of the public administration–and by showing how capacity-building measures affect short-term and long-term administrative performance. As our paper informs about the returns on investment in capacity-building, we also contribute to the literature on the returns to investments in the public administration (for example, Sarin and Summers, 2019; Boning et al., 2023, estimate the returns to investments in tax audits).

Since successful knowledge transfer is a plausible explanation for our results, our paper also relates to the literature on knowledge spillovers via labor mobility. Prior research documents that firm-to-firm labor mobility can enhance both firm and co-worker performance (e.g., Mion

et al., 2024; Poole, 2013). Although anecdotal evidence suggests that firms use labor mobility for knowledge transfer, studies on corporate transferees have so far been purely correlational (e.g., Astorne-Figari and Lee, 2019; Lodefalk, 2016). In contrast, our analysis, while in a public-sector context, provides causal evidence that temporary employee transfers have positive effects on the receiving organizations.

Finally, we study capacity-building in the East German tax administration after German reunification that has been used as a natural experiment by many papers in the economic literature. Earlier studies analyze individuals' savings behavior (Fuchs-Schündeln and Schündeln, 2005; Fuchs-Schündeln, 2008), preferences on redistribution (Alesina and Fuchs-Schündeln, 2007), agglomeration forces (Ahlfeldt et al., 2015), television and consumption (Bursztyn and Cantoni, 2016) as well as the importance of market access (Redding and Sturm, 2008) and social ties for economic development (Burchardi and Hassan, 2013). We add a novel angle by exploiting variation within East Germany instead of between East and West Germany or within West Germany.

The paper is structured as follows. Section 2 describes the institutional setting. Section 3 explains our conceptual framework and outlines our estimation strategy. Section 4 presents the data that we collected. Section 5 summarizes our regression results and section 6 derives recommendations for the design of future capacity-building initiatives. The last section concludes.

2 Institutional Setting

2.1 Large-scale capacity-building initiative

We study the measures taken to build capacity in the tax administration in the East German federal states (Brandenburg, Mecklenburg-West Pomerania, Saxony, Saxony-Anhalt, Thuringia) after reunification on 3 October 1990. The German Democratic Republic (GDR) was a socialist state where taxes played a subordinate role for public finances. In 1988, only 8% of government revenues resulted from taxes (Eisold, 1990). Correspondingly, the GDR did not have a tax administration comparable to the one in the Federal Republic of Germany (FRG) (Duda (2011, 47) and Richter (2004, 911)). As taxes are the main source of government funding in a market economy, it was of crucial importance to rapidly build a well-functioning tax administration after reunification (Ministerium für Finanzen und Preise der DDR, 1990, 1).

On 1 July 1990—three months after the people of the GDR had voted in favor of reunification in the parliamentary elections of March 1990, but before actual reunification—121 tax offices were established in the GDR (Kartmann and Schipanski, 2009, 121, 225): eight in East Berlin, 21 in Brandenburg, 16 in Mecklenburg-West Pomerania, 35 in Saxony, 21 in Saxony-Anhalt, and 20 in Thuringia (see Appendix B.1 for a list). On the same day, the West German value-added tax (VAT) and a simplified variant of the West German wage tax were introduced in the GDR as part of the Monetary, Economic and Social Union (Kartmann and Schipanski, 2009, 220). The full West German tax system was introduced on 1 January 1991 (see Table 1).

Table 1: Timeline: Establishment of the tax administration

9 Nov 1989	Fall of the Berlin Wall
18 Mar 1990	"Volkskammerwahlen" (parliamentary elections) Winner: "Allianz für Deutschland" → Goal: reunification
20 Apr 1990	Creation of partnerships for capacity-building in the public administration at the state level
18 May 1990	Treaty on the Economic, Monetary and Social Union between the GDR and the FRG
1 Jul 1990	Establishment of 121 tax offices Introduction of value added tax and wage tax in GDR
3 Oct 1990	Reunification of Germany
1 Jan 1991	Introduction of the West German tax system in former GDR

Sources: Kartmann and Schipanski (2009, 220–231), Reuter (1990), Rosen (1993), (Duda, 2011, 122), Bundesministerium der Finanzen (1992a), 2–3, Bundesministerium der Finanzen (1990).

Employees were initially recruited from the finance departments of the former District Councils, the regional administration in the GDR (Ministerium für Finanzen und Preise der DDR, 1990, 6). The employees were thus used to working with numbers and had experience working in an administration, but they did not have knowledge about taxation or the organization and procedures of an efficient tax administration (Kartmann and Schipanski, 2009, 220).

The stark difference in the relative importance of the tax administration between the GDR and the Federal Republic of Germany (FGR) is reflected in the number of employees. In the GDR, before reunification, only 2,300 employees worked on taxes and levies (compared to 76,000 in the FGR). In July 1991 already, almost 11,000 employees worked in the 113 tax offices in the East German federal states. Their number grew to 20,200 tax office employees by the year 1999 (Bundesministerium der Finanzen, 1999, 6), when the East German tax administration

reached a ratio of tax office employees to taxpayers comparable to that of the West.[3]

The 113 tax offices in the five reestablished East German federal states are the units of our analysis. We exclude the eight tax offices in the city state of Berlin, because the tax offices in East Berlin were integrated with the existing tax offices in West Berlin into one tax administration. Appendix B.1 provides further details on the historical context.

2.2 Capacity-building through partnerships

For historical reasons, the public administration is a state responsibility (Article 30 of the German Constitution), not a federal responsibility, in Germany (Bogumil and Jann, 2009, 76). Article 35 of the German Constitution stipulates that all administrations of the federal government and the federal states are obligated to mutual legal and administrative support. Article 5 of the German Reunification Treaty codifies that the federal government and the West German federal states support the East German federal states in establishing their administration.

In April 1990, the West German federal states created partnerships to build capacity in the public administration of the five East German federal states that were to be reestablished as part of reunification (Bundesministerium der Finanzen, 1992a, 2–3; Bundesministerium der Finanzen, 1990). The partnerships comprised support to build capacity in all branches of the public administration, that is, not only the tax administration, but also the police force and the justice system (Kartmann and Schipanski (2009, ch. 3.6), Bundesministerium der Finanzen (1992b, 6)).

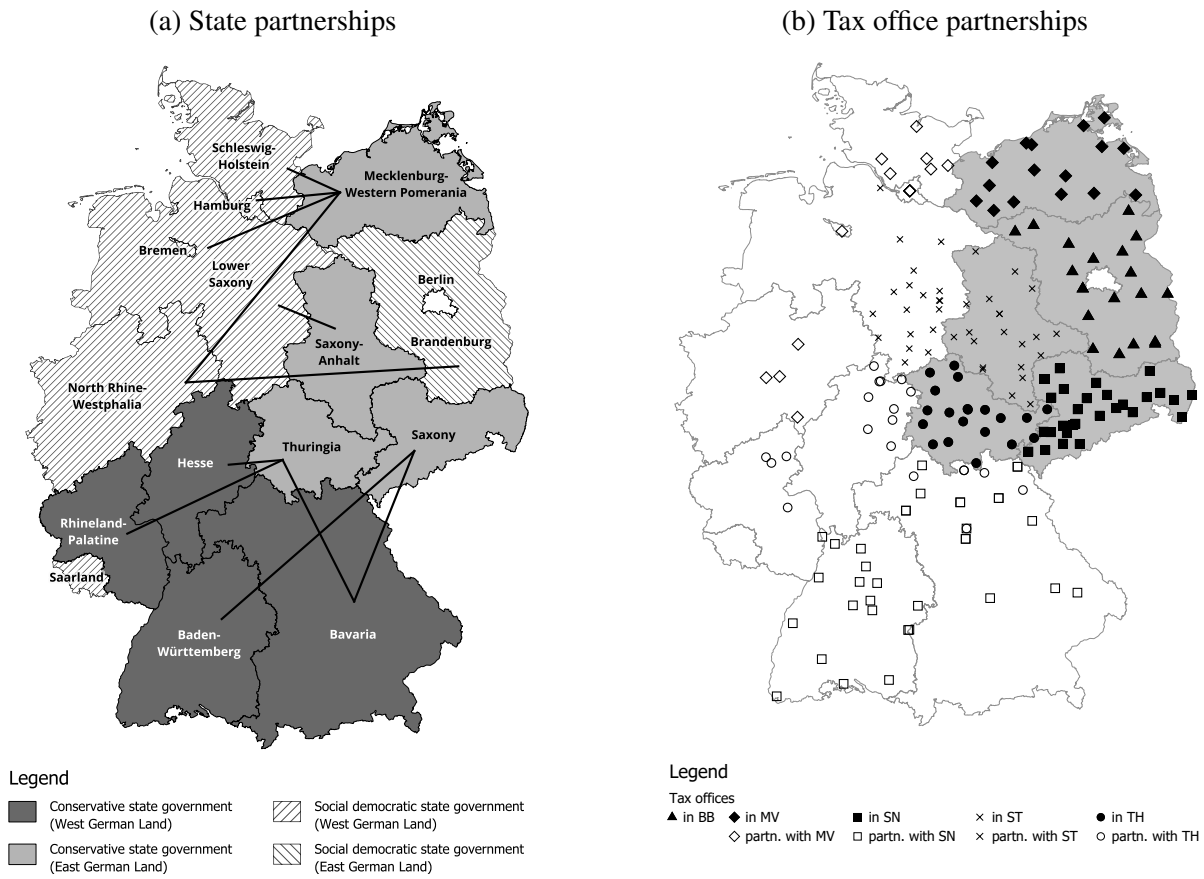
The state-level partnerships emerged as a result of uncoordinated contacts between the West German federal states and institutions in the former GDR after the fall of the Berlin wall (Kartmann and Schipanski, 2009, 48). Figure 1a displays the partnerships as of July 1991.[4] The figure suggests that partnerships were formed mainly based on geographic and political proximity and on historical ties.

The West German federal states were responsible for the capacity-building measures. Until 1992, the West German federal states even covered the full costs of capacity building (Min-

[3]Employment figures from Oberfinanzdirektion Chemnitz (1998, 11) for former GDR, Landesarchiv Thüringen (1990) for FGR 1990, Bundesarchiv (1991, 6) for 1991.

[4]Initially, the state of North Rhine-Westphalia supported the district of Leipzig in Saxony. However, due to the high geographic distance and the support provided for all tax offices in Brandenburg and those in the district Neubrandenburg in Mecklenburg-Western Pomerania, North Rhine-Westphalia withdrew from Saxony in the first half of 1991 (Oberfinanzdirektion Chemnitz, 1998).

Figure 1: Partnerships between West and East German federal states and tax offices, July 1991



isterpräsidentenkonferenz, 1991). After 1992, they covered a substantial fraction of the costs (Rosen, 1993). The federal government did not issue a plan or guidelines for the states. While the states convened for regular coordination meetings to discuss progress, these meetings did not result in enforceable decisions prompting adjustments in the capacity-building efforts. The West German federal states had discretion in determining the extent of capacity-building measures without being required to provide a minimum amount (Bundesrechnungshof, 1994, 23).

The state-level partnerships were complemented by decentralized partnerships. Each East German tax office was assigned at least one West German partner tax office which was responsible for the capacity-building in the tax office (see Appendix B.1). In the state of Brandenburg, the East German tax offices were matched to one of the three Higher Financial Directorates within the partner state of North Rhine-Westphalia; the tax office level partnerships played a subordinate role in practice. Importantly, the rapid pace of events precluded a careful matching of East German and West German tax offices. After all, the co-existence of two separate German states was a possibility until the parliamentary elections on 18 March 1990. At the same time, the introduction of the VAT and simplified wage tax on 1 July 1990 created high time

pressure (Spi (1990), Annex IV to the Treaty on the Economic, Monetary and Social Union between the GDR and the FRG). The partnerships were announced even before the tax offices were officially established.[5] Decisions had to be taken based on limited information about the population and economic structure of the tax office districts, not least because the early 1990s were a period of economic turbulence and a high degree of emigration from the East German federal states. The offices were therefore matched mainly based on geographic proximity and similarity of locality and tax office size (e.g., Kartmann and Schipanski, 2009, 223).

The aim of the capacity-building measures was to rapidly convey knowledge to the East German personnel, enabling them to carry out the duties of tax officials, including tax assessment, collection and enforcement. The capacity-building measures also aimed at creating efficient organizational structures and processes in the tax offices (Bundesministerium der Finanzen, 1992a, 3). To achieve these objectives, the West German tax offices sent tax officials on secondment to the East German tax offices (Bundesministerium der Finanzen, 1992a, 3). They recruited the seconded officials among their own workforce or, in case of personnel shortages, from neighboring tax offices in their state (Kartmann and Schipanski, 2009, 227–8, Oberfinanzdirektion Chemnitz, 1998, 5). The seconded tax officials provided on-the-job training to the East German personnel. They also assumed the managerial roles of head of tax office or head of department within a tax office, in particular in the early 1990s (Richter, 2004, 912). The secondments complemented compulsory training courses for the East German personnel, which were uniform across tax offices (Oberfinanzdirektion Chemnitz (1998, 16, 18, 27ff.), Bundesministerium der Finanzen (1992a, 47–48). .

2.3 Exogenous variation in capacity-building measures

The West German federal states agreed to adhere to the principle of voluntary participation to recruit tax officials for capacity building.To compensate tax officials for their capacity-building efforts, the West German federal states decided to pay tax-free monthly allowances equal to 40%-60% of the baseline monthly salary (on top of reimbursements for travel expenses). The federal government issued a recommendation for the level of allowances by rank of the pub-

[5]To give a few examples, Hessian tax office partnerships were announced on 18 June 1990, but Hessian tax officials traveled to the East German tax offices to assess their situation and needs only in July 1990 (Appendix Y illustrates the example of Hesse.). Bavaria informed its tax offices about the partnerships on 25 June 1990, while the structure of the Ministry of Finance in Saxony and its subordinate tax offices were only constituted in August 1990 (Richter, 2004, 522).

lic civil servants, but the actual value varied across West German states (see Appendix Z for details).

Together with the tax-office level partnerships, the principle of voluntary participation yields a crucial feature of our institutional setting: variation in the capacity-building measures that is exogenous to the situation and needs of the East German tax office and thus allows to estimate the causal effect of the capacity-building measures. Our identification strategy builds on the assumption that West German tax officials traded off the costs and benefits of engaging in capacity-building in their decision to participate. The benefit of capacity-building increases with the financial incentive, whose real value varies across West German tax offices within federal states due to differences in the local price level. Engaging in capacity-building is the more costly for tax officials (and their families), the higher the distance is between the West German and East German tax office. As Figure 1b illustrates, some tax office pairs lay within commuting distance, while others required half-day travel. Finally, larger West German partner tax offices offered a larger supply of possible volunteers. Indeed, as we document in section 5.1, the real value of the financial incentive at the West German partner tax office, the distance between partner tax offices, and their relative size significantly affected the amount of capacity-building measures received by East German tax offices.

A potential concern related to this identification strategy is that the West German fiscal administrations took into account the expected needs of the individual East German tax offices when forming the tax office level partnerships. As explained in the previous section, the timing of events makes this highly unlikely. Moreover, crucial features of the capacity-building measures, such as the financial incentives, were determined only after the tax office partnerships had been formed.

Nonetheless, we investigate whether systematic matching occurs among East German tax offices and their West German partners. We examine whether partner tax offices are selected to resemble East German tax offices, with similarity quantified using a k-nearest-neighbors algorithm and different sets of tax office and locality characteristics (see Appendix Y for details). For each East German tax office, we determine the five and ten most similar tax offices from the West German partner state. Table 2 presents a comparison between the number of tax offices that would be paired with a partner among the k most similar tax offices under random matching and the observed number of similar pairs (section 4 describes the data). Except for Saxony-

Table 2: Few East German tax offices matched to similar West German partners

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EG tax offices		WG tax offices		partner among 5 NN		partner among 10 NN	
	Total	Used	Total	Used	Random	Actual	Random	Actual
BB	21	20	110	110	1.0	3	2.0	5
MV	16	11	155	130	0.4	0	0.9	0
SN	35	35	160	160	1.2	0	2.4	2
ST	21	21	57	57	2.3	10	4.6	12
TH	20	20	160	160	0.7	3	1.3	4

Notes: The table compares, by East German federal state, the actual number of East German tax offices that are matched with one of the five or ten most similar West German tax offices (columns 6, 8) to the hypothetical number if matching was random (columns 5, 7). Columns 1 and 3 display the total number of East German (EG) tax offices and potential West German (WG) partner tax offices. The number of tax offices used in the analysis (columns 2, 4) is lower for BB and MV due to missing data: one tax office in BB lacks a partner tax office, and personnel data is unavailable for tax offices in the WG partner states of Bremen and Hamburg.
Method: k-nearest neighbor matching algorithm using Euclidean distance; variables: tax office personnel (observed for WG, target for EG), population of tax office district, years: 1989/90. BB - Brandenburg, MV - Mecklenburg-West Pomerania, SN - Saxony, ST - Saxony Anhalt, TH - Thuringia.

Anhalt–where the number of potential West German tax offices is very low, but each tax office is matched with multiple partners–most East German tax offices are not paired with their most similar West German counterparts. The number is higher for some states, but lower for others. Results are robust to alternative tax office characteristics and alternative distance metrics. Overall, the analyses reinforce our confidence in the assumptions underlying our identification strategy.

3 Conceptual Framework

To understand the impact of the capacity-building measures, we study their effects on two margins of tax office performance: tax office productivity and the quality of tax office output. Both margins reflect important aspects of performance. Tax office productivity reflects the efficiency of the fiscal administration. Studying the quality of tax office output allows us to assess whether capacity building affects the accuracy of the decisions of the fiscal administration.

3.1 Tax office output quantity

We conceptualize the capacity-building measures as on-the-job training and specify a tax office production function to estimate their effect on productivity. We build on the framework in

Konings and Vanormelingen (2015) to estimate the effect of worker training on firm productivity. In this framework, firm output depends on the effective labor input, which is a function of the number of workers, their average schooling level, their average training intensity, and unobserved worker attributes.

We formalize tax office output as a function of the effective labor input of the tax office and unobserved tax office productivity:

$$Y_{it} = \hat{L}_{it}^{\beta_\ell} \cdot \exp\{q_{it}\} \cdot \exp\{\varepsilon_{it}\} \tag{1}$$

Y_{it} denotes the output of tax office i in year t. $\hat{L}_{it}$ is its effective labor input and β_ℓ denotes the labor input elasticity. q_{it} denotes unobserved tax office productivity and ε_{it} denotes unobserved transitory shocks to tax office output. The effective labor input depends on the amount of capacity-building measures. Following Konings and Vanormelingen (2015), we normalize the number of days that West German tax officials spent in an East German tax office with the size of the East German tax office to capture the average training intensity per tax office employee.

$$\ln \hat{L}_{it} = \ln L_{it} + \beta_T \frac{\#\text{days}}{L_{it}} + Z_{it} \tag{2}$$

L_{it} denotes the number of employees (measured in full-time equivalents) of the East German tax office. $\#\text{days}/L_{it}$ denotes the average training intensity. Z_{it} denotes the unobserved labor quality of the tax office employees.

Taken together, these assumptions yield the following equation:

$$\ln Y_{it} = \beta_0 + \beta_\ell \ln L_{it} + \beta_\ell \beta_T \frac{\#\text{days}}{L_{it}} + \omega_{it} + \varepsilon_{it}, \tag{3}$$

where $\omega_{it} = q_{it} + \beta_\ell Z_{it}$.

Similar to the estimation of firm productivity, the number of employees may be endogenous in equation 3. Unlike firms, tax offices do not make hiring decisions themselves. However, the number of positions allocated to the tax office by state level authorities increases with the population and the number of firms in the tax office district. Tax offices may be granted additional positions if they repeatedly fail to handle their workload. We therefore reformulate

equation 3 and obtain our estimation equation:[6]

$$\ln \frac{Y_{it}}{L_{it}} = \beta_0 + \beta_\ell \beta_T \frac{\#\text{days}}{L_{it}} + \omega_{it} + \varepsilon_{it} = \beta_0 + \beta_1 \frac{\#\text{days}}{L_{it}} + \omega_{it} + \varepsilon_{it}, \tag{4}$$

It is non-trivial to measure tax office output. By law, tax offices are responsible for any taxation in their district, i.e., their designated geographic area. Responsibilities are centralized at a subset of tax offices for complex tasks (e.g., external tax audits) or infrequent taxes (e.g., the inheritance tax or the casino tax) in practice. Virtually all tax offices assess taxes on the firms and employees in their area.

Tax revenues are one option to measure tax office output. Tax revenues would be equivalent to sales typically used as dependent variable in the production function estimation of firms. However, unlike firm sales, tax revenues do not only depend on the productivity of the tax office, but are largely determined by the economic structure of the district of the tax office. It is also unclear whether higher tax revenues are necessarily better, as firms may make losses, in particular in a transition period like the period after reunification. In such a period, good performance of a tax office may be reflected in acknowledging losses rather than trying to extract the maximum possible amount of tax revenues.[7] The performance of the tax office is thus reflected in whether it achieves its tax revenue potential, neither exceeding nor falling short of it, but the tax revenue potential is unobservable.

We therefore focus on the number of cases assessed in a tax office for the main tax types to measure tax office output. We aggregate the number of tax declarations assessed for the corporate income tax, the personal income tax and the wage tax.[8] As the tax declarations differ with respect to their complexity, we use as weights the amount of time budgeted for each type of declaration in the staffing planning of one East German federal state in the 1990s. The number of cases assessed are a measure of the physical output of the tax office. Unlike tax revenues, they are not sensitive to economic conditions, as the obligation of citizens and firms to file their tax declaration is independent of economic circumstances.[9] Higher tax office productivity is

[6] Implicitly, the reformulation implies that $\beta_\ell = 1$. When we correlate tax office output and the number of employees, coefficients are not significantly different from 1.

[7] The task of tax authorities is to determine and collect taxes in accordance with the laws. In particular, they must ensure that taxes are not understated, incorrectly levied, or that tax refunds and credits are neither improperly granted nor denied (Rechnungshof der Freien und Hansestadt Hamburg). Indeed, most tax offices report negative corporate and personal income tax revenues until the early 2000s.

[8] We exclude the value added tax, as it is a self-assessment tax.

[9] It is important to note that shareholders of partnerships file personal income tax declarations, because these

unambiguously reflected in a higher number of cases assessed per employee.

Shortly after reunification, the record date of statistics on the number of tax declarations assessed differs between East German federal states and across years. To control for state-specific changes in record dates, we include federal-state specific time trends and exploit within-federal state-year variation only.

To assess potential contemporaneous effects of capacity building, we set #days = #days$_{it}$. The sign and interpretation of the contemporaneous coefficient are ex ante ambiguous. A positive sign may reflect successful capacity transfer, but it may also reflect that the West German tax officials actively assessed tax declarations in the East German tax office and thus increased output. A negative coefficient would not necessarily indicate lack of capacity building, but could as well indicate that capacity-building efforts bind resources, which cannot be used to assess declarations, thus reducing contemporaneous tax office output.

To assess the long-term effects of capacity building, we set #days = $\sum_{\tau=1990}^{1993}$#days$_{i\tau}$ and consider output in the years 1995 onward. A productivity-increasing effect of the capacity-building measures would be reflected in a positive sign of the coefficient. We focus on the capacity-building measures during the years 1990-1993, as the capacity-building measures were directed only to a subset of tax offices with special responsibilities (in particular external tax auditing) from 1994 onward (for details see section 4.1).

3.2 Quality of tax office output

The number of cases assessed is only one margin of tax office performance. It is equally important that the assessments, as well as other decisions by the tax office, are correct. Under German law, taxpayers can file an objection against a tax assessment or another decision of the tax office whenever they disagree with an official decision from the tax office. The tax administration then reevaluates the tax case and potentially makes adjustments before the matter may be taken to court. This allows us to study the effect of the capacity-building measures not only on the quantity, but also on the quality of tax office output.

The reevaluation can lead to three different outcomes. (i) The tax office revises its decision and grants the taxpayer's objection; (ii) the tax office maintains its decision and the taxpayer withdraws her objection; and (iii) the tax office rejects the objection and the taxpayer pursues

firms are taxed transparently.

legal action. We consider both the number of objections received and the outcome of objections raised to investigate the quality of the tax office's work. In general, we will assume that an objection is granted if the decision by the tax office was indeed at least partly incorrect and that the rejection of an objection indicates that the tax office decision was actually correct. This is consistent with the interpretation of the fiscal administration. It is important to keep in mind, however, that an objection may be rejected after the tax office issued an amendment notice which addressed the taxpayers concern. Likewise, an objection may be granted because the taxpayer submitted additional information which were missing in the original tax declaration (Bundesministerium der Finanzen, 2020). In that sense, the outcome of objections are an imperfect measure of the quality of the tax office decision.

We specify a reduced form estimation equation:

$$\frac{Y_{it}}{L_{it}} = \gamma_0 + \gamma_1 \frac{\#\text{days}}{L_{it}} + \eta_{it} + \upsilon_{it}, \tag{5}$$

where Y_{it} denotes the number of objections filed by taxpayers, the number of objections granted in favor of the taxpayer or the number of objections rejected in tax office i in year t. η_{it} denotes the unobserved tax office quality. Unlike for tax office productivity, successful capacity-building would be reflected in a negative effect of the coefficient for the number of objections, as taxpayers raise fewer objections against tax office decisions.

3.3 Identification strategy

The number of days of secondments received per employee by the East German tax offices is an endogenous variable in equations (4) and (5). On the one hand, West German tax officials may respond to requests by East German tax offices. If weaker tax offices demand more support, i.e., if $Cov(\#\text{days}/L_{it}, \omega_{it}) < 0$, the coefficient of the capacity-building measures would be biased towards zero. On the other hand, West German tax officials may find it more rewarding to support stronger tax offices because they immediately see the results of their efforts. In that case, the regressions could overestimate the effects of the capacity-building measures, as $Cov(\#\text{days}/L_{it}, \omega_{it}) > 0$.

To address these concerns, we exploit the principle of voluntary participation and implement an instrumental variables (IV) strategy. Our instruments capture the costs and benefits of being seconded for West German tax officials. We use the local real value of the financial incentive,

measured in square meters of construction-ready land, to capture the benefit of secondments. The distance between the East German and West German tax office proxies the commuting costs associated with secondments. Finally, we use the ratio of the size of the West German tax office before reunification relative to the East German tax office in order to capture the supply of tax officials that could volunteer for secondments in East Germany.[10] In short, we estimate the following first-stage specification:

$$\frac{\#\text{days}_{it}}{L_{it}} = \alpha_0 + \alpha_1 \text{real fin. incentive}_{it} + \alpha_2 \text{distance}_i + \alpha_3 \frac{\#\text{West German FTE}_{i,1990}}{\#\text{East German FTE}_{it}} + u_{it} \quad (6)$$

We use contemporaneous variables to instrument contemporaneous capacity-building measures $\#\text{days}_{it}$. To instrument the aggregate capacity-building measures $\sum_{\tau=1990}^{1993} \#\text{days}_{i\tau}$, we use the average values of the IVs in the years 1990-93.

We interpret the 2SLS estimates of β_1 and γ_1 in equations (4) and (5) as the causal effect of the capacity-building measures per FTE on tax office outcomes. This interpretation assumes that the IVs change only the number of days of capacity building per FTE. One may be concerned that the IVs also affect the composition of tax officials volunteering to go on secondment. In particular, the unobservable intrinsic motivation to build capacity in the East German fiscal administration could vary across individuals. Thus, higher financial incentives or lower distance could not only increase the amount of capacity building, but also induce less intrinsically motivated individuals to participate. If this is the case and if higher intrinsic motivation increases the effectiveness of capacity building, the estimated coefficients in our regressions would estimate a lower bound of the causal effect of the capacity building on tax office outcomes.

4 Data

4.1 Capacity-building measures

We collected data on the monthly scope of secondments (in workdays) at the level of the tax office for all East German federal states. Collecting the data on secondments was challenging, because the key benefit of the institutional set-up for identification proved a major difficulty for data collection. The decisions on secondments were taken in a decentralized way by the West

[10] For some West German federal states, personnel information is not available for 1990. In this case, we use the earliest years available, as explained in detail in Appendix X.

German federal states or even by individual West German tax offices: The different German states neither coordinated whether to record information on the capacity-building measures nor which authority records information in which format. We closely collaborated with the Ministries of Finance and agencies in all German federal states as well as with the Federal Archives ("Bundesarchiv") and the archives of the German federal states ("Landesarchive") to collect the data.

For a subset of federal states, we were able to uncover data on individual secondments (comprehensively for Saxony; for subsets of tax offices or time periods for the other federal states). In fact, the data from two West German federal states was recovered from individual personnel files by the researchers and by the personnel department of the fiscal administration. This individual level data contains information on each seconded tax official (hierarchical rank, gender, tax office of origin) as well as information on each of their secondment spells (start and end date, tax office of destination, performed task at destination).[11] Our diligent work resulted in a comprehensive data set on the capacity-building measures implemented in all tax offices in East Germany during 1990–2000.

Figure 2 depicts the amount of capacity building per tax office, as measured by the number of workdays that West German tax officials spent working in a tax office. Panel A shows the average number of workdays per tax office by year. While tax officials were present in East German tax offices on only relatively few days in 1990 (145 workdays, on average), we observe a dynamic increase in 1991 and 1992, reaching the peak of 1,665 workdays (on average) in 1992. This is equivalent to the annual number of workdays of seven tax officials.

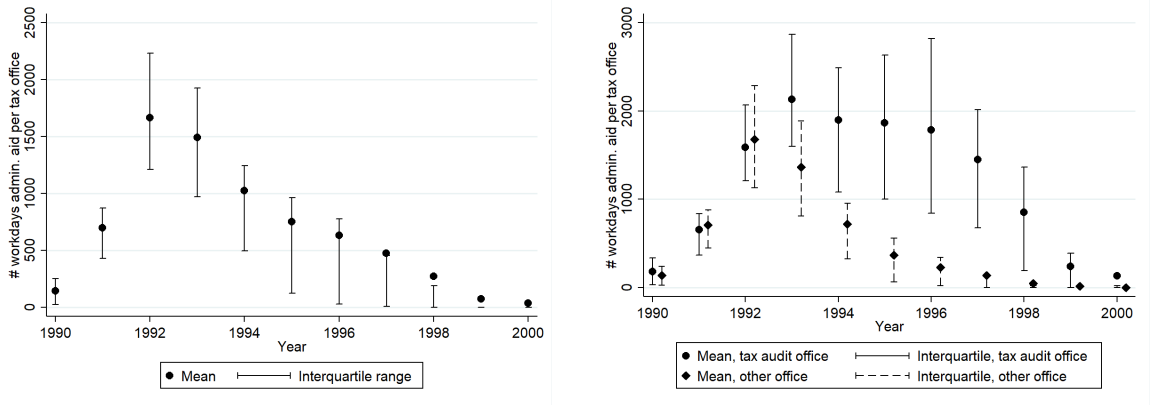
Panel B separately shows the average number of workdays for tax offices without (circles) and with (diamonds) tax audit unit. The units for external audits were built up later than, e.g., the assessment units; they were mainly established in 1994–1998 period as compared to 1990–1993 for the other units. This seems natural given that an external tax audit is a conclusive, retrospective review of the tax case. That audit units were established and supported at a later point in time also shows up in Panel B: In tax offices with audit unit, we observe sustained levels of capacity building throughout 1997, declining only thereafter. In contrast, in tax offices without audit unit, the average number of workdays of seconded tax officials per tax office is significantly smaller after 1993, quickly fading out. By 1999/2000, the number of workdays is

[11] The individual level data also contains information on secondments to other parts of the tax administration such as to the intermediate authorities and to training institutions. We focus on tax offices only.

close to zero for all types of tax offices.

Based on Figures 2, we identify three phases of capacity building: In the first phase (1990–1993), all tax offices received a substantial amount of capacity building; in the second phase (1994–1998), the support was predominantly focused on tax offices with audit units, and in the third phase (1999/2000 and beyond), the capacity building came to an end. In our analyses we focus on the capacity-building measures during the first phase, the years 1990-1993. Information on the tasks of West German tax officials confirm that the support was mainly directed to audit units in the 1994–1998 period.

Figure 2: Capacity building for general tasks focused on years 1990–93



(a) Panel A: Number of days, by year

(b) Panel B: Number of days, by year and task

This figure plots the mean and interquartile range of the capacity-building measures per East-German tax office over time. Panel A provides statistics for all tax offices; Panel B provides statistics separately for tax offices with and without tax audit responsibility. The figure includes tax offices in Mecklenburg-Western Pomerania (except those supported by Hamburg), Saxony and Thuringia.

In our regressions, we scale the number of workdays of capacity building by the size of each East German tax office (measured in full-time equivalents of East German personnel). In Table 3 we provide descriptive statistics on our main explanatory variable, our instruments and control variables. On average, West German tax officials spent 14 days per full-time equivalent on secondment in each East German tax office. This accumulated to an average of 48 days in the years 1990–1993, with noteworthy variation across tax offices (standard deviation of 29). For each day on secondment, German tax official receive financial incentives equal to 0.7 square metres of building (standard deviation of 0.4). West German tax offices (in terms of full-time equivalents in 1989) were about 2.3 times larger than East German tax offices in years 1990–1993. The mean distance between the East German tax office and their West German partner was about 232 km, with significant variation across offices. About 13% of tax offices

have an audit unit, and roughly 142 thousand individuals live in one tax office's district.

Table 3: Summary statistics: capacity building

	Mean	SD
# days per FTE, same year	14.151	10.365
# days per FTE, 1990-93	48.219	28.553
Mean real financial incentive (in sqm land)	0.727	0.449
Relative tax office size	2.303	1.362
Mean distance to partner (in km)	232.046	135.673
Audit unit (0/1)	0.126	0.333
Population (in thsd.)	141.956	79.815
Observations	253	

Sample: The sample consists of all East German tax offices in 1991 to 1993 (for now excluding those in Brandenburg).

To understand in depth the conditions, constraints and considerations for capacity building after German reunification, we conducted more than 50 interviews with contemporary witnesses. The interviewees include former prime ministers, former and current Ministers of Finance and State Secretaries of East German federal states, former and current Heads of Tax Departments, former West German officials on secondment and East German tax officials. The interviews have greatly improved our understanding of the immediate context after the reunification and informed our instrumental variable strategy and other elements of the empirical set-up.

4.2 Tax office performance

As explained in Section 3, we consider two dimensions of tax office performance: tax office productivity and quality of work. Summary statistics on both dimensions are presented in Table 4. The table splits our data in years 1992–1993 (columns 1 and 2, short-term) and years 1995–2000 (columns 3 and 4, long-term). The average number of cases assessed per tax office employee for the corporate income tax more than doubles from 3 (1992-1993) to 7 (1995–2000). For the personal income tax the average number of cases increases substantially from 35 (1992–1993) to 62 (1995–2000). We also observe an increase for the wage tax, although it is less pronounced. Overall, the average tax office productivity significantly increased over time. On average, taxpayers raise 13 objections per tax office employee in 1992–1993, increasing to 30 in 1995–2000. A rise is to be expected for two reasons: First, every tax office employee assesses a greater number of tax declarations in later years, mechanically increasing the number

of objections per employee. Second, the timing of events contributes to this pattern. Prior to raising an objection, taxpayers need file a tax declaration and receive a tax statement.

Table 4: Summary statistics: performance

	1992–1993		1995–2000	
	Mean	SD	Mean	SD
Number of cases assessed per employee				
corporate income tax	2.784	2.580	6.930	3.201
personal income tax	35.332	17.004	61.552	17.886
wage tax	141.961	52.096	177.693	39.956
Number of objections per employee				
raised	13.167	10.141	30.645	10.702
thereof: withdrawn	2.110	1.432	6.683	2.130
thereof: granted	7.912	7.846	20.179	8.605
Ratio: objections withdrawn / objections granted	30.795	10.707	36.377	11.994
Observations	158		476	

Sample: The sample consists of all East German tax offices in 1991 to 1993 (for now excluding those in Brandenburg).

Output quality also influences the resolution of objections. Tax offices may reject or grant objections. Unclear objections are decided in court. We interpret rejected objections as indicative of high output quality and objections granted by the tax office as indicative of low output quality. For a subset of objections, namely all objections raised in Saxony-Anhalt, tax offices documented both the type of objection resolution (rejection, approval, decision in court) and whether an objection was fully unsuccessful, partly successful, or fully successful from the taxpayer's perspective for each case. In Figure A.1 in the appendix, both variables are plotted against each other, revealing that fully unsuccessful objections are usually rejected by the tax office, while fully and partly successful objections are typically granted by the tax office. Decisions in court can indicate both fully unsuccessful and successful objections. Taken together, the figure suggests that rejections and approvals can be used to measure tax office output quality.

4.3 Sample

Our main sample thus consists of the tax offices in the East German states of Thuringia, Saxony, and Mecklenburg-West Pomerania, excluding those partnered with tax offices in Hamburg. In the body of the paper, we also report the OLS results including Brandenburg and the tax offices in Mecklenburg-West Pomerania partnered with counterparts in Hamburg. We document that

our results are robust to including Saxony-Anhalt in the Appendix.

5 Results

5.1 West German tax office characteristics determine amount of capacity building

First, we document that the amount of the capacity-building measures received by East German tax offices varied with characteristics of their West German partner tax office. The capacity-building measures were indeed partly determined by factors exogenous to the situation and needs of the East German tax office.

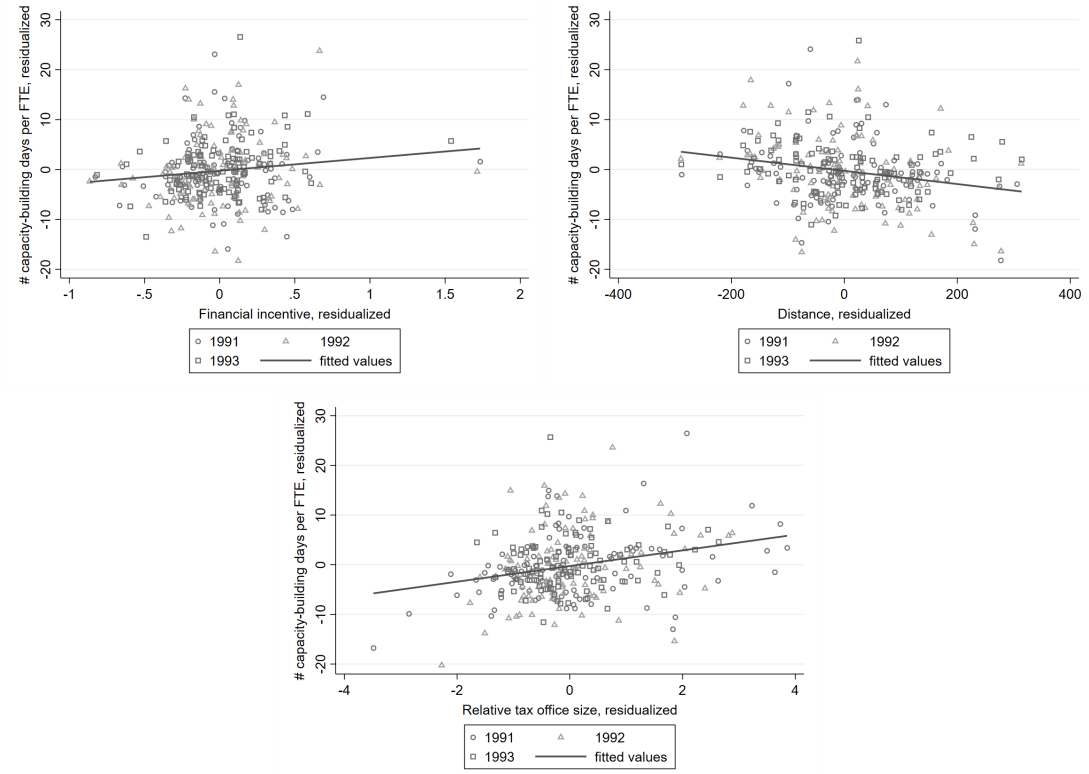
We use as instruments the local real value of the daily financial incentive, the distance as proxy for the travel costs, and the relative size of the West to East German tax offices. Figure 3 displays the relation between the instrumental variables and the number of days of West German presence per East German tax office employee in 1991-93. Consistent with our priors, the financial incentive and the relative tax office size are positively correlated with capacity-building measures, while the distance correlates negatively.

Table 5 shows the results from regressing the number of days of capacity-building measures per East German tax office employee on the instrumental variables (equation (6)). Column 1 is estimated at the level of tax office. Column 2 is estimated at the city level, because population is only available at the city level.

Financial incentives, distance, and relative tax office size are each important determinants of the amount of capacity building. Increasing the financial incentive by one standard deviation leads to an increase of the capacity-building measures by 0.24 standard deviations according to our estimates in column 1. Similarly, a one-standard-deviation lower distance increases the capacity building measures by 0.35 standard deviations. Our findings are consistent with West German tax officials voluntarily participating in the capacity building.

An East German tax office partnered to tax offices in the West with relatively more personnel receives a larger amount of capacity-building measures: a one-standard-deviation increase in the relative size of West to East German tax offices increases the amount of capacity building by 0.45 standard deviations. This finding reflects that a larger number of West German tax

Figure 3: Correlations of West German partner characteristics and amount of capacity building



Scatter plots show correlations between residualized instruments (financial incentive, distance, relative tax office size) and residualized number of capacity-building days (1991–3), partialling out the effect of the other instruments and federal-state specific time trends. Main sample (see section 4.3).

officials could volunteer if the partner tax office was relatively larger. Overall, the West German tax office characteristics have a high explanatory power, with a F-statistic of 23.

Our results are robust to controlling for population as a proxy for the workload in each tax office. As population is only available at the city level, and as large cities usually have several tax offices that may specialize in certain tasks,[12] we aggregate tax offices in large cities to one unit of observation. Regressions results at the city level (column 2) are similar despite fewer observations. A one-standard-deviation increase in the financial incentive leads to an increase in the amount of capacity building by 0.21 standard deviations. The corresponding figures for lower distance and larger relative size are 0.31 and 0.44 standard deviations. The F-statistic decreases slightly to 20.3. Overall, our results show that the amount of capacity building in East German tax offices significantly depends on characteristics of West German partner tax offices.

[12]For example, one city tax office may specialize on the assessment of employees, while another city tax office may specialize on assessing the corporate income tax.

Table 5: Characteristics of West German tax offices determine the amount of capacity building

	# days per FTE, same year	
	tax office	city
	(1)	(2)
Mean real financial incentive (in sqm land)	3.486**	2.861*
	(1.545)	(1.501)
Mean distance to partner	-0.016***	-0.014***
	(0.003)	(0.003)
Relative tax office size	1.962***	2.021***
	(0.374)	(0.451)
Log population		-0.617
		(1.125)
Constant	3.547	10.118
	(2.857)	(13.781)
EG state trend	✓	✓
F-statistic	23.467	20.306
Number of Observations	197	182

Notes: The table shows that West German tax office characteristics determined the amount of capacity-building measures received by East German tax offices (estimation equation (6)). *Dependent variable*: number of workdays of capacity-building measures per East German tax office employee per year. *Independent variables*: daily financial incentive for West German tax officials (in square meters of building land), distance between West and East German partner tax offices, relative size of West and East German tax offices, log population (column 2). Average incentive, distance and relative size for East German tax offices with several partner tax offices. Column 1 estimated at the level of the tax office; column 2 estimated at the city level. Standard errors clustered by tax office (column 1) and city (column 2) in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$. *Sample:* Main sample, 1991–93.

5.2 Capacity-building measures increase short-term output quantity

We exploit the exogenous variation in the capacity-building measures to identify causal effects on East German tax office output quantity. We measure output quantity with the number of tax declarations assessed as explained in section 3.1.

We investigate short-term and long-term effects based on equation (4). For the short-term estimates, we relate output quantity per East German tax office full-time employee in years 1992 and 1993 to the contemporaneous amount of capacity-building measures per employee. For the long-term estimates, we relate output quantity in years 1995 to 2000 to the aggregate amount of capacity-building measures a tax office received per employee in 1990–93. All effects are estimated with both OLS and 2SLS. We run the regressions at the city level and cluster standard errors accordingly in order to include population as control variable and to account for possible specialization on tax types at the city level.

Table 6: Capacity-building measures increase tax office output quantity in the short term

	Log # of tax declarations per FTE					
	Short-term			Long-term		
	OLS	OLS	IV	OLS	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
# days per FTE, same year	0.008***	0.010***	0.016***			
	(0.002)	(0.002)	(0.006)			
# days per FTE, 1990-93				-0.001	-0.000	0.001
				(0.001)	(0.001)	(0.003)
Audit unit (0/1)				-0.198***	-0.219***	-0.211***
				(0.032)	(0.035)	(0.040)
Log population	0.133***	0.112***	0.135***	0.073*	0.086**	0.099**
	(0.041)	(0.035)	(0.038)	(0.039)	(0.042)	(0.047)
Constant	3.482***	3.918***	4.227***	5.204***	5.014***	4.952***
	(0.472)	(0.424)	(0.472)	(0.475)	(0.498)	(0.587)
EG state trend	✓	✓	✓	✓	✓	✓
Number of Observations	173	121	121	448	329	329
R^2	0.861	0.894		0.339	0.348	
F-statistic			15.264			8.415

Notes: The table documents that the capacity-building measures increase tax office output quantity in the short term (estimation equation (4)). *Dependent variable*: log number of declarations assessed per East German tax office employee and year. *Independent variables*: number of workdays of capacity-building measures per East German tax office employee, log population, presence of a unit for external company audits (only long-term analyses), federal-state-specific time trends. Columns 1, 2, 4, 5: OLS results; columns 3, 6: 2SLS results. *Instrumental variables*: daily financial incentive for West German tax officials (in sqm of building land), distance between West and East German partner tax offices, relative size of West and East German tax offices. Contemporaneous capacity-building measures instrumented with contemporaneous variables, aggregate capacity-building measures instrumented with average values in years 1990-93. Standard errors clustered by city in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$.
Sample: Main sample; columns 1, 4 additionally include Brandenburg and tax offices partnered with tax offices in Hamburg. Years: 1992–1993 (columns 1–3, short-term effects) and 1995–2000 (columns 4–6, long-term effects).

Table 6 presents the results on the impact of capacity-building on tax office output quantity. The estimates for capacity building are positive and highly significant in the short term. The IV coefficients are slightly larger than the OLS coefficients, suggesting that weaker tax offices received a higher amount of capacity-building measures. A one-standard deviation increase in capacity building increases the number of declarations assessed per tax office employee by 9.5% (2SLS). Our specification has high explanatory power for short-term output quantity with R^2 of 0.86 and 0.89 in the OLS regressions. The point estimates for the long-term effects of the capacity-building measures are both statistically and economically zero (columns 4–6).

Robustness. Table C.6 in the Online Appendix documents that results are robust to including Saxony-Anhalt in the sample. Table **??** shows that results are similar if we use the recommended financial incentive at the federal level instead of state-level incentives. All the findings are robust to estimations at the tax office level as documented in Appendix Table XX.

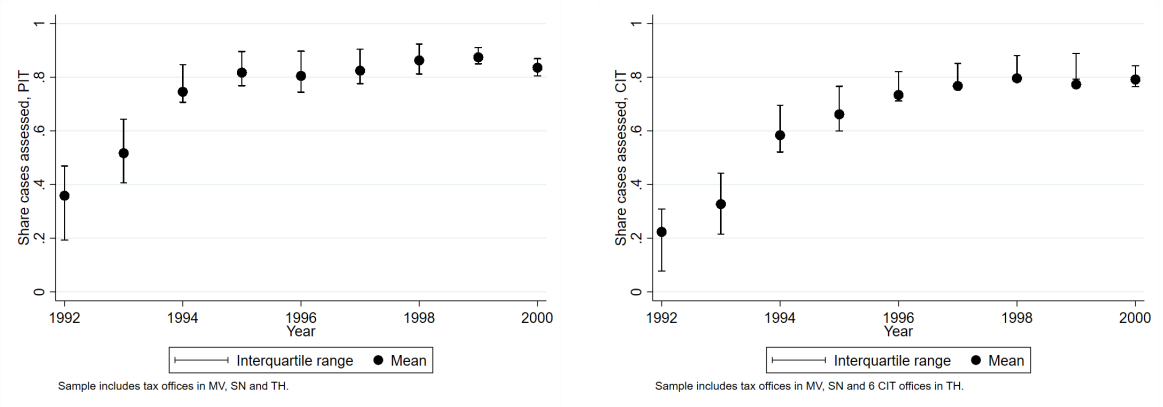
Returns to capacity-building. We use the regression results on output quantity to conduct back-of-the-envelope calculations of the implied returns to capacity-building. To do so, we compare the increase of the number of tax declarations assessed per year of secondment to its opportunity costs, the number of tax declarations that the seconded official would have assessed in their West German tax office. At the mean, an additional year of capacity-building increases the number of tax declarations assessed per employee by 5.3 (in 1992), or 725 declarations per tax office and year. On average, a West German tax official assessed 500 tax declarations in 1990. The return to one year of secondments, relative to the foregone tax declarations in the West, is thus in the ballpark of 1.5 (in 1992) to 2.2 (in 1993). Accounting for the financial incentives reduces the return, but it remains larger than one and sizable at 1.1 (in 1992) and 1.8 (in 1993). We provide details on our calculation in Appendix W.

Mechanisms. Why do the capacity-building measures increase tax office output quantity, and why does their effect dissipate quickly? To make progress on the first question, Table 7 reports regression results separately for the three tax types, wage tax, personal income tax, and corporate income tax. The taxes vary in complexity for tax officials when assessing declarations (see Appendix B.2). We find that the short-term effects are more pronounced for the corporate income tax than for the personal income tax, and, in turn, slightly larger (although not statistically different) for the personal income tax than for the wage tax. The corporate income tax is

the most complex of the three tax types. Personal income tax declarations require case-by-case decisions, while the wage tax tends to be the most standardized among the three tax types. The capacity-building measures thus have a stronger effect for more complex tasks. This is consistent with successful knowledge transfer as the mechanism driving capacity-building. Appendix table A.4 reports the absence of long-term effects by tax type.

Regarding the long-term effects, it is crucial whether differences disappear because all tax offices converge to a high level of output quantity, or because all tax offices fall to a low output level. We find that all tax offices converge to a high output level from the mid-1990s onwards. In fact, as Figure 4 documents, the speed of assessment increases to its permanent level of around 80% for the personal income tax (PIT) by 1995 and for the corporate income tax (CIT) by 1997. At the same time, the variance in the speed decreases, reflecting that all tax offices reach similar levels. This pattern is consistent with successful knowledge transfer as mechanism behind the effects of capacity building. The variation in capacity-building measures across offices gave some tax offices a head start, but training courses and learning-by-doing allowed tax offices with fewer secondments to catch up over time.

Figure 4: Mean speed of assessment increases and variance declines quickly



(a) Share of cases assessed, PIT

(b) Share of cases assessed, CIT

This figure plots the mean and interquartile range of the share of tax declarations filed for year $t-1$ that are assessed by the end of year t per East-German tax office over time. Panel (a) plots statistics for the PIT; Panel (b) plots statistics for the CIT. Main sample (see section 4.3). CIT responsibilities are concentrated at six tax offices in Thuringia.

5.3 Capacity-building measures increase long-term output quality

We assess the causal effect of capacity building on output quality using the objections that taxpayers raise.

Table 7: Larger effect of capacity-building measures for complex tax types

	Log # of CIT declarations per FTE			Log # of PIT declarations per FTE			Log # of WT declarations per FTE		
	OLS	OLS	IV	OLS	OLS	IV	OLS	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
# days per FTE, same year	0.015***	0.023***	0.032***	0.010***	0.013***	0.013**	0.007**	0.008**	0.017*
	(0.005)	(0.007)	(0.012)	(0.003)	(0.004)	(0.006)	(0.003)	(0.004)	(0.009)
Log population	0.355***	0.431***	0.467***	0.012	-0.060	-0.061	0.128**	0.114**	0.150***
	(0.068)	(0.083)	(0.087)	(0.059)	(0.069)	(0.066)	(0.050)	(0.050)	(0.055)
Constant	-3.839***	-4.216***	-3.396***	2.902***	3.989***	4.557***	2.812***	3.022***	3.384***
	(0.829)	(1.010)	(1.091)	(0.693)	(0.816)	(0.775)	(0.587)	(0.602)	(0.685)
EG state trend	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Observations	142	90	90	173	121	121	173	121	121
R^2	0.771	0.830		0.822	0.850		0.759	0.727	
F-statistic			15.300			15.264			15.264

Notes: The table documents that the capacity-building measures have a larger impact on short-term tax office output quantity for more complex tax types (estimation equation (4)). *Dependent variable*: log number of declarations assessed per East German tax office employee and year, differentiating between the corporate income tax (CIT, columns 1-3), the personal income tax (PIT, columns 4-6), and the wage tax (WT, columns 7-9). CIT is more complex than PIT, and PIT is more complex than WT, see appendix B.2. Only a subset of tax offices has CIT responsibilities in Thuringia, resulting in a lower number of observations in columns 1-3. *Independent variables*: number of workdays of capacity-building measures per East German tax office employee, log population, federal-state-specific time trends. Columns 1, 2, 4, 5, 7, 8: OLS results; columns 3, 6, 9: 2SLS results. *Instrumental variables*: daily financial incentive for West German tax officials (in sqm of building land), distance between West and East German partner tax offices, relative size of West and East German tax offices. Contemporaneous capacity-building measures instrumented with contemporaneous variables. Standard errors clustered by city in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$.
Sample: Main sample; columns 1, 4, 7 additionally include Brandenburg and tax offices partnered with tax offices in Hamburg. Years: 1992–1993.

Table 8 documents the impact of capacity building on the number of objections. Columns 1–3 show that the capacity-building measures does not affect the number of objections in the short term. This is remarkable given that we find in the previous section that capacity building increases tax office output quantity. With higher output quantity, one would expect a higher number of objections if quality was the same across tax offices. We interpret the absence of an increase in objections as indicative for higher output quality.

Columns 4–6 show that capacity building reduces the number of objections raised in the long term. The IV coefficient is more negative than the OLS coefficient, although differences are not significant. The estimated impact of capacity building is statistically and economically significant. A one-standard-deviation increase in capacity-building measures reduces the number of objections by 0.33 standard deviations (based on IV estimate, column 6). Tax offices with tax audit units receive significantly fewer objections per employee, reflecting that part of their workforce are entrusted with tasks that are different from assessment.

Table 8: Capacity-building measures increase tax office output quality in the long term

	# of objections per FTE					
	Short-term			Long-term		
	OLS	OLS	IV	OLS	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
# days per FTE, same year	−0.013	−0.028	−0.001			
	(0.094)	(0.126)	(0.236)			
# days per FTE, 1990-93				−0.234***	−0.158**	−0.202*
				(0.081)	(0.076)	(0.120)
Audit unit (0/1)				−5.264***	−5.223***	−5.509***
				(1.764)	(1.755)	(1.690)
Population (in thsd.)	0.016**	0.013*	0.014**	0.016**	0.023***	0.022***
	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)
Constant	25.895***	5.915***	24.022***	54.206***	23.525***	33.766***
	(2.096)	(2.077)	(4.097)	(4.079)	(3.055)	(3.814)
EG state trend	✓	✓	✓	✓	✓	✓
Number of Observations	152	121	121	356	282	282
R^2	0.535	0.445		0.663	0.415	
F-statistic			15.265			14.168

Notes: The table documents that capacity-building measures increase tax office output quality in the long term (estimation equation (5)). *Dependent variable*: number of objections raised per East German tax office employee and year. *Independent variables*: number of days of capacity-building measures per East German tax office employee, presence of a unit for external company audits (years 1995-2000), population (in thousands), federal-state-specific time trends. Columns 1–3 document short-term effects; columns 4–6 document long-term effects. Columns 1, 2, 4, 5: OLS results; columns 3, 6: 2SLS results. Instrumental variables for capacity-building measures: daily financial incentive for West German tax officials (in sqm of building land), distance between West and East German partner tax offices, relative size of West and East German partner tax offices. Contemporaneous capacity-building measures instrumented with contemporaneous variables, aggregate capacity-building measures instrumented with average values in years 1990-93.
Sample: Main sample; columns 1, 4 include tax offices in Brandenburg and those partnered with tax offices in Hamburg.

One might be concerned that tax office districts differ in individuals' willingness to raise objections for reasons unrelated to capacity building, such as social or cultural reasons. To assess

this possibility, we use statistics on the number of complaints and requests directed toward the administration of the former GDR. The statistics are contained in the Potsdam Grievance Statistics File (Class et al., 2018). Our instruments are not correlated with the likelihood that citizens submitted complaints or requests in 1988 and 1989 (see table A.5 in the appendix). This evidence supports our interpretation that the differences in the number of objections are indeed driven by the capacity building measures.

Table 9: Capacity-building measures decrease number of granted and rejected objections

	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) IV
Panel A: Objections granted						
# days per FTE, same year	0.000	0.005	−0.020			
	(0.079)	(0.107)	(0.218)			
# days per FTE, 1990-93				−0.147***	−0.126**	−0.117+
				(0.048)	(0.049)	(0.086)
R^2	0.479	0.362		0.503	0.418	
F-statistic			15.265			14.168
Panel B: Objections rejected						
# days per FTE, same year	−0.007	−0.001	−0.021			
	(0.007)	(0.009)	(0.029)			
# days per FTE, 1990-93				−0.046**	−0.042**	−0.081**
				(0.018)	(0.019)	(0.032)
R^2	0.774	0.759		0.544	0.528	
F-statistic			15.265			14.168
EG state trend	✓	✓	✓	✓	✓	✓
Number of Observations	152	121	121	300	282	282

Notes: The table documents that capacity-building measures decrease both the number of granted and rejected objections in the long term (estimation equation (5)). *Dependent variable*: number of objections granted (panel A), number of objections rejected (panel B), respectively, per East German tax office employee and year. *Independent variables*: number of days of capacity-building measures per East German tax office employee, unreported: presence of a unit for external company audits (years 1995-2000), population (in thousands), federal-state-specific time trends. Columns 1–3 document short-term effects (1992–93); columns 4–6 document long-term effects (1995–2000). Columns 1, 2, 4, 5: OLS results; columns 3, 6: 2SLS results. Instrumental variables for capacity-building measures: daily financial incentive for West German tax officials (in sqm of building land), distance between West and East German partner tax offices, relative size of West and East German partner tax offices. Contemporaneous capacity-building measures instrumented with contemporaneous variables, aggregate capacity-building measures instrumented with average values in years 1990-93.
Sample: Main sample; columns 1, 4 include tax offices in Brandenburg and those partnered with tax offices in Hamburg. Lower number of observations than in table 8 due to missing values for the composition of objections for Brandenburg in years 1997–1999 ($N = 19$ in 1997 and 1998, $N = 18$ in 1999).

Mechanisms. We study the outcome of objections to understand the mechanisms driving the negative effect of capacity building on their number. Table 9 separately presents the results for successful objections for which the tax office revises its decision in favor of the taxpayer (ob-

jections granted, about 60% of objections raised), and the results for unsuccessful objections that are rejected by the tax office (objections rejected, about 25% of objections raised). Consistent with the interpretation of the tax administration, we interpret a decline of the number of successful objections as suggestive of higher tax office output quality, because the tax office makes fewer mistakes. We interpret a lower number of unsuccessful objections as indicative of higher taxpayer trust in the tax offices, as taxpayers raise fewer unfounded objections.

The short-term estimates in Table 9 are insignificant and small for both types of objections. In the long term, our regressions document that capacity building significantly reduces both the number of successful and unsuccessful objections. The magnitude of the effect is both statistically and economically significant: an increase of the capacity-building measures by one standard deviation decreases the number of successful objections by 0.19 standard deviations and the number of unsuccessful objections by 0.31 standard deviations (both based on the IV estimates in column 6).

These results are consistent with successful knowledge transfer as mechanism behind the effects of capacity building. The lower number of successful objections could either reflect that tax office employees make fewer mistakes in assessing taxes, or that they handle objections more effectively. Either interpretation is consistent with higher knowledge of tax officials. The lower number of unsuccessful objections is indicative of higher taxpayer trust in these offices.

Robustness. Table C.7 in the Online Appendix documents that results are robust to including Saxony-Anhalt in the sample.

6 Design of capacity-building initiatives

We exploit additional dimensions of our data to shed light on how to optimally design capacity-building initiatives. Sections 6.1 to 6.2 exploit that we have individual-level information on capacity-building measures for a subset of tax offices, which allows us to analyze the effect of variation in the length of secondments, XXX and YYY.

6.1 Secondments of intermediate length are most effective

We next explore whether the length of secondments affects the effectiveness of capacity-building measures. Anecdotal evidence suggests that short-term stays by many different West German

tax officials reduces effectiveness, as West German tax officials need time to familiarize themselves with the situation in the East German tax offices and as it was difficult for West German officials to coordinate (see Appendix B.3). At the same time, very long secondments likely have decreasing returns as well, because individual expertise is limited and seconded officials may become more and more involved in day-to-day responsibilities over time.

We use comprehensive secondment-level information from the West German states of Bavaria, Baden-Württemberg, and Hamburg to explore the effects of different secondment lengths on tax offices in Saxony, as well as those in Mecklenburg-West Pomerania supported by Hamburg, and those in Thuringia supported by Bavaria. Due to the reduced number of tax offices, we report only OLS results. We assign secondments to three categories: short secondments of up to one month, i.e., up to 20 workdays, intermediate secondments of one to three months, i.e., 21-60 workdays, and long secondments of more than three months, i.e., more than 60 workdays. We omit breaks of less than five workdays between two consecutive secondments to avoid overestimating the role of short secondments. For short-term analyses, we compute secondment lengths up to the end of a year. For long-term analyses, we compute secondment lengths during the 1990–93 period.

We include the ratio of short-term to long-term secondments in equation (5):[13]

$$\frac{Y_{it}}{L_{it}} = \gamma_0 + \gamma_1 \frac{\text{\#days}}{L_{it}} + \gamma_2 \frac{\text{\#days, short-term}}{\text{\#days, long-term}} + \eta_{it} + \upsilon_{it}. \tag{7}$$

The coefficient γ_2 shows whether shifting days between short-term and long-term secondments affects tax office output quality for a given amount of capacity-building measures per employee. We define short vs. long-term in two different ways: secondments of up to three months vs. more than three months and secondments of up to one month vs. more than one month. Table 10 presents our regression results.

Columns 1 and 2 show for all quality measures that the ratio of short-term to long-term secondments does not affect tax office output quality contemporaneously. Columns 3 and 4 indicate that shifting days from the long-term to the short-term category increases long-term output quality. At the mean of 30.5 days per employee, an increase of the ratio of short-term to long-term secondments by one standard deviation is equivalent to shifting 2.9 days (2.6 days) per

[13] We analogously explore the effect of secondment length on tax office productivity, but cannot detect signficant effects. We report results in Appendix Table X.

employee if we define short-term secondments as those lasting up to three months (one month). Reducing secondment lengths from above to below three months decreases the number of objections filed per employee by 2.1, the number of objections granted per employee by 1.7, and the number of rejected objections per employee by 0.6 according to column 3. Column 4 shows that the effect of a shift towards even shorter secondments is smaller: shifting days towards secondments of up to one month decreases the number of objections filed per employee by 1.8, the number of objections granted per employee by 1.5 and the number of rejected objections per employee by 0.5.

We interpret these findings as indicating that secondments of intermediate length are most effective. An intermediate secondment length plausibly balances the problems related to both a lack of coordination and a loss of expertise resulting from frequent changes in seconded officials, and the problems related to their involvement in day-to-day duties during prolonged stays.

Table 10: Secondments of intermediate length are most effective

	(1)	(2)	(3)	(4)
Panel A: Objections filed per FTE	*1992–93*		*1995–2000*	
# days per FTE, same year	0.101	0.102		
	(0.168)	(0.163)		
Ratio $<$ 3 months/$>$ 3 months, same year	-1.676			
	(2.246)			
Ratio $<$ 1 month/$>$ 1 month, same year		-5.313		
		(4.989)		
# days per FTE, 1990-93			-0.108^{+}	-0.116^{+}
			(0.069)	(0.075)
Ratio $<$ 3 months/$>$ 3 months, 1990-93			-9.136^{*}	
			(4.539)	
Ratio $<$ 1 month/$>$ 1 month, 1990-93				-12.233^{*}
				(6.485)
R^2	0.378	0.382	0.368	0.353
Panel B: Objections rejected per FTE	*1992–93*		*1995–2000*	
# days per FTE, same year	0.013	0.013		
	(0.013)	(0.013)		
Ratio $<$ 3 months/$>$ 3 months, same year	0.083			
	(0.304)			
Ratio $<$ 1 month/$>$ 1 month, same year		0.152		
		(0.626)		
# days per FTE, 1990-93			-0.037^{*}	-0.038^{*}
			(0.020)	(0.021)
Ratio $<$ 3 months/$>$ 3 months, 1990-93			-2.505^{**}	
			(1.083)	
Ratio $<$ 1 month/$>$ 1 month, 1990-93				-3.631^{**}
				(1.659)
R^2	0.723	0.723	0.327	0.322
Panel C: Objections granted per FTE	*1992–93*		*1995–2000*	
# days per FTE, same year	0.135	0.135		
	(0.146)	(0.143)		
Ratio $<$ 3 months/$>$ 3 months, same year	-0.767			
	(1.771)			
Ratio $<$ 1 month/$>$ 1 month, same year		-2.452		
		(3.720)		
# days per FTE, 1990-93			-0.085^{**}	-0.091^{*}
			(0.042)	(0.047)
Ratio $<$ 3 months/$>$ 3 months, 1990-93			-7.418^{**}	
			(3.188)	
Ratio $<$ 1 month/$>$ 1 month, 1990-93				-10.283^{**}
				(4.207)
R^2	0.296	0.297	0.378	0.362
Number of observations	82	82	224	224

Notes: The table documents that secondments of intermediate length are most effective. We include the ratio of the number of days of secondments of less than three (one) months to the number of days of secondments of more than three (one) months in equation (5). Dependent variable: # objections filed (panel A), # objections rejected (panel B), # objections granted (panel C). Independent variables: # days of capacity-building measures per EG tax office employee, ratio of short-term to long-term secondments, omitted: presence of a unit for external company audits, population, constant, EG federal-state-specific time trends. OLS results. SE clustered by EG tax office in parentheses. $^{+}$ $p < .20$, * $p < .10$, ** $p < .05$.

Sample: The sample consists of the EG tax offices in Saxony as well as those in Meckelenburg-West Pomerania supported by Hamburg and those in Thuringia supported by Bavaria. Data on objections is missing for Thuringia in 1995 and 1997.

6.2 ...

To be added. This section explores whether effects are stronger

- *if seconded tax officials have a higher rank (reflecting their education),*
- *if managerial positions (head of tax office or department) are held by West German tax officials.*

Further, we plan to study whether effects vary with the tasks of seconded tax officials.

7 Conclusion

TBC

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