FRIEDRICH-SCHILLER-
UNIVERSITÄT
JENA

# *The impact of socialist legacy on regional differences in innovation activities and cooperation in Europe: A mediation analysis*

Michael Fritsch | Maria Greve | Michael Wyrwich

JENA ECONOMICS RESEARCH PAPERS · # 2025 – 010

The JENA ECONOMICS RESEARCH PAPERS
is a publication of the Friedrich Schiller University Jena, Germany (www.jenecon.de).

# The impact of socialist legacy on regional differences in innovation activities and cooperation in Europe: A mediation analysis

Michael Fritsch[a], Maria Greve[b] and Michael Wyrwich[c]

October 2025

**Abstract**

This paper examines how the legacy of socialist regime in countries of Central and Eastern Europe has affected innovation and R&D cooperation and compares this to Western Europe. Our analysis reveals that the negative impact of socialism on innovation Central and Eastern European countries is mediated by interpersonal trust and the quality of government. These findings highlight the significance of historical context for innovation activity. Our insights are particularly relevant for policymakers who are trying to create effective strategies to encourage technological development in post-socialist regions.

Keywords: Innovation, socialist legacy, institutional quality, trust

JEL-codes: O31, O43, P20, R11

a) Friedrich Schiller University Jena, Germany. m.fritsch@uni-jena.de ORCID 0000-0003-0337-4182

b) University of Utrecht, the Netherlands. m.greve@uu.nl ORCID 0000-0001-5855-9753

c) University of Groningen, The Netherlands, and Friedrich Schiller University Jena, Germany. m.wyrwich@rug.nl ORCID 0000-0001-7746-694

## 1. Aims and scope[1]

Europe is marked by a deep East-West divide when it comes to the level of innovation input and output (e.g. Sommerfeld, Fritsch and Wyrwich 2025). More precisely, innovation activity in the post-communist countries of Central and Eastern Europe (CEE) is much lower than in Western Europe. Quite frequently this pattern is regarded a legacy of the socialist innovation system and its reorganization (Radosevic 2022). Identifying and disentangling these reasons and mechanisms behind the East-West gap in innovation activity is important for guiding policy that aims at stimulating technological catch-up of post-socialist regions (e.g. Shkolnykova et al. 2024).

In this paper we analyze the role of institutional quality and interpersonal trust for explaining the East-West gap in innovation activity found in Europe. Both factors were shown to be important for innovation performance (e.g. Nooteboom et al. 1997; Rodríguez-Pose and Di Cataldo 2015) and both were adversely affected by autocratic rule during the communist period or in the often-incomplete institutional transition (Sapsford et al. 2015; Lichter et al. 2021).

We find that about 70 percent of the negative impact of socialist legacy on the level of innovation activity (measured by patenting) is mediated by institutional quality and interpersonal trust. Hence, we identify an important mechanism of the adverse socialist legacy effect on innovation activity. In our analysis, we also explore the impact of socialist legacy on R&D cooperation (in terms of co-patenting) as this requires a particularly high level of trust and institutional quality (e.g. Nooteboom et al. 1997; Ertug et al. 2013). The results for R&D cooperation are comparable to those on the general level of innovation activity.

Our study contributes to the literature in several ways. First, we enhance the understanding of the historical roots of regional differences in innovation activities in Europe (e.g. Radosevic 2022). Furthermore, our study helps to understand why socialist legacy affects innovation activity and cooperation

[1] Financial support provided by the German Federal Ministry of Education and Research in the framework of a joint research project Modernisierungsblockaden in Wirtschaft und Wissenschaft der DDR (Obstacles to Modernization in the Economy and Science of the GDR) (project number 01UJ1806DY) is gratefully acknowledged.

adversely (e.g. Fritsch, Greve and Wyrwich 2025). Therefore, we contribute to research on the role of economic history in understanding contemporaneous phenomena (e.g., Nunn 2020) and the literature on economic transition (e.g., Aslund and Djankov 2014). We also add to the literature on the determinants of innovation activity (Buesa et al. 2010) and the role of context in innovation strategies such as R&D cooperation (Wyrwich et al. 2022).

The remainder of the paper is organized as follows. In the following section we develop the conceptual framework for the analysis and Section 3 introduces the empirical set-up. The descriptives and findings are presented in Sections 4 and 5, respectively, and the final section (Section 6) concludes.

## 2. Conceptual framework

### 2.1 The socialist innovation model: its pitfalls and adverse legacy

During the Cold War, the innovation systems of the socialist countries of CEE were modeled on the Soviet system. This system largely followed a linear view of innovation activities, regarding basic research as a vital component in the development of new products and processes. In practice, state institutes such as the national academy of sciences dominated research (see, for example, Mayntz 1998), while hardly any R&D took place at enterprise level. Crucially, the linear model disregarded feedback loops between the various stages and key players in the innovation process, such as research institutes, enterprises, and end users, thereby weakening knowledge diffusion and learning (see Radosevic 2022, for an overview).

By contrast, Western-type innovation systems incorporate various feedback loops between stakeholders across all stages of the innovation process. The absence of such interactions in socialist innovation systems is problematic, as these contacts and feedback loops facilitate the dissemination of knowledge, as well as individual and organizational learning (Chandler 1993; Radosevic 2022). Technological embargoes imposed by the West (Cain 2005; Augustine 2013) and, more importantly, the general inefficiencies of socialist economic principles (Kornai 1992) meant that communist countries could not keep up with technological developments in Western Europe.

The dissolution of the communist systems in the CEE countries around the year 1990 led to a massive re-organization of the innovation systems towards the Western-type model. Nonetheless, until today CEE countries lag considerable behind in terms of innovation activities (Sommerfeld et al. 2025). Figure 1 shows the number of patent applications in the period 2016-2020 per 10.000 inhabitants in the NUTS2 regions and highlights a remarkably higher level of innovation activity in Western and Northern Europe, while Eastern and Southern regions exhibit much lower levels.

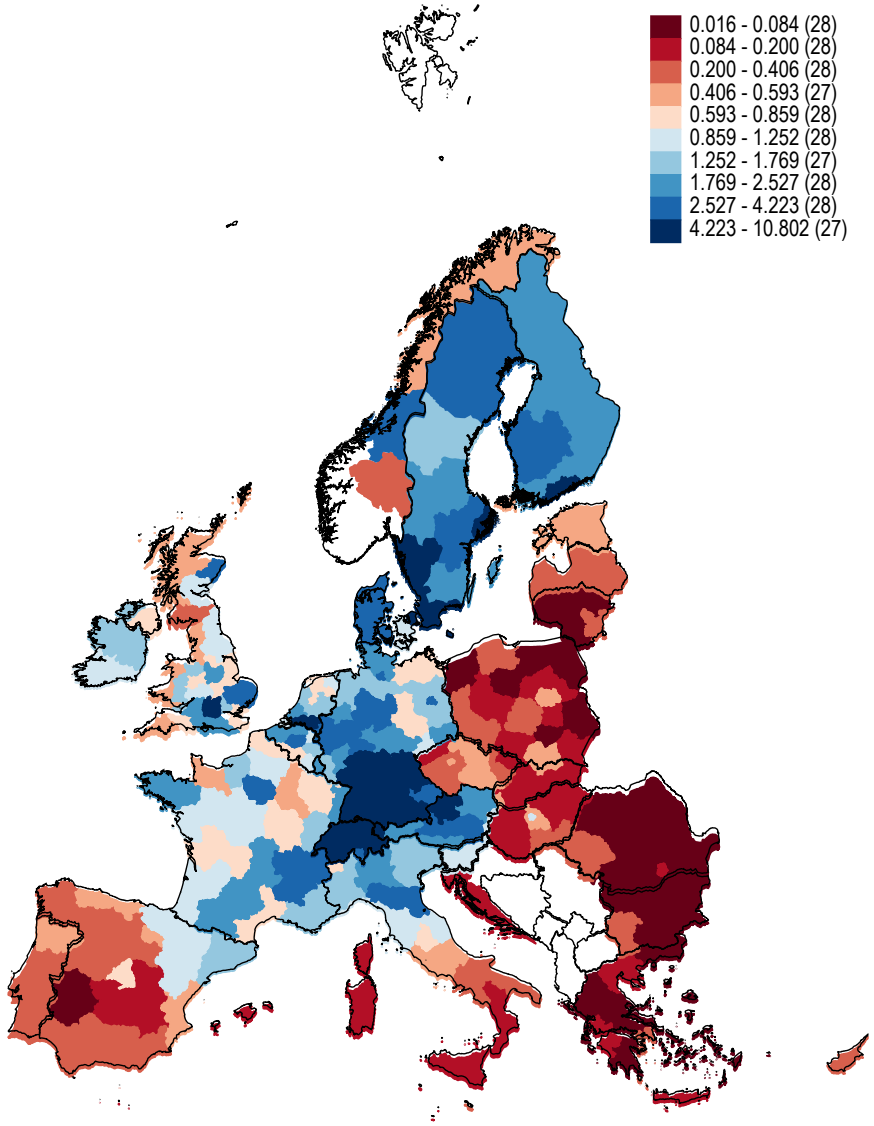


Figure 1: Innovation activity: Patents per capita 2016-2020

There is a common understanding that this gap is linked to several legacies of the socialist system such as too weak organizational capabilities for innovation

at the firm level, highly underdeveloped dynamic interactive capabilities ('systemness') such as feedback loops and, and too low levels of knowledge generation and cutting-edge technology development (Radosevic 2022; Kattel and Suurna 2024: Ruhrmann et al. 2022). There is also a long-term effect of socialism on interpersonal trust and institutional quality, which are both decisive for innovation activity, as we will elaborate in the following sections.

### 2.2 Communism, interpersonal trust, and innovation

There are a number of reasons why interpersonal trust matters for innovation activities. Generally, interpersonal trust can be expected to lead to lower transactions costs, more effective cooperation and a greater readiness to share knowledge that is particularly important in the division of innovative labor (e.g. Nooteboom et al. 1997; Akçomak and ter Weel 2009; Bischoff et al. 2023; Dindaroglu 2023).[2] Hence, regional differences in the level of interpersonal trust may contribute to explaining differences in the level of innovation activities and particularly of R&D cooperation across regions.

Evidence at the individual and firm levels supports this view. For example, Ferrin and Gillespie (2010) demonstrated that individuals from countries with higher levels of generalized trust exhibit higher levels of cooperation compared to those from low-trust countries. At the firm level, Ertug et al. (2013), for incidence, reveal that higher levels of generalized trust within a society positively influence firms' perceptions of the trustworthiness of specific partners. Similarly, Laursen et al. (2012) document that firms located in high-trust areas tend to make greater investments in research and development (R&D).

The reasons why trust levels vary across regions can be manifold. Numerous studies explored the role of historical antecedents in shaping contemporary trust levels (Tabellini 2010; Grosjean 2011; Becker et al. 2016). In this sense, the communist episode might have also played a decisive role for trust levels in the CEE regions. In general, autocratic regimes tend to erode trust while

[2] Inherent uncertainty of R&D projects makes it difficult to develop contracts ruling out opportunistic behavior of partners (Mayer and Nickerson 2005; Ulset 1996). Trusting that the partner will not behave opportunistically increases the willingness to cooperate on innovation. Trust is a form of social capital (Coleman 1988) and trust and social capital are sometimes used synonymously used in research on regional innovation activities.

democracies foster it (e.g. Rainer and Siedler 2009; Sapsford et al. 2015). Particularly in former socialist countries such as the CEEs, governments aimed to exert control over their citizens and shape their perceptions of the society (Svolik 2012; Gerschewski 2013). One tool to achieve this goal was surveillance activities that create an environment of low trust where individuals view each other with suspicion.

It has been shown that the negative impact of past exposure to autocracy on trust can be rather long-lasting (Sapsford et al. 2015; Lichter et al. 2021) and persist for several generations (Xu and Jin 2018). This makes trust (re)building a key challenge in post-socialist transition countries after a switch to a more democratic regime (Badescu and Uslaner 2003; Kornai et al. 2004). Low trust in a society can have severe consequences for knowledge transfer and the division of innovation labor. For example, Wyrwich et al. (2022) could show for the case of East Germany that growing up in a region with high levels of surveillance activities is related with low levels of R&D cooperation behavior among entrepreneurs in the post-socialist period.

Based on the evidence of an enduring negative influence of autocratic regimes on individual trust in general and exposure to communist rule in particular, we expect that there is a negative effect of socialist legacy on trust levels which in turn mediates the negative effect of socialist legacy on innovation activity and R&D cooperation. Hence:

*H1a: The negative effect of socialist legacy on innovation activity is mediated by the level of interpersonal trust.*

*H1b: The negative effect of socialist legacy on R&D-cooperation is mediated by the level of interpersonal trust.*

### 2.3 Communism, institutional quality, and innovation

Institutional quality plays an important role for innovation. Across EU regions, quality components such as control of corruption, rule of law, government effectiveness, and accountability are positively associated with innovative activity (Rodríguez-Pose and Di Cataldo 2015; D'Ingiullo and Evangelista 2020; Sharma et al. 2022). Knowledge diffusion is hampered when the rule of law (e.g. enforcement of intellectual property rights) is incomplete. Furthermore, ineffective and corrupt governments tend to cause relatively high transaction costs

of innovation and accelerate uncertainties related to innovation efforts. Accordingly, firms in stable institutional environments characterized by predictable rules, low transaction costs, and effective, impartial public services, are more likely to invest in innovation and to access knowledge and resources those investments require (e.g. Hemmert 2004; Blind 2012; Fuentelsaz et al. 2018).

There are many theoretical mechanisms behind the impact of institutional quality on innovation. First, a strong rule of law is essential for ensuring the appropriability of innovations (e.g. effective protection of intellectual property rights). Second, trust in institutions (e.g. the government, the bureaucracy, and decision-makers) supports firms' expectations of fair treatment and contract enforcement (see Rodríguez-Pose and Di Cataldo 2015, for a discussion). Third, regional self-governance can encourage innovation because local actors often have a better understanding of local innovation dynamics and requirements. Finally, an effective government is better able to develop long-term credible and enforceable innovation strategies.

During the economic transition from socialism to capitalism, institutions in CEE regions were often inadequately developed, which hindered economic activity (Meyer 2001; Roland 2002; Aslund and Djankov 2014). Inefficient institutions cause unnecessary transaction costs, hindering economic activity. Corruption, for example, is a problem in many post-socialist CEECs and is regarded as a legacy of communism and the transition (Holmes 2003; Hooghe and Quintelier 2014). Inadequate protection of intellectual property rights is also an obstacle in some CEECs (e.g. Krammer 2009). Furthermore, the incomplete development of institutional frameworks accelerated uncertainties relating to innovative activities, particularly with regard to innovative entrepreneurship (Puffer et al. 2010).

Institutional voids were often filled by network-based coordination involving former members of the communist elite (e.g. Stark 1996). Such insider networks — informal social and professional relationships composed of privileged individuals, often former influential people from the socialist era — have maintained exclusive access to resources, information and opportunities. Consequently, these closed networks have often hindered the development of an

adequate formal institutional framework and promoted informal workarounds. Furthermore, the low enforcement of rules makes it even more important to rely on trust in established networks, which can hinder innovation-driven development (Ahlstrom and Bruton 2006; Puffer et al. 2010). Therefore, institutional development in CEE countries bears the imprint of the legacy of socialism.

In sum, the transition in the CEE regions resulted in institutional voids and low-quality institutions that impede innovation. Given the influence of the socialist legacy, we hypothesize that the quality of institutions is a key factor in the East-West gap in innovation activity in Europe. The presence of a low-quality institutional framework increases the importance of trust in R&D cooperation, which tends to be low in the CEE regions (Section 2.2). Thus, firms in these regions are more likely to operate in "thin innovation systems," meaning that there exist relatively few suitable collaboration partners. This suggests that the adverse impact of the socialist legacy on innovation and R&D cooperation is partly mediated by institutional quality. Based on these considerations, we expect:

*H2a: The negative effect of socialist legacy on innovation activity is mediated by institutional quality.*

*H2b: The negative effect of socialist legacy on R&D-cooperation is mediated by institutional quality.*

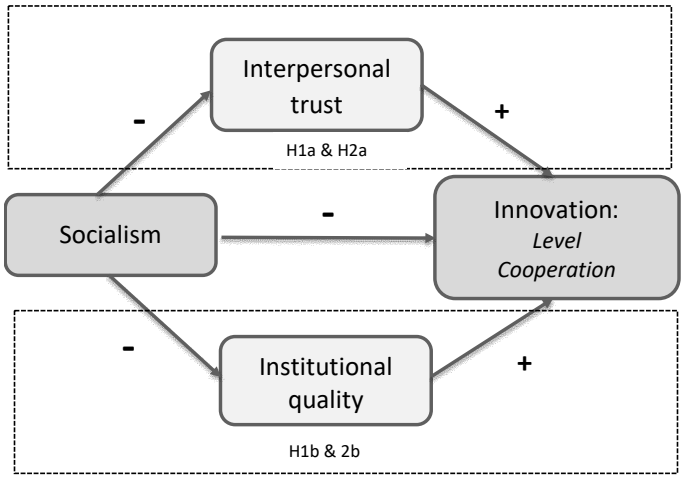


Figure 2: Conceptual model

Figure 2 provides an overview on the conceptual framework of our analysis. According to this model there is a negative influence of socialism on interpersonal trust and institutional quality. This leads to indirect negative effects

of socialism on innovation because of the generally positive relationship between interpersonal trust and institutional quality with innovation. There is also a direct negative impact of socialism on innovation. Thus, interpersonal trust and institutional quality act as mediators (H1a/b and H2a/b) in the expected overall negative relationship between socialism and innovation.

## 3. Data and measurement

### 3.1 Dependent variables

Our empirical analysis is based on patents as an indicator of innovation. It is the best available measure of innovative activity that allows comparison across regions and over time. A further advantage of patents as measure of innovative activity is that patent documents include considerable information such as the technological field according to the International Patent Classification (IPC), the date of application, the name(s) and address(es) of the applicant(s), as well as name and address of each of the inventors (for an overview, see Griliches 1990; and Nagaoka, Motohashi and Goto 2010).

A disadvantage of patents as an innovation indicator is the fact that they represent only the first stage of an innovation process. Therefore, we do not know if, when, and how the invention will be applied in a production process or product (Feldman and Kogler 2010). Another critical issue is that not all firms or inventors use patents as a means to protect their intellectual property (Cohen, Nelson and Walsh 2000; Blind et al. 2006). Moreover, some inventors file several patent applications for closely related versions of basically the same invention to block follow-up patents by rivals. Such a strategic filing behavior can inflate patent counts.

R&D cooperation, reflecting joint innovation activities, is another critical measure in our study. Our measure for R&D cooperation is the number and regional share of co-inventions based on the patent data from OECD REGPAT (Version 2023).

### 3.2 Independent variables and mediators

The main variable of interest in our analysis is a binary indicator of whether a NUTS2-region was part of a communist country before 1989. We argue that the effect of the communist legacy on innovation is mediated by the level of interpersonal trust and institutional quality.

Table 1: Definition of variables

| Variable | Description | Data source |
|---|---|---|
| Innovativeness | | |
| Patents | Number of patent applications with at least one inventor residing in the region per 10 thousand population | OECD REGPAT |
| Co-patents | Number of patent applications with at least one inventor residing in the region and with at least one co-inventor (fractional count) per 10 thousand population | OECD REGPAT |
| Regional co-patents | Number of patent applications with at least one inventor residing in the region and with at least one co-inventor in the same region per 10 thousand population | OECD REGPAT |
| Interregional co-patents | Number of patent applications with at least one inventor residing in the region and with at least one co-inventor in another region per 10 thousand population | OECD REGPAT |
| International co-patents | Number of patent applications with at least one inventor residing in the region and with at least one co-inventor in another country per 10 thousand population | OECD REGPAT |
| *Trust* | | |
| Interpersonal trust | Average response to the question "Most people can be trusted or you can't be too careful" that are on an ordinal scale from 0 (lowest trust) to 10 (highest trust level). | ESS Round 9 (2021) |
| *Quality of government* | | |
| EQI index | The European Quality of Government Index (EQI) measures regional governance quality across EU member states, focusing on corruption, impartiality, and quality in public services. It is constructed by combining national governance scores from the World Bank's Governance Indicators (WGI) with region-specific survey data, adjusting for country-level averages. The three governance pillars are standardized and equally weighted to create the final EQI score. | Charron et al. (2021) |
| *Control variables* | | |
| R&D employment | Percentage of total employment engaged in knowledge-intensive activities within business industries, 2018. | Regional Innovation Scoreboard 2021 |
| R&D expenditure business sector | Percentage of GDP allocated to all R&D expenditures within the business sector (BERD), 2019. | Regional Innovation Scoreboard 2021 |
| Population density | Persons per 1000 square kilometre, 2017. | Eurostat |

For measuring institutional quality, we rely on the European Quality of Government Index (European QoG Index – EQI 2021; see Charron et al 2021)[3]. EQI combines national-level World Bank Governance Indicators with region-specific survey data and summarizes three pillars — corruption, impartiality, and quality of public services. In a nutshell, this index captures the extent to which people believe various public sector services are impartially allocated and of good quality in the regions of the EU. Data on the quality of government has been widely used in research (e.g. Charron et al. 2014, 2022a; Corradini 2021).

For measuring interpersonal trust, we utilize data from the European Social Survey, Round 9[4] (ESS ERIC 2021), which is a reliable source for regional trust data in the literature (e.g., Corradini 2021, Akçomak and Müller-Zick 2018). For our analysis, we use the responses to the question: 'Most people can be trusted or you cannot be too careful" that are on an ordinal scale from 0 (lowest trust) to 10 (highest trust level).

### 3.3 Control variables

We control for a number of factors that are likely to affect innovation activity (e.g., Buesa et al. 2010; Feldman and Kogler 2010). These factors comprise R&D expenditures in the business sector, R&D employment, and population density. R&D employment and R&D expenditure in the business sector are retrieved from the Regional Innovation Scoreboard 2021 (see European Commission (2021) for detailed definitions).

R&D expenditure in the business sector represents an important part of innovation input. Employment in R&D employment indicates the regional knowledge base, and population density represents all kinds of agglomeration effects such as the availability of resources and spillovers.

[3] The European Quality of Government Index (EQI) 2021 survey data was collected between October 2020 and the first week of February 2021 (Charron et al. 2021).

[4] This round covers years 2018-2019. We intentionally opt for the latest pre-pandemic wave to eliminate any COVID-related biases in our data.

## 4. Descriptive overview

Table 2 presents a comparison of innovation measures between regions with and without a communist legacy. We observe significant differences in innovation outcomes between regions with and without a communist legacy. The average number of patents per 10,000 population is more than four times lower in communist legacy regions (0.654) compared to non-legacy regions (2.894). There is also a significant difference for co-patents (0.312 vs. 1.518). R&D expenditures in the business sector are significantly lower in post-communist regions (0.266 vs. 0.464). Interestingly, communist legacy regions show no significant differences in employment in knowledge-intensive activities and population density.

Table 2: Innovation outcomes and population density in regions with and without communist legacy

| Variable | All regions | Communist legacy | | Difference |
|---|---|---|---|---|
| | | Yes | No | |
| *Innovation measures* | | | | |
| Number of patents with local inventors per 10 thousand population | 2.26 | 0.654 | 2.894 | -2.240*** |
| Number of regional co-patents (fractional count) per 10 thousand population | 1.176 | 0.312 | 1.518 | -1.206*** |
| Employment knowledge-intensive activities, share of all activities | 0.562 | 0.567 | 0.56 | 0.007 |
| R&D expenditures business sector | 0.409 | 0.266 | 0.464 | -0.198*** |
| Population per 1,000 km squared, 2017 | 0.319 | 0.293 | 0.329 | -0.036 |

*Notes:* The column difference gives the result of a t-test for the respective variable. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table 3 presents a comparison of trust levels and quality of government between regions with and without a communist legacy. We find that the average levels of all types of trust surveyed by the ESS are higher at the 1-percent level of significance in regions without a communist legacy. Measures of government and of its pillars (corruption, impartiality and quality) score also at the 1% level

Table 3: Interpersonal trust, institutional quality and further measures in regions with and without communist legacy

| Variable | All regions | Communist legacy | | Difference |
|---|---|---|---|---|
| | | Yes | No | |
| *Trust* | | | | |
| Most people can be trusted or you can't be too careful (interpersonal trust: dependent variable) | 5.047 | 4.381 | 5.31 | -0.929*** |
| Most people try to take advantage of you, or try to be fair | 5.728 | 5.053 | 5.995 | -0.942*** |
| Most of the time people are helpful or mostly looking out for themselves | 4.927 | 4.429 | 5.124 | -0.695*** |
| Trust in the country's parliament | 4.548 | 3.847 | 4.825 | -0.978*** |
| Trust in the legal system | 5.447 | 4.591 | 5.785 | -1.194*** |
| Trust in the police | 6.597 | 5.77 | 6.923 | -1.153*** |
| Trust in politicians | 3.645 | 3.214 | 3.815 | -0.601*** |
| Trust in political parties | 3.591 | 3.213 | 3.741 | -0.528*** |
| Trust in the European Parliament | 4.501 | 4.313 | 4.576 | -0.263*** |
| Trust in the United Nations | 5.146 | 4.924 | 5.234 | -0.310*** |
| *Quality of government* | | | | |
| EQI Index 2021 (dependent variable) | 0.166 | -0.638 | 0.484 | -1.122*** |
| Quality pillar, country centered and z-score standardized | 0.155 | -0.702 | 0.493 | -1.195*** |
| Impartiality pillar, country centered and z-score standardized | 0.152 | -0.598 | 0.448 | -1.046*** |
| Corruption pillar, country centered and z-score standardized | 0.173 | -0.542 | 0.455 | -0.997*** |
| *Social capital* | | | | |
| Social capital: aggregate index | 3.474 | 3.192 | 3.585 | -0.393*** |
| Social capital: institutional trust pillar | 4.782 | 4.267 | 4.985 | -0.718*** |
| Social capital: social trust pillar | 5.234 | 4.621 | 5.476 | -0.855*** |
| Social capital: civic-social engagement pillar | 1.836 | 1.905 | 1.809 | 0.096*** |
| Social capital: political networks pillar | 1.908 | 1.934 | 1.897 | 0.037*** |
| Social capital: social networks pillar | 3.61 | 3.232 | 3.759 | -0.527*** |
| Number of observations in the baseline estimation | 205 | 58 | 147 | |

*Notes:* Two variables that are underlined are used in the main analysis. The remaining variables contribute to a broader understanding of the overall patterns. The social capital index is used in an additional test described in section 4.4. The column difference gives the result of a t-test for the respective variable. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

significantly higher in regions without a communist legacy.[5] The corruption pillar captures both perceptions and experiences of corruption in various public services. The impartiality pillar assesses fairness and equality in the delivery of public services. It includes indicators that measure whether some individuals receive special advantages in education, healthcare or law enforcement, as well as whether all individuals are treated equally in these domains. The quality pillar evaluates the perceived quality of public services, specifically in education, healthcare, and law enforcement (for all details regarding the index construction, see Charron et al. 2022b). Table A1 provides a correlation matrix that includes the different measures described in this section.

In Table 3 we also provide an overview on indicators for social capital, as we will use this as an alternative mediating channel in the analysis (Section 5.3). There are significant differences between countries with and without communist legacy for all different measures of social capital (for a definition, see Table A2 in the Appendix).

## 5. Empirical analysis

### 5.1 Method

Our study focuses on measuring inventive activity at the NUTS2 regional level in several European countries.[6] We apply Structural Equation Modelling (SEM), which is a state-of-the-art method for investigating the mediating mechanisms through which a treatment affects an outcome. The treatment in the context of our study is being a communist country before the fall of the Iron Curtain in 1989.

[5] The index can assume negative values which is due to the computation method. EQI scores represent z-scores, EU average is therefore equal to 0. Positive (negative) values reflect higher (lower) than the EU average quality of government. For details, see e.g. Charron et al. (2024).

[6] Our full dataset includes 205 NUTS2 regions, with 58 regions such as East Germany, Eastland, Croatia, Latvia, Lithuania, Hungary, Poland, Slovenia, Slovakia, Czech Republic, and Bulgaria. The remaining 147 regions are from the following Western countries: Belgium, Denmark, West Germany, Spain, France, Italy, the Netherlands, Portugal, Finland, Sweden, Ireland, Cyprus and Austria. For our analysis, we use the 2021 NUTS2 classification, harmonizing all datasets at this level using official correspondence tables. Sub-datasets come in different NUTS versions. So, for instance, the RegPat is using NUTS classification from 2013. The QoG data comes at the NUTS2 version of 2016. The issues of temporal comparisons across member countries due to changes in NUTS classifications across years are discussed in Charron et al. 2024. We harmonize all datasets using 2021 NUTS classification. However, when harmonizing the NUTS2 classification to one version, some observations get lost. Therefore, the final sample used in the baseline regression comprises 202 regions.

The trust and the institutional quality of government serve as our mediating variables. Given the historical nature of region's exposure to communist rule before 1989, treatment assignment is plausibly exogenous . Put differently, historical levels of interpersonal trust between individuals and institutional quality are not determining factors in whether a country became communist or not. Hence, we can talk of a quasi-natural experiment largely ruling out the issue of reverse causality and endogeneity.

One advantage of the SEM method is that it allows us to decompose the effects of the socialist legacy on innovation activity into direct effects and indirect effects that become effective through trust and quality of government. We include robust standard errors and allow residuals of our mediating variables to be correlated with each other to account for the possibility that they may have parallel effects on innovation.

### 5.2 Main results

The main results are summarized in Figures 3 and 4. The full estimates are presented in Tables A3 and Table A4 in the Appendix. In line with our expectations, we notice that socialist legacy has a negative effect on levels of interpersonal trust (-0.470***) and the quality of government (-0.537***). We find a highly significant negative direct effect of socialist legacy on patenting activity (-0.117***). The quality of government is significantly related to patenting with a positive sign (0.414***). We also find evidence for a direct impact of interpersonal trust on innovation (0.150***). The pathway *socialism → QoG → patenting activity* is highly significant (-0.222***) with a negative sign. [7] The pathway *socialism → trust → patenting activity* is highly significant (-0.070***) with a negative sign.

The total effect of socialism on innovation activity is the sum of the direct effect and the indirect effects via quality of government and trust. This means that the indirect effect via quality of government contributes 54.1 percent to the total effect while the contribution of trust is about 17.1 percent.[8] This implies, in turn,

[7] The indirect effect is calculated as follows: -0.537 × 0.414 = -0.222318 as a product of the path *socialism → QoG*: -0.537 and the path *QoG → patenting activity*: 0.414.

[8] The total effect is (-0.117 + (-0.222) + (-0.07=0.410).

that 28.8 percent of the negative impact of socialism on innovation activity cannot be explained by trust and quality of government.

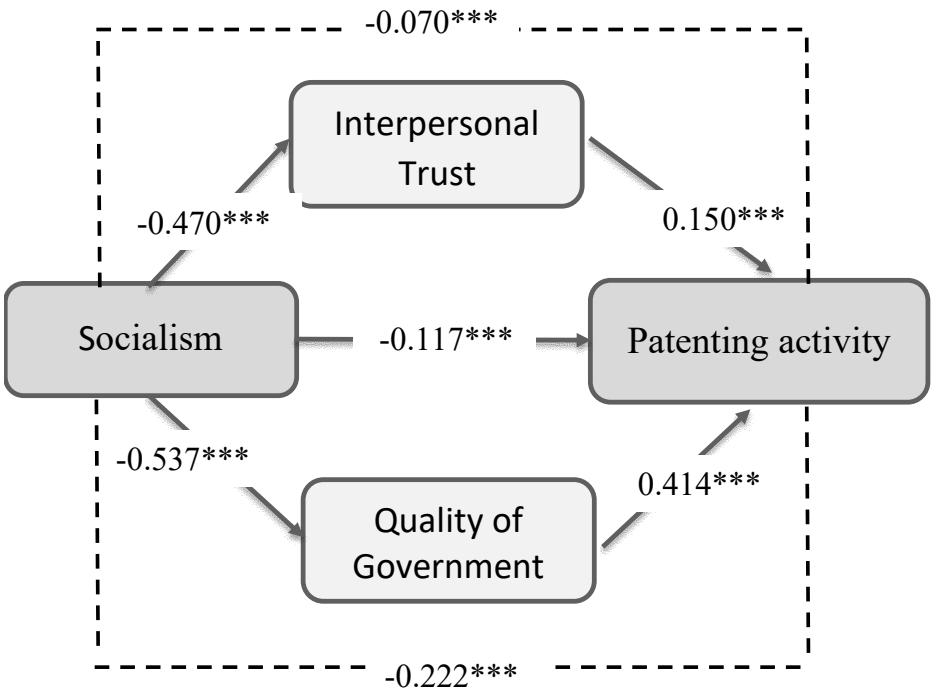


Figure 3: SEM results for patenting activity[9]

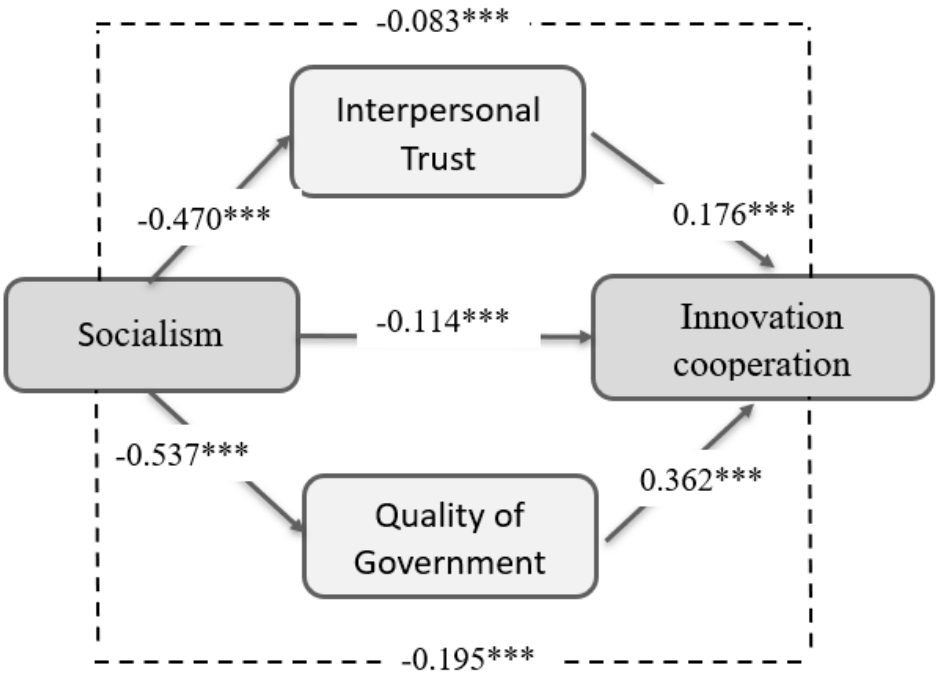


Figure 4: SEM results for innovation cooperation

[9] Dashed lines show indirect effects of socialism via the mediators

The results for innovation cooperation are similar. It should be noted that the direct effect of socialism on trust and quality of government must be the same as in the previous analysis. Apart from that, we find a highly significant negative direct effect of socialist legacy on innovation cooperation patenting activity (-0.114***) which is almost similar to the effect on patenting. The quality of government is significantly related to patenting with a positive sign (0.362***) and the effect is somewhat smaller than compared to the assessment of patenting activity. We also find evidence for a direct impact of interpersonal trust on innovation (0.176***), which is slightly larger compared to analysis of patenting activity. The pathway *socialism → QoG → patenting* activity is highly significant (-0.195***) with a negative sign. The pathway *socialism → trust → patenting activity* is highly significant (-0.083***) with a negative sign. This means that indirect effects are similar to the findings for patenting activity.

The indirect effect via quality of government contributes 49.8 percent to the total effect while the contribution of trust is about 21.2 percent. This implies, in turn, that 29 percent of the negative impact of socialism on innovation cooperation cannot be explained by trust and quality of government.

Overall, the analysis reveals that socialism exerted a significantly negative impact on innovation, both directly and indirectly (via *QoG* and *trust*). Furthermore, socialism links negatively both to trust and the quality of government. Moreover, the relationship between socialist legacy, patenting and R&D cooperation is partially by the quality of government and interpersonal trust. Despite the mediation effects, there remains a significant direct impact of the socialist legacy on innovation that is not explained by either trust nor the quality of government.

The findings suggest that trust is mediating the impact of socialism on innovation. At the same time, its influence on innovation may be partially captured already by the mediation effect of quality of government as both are intertwined (Martinangeli et al. 2024). When we estimate the mediation effect of trust in a model without using quality of government as a mediator (see Table A5 in the Appendix), the pathway *Socialism → trust → Patenting* activity is highly significant (-0.184***) with a negative sign and contributes 51 percent to the total effect. Running the model with only institutional quality as mediator, the pathway

*Socialism* → *QoG* → *Patenting* activity is highly significant (-0.280***) with a negative sign and contributes 72.5 percent to the total effect. This effect is similar to the 71.4 percent of the effect that both mediators contribute when both are introduced into the model. This suggests that trust and institutional quality are indeed intertwined.[10]

### 5.3 Competing explanations for the legacy of socialism on innovation

To rule out competing explanations, we also test an alternative mechanism eventually linking socialist legacy to innovation activity, namely social capital, which is typically understood as a combination of networks, trust, and civic engagement (Putnam, 1993). We use social capital as mediation instead of interpersonal trust and institutional quality.

Trust is already captured in the main analysis. Networks and civic engagement were also impacted by the socialist regime (Lichter et al. 2021) and networks are vital for innovation (Crescenzi et al. 2013). Since trust is a crucial condition for network formation, using a social capital variable may also capture trust effects. At the same time, social capital is strongly linked to institutional quality (Putnam, 1993). This makes it plausible to use social capital without including trust and QoG in the same model.

We expect that the mediation effect of social capital is not much higher than the mediation effects of trust and institutional quality in the main models as there are few arguments for additional social capital effects beyond what was already captured by trust and institutional quality. If social capital proves to be more important than interpersonal trust and quality of governance, we would observe a larger indirect effect and a smaller and/or statistically insignificant direct effect in comparison to the full baseline model. The results of the decomposition analysis for the alternative channels and individual trust and QoG models are summarized in Table 4.

As discussed above, both interpersonal trust and QoG play an important role in mediating the relationship between socialism and innovation. The

[10] In the models for innovation cooperation the contribution of trust to the total effect is about 52 percent when used as only mediator while it is 71.2 percent for quality of government (see Table A6 in the Appendix).

mediation effect of social capital is 71.9 percent, which is similar to using models with trust and institutional quality as mediators (71.9 percent) or when using institutional quality (72.5 percent) as only mediator. The effect is higher compared to a model using only interpersonal trust as mediator (51 percent) (see Table A5 in the Appendix). This means that additional components of social capital, namely networks and civic engagement do add to the mediation effect of trust-component of social capital but compared to a model including either only institutional quality or trust and institutional quality, there is no add-on effect of social capital.

Table 4: Decomposition of effects for different mechanisms

| *Panel A. Patenting activity* | | | |
|---|---|---|---|
| Mediators used | Direct effect socialism (%) | Indirect effect socialism via mediator (%) | Total effect (%) |
| Trust & QoG | 28.8 | 71.2 | 100 |
| Trust-only | 48.9 | 51.1 | 100 |
| QoG-only | 27.5 | 72.5 | 100 |
| Social capital | 28.1 | 71.9 | 100 |
| *Panel B. Innovation cooperation* | | | |
| Trust & QoG | 28.9 | 71.1 | 100 |
| Trust-only | 48.0 | 52.0 | 100 |
| QoG-only | 28.8 | 71.2 | 100 |
| Social capital | 28.1 | 71.9 | 100 |

*Notes:* The decomposition percentages are calculated by dividing the absolute value of the respective direct or indirect effect by the absolute value of the total effect. For example, in the trust-only model, the total *socialism → trust → patenting activity* effect can be seen as the sum of the indirect effect of socialism via trust and direct socialism effect on patenting. The indirect effect of socialism is calculated as the product of the direct effect of Socialism on trust and the direct effect of trust on patenting, which yields an indirect effect of socialism via trust. For complete regression results incl all underlying coefficients, refer to Tables A3 to A6 in the Appendix.

We also ran several further robustness checks such as using alternative time periods for the dependent variables, i.e. averages between 2015-19 or 2017-2019. The results remain robust across all estimations.[11]

[11] Results are not reported but can be obtained upon request.

## 6. Conclusions

Our research aims to understand the impact of the communist legacy on innovation activity in Eastern Europe, as well as how this legacy contributes to the East-West gap in Europe. Specifically, we are interested in how institutional framework conditions, both formal and informal, in Eastern Europe help explain this gap. These framework conditions are often cited as hindering innovation activity and are rooted in the communist legacy. We explore how much of the East-West gap can be attributed to these framework conditions, specifically to institutional quality (i.e., quality of government) and interpersonal trust. Both factors are important for innovation, but they are clearly less favorable in Eastern Europe, mostly due to the communist legacy. For testing the effect of communism on innovation, we analyzed patenting activities across European regions.

We find that the effect of the socialist legacy on innovation activity is largely mediated by the quality of the government and by interpersonal trust. At the same time, the socialist legacy negatively affects trust and quality of government, confirming previous research. Overall, circa 70 percent of the impact of socialism on innovation activity can be attributed to these two mediators. Interpersonal trust explains about 17 percent and quality of government contributes 53 percent. Hence, a large share of the impact of communism on innovation activity can be attributed to the negative legacy effects of communism on trust and institutional quality. Since institutional quality and interpersonal trust also play an important role for cooperation, we analyzed the number of co-patents. The results resemble our findings for the overall level of innovation activity. Therefore, socialism also affected the mode of innovation.

When using a model with only trust as mediator, 50 percent of the impact of socialism on innovation activity can be explained via this mediator. Using only quality of government reveals that this mediator explains 70 percent of the negative communism effect. These additional decomposition analyses indicate that institutional quality and interpersonal trust are highly intertwined. Furthermore, we also tested social capital as a mediator, as this was also negatively impacted by communism. Social capital includes interpersonal trust and other forms of social capital, such as civic engagement and networks. Our results suggest that social capital explains 70 percent of the communism effect.

This is 20 percent more compared to the model where only interpersonal trust is used. Thus, other components of social capital apparently play a smaller role than trust. The high explanatory power of social capital confirms that the impact of communism on the mediating variables is intertwined.

Our research contributes to the literature in many ways. The literature on innovation has long emphasized the importance of institutional environments in fostering or hindering innovative activity (see, e.g., Rodriguez-Posé 2020; Rodriguez-Posé and Ganau 2022). Our findings align with this perspective by demonstrating that institutional quality and interpersonal trust, both of which are compromised by the communist legacy, are critical mediators of innovation outcomes. This underscores the need for innovation policies to address not only formal institutions (e.g., governance structures) but also informal ones (e.g., trust and social capital).

Our analysis of co-patents further extends this contribution by revealing that the communist legacy also affects the mode of innovation, particularly collaborative efforts. This aligns with research on regional innovation systems, which highlights the importance of network structures and cooperation for knowledge spillovers and innovation (see, e.g., Cooke 2001; Fritsch and Graf 2011).

Our research also adds to the field of regional economics. The East-West divide in Europe has been a central topic in regional economics, with scholars debating the relative importance of historical, institutional, and economic factors (e.g., Rodrik 2000; Roland 2002). Our study adds nuance to this debate by quantifying the degree to which institutional and social factors explain the innovation gap. We move beyond explanations based solely on economic disparities or transition shocks and demonstrate that institutional and social legacy is deeply embedded and continue to influence innovation long after the transition to market economies.

We also contribute to institutional theory. This theory posits that historical institutions shape long-term economic and social outcomes by creating path dependencies (North 1990; Acemoglu and Robinson 2012). Our study provides empirical support for this perspective by showing how communist institutions

have left a lasting imprint on both formal (government quality) and informal (trust, social capital) institutions, which in turn affect innovation. Our decomposition analysis also reveals the intertwined nature of institutional quality and social capital, consistent with research on institutional complementarities (Hall and Gingerich 2009). This interplay suggests that policies aimed at improving innovation must adopt a holistic approach.

We also noticed that the direct effect of the socialist legacy on innovation remains pronounced (approximately 30 percent). This effect is not explained by institutional quality, interpersonal trust, and social capital. Thus, while our study sheds light on the mechanisms linking communist legacy to innovation, several questions remain. First of all, the persistent direct effect of communism calls for further investigation of other mediating factors, such as risk preferences, cultural attitudes, or the structure of regional innovation systems. While the negative impact of communist exposure on risk preference is ambiguous (Heineck and Süssmuth 2013), a nuanced perspective may discover how personality factors may lead to an East-West gap with respect to innovation activity. There may also be specific aspects of regional innovation systems, such as a lack of "systemness" (Ruhrmann et al. 2020) that may explain East-West differences. Such an analysis requires an assessment of network structures across regions (e.g., Fritsch and Graf 2011).

Our focus on patenting and co-patenting leaves open the question of how communist legacy affects other forms of innovation (e.g., non-patented R&D, entrepreneurial activity). Heterogeneity across Central and Eastern European (CEE) regions warrants deeper exploration as well, as the impact of communism may vary depending on pre-communist conditions or post-transition reforms. Finally, our study raises broader questions about the long-term effects of historical institutions on economic outcomes. Future research could explore whether the effects of communism on innovation diminish over time as new generations enter the workforce. For example, there might also be regional differences pre-dating communism that leave a long-lasting imprint on the innovation landscape in Europe.

Altogether, our findings underscore the enduring power of history in shaping innovation and regional disparities. By quantifying the role of

institutional quality, trust, and social capital, we provide a more nuanced understanding of the East-West innovation gap in Europe. For policymakers, this research highlights the need for integrated strategies that address both formal institutions and social norms to foster innovation in post-communist regions. For scholars, it opens new avenues for exploring the interplay between history, institutions, and innovation in other global contexts, and much more research is warranted to understand the impact of history on innovation in Europe.

**References**

Ahlstrom D. and G. D. Bruton (2006). Venture capital in emerging economies: Networks and institutional change. *Entrepreneurship Theory and Practice*, 30, 299–320. https://doi.org/10.1111/j.1540-6520.2006.00122.x

Akçomak, İ. S. and B. ter Weel (2009). Social capital, innovation and growth: Evidence from Europe. *European Economic Review*, 53, 544–67. https://doi.org/10.1016/j.euroecorev.2008.10.001

Akçomak, İ. S., and H. Müller-Zick (2018). Trust and inventive activity in Europe: Causal, spatial and nonlinear forces. *Annals of Regional Science*, 60, 529–68. https://doi.org/10.1007/s00168-015-0729-2

Aslund, A., and S. Djankov (2014). *The great rebirth: lessons from the victory of capitalism over communism*. Washington D.C.: Peterson Institute for International Economics.

Augustine, D. L. (2013), Innovation and Ideology: Werner Hartmann and the Failure of the East German Electronics Industry. In: Berghoff, H., Balbier UA, eds. *The East German Economy, 1945–2010: Falling Behind or Catching Up?* Cambridge (UK): Cambridge University Press, pp. 95-110.

Badescu, G. and E. M. Uslaner (2003), *Social capital and the transition to democracy*. London: Routledge.

Becker, S. O., Boeckh, K., Hainz, C. and L. Woessmann (2016). The empire is dead, long live the empire! Long-run persistence of trust and corruption in the bureaucracy. *Economic Journal*, 126, 40-74. https://doi.org/10.1111/ecoj.12220

Benzecry, G., Reinarts, N., and D. J. Smith (2024). The Road to Censorship: Socialism's Chilling Effect on Academic Freedom. http://dx.doi.org/10.2139/ssrn.4723482

Bischoff, T. S., Hipp, A., and P. Runst (2023). Firm innovation and generalized trust as a regional resource. *Research Policy*, 52, 104813. https://doi.org/10.1016/j.respol.2023.104813

Bischoff, T. S., Runst, P., and K. Bizer (2024). Spatial Heterogeneity in the Effect of Regional Trust on Innovation. *Economic Geography*, 100, 80–101. https://doi.org/10.1080/00130095.2023.2252552

Blind, K., J. Edler, R. Frietsch and U. Schmoch (2006). Motives to patent: Empirical evidence from Germany. *Research Policy*, 35, 655–672. https://doi.org/10.1016/j.respol.2006.03.002

Blind, K. (2012). The influence of regulations on innovation: A quantitative assessment for OECD countries- *Research Policy*, 41, 391-400. https://doi.org/10.1016/j.respol.2011.08.008

Buesa, M., J. Heijis and T. Baumert (2010). The determinants of regional innovation in Europe: A combined factorial and regression knowledge production function approach. *Research Policy*, 39, 722-735. https://doi.org/10.1016/j.respol.2010.02.016

Cain, F. (2005). Computers and the Cold War: United States restrictions on the export of computers to the Soviet Union and Communist China. *Journal of*

*Contemporary History*, 40, 131-147. https://doi.org/10.1177/0022009405049270

Chandler, A.D. (1993). Organizational capabilities and industrial restructuring: a historical analysis. *Journal of Comparative Economics*, 17, 309–337. https://doi.org/10.1006/jcec.1993.1028

Charron, N., L. Dijkstra and V. Lapuente (2014). Regional Governance Matters: Quality of Government within European Union Member States. *Regional Studies,* 48, 68-90. https://doi.org/10.1080/00343404.2013.770141

Charron, N., V. Lapuente, M. Bauhr and P. Annoni (2022a). Change and Continuity in Quality of Government: Trends in subnational quality of government in EU member states. *Investigaciones Regionales-Journal of Regional Research*, 53, 5-23. https://doi.org/10.38191/iirr-jorr.22.008

Charron, N., V. Lapuente and M. Bauhr (2021). Subnational variations in the 2021 European Quality of Government Index and its relationship with Covid-19 indicators. Gotheburg: Quality of Government Institute, 653-8919. https://hdl.handle.net/2077/68410.

Charron, N., M. Bauhr, V. Lapuente, P. Fernández-Vázquez, P. Chmieliński and B. Wieliczko (2022b). *Measuring the Quality of Government at the Sub-National Level and Comparing Results with Previous Studies: Final Technical Report & Select Case Studies in Spain and Poland*, Directorate-General for Regional and Urban Policy. Luxembourg: Publications Office of the European Union. https://doi.org/10.2776/87917

Charron, N., V. Lapuente and M. Bauhr (2024). The Geography of Quality of Government in Europe: Subnational variations in the 2024 European Quality of Government Index and comparisons with previous rounds. Working Papers, 2024:2, Gothenburg: The Quality of Government Institute. https://hdl.handle.net/2077/80191

Cohen, W.M., R.R. Nelson and J.P. Walsh (2000). Protecting their Intellectual Assets: Appropriability Conditions and why U.S. Manufacturing Firms Patent (or not). NBER Working Paper 7552. Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/papers/w7552

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94 (Suppl.), 95–120. https://doi.org/10.1086/228943

Cooke, P. (2001). Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10, 945–974. https://doi.org/10.1093/icc/10.4.945

Corradini, C. (2021). Local institutional quality and economic growth: A panel-VAR analysis of Italian NUTS-3 regions. *Economics Letters*, 198, 109659. https://doi.org/10.1016/j.econlet.2020.109659

Crescenzi, R., Gagliardi, L. and M. Percoco (2013). Social capital and the innovative performance of Italian provinces. *Environment and Planning A: Economy and Space*, 45(4), 908–929. https://doi.org/10.1068/a45221

D'Ingiullo, D. and V. Evangelista (2020). Institutional quality and innovation performance: evidence from Italy. *Regional Studies*, 54, 1724-1736. https://doi.org/10.1080/00343404.2020.1765230

Dindaroglu, B. (2023). Interpersonal trust, invention, and innovation across European regions. *Growth and Change*, 54, 794-817. https://doi.org/10.1111/grow.12674.

Ertug, G., Cuypers, I.R., Noorderhaven, N.G.. and B.M. Bensaou (2013). Trust between international joint venture partners: Effects of home countries. *Journal of International Business Studies*, 44, 263-282. https://doi.org/10.1057/jibs.2013.6.

European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2021). *European Innovation Scoreboard 2021*. Luxembourg: Publications Office of the European Union. https://data.europa.eu/doi/10.2873/725879

Feldman, M. and D. Kogler (2010). Stylized Facts in the Geography of Innovation. In: B. H. Hall and N. Rosenberg (eds.): *Handbook of the Economics of Innovation*. Vol. 1, Amsterdam: North Holland Publishers, pp. 381-410. https://doi.org/10.1016/S0169-7218(10)01008-7

Ferrin, D.L. and N. Gillespie (2010). Trust differences across national-societal cultures: much to do, or much ado about nothing? In: M.N.K. Saunders, D. Skinner, G. Dietz, N. Gillespie and R. J. Lewicki (Eds.), *Organizational trust: A cultural Perspective.* Cambridge UK: Cambridge University Press, UK, pp. 42–86.

Fritsch, M. and H. Graf (2011). How sub-national conditions affect regional innovation systems: The case of the two Germanys. *Papers in Regional Science*, 90(2), 331–353. https://doi.org/10.1111/j.1435-5957.2011.00364.x

Fritsch, M., Greve, M. and M. Wyrwich (2025) The long-lasting impact of historical shocks on innovation activity: The case of German separation and reunification. *Technovation*, 148, 103318. https://doi.org/10.1016/j.technovation.2025.103318

Fuentelsaz, L., J-P. Maicas and J. Montero (2018). Entrepreneurs and innovation: The contingent role of institutional factors. *International Small Business Journal*, 36, 686-711. https://doi.org/10.1177/02662426187662

Gerschewski, J. (2013). The three pillars of stability: Legitimation, repression, and co-optation in autocratic regimes. *Democratization*, 20, 13-38. https://doi.org/10.1080/13510347.2013.738860

Griliches, Z. (1990). Patent statistics as economic indicators: A survey. *Journal of Economic Literature,* 28, 1661–1707. https://www.jstor.org/stable/2727442

Grosjean, P. (2011). The Weight of History on European Cultural Integration: A Gravity Approach. *American Economic Review*, 101, 504–08. https://doi.org/10.1257/aer.101.3.504

Hauser, C., G. Tappeiner and J. Walde (2007). The learning region: The impact of social capital and weak ties on innovation. *Regional Studies,* 41, 75-88. https://doi.org/10.1080/00343400600928368

Heineck, G. and B. Süssmuth (2013). A different look at Lenin's legacy: Social capital and risk taking in the Two Germanies. *Journal of Comparative Economics*, 41(3), 789–803. https://doi.org/10.1016/j.jce.2013.02.005

Hemmert, M. (2004). The influence of institutional factors on the technology acquisition performance of high-tech firms: survey results from Germany and Japan. *Research Policy*, 33, 1019-1039. https://doi.org/10.1016/j.respol.2004.04.003

Hervás-Oliver, J. L., M.D. Parrilli, A. Rodríguez-Pose and F. Sempere-Ripoll (2021). The drivers of SME innovation in the regions of the EU. *Research Policy*, 50, 104316. https://doi.org/10.1016/j.respol.2021.104316

Holmes, L. (2003). Political Corruption in Central and Eastern Europe. In: M.J. Bull and J.L. Newell (eds): *Corruption in Contemporary Politics*. Palgrave Macmillan, London. https://doi.org/10.1057/9781403919991_15

Hooghe, M. and E. Quintelier (2014). Political participation in European countries: The effect of authoritarian rule, corruption, lack of good governance and economic downturn. *Comparative European Politics*, 12, 209–232. https://doi.org/10.1057/cep.2013.3

Kattel R. and M. Suurna (2024). Industrial Restructuring and Innovation Policy in Central and Eastern Europe since 1990. In: R. Kattel (ed): *The Other Canon of Economics: Essays in the Theory and History of Uneven Economic Development*. Anthem Press. pp. 677-708.

Kornai, J. (1992). *The Socialist System: The Political Economy of Communism*. Princeton University Press. https://doi.org/10.2307/j.ctv1ddczdr

Kornai, J., B. Rothstein, S. Rose-Ackerman, J.N. Kornai, B. Rothstein and S. Rose-Ackerman (2004). *Creating social trust in post-socialist transition*. New York: Palgrave Macmillan.

Krammer, S. M. (2009). Drivers of national innovation in transition: Evidence from a panel of Eastern European countries. *Research Policy*, 38, 845-860. https://doi.org/10.1016/j.respol.2009.01.022

Laursen, K., F. Masciarelli and A. Prencipe (2012). Regions matter: How localized social capital affects innovation and external knowledge acquisition. *Organization Science*, 23, 177-193. https://doi.org/10.1287/orsc.1110.0650

Lichter, A., S. Siegloch and M. Loeffler (2021). The long-term costs of government surveillance: Insights from Stasi spying in East Germany. *Journal of the European Economic Association*, 19, 741-789. https://doi.org/10.1093/jeea/jvaa009

Maraut S., H. Dernis, C. Webb, V. Spiezia and D. Guellec (2008). The OECD REGPAT Database. Technical rep. Paris: OECD.

Meyer K. E. (2001). Institutions, transaction costs, and entry mode choice in Eastern Europe. *Journal of International Business S*tudies, 32, 357–367. https://doi.org/10.1057/palgrave.jibs.8490957

Martinangeli, A. F., M. Povitkina, S. Jagers and B. Rothstein (2024). Institutional quality causes generalized trust: experimental evidence on trusting under the shadow of doubt. *American Journal of Political Science*, 68(3), 972-987. https://doi.org/10.1111/ajps.12780

Mayer, K. J. and J. A. Nickerson (2005). Antecedents and performance implications of contracting for knowledge workers: Evidence from

information technology services. *Organization Science*, 16, 225-242. https://doi.org/10.1287/orsc.1050.0125

Mayntz, R. (1998). Socialist academies of sciences: the enforced orientation of basic research at user needs. *Research Policy*, 27, 781-791. https://doi.org/10.1016/S0048-7333(98)00090-0

Nagaoka, S., K. Motohashi and A. Goto (2010). Patent Statistics as an Innovation Indicator. In: B. H. Hall and N. Rosenberg (eds.): *Handbook of the Economics of Innovation*. Vol. 2, Dordrecht: Elsevier, pp. 1083-1127. https://doi.org/10.1016/S0169-7218(10)02009-5

Nooteboom, B., H. Berger, H. and N.G. Noorderhaven (1997). Effects of trust and governance on relational risk. *Academy of Management Journal*, 40(2): 308-338.

Nunn, N. (2020). The historical roots of economic development. *Science*, 367(6485), eaaz9986. https://doi.org/10.1126/science.aaz9986

Portela, M., I. Neira and M.M. Salinas-Jiménez (2013). Social Capital and Subjective Wellbeing in Europe: A New Approach on Social Capital. *Social Indicators Research*, 114, 493–511. https://doi.org/10.1007/s11205-012-0158-x

Puffer, S. M., D.J. McCarthy and M. Boisot (2010). Entrepreneurship in Russia and China: The Impact of Formal Institutional Voids. *Entrepreneurship Theory and Practice*, 34, 441-467. https://doi.org/10.1111/j.1540-6520.2009.00353.x

Putnam, R. D. (1993). *Making democracy work*. Princeton: Princeton University Press.

Radosevic, S. (2022). Techno-economic transformation in Eastern Europe and the former Soviet Union–A neo-Schumpeterian perspective. *Research Policy*, 51, 104397. https://doi.org/10.1016/j.respol.2021.104397

Rainer, H. and T. Siedler (2009). Does Democracy Foster Trust? *Journal of Comparative Economics*, 37, 251–269. https://doi.org/10.1016/j.jce.2008.09.003

Rodríguez-Pose, A. and M. Di Cataldo (2015). Quality of government and innovative performance in the regions of Europe. *Journal of Economic Geography*, 15, 673–706. https://doi.org/10.1093/jeg/lbu023

Rodríguez-Pose, A. (2020). Institutions and the fortunes of territories. *Regional Science Policy & Practice*, 12, 371-386. https://doi.org/10.1111/rsp3.12277

Rodríguez-Posé, A. and R. Ganau (2022). Institutions and the productivity challenge for European regions. *Journal of Economic Geography*, 22, 1–25. https://doi.org/10.1093/jeg/lbab003

Rodrik, D. (2000). Institutions for high-quality growth: What they are and how to acquire them. *Studies in Comparative International Development*, 35, 3–31. https://doi.org/10.1007/BF02699764

Roland, G. (2002). The political economy of transition. *Journal of Economic Perspectives*, 16, 29-50. https://doi.org/10.1257/0895330027102

Ruhrmann, H., M. Fritsch and L. Leydesdorff (2022). Synergy and Policy-making in German Innovation Systems – Smart Specialization Strategies at National, Regional or Local Levels? *Regional Studies*, 56, 1468-1479. https://doi.org/10.1080/00343404.2021.1872780

Sapsford, R., P. Abbott, C. Haerpfer and C. Wallace (2015). Trust in Post-Soviet Countries, Ten Years On. *European Politics and Society*, 16:4, 523-539. https://doi.org/10.1080/23745118.2015.1039286

Sharma, A., C. Sousa, and R. Woodward (2022). Determinants of innovation outcomes: The role of institutional quality. *Technovation*, 118, 102562. https://doi.org/10.1016/j.technovation.2022.102562

Shkolnykova, M., L. Steffens and J. Wedemeier (2024). Systems of innovation: Path of economic transition and differences in institutions in Central and Eastern Europe? *Growth and Change*, 55(1), e12703. https://doi.org/10.1111/grow.12703

Sommerfeld, A.-M., M. Fritsch and M. Wyrwich (2025). The Dynamics of Innovation Activity in Europe over the Early 21st Century: A Tale of Concentration and Transformation. Jena and Utrecht, mimeo.

Stark, D. (1996). Recombinant Property in East European Capitalism. *American Journal of Sociology,* 101, 993-1027. https://doi.org/10.1111/j.1467-954X.1998.tb03472.x

Svolik, M.W. (2012). *The Politics of Authoritarian Rule*. New York, NY: Cambridge University Press.

Tabellini, G. (2010). Culture and institutions: economic development in the regions of Europe. *Journal of the European Economic Association*, 8, 677-716. https://doi.org/10.1111/j.1542-4774.2010.tb00537.x

Ulset, S. (1996). R&D outsourcing and contractual governance: An empirical study of commercial R&D projects. *Journal of Economic Behavior & Organization*, 30, 63-82. https://doi.org/10.1016/S0167-2681(96)00842-6

Wyrwich, M., P.J. Steinberg, F. Noseleit and P. de Faria (2022). Is open innovation imprinted on new ventures? The cooperation-inhibiting legacy of authoritarian regimes. *Research Policy*, 51, 104409. https://doi.org/10.1016/j.respol.2021.104409

Xu, X. and X. Jin (2018). The autocratic roots of social distrust. *Journal of Comparative Economics*. 46, 362-380. https://doi.org/10.1016/j.jce.2017.12.002

## Appendix

Table A1: Correlation matrix

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Most people can be trusted | 1 | | | | | | | | | | | | |
| 2 | Most people try to be fair | 0.851 | 1 | | | | | | | | | | | |
| 3 | Most of the time people are helpful | 0.847 | 0.826 | 1 | | | | | | | | | | |
| 4 | Trust in country's parliament | 0.815 | 0.741 | 0.695 | 1 | | | | | | | | | |
| 5 | Trust in the legal system | 0.825 | 0.76 | 0.79 | 0.897 | 1 | | | | | | | | |
| 6 | Trust in the police | 0.759 | 0.729 | 0.676 | 0.769 | 0.865 | 1 | | | | | | | |
| 7 | Trust in politicians | 0.772 | 0.741 | 0.714 | 0.922 | 0.85 | 0.662 | 1 | | | | | | |
| 8 | Trust in political parties | 0.776 | 0.731 | 0.719 | 0.914 | 0.836 | 0.641 | 0.976 | 1 | | | | | |
| 9 | Trust in the European Parliament | 0.478 | 0.422 | 0.25 | 0.64 | 0.49 | 0.494 | 0.612 | 0.608 | 1 | | | | |
| 10 | Trust in the United Nations | 0.595 | 0.574 | 0.515 | 0.658 | 0.616 | 0.596 | 0.649 | 0.656 | 0.752 | 1 | | | |
| 11 | EQI Index 2021 | 0.735 | 0.888 | 0.789 | 0.698 | 0.694 | 0.659 | 0.678 | 0.659 | 0.299 | 0.332 | 1 | | |
| 12 | Quality pillar, country centered and z-score standardized | 0.737 | 0.857 | 0.759 | 0.68 | 0.674 | 0.647 | 0.642 | 0.618 | 0.301 | 0.332 | 0.952 | 1 | |
| 13 | Impartiality pillar, country centered and z-score standardized | 0.717 | 0.877 | 0.784 | 0.671 | 0.675 | 0.637 | 0.661 | 0.639 | 0.278 | 0.319 | 0.972 | 0.883 | 1 |
| 14 | Corruption pillar, country centered and z-score standardized | 0.688 | 0.853 | 0.754 | 0.681 | 0.672 | 0.636 | 0.672 | 0.664 | 0.293 | 0.317 | 0.967 | 0.869 | 0.926 |

Table A2: Definition of social capital

| *Social capital* | | |
|---|---|---|
| Aggregate index | To create a multidimensional measure of social capital, we follow the approach suggested by Portela et al. (2013), which describes grouping ESS items into five pillars that constitute the social capital index: institutional trust, social trust, civic-social engagement, political networks, and social networks. | ESS 2021 |
| Institutional trust | The pillar of institutional trust comprises the following questions: "Trust in country's parliament", "Trust in the legal system", "Trust in the police", "Trust in politicians", "Trust in political parties", "Trust in the European Parliament", and "Trust in the United Nations". | ESS 2021 |
| Social trust | The social trust pillar is composed of the questions: "Most people can be trusted or you can't be too careful", "Most people try to take advantage of you, or try to be fair", and "Most of the time people are helpful or mostly looking out for themselves". | ESS 2021 |
| Civic-social engagement | The civic-social engagement pillar encompasses the questions: "Signed petition last 12 months", "Boycotted certain products last 12 months", "Taken part in lawful public demonstration last 12 months", "Worn or displayed campaign badge or sticker last 12 months", and "Worked in another organization or association last 12 months". | ESS 2021 |
| Political networks | The political networks pillar includes the questions: "Worked in political party or action group last 12 months" and "Contacted politician or government official last 12 months". | ESS 2021 |
| Social networks | The social networks pillar consists of the questions: "How often socially meet with friends, relatives or colleagues", "Take part in social activities compared to others of same age", "How many people with whom you can discuss intimate and personal matters", and "Internet use, how often". | ESS 2021 |

Table A3: Baseline results. General patenting activity

| | $\beta$ standardized | Standard error | P>\|z\| | 95% CI lower | 95% CI upper | Decomposition (%) |
|---|---|---|---|---|---|---|
| *Direct effects* | | | | | | |
| Socialism → Patenting activity | -0.117*** | 0.034 | 0.001 | -0.184 | -0.051 | 28.8 |
| Socialism → Trust | -0.470*** | 0.045 | 0.000 | -0.558 | -0.381 | |
| Socialism → QoG | -0.537*** | 0.054 | 0.000 | -0.644 | -0.431 | |
| Trust → Patenting activity | 0.150** | 0.065 | 0.020 | 0.023 | 0.276 | |
| QoG → Patenting activity | 0.414*** | 0.045 | 0.000 | 0.326 | 0.502 | |
| *Indirect effects* | | | | | | |
| Socialism → Trust → Patenting activity | -0.070** | 0.029 | 0.017 | -0.128 | -0.013 | 17.1 |
| Socialism → QoG → Patenting activity | -0.222*** | 0.033 | 0.000 | -0.288 | -0.157 | 54.1 |
| *Total effect* | | | | | | |
| Socialism → Patenting activity | -0.410*** | 0.029 | 0.000 | -0.467 | -0.353 | 100 |

*Notes*: The results are based on SEM model. Following control variables are included in each regression but omitted from the output for brevity reasons: Employment knowledge-intensive activities, R&D expenditures business sector, Persons per 1,000 square km. Significance levels indicated as follows: ***p < 0.01, **p < 0.05, *p < 0.10. Number of observations is 205. The decomposition percentages are calculated by dividing the absolute value of the respective direct or indirect effect by the absolute value of the total effect. For example, in the Trust-only Model, the total Socialism → Trust → Patenting effect can be seen as the sum of the indirect effect of socialism via trust and direct socialism effect on patenting. The indirect effect of socialism is calculated as the product of the direct effect of Socialism on Trust and the direct effect of Trust on Patenting, which yields an indirect effect of socialism via trust.

Table A4: Baseline results. Innovation cooperation

| | $\beta$ standardized | Standard error | P>\|z\| | 95% CI lower | 95% CI upper | Decomposition (%) |
|---|---|---|---|---|---|---|
| *Direct effects* | | | | | | |
| Socialism → Innovation cooperation | -0.114*** | 0.035 | 0.001 | -0.182 | -0.045 | 28.9 |
| Socialism → Trust | -0.470*** | 0.045 | 0.000 | -0.558 | -0.381 | |
| Socialism → QoG | -0.537*** | 0.054 | 0.000 | -0.644 | -0.431 | |
| Trust → Innovation cooperation | 0.176*** | 0.067 | 0.009 | 0.045 | 0.308 | |
| QoG → Innovation cooperation | 0.362*** | 0.047 | 0.000 | 0.270 | 0.454 | |
| *Indirect effects* | | | | | | |
| Socialism → Trust → Innovation cooperation | -0.083*** | 0.031 | 0.008 | -0.144 | -0.022 | 21.2 |
| Socialism → QoG → Innovation cooperation | -0.195*** | 0.032 | 0.000 | -0.258 | -0.131 | 49.9 |
| *Total effect* | | | | | | |
| Socialism → Innovation cooperation | -0.391*** | 0.030 | 0.000 | -0.450 | -0.332 | 100 |

*Notes:* The results are based on SEM model. Following control variables are included in each regression but omitted from the output for brevity reasons: Employment knowledge-intensive activities, R&D expenditures business sector, Persons per 1,000 square km. Significance levels indicated as follows: ***p < 0.01, **p < 0.05, *p < 0.10. Number of observations is 205. For an explanation behind the decomposition logic see notes under Tables A2.

Table A5: Single mechanisms tests. Patenting activity

| | *β* standardized | Standard error | P>\|z\| | 95% CI lower | 95% CI upper | Decomposition (%) |
|---|---|---|---|---|---|---|
| *Panel A. Trust-only model* | | | | | | |
| *Direct effects* | | | | | | |
| Socialism → Patenting activity | -0.176*** | 0.031 | 0.000 | -0.237 | -0.116 | 48.9 |
| Socialism → Trust | -0.455*** | 0.045 | 0.000 | -0.543 | -0.367 | |
| Trust → Patenting activity | 0.404*** | 0.044 | 0.000 | 0.317 | 0.491 | |
| *Indirect effects* | | | | | | |
| Socialism → Trust → Patenting activity | -0.184*** | 0.026 | 0.000 | -0.235 | -0.132 | 51.1 |
| *Total effect* | | | | | | |
| Socialism → Patenting activity | -0.360*** | 0.025 | 0.000 | -0.409 | -0.311 | 100 |
| *Panel B: QoG-only model* | | | | | | |
| *Direct effects* | | | | | | |
| Socialism → Patenting activity | -0.106*** | 0.029 | 0.000 | -0.162 | -0.049 | 27.5 |
| Socialism → QoG | -0.495*** | 0.051 | 0.000 | -0.595 | -0.395 | |
| QoG → Patenting activity | 0.566*** | 0.032 | 0.000 | 0.504 | 0.628 | |
| *Indirect effects* | | | | | | |
| Socialism → QoG → Patenting activity | -0.280*** | 0.033 | 0.000 | -0.345 | -0.215 | 72.5 |
| *Total effect* | | | | | | |
| Socialism → Patenting activity | -0.386*** | 0.028 | 0.000 | -0.441 | -0.331 | 100 |
| *Panel C: Social capital model* | | | | | | |
| *Direct effect* | | | | | | |
| Socialism → Patenting activity | -0.101*** | 0.032 | 0.002 | -0.164 | -0.038 | 28.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Socialism → Social capital | -0.511*** | 0.038 | 0.000 | -0.585 | -0.437 | |
| Social capital → Patenting activity | 0.506*** | 0.049 | 0.000 | 0.410 | 0.602 | |
| *Indirect effect* | | | | | | |
| Socialism → Social capital → Patenting activity | -0.259*** | 0.031 | 0.000 | -0.319 | -0.198 | 71.9 |
| *Total effect* | | | | | | |
| Socialism → Patenting activity | -0.360*** | 0.025 | 0.000 | -0.409 | -0.311 | 100 |

*Notes:* The results are based on SEM model. Following control variables are included in each regression but omitted from the output for brevity reasons: Employment knowledge-intensive activities, R&D expenditures business sector, Persons per 1000 square km. Significance levels indicated as follows: ***p < 0.01, **p < 0.05, *p < 0.10. Number of observations is 249 for the trust-only, and social capital models, 224 for the QoG-only model. For an explanation behind the decomposition logic see notes under Tables A2.

Table A6: Single mechanisms tests. Innovation cooperation

| | *β* standardized | Standard error | P>\|z\| | 95% CI lower | 95% CI upper | Decomposition (%) |
|---|---|---|---|---|---|---|
| *Panel A. Trust-only model* | | | | | | |
| *Direct effects* | | | | | | |
| Socialism → Innovation cooperation | -0.166*** | 0.032 | 0.000 | -0.229 | -0.103 | 48.0 |
| Socialism → Trust | -0.455*** | 0.045 | 0.000 | -0.543 | -0.367 | |
| Trust → Innovation cooperation | 0.396*** | 0.047 | 0.000 | 0.304 | 0.488 | |
| *Indirect effect* | | | | | | |
| Socialism → Trust → Innovation cooperation | -0.180*** | 0.027 | 0.000 | -0.233 | -0.127 | 52.0 |
| *Total effect* | | | | | | |
| Socialism → Innovation cooperation | -0.346*** | 0.026 | 0.000 | -0.396 | -0.296 | 100 |
| *Panel B. QoG-only model* | | | | | | |
| *Direct effects* | | | | | | |
| Socialism → Innovation cooperation | -0.106*** | 0.029 | 0.000 | -0.163 | -0.049 | 28.8 |
| Socialism → QoG | -0.495*** | 0.051 | 0.000 | -0.595 | -0.395 | |
| QoG → Innovation cooperation | 0.530*** | 0.034 | 0.000 | 0.463 | 0.596 | |
| *Indirect effects* | | | | | | |
| Socialism → QoG → Innovation cooperation | -0.262*** | 0.032 | 0.000 | -0.325 | -0.200 | 71.2 |
| *Total effect* | | | | | | |
| Socialism → Innovation cooperation | -0.368*** | 0.029 | 0.000 | -0.424 | -0.312 | 100 |
| *Panel C. Social capital model* | | | | | | |
| *Direct effects* | | | | | | |
| Socialism → Innovation cooperation | -0.097*** | 0.034 | 0.004 | -0.163 | -0.031 | 28.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Socialism → Social capital | -0.511*** | 0.038 | 0.000 | -0.585 | -0.437 | |
| Social capital → Innovation cooperation | 0.487*** | 0.049 | 0.000 | 0.390 | 0.583 | |
| *Indirect effect* | | | | | | |
| Socialism → Social capital → Innovation cooperation | -0.249*** | 0.031 | 0.000 | -0.309 | -0.189 | 71.9 |
| *Total effect* | | | | | | |
| Socialism → Innovation cooperation | -0.346*** | 0.026 | 0.000 | -0.396 | -0.296 | 100 |

*Notes:* The results are based on SEM model. Following control variables are included in each regression but omitted from the output for brevity reasons: Employment knowledge-intensive activities, R&D expenditures business sector, Persons per 1000 square km. Significance levels indicated as follows: ***p < 0.01, **p < 0.05, *p < 0.10. Number of observations is 249 for the trust-only, and social capital models, 224 for the QoG-only model. For an explanation behind the decomposition logic see notes under Tables A2.

IMPRESSUM
Jena Economics Research Papers
ISSN 1864-7057
Friedrich Schiller University Jena
Faculty of Economics and Business Administration
Carl-Zeiss-Str. 3
D-07743 Jena, Germany

Email: office.jerp@uni-jena.de
Editor: Silke Übelmesser
Website: www.wiwi.uni-jena.de/en/jerp