MASTERARBEIT | MASTER'S THESIS

Titel | Title

Political Decentralization and Nuclear Power Plant Lead Times: Replication of Benson (2022) with Extension on Administrative vs Fiscal Effects

verfasst von | submitted by

Matthias Freudling-Braun B.Sc.

angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien | Vienna, 2026

Studienkennzahl lt. Studienblatt | Degree programme code as it appears on the student record sheet:	UA 066 913
Studienrichtung lt. Studienblatt | Degree programme as it appears on the student record sheet:	Masterstudium Applied Economics
Betreut von | Supervisor:	Assoz. Prof. Daniel Garcia PhD

Acknowledgements

I am sincerely grateful to Assoc. Prof. Daniel Garcia, PhD (University of Vienna, Department of Economics) for supervising this thesis and for his valuable feedback and guidance throughout the project. I also thank Dr. Mariya Teteryatnikova for her support and advice during the earlier stages of this work.

This thesis used ChatGPT (OpenAI) as a language-support tool (grammar and clarity) in accordance with the University of Vienna's AI policy. All scientific content, analysis, and final wording remain the author's responsibility.

Table of Contents

Abstract

This thesis examines whether decentralization helps explain cross-country differences in nuclear power plant construction lead times. It replicates the main non-restricted empirical results in Benson (2022) and extends them in two ways: first, by decomposing political decentralization into local and regional components using V-Dem indicators; second, by incorporating fiscal decentralization in an OECD subsample. Using reactor-level data from Benson's Global NPP Database, the analysis estimates Benson-style regressions with reactor-model controls, clustered standard errors, and instrumental-variable specifications for potentially endogenous shock-exposure indicators. The results replicate the core finding that greater political decentralization is associated with longer net nuclear lead times. In the extension, this positive association appears across several related political decentralization measures and is most stable for the regional dimension. By contrast, the fiscal decentralization evidence in the OECD subsample is fragile and sensitive to specification choice. Overall, the findings support an observational link between political decentralization and longer nuclear project delivery timelines, while evidence for fiscal decentralization remains fragile and subject to important identification and sample limitations.

Keywords: nuclear power plants; construction lead times; political decentralization; fiscal decentralization; V-Dem; instrumental variables

Zusammenfassung

Diese Arbeit untersucht, ob Dezentralisierung zur Erklärung länderübergreifender Unterschiede in den Bauzeiten von Kernkraftwerken beitragen kann. Sie repliziert die zentralen, nicht eingeschränkten empirischen Ergebnisse von Benson (2022) und erweitert diese in zweierlei Hinsicht: Erstens wird politische Dezentralisierung mithilfe von V-Dem-Indikatoren in lokale und regionale Komponenten zerlegt; zweitens wird fiskalische Dezentralisierung in einer OECD-Teilstichprobe berücksichtigt. Auf Basis reaktorspezifischer Daten aus Benson's Global NPP Database schätzt die Analyse Benson-orientierte Regressionsmodelle mit Reaktormodell-Kontrollen, auf Länderebene geclusterten Standardfehlern und Instrumentvariablen-Spezifikationen für potenziell endogene Schock-Expositionsindikatoren. Die Ergebnisse replizieren den zentralen Befund, dass stärkere politische Dezentralisierung mit längeren Netto-Bauzeiten von Kernkraftwerken verbunden ist. In der Erweiterung zeigt sich dieser positive Zusammenhang über mehrere verwandte Maße politischer Dezentralisierung hinweg und ist für die regionale Dimension am stabilsten. Demgegenüber erweist sich die Evidenz für den hypothesisierten positiven Zusammenhang zwischen fiskalischer Dezentralisierung und längeren Netto-Bauzeiten in der OECD-Teilstichprobe als fragil und sensitiv gegenüber der Spezifikationswahl. Insgesamt sprechen die Ergebnisse für einen assoziativen Zusammenhang zwischen dezentraler Governance und längeren Projektlaufzeiten im Kernkraftwerksbau. Die Ergebnisse der fiskalischen Dezentralisierung verweisen jedoch zugleich auf wichtige Identifikations- und Stichprobenbeschränkungen.

Schlagwörter: Kernkraftwerke; Bauzeiten; politische Dezentralisierung; fiskalische Dezentralisierung; V-Dem; Instrumenten Variable

1 Introduction

1.1 Motivation

Nuclear power occupies a distinctive position in the low-carbon transition: it is a mature source of low-carbon electricity that can provide sustained electricity generation at scale (IEA, 2025; IAEA, 2024). It is also increasingly framed as part of strategic competition over industrial capabilities and energy security (Arden, 2025; Mustafayev & Akbarov, 2025). Yet a persistent gap has emerged between global nuclear momentum and Western delivery. While new nuclear construction continues internationally, recent performance and expansion dynamics suggest that the nuclear renaissance is unfolding unevenly. This raises questions not only about decarbonization pathways, but also about which institutional conditions are associated with timely delivery of large, regulated infrastructure and whether political decentralization systematically shapes nuclear construction lead times (Benson, 2022).

A central reason for this tension is that modern nuclear projects are repeatedly undermined by delays and cost escalation. Construction lead time, defined as the period from construction start to commissioning, is not a secondary metric; it is a key determinant of nuclear project economics and is closely linked to overall investment feasibility (Benson, 2022; Berthélemy & Escobar Rangel, 2015). This sensitivity is amplified because nuclear projects are capital intensive and the expenses are front-loaded (OECD/NEA, 2024; IEA, 2025). If schedules slip, financing costs accumulate and the risk profile of the project worsens, which can raise the cost of capital and further undermine viability (Berthélemy & Escobar Rangel, 2015; Benson, 2022). As a result, persistent schedule risk can make new builds both financially and politically difficult to realize. This is especially true in liberalized power markets or contested policy environments (Arden, 2025; Benson, 2022).

What makes the lead time problem especially important for research is the scale of cross-national variation. Despite an industry dominated by a relatively small set of multinational vendors and common engineering constraints, observed construction lead times differ vastly across countries and have trended upward in many Western countries while remaining comparatively stable and shorter in several East Asian programs (Benson, 2022). This pattern is difficult to explain using technological differences alone. Because nuclear projects are unusually capital-intensive, heavily regulated, and politically salient, they also provide a useful test case for how institutions may affect delivery in other large, regulated infrastructure and megaproject settings.

The existing nuclear cost and construction literature provides insights but also points to limits of purely technical explanations. One influential perspective emphasizes standardization and learning spillovers: lower design diversity and accumulated experience within architect–engineer organizations can shorten lead times, and because lead time is a key driver of overnight costs (construction cost excluding all interest payments), this can improve cost performance (Berthélemy & Escobar Rangel, 2015).

At the same time, the historical record cautions against the assumption that learning-by-doing will automatically dominate. The French scale-up, often cited as a coordinated national program, still exhibits some patterns consistent with negative learning in certain periods. This highlights how organizational change, regulatory evolution, and program complexity can offset expected learning gains (Grubler, 2010). Similarly, global historical cost evidence shows substantial heterogeneity across countries and eras, implying that nuclear cost escalation is not an inherent technological problem but is dependent on context and institutions (Lovering et al., 2016).

These results suggest that delays are often tied to governance and state capacity, not just technology. In a policy report on U.S. transportation infrastructure delivery, Niehaus (2025) characterizes the approval process as a set of litigation-prone veto points. He also argues that reduced in-house public capacity increases reliance on consultants, while procurement practices can incentivize underbidding followed by change orders and litigation.

While this is not only about nuclear power, it especially matters for nuclear construction because nuclear projects can face lengthy permitting and legal contestation and often depend on public acceptance, alongside long construction timelines (Niehaus, 2025; National Academies of Sciences, Engineering, and Medicine, 2023; Benson, 2022). Under these conditions fragmented decision-making can easily lead to delays (Niehaus, 2025; Benson, 2022). Similarly, Arden (2025) frames the U.S. nuclear slowdown as a strategic coordination failure and argues that treating nuclear as "strategic infrastructure" would require clearer responsibilities and stronger coordination to sustain long-term project delivery.

A specific institutional feature that plausibly intensifies these coordination problems is decentralization. Evidence from public procurement indicates that execution performance can differ systematically across levels of government. By using a large sample of Italian public works, Guccio et al. (2014) find that local governments experience longer execution delays than central government. This disadvantage is especially strong in smaller municipalities and when projects rely heavily on external financing. Their results underline a broader point that delays impose welfare costs beyond measured overruns by postponing the delivery. This argument transfers naturally to energy infrastructure where timeliness has systemwide impacts (Guccio et al., 2014). If a decentralized authority multiplies the number of actors involved in siting, permitting, compliance oversight, financing coordination, and dispute resolution, it may increase transaction costs, create sequential approval bottlenecks, and amplify veto opportunities, thereby lengthening construction lead times even when formal goals are shared (Benson, 2022; Niehaus, 2025).

This thesis focuses on lead time and examines decentralization as a possible driver of cross-country differences. Following Benson (2022), the empirical outcome is net construction lead time, defined as the duration between construction start and commissioning minus suspension periods. The practical motivation is straightforward: if nuclear is to play a significant role in decarbonization and energy security strategies, it must be deployed at scale within predictable time horizons and under institutional arrangements that can sustain delivery (Arden, 2025; Mustafayev & Akbarov, 2025). For research, nuclear projects are a good test case because results vary across countries and decentralization could plausibly affect delivery (Benson, 2022; Guccio et al., 2014).

1.2 Research question and hypothesis

This thesis examines decentralization as the central institutional factor of interest, distinguishing between political decentralization in the global sample and fiscal decentralization in the OECD subsample. The empirical analysis then studies heterogeneity by ownership and democracy for political decentralization, and by veto points for fiscal decentralization. The general idea is that when authority is spread across levels of government, large projects can face more coordination requirements and more opportunities for delay (Niehaus, 2025; Benson, 2022). This concern is also consistent with arguments that nuclear needs stable coordination and long-term institutional commitment to be delivered reliably (Arden, 2025).

Research question (Replication)

Does political decentralization help explain cross-country differences in nuclear power plant construction lead times?

Following Benson (2022), the main dependent variable is net construction lead time, defined as the duration from construction start to commissioning, net of formally suspended periods. This outcome captures the construction phase only and excludes pre-construction delays such as siting, licensing, litigation, and political bargaining.

Hypothesis on political decentralization (Extension)

Higher political decentralization is associated with higher net lead times for nuclear power plants (Benson, 2022). We further examine whether this relationship is also visible when the decentralization index is decomposed into its local and regional components.

Hypothesis on fiscal decentralization (Extension)

Motivated by fiscal federalism (Oates, 1972) and evidence from public works that decentralization can affect time performance (Guccio et al., 2014), greater fiscal decentralization is hypothesized to be associated with longer nuclear construction lead times, conditional on political decentralization and standard controls.

The mechanisms motivating both hypotheses are developed in Chapter 3, beginning with a general decentralization framework and then distinguishing between political and fiscal channels.

1.3 Contribution: replication + extension

This thesis makes three contributions. First, it provides a careful replication of the main (non-restricted) empirical results in Benson (2022) on the relationship between political decentralization and nuclear construction lead times.

Second, the thesis improves measurement by going beyond a single composite decentralization indicator. It decomposes decentralization measures into local and regional components to test whether the association with lead times is driven by one level of subnational governance rather than decentralization in general (Benson, 2022).

Third, the thesis extends the framework by examining fiscal decentralization in an OECD subsample and, in additional OECD robustness checks, assessing whether the political decentralization association remains positive when fiscal decentralization is controlled for. This extension is motivated by evidence that implementation performance can differ systematically across levels of government and financing settings (Guccio et al., 2014). Together, these steps aim to clarify which institutional dimensions are most consistently related to nuclear construction timelines and to improve descriptive precision in interpreting decentralization effects, without fully identifying the causal effect of decentralization itself.

2 Background and related literature

2.1 NPP construction delays / megaproject delays

Nuclear power plants are highly capital-intensive, and their economic performance is strongly shaped by how long they take to build. A common measure is construction lead time. In this thesis, the main outcome is net lead time, which subtracts formally recorded suspension periods from gross construction time to better capture implementation performance (Benson, 2022).

Why delays matter in nuclear

Delays matter in nuclear for three related reasons: direct construction cost increases, financing cost exposure, and delayed delivery of low-carbon electricity. Because nuclear projects take longer to complete than many competing generation technologies, interest during construction makes up a comparatively large share of total capital cost (Benson, 2022). Longer schedules also delay the point at which plants generate electricity and revenues, and they raise uncertainty and can lead to additional rounds of project adjustment and oversight.

The empirical literature suggests that lead time is not only a symptom of project difficulty, but also an important cost driver. Using a simultaneous system that treats overnight costs and lead time as jointly determined, Berthélemy and Escobar Rangel (2015) find a strong positive relationship between construction duration and overnight costs. This implies that schedule performance is economically consequential, not only an implementation detail.

Evidence that nuclear delays are common and large

A recurring theme across the nuclear cost and performance literature is that outcomes vary substantially by country and period, but delays and overruns are persistent risks in many settings. Lovering et al. (2016) show that cost trends are not uniform. Some countries and time periods show relative stability or even declining costs, while others show increases. This matters because it suggests that poor construction performance is not mechanically built into the technology. Instead, cross-country and over-time variation is consistent with a role for institutions, program design, and delivery environments.

At the same time, the critical appraisal by Gilbert et al. (2017) stresses how severe overruns and delays can be in practice when nuclear projects are compared to other infrastructure and energy technologies. Drawing on a comparative dataset, Gilbert et al. (2017) argue that nuclear exhibits comparatively weak cost and time performance relative to other infrastructure and energy technologies, and that financial risk is amplified when time overruns compound with cost escalation and financing exposure (Gilbert et al., 2017). Their broader point is that nuclear construction is especially exposed to financial risk because cost escalation often compounds with time overruns and interest costs (Gilbert et al., 2017). Even if one takes a more optimistic view on country experiences (as emphasized by Lovering et al., 2016), this comparison underlines why schedule risk is central for nuclear project economics.

Explanations inside the nuclear literature: standardization, learning, and program structure

A major strand of literature focuses on whether repeated building and standardization improve performance. Berthélemy and Escobar Rangel (2015) explicitly test standardization and learning channels and conclude that standardization is a key factor for reducing construction costs, while also emphasizing how construction time and costs interact. This perspective is consistent with historical cases where coordinated programs achieved comparatively short build times. France's

PWR program benefited from centralized decision making, a high degree of standardization, and regulatory stability, and this institutional setting supported comparatively short construction times (Grubler, 2010). However, Grubler (2010) also shows that even this "best case" scale-up experienced substantial real cost escalation over time which is a useful warning. Short lead times alone do not guarantee cost stability, and learning effects are not automatic.

Overall, the nuclear literature points to a practical implication: if the policy goal is a sustained build program, performance likely depends not only on reactor technology but on repeatability, regulatory stability, and organizational learning that supports a consistent delivery environment over long horizons (Berthélemy & Escobar Rangel, 2015; Grubler, 2010; Lovering et al., 2016).

Nuclear as a "megaproject" problem

Nuclear new-builds also fit the broader pattern described in the megaproject literature. Large projects frequently suffer from systematic underestimation of costs and timelines, and risk is often poorly managed early on. Flyvbjerg, Bruzelius, and Rothengatter (2003) document that cost overruns of 50–100% in real terms are common in megaprojects (and that overruns above 100% are not uncommon) and argue that persistent underestimation is not well explained by random error. Instead, they emphasize incentive problems and accountability failures, including strategic misrepresentation and biased forecasting used to secure project approval. They also note that the length and cost of delays are commonly underestimated and that construction periods for megaprojects are often decade-long. This pushes operational concerns into a distant future and makes early-stage appraisal especially vulnerable to optimism and manipulation (Flyvbjerg et al., 2003).

These features are consistent with the mechanisms Flyvbjerg et al. (2003) identify as producing disappointing megaproject performance. Nuclear projects combine large sunk costs and long schedules, high technical and regulatory complexity, frequent exposure to scope changes and external shocks, as well as high political risks. These features line up closely with the mechanisms Flyvbjerg et al. (2003) identify as producing disappointing megaproject performance. The result is that nuclear construction delays should not be treated as rare "project mistakes," but as a core risk category that requires institutional and contractual arrangements designed for long-horizon delivery and credible accountability.

2.2 Decentralization of decision making and coordination problems

Political decentralization describes a system in which authority is shared across multiple tiers of government, giving subnational governments meaningful autonomy over policy and administration. For infrastructure delivery, the key issue is whether subnational actors hold real decision rights that allow them to shape implementation and timing.

Local governments may be better informed about local conditions and can adapt policies to heterogeneous needs (Oates, 1972). At the same time, dispersing authority increases the number of actors involved in decision making. This raises transaction costs because responsibilities must be negotiated, information must be shared, and approvals can become sequential rather than parallel. In complex projects, these frictions can accumulate into substantial delays.

Nuclear construction projects require stable regulatory interpretation and sustained coordination among regulators, utilities, contractors, and public authorities over long horizons (Benson, 2022). Even when nuclear policy is set nationally, implementation often intersects with subnational responsibilities such as land-use planning, emergency preparedness, and public acceptance. If decentralization expands the set of actors with formal or informal veto power, it can increase bargaining and coordination frictions, which may translate into longer construction lead times (Benson, 2022).

Decentralization does not automatically imply slower delivery. If subnational administrations have strong capacity, clear responsibilities, and well-defined procedures, decentralization may improve local problem solving and reduce information bottlenecks. The empirical question is therefore whether, in the nuclear domain, the benefits of local responsiveness outweigh the coordination costs that arise when authority is dispersed across government tiers.

2.3 Fiscal decentralization and institutional context

Fiscal decentralization captures how much spending authority sits with subnational governments rather than the center (Oates, 1972). Even when national governments retain authority over nuclear policy, subnational fiscal autonomy can shape implementation incentives and constraints, for example through co-financing arrangements, the capacity to provide complementary infrastructure, and the ability to absorb or contest fiscal risks associated with large projects.

Evidence from public procurement supports the idea that delivery performance differs by level of government. Using a large dataset of Italian public works, Guccio et al. (2014) find longer execution delays for projects managed by local governments than for those managed by central government, with disadvantages that are stronger in smaller municipalities and when projects rely on external financing.

3 Conceptual Framework and Hypotheses

This chapter outlines why decentralization may shape nuclear power plant (NPP) construction performance and derives the hypotheses tested in the empirical analysis. Following Benson (2022), the outcome of interest is (net) construction lead time, i.e., the duration between construction start and commissioning net of formally recorded suspension periods.

3.1 Mechanisms: why decentralization may affect NPP lead times

The central mechanism is coordination and veto-point complexity. When authority is distributed across government levels, more actors can influence siting, licensing, inspections, and compliance. Even with aligned objectives, additional decision-makers typically raise transaction costs: information and responsibilities must be coordinated, approvals may become sequential, and disputes can take longer to resolve. For NPPs, where regulatory requirements are stringent and resolving safety-related issues can be time-consuming, these frictions are likely to translate into longer construction durations.

A second channel is political accountability and contestation. Decentralization can increase responsiveness to local preferences, potentially strengthening incentives for subnational politicians to demand additional safeguards, bargaining, or procedural scrutiny. This can lengthen lead times even without bad governance.

A third channel concerns capacity differences across subnational governments. Where local or regional administrations lack specialized technical expertise and administrative resources, decentralization may slow implementation; where capacity is strong, it may help resolve site-specific constraints more quickly. Empirically, the net effect is therefore an open question, but the NPP context suggests coordination costs may plausibly dominate.

3.2 Hypothesis on political decentralization

Greater political decentralization is associated with longer NPP construction lead times, conditional on controls (Benson, 2022).

The hypothesis follows from the coordination and veto-point logic. Where subnational governments are elected and can operate with meaningful autonomy, more actors may influence project timelines through permitting, administrative review, and political bargaining. To capture different dimensions of political decentralization, this thesis uses four related measures: a composite division of power index and three component-style indicators that distinguish local versus regional institutional features (local elections, regional elections, and the regional offices relative power). Consistent results across measures would strengthen the interpretation that the relationship reflects institutional decentralization rather than a single index.

3.3 Hypothesis on fiscal decentralization

Greater fiscal decentralization is hypothesized to be associated with longer NPP construction lead times, conditional on controls.

This hypothesis follows from the trade-off logic of fiscal federalism. Oates (1972) argues that decentralization can improve outcomes when it allows policy to reflect heterogeneous local preferences, but that greater centralization may be preferable when spillovers, economies of scale, and decision-making costs are important. In the case of NPP construction, projects typically require coordination across levels of government over co-financing arrangements, complementary infrastructure, and the allocation of fiscal risks. In this setting, fragmented fiscal authority may increase bargaining and coordination frictions and thereby lengthen construction lead times.

The relationship between political decentralization and lead times may also vary across institutional contexts. In particular, ownership structure and democracy may condition how decentralization-related coordination frictions translate into construction performance. State-owned utilities may differ from investor-owned utilities in financing conditions and risk-bearing capacity, which can affect the costs of delay and the incentives to maintain schedule discipline. Likewise, democracy may strengthen transparency and accountability, but it may also broaden contestation and increase the number of actors able to delay projects (Benson, 2022). These potential conditioning factors are examined in the political decentralization analysis below.

4 Data

This thesis replicates the main (non-restricted) empirical results of Benson (2022). The analysis relies on Benson's reactor-level "Global NPP Database," which combines project information from the IAEA Power Reactor Information System (PRIS) with manual cleaning and supplementation using engineering, historical, and country-level sources.

4.1 Data sources (Benson, 2022)

4.1.1 Core plant-level database: IAEA PRIS and manual updates

The foundation of Benson's NPP database is the IAEA PRIS. While PRIS provides a public interface and summary publications, Benson reports temporary access (July 2018) to a restricted PRIS version.

This restricted access matters because parts of the database construction and some variables used in the paper draw on PRIS fields that are not always fully available or consistently coded in the public dataset. PRIS covers reactors in commercial operation, reactors that have begun construction (including later abandoned projects), and a set of planned reactors. PRIS defines construction start as the point when the "first major placing of concrete" occurs, rather than earlier site preparation. Benson also notes that PRIS can be incomplete for proposed but never-built units in some contexts, which motivates manual updates to the database in such cases. In its final form, the dataset contains 1,087 reactor observations at 404 sites in 50 countries (status as of April 6, 2021).

4.1.2 Data cleaning and supplementary technical sources

Because PRIS data are reported by plant owners or government representatives, Benson emphasizes that the raw PRIS data contains internal inconsistencies (e.g., firm name changes and inconsistent labeling conventions) as well as substantial missingness in some reactor entries.

4.1.3 Site geography and local environment

Benson compiles site-level latitude and longitude primarily from the World Resources Institute's Global Power Plant Database, supplemented by Nucleopedia and Oak Ridge reports for U.S. sites when needed.

To capture physical context relevant for construction and plant design, Benson matches each site to local climate classifications using Chen and Chen's global Köppen climate grid. He applies a nearest-centroid matching procedure with adjustments for ocean grid cells. Benson also codes aspects of cooling-water characteristics, including salinity categories, as part of the site environment description.

4.1.4 Construction timeline variables and project dates

The PRIS provides core "dates of significance," including construction start, first criticality, and grid connection. Benson adopts PRIS's definition of construction start ("first concrete").

A particularly important extension is Benson's treatment of construction interruptions. He reports that a substantial number of reactors experienced construction suspensions, but suspension dates are incompletely available in PRIS and may be recorded in fields intended for other events. To resolve this, he creates separate suspension and restart variables and supplements missing suspension dates through case-by-case historical research, primarily using Nucleonics Week. Restart dates are not provided by PRIS and are gathered manually, again through historical research, with indicators for the precision of the date information.

4.1.5 Country-level economic and political data

Benson links the plant-level database to country-level covariates measured at the country-year level. For economic development, he uses historical GDP per capita estimates from the Maddison

Project Database; for East and West Germany, he uses Broadberry and Klein because Maddison does not disaggregate those cases. For democracy, Benson's preferred measure is the V-Dem Polyarchy index of electoral democracy. He also reports robustness checks using the Polity IV democracy/autocracy measure (Center for Systemic Peace).

4.1.6 Measures of decentralization

Benson operationalizes decentralization using multiple measures that vary in conceptual richness and data coverage. He used a federal constitution indicator (binary). It is a coarse measure based on whether a country is classified as federal or unitary in the year construction begins. This measure may miss more nuanced cases where formal constitutional structure differs from de facto regional autonomy. The V-Dem division of power index is a more detailed measure capturing the existence and electoral status of local and regional governments and their ability to operate without interference from unelected bodies. The richest measure of subnational autonomy comes from Hooghe et al.'s Regional Authority Index (RAI), which scores countries based on constitutional and historical features of regional authority. Benson uses the self-rule component (rather than shared rule) because it aligns more closely with his theoretical mechanism. To increase coverage, he uses Sorens' coding of self-rule for South Africa; nevertheless, RAI self-rule is only matched to a subset of completed reactors in the sample.

4.2 Additional data sources for this thesis

4.2.1 Administrative decentralization measures (V-Dem)

To test the political decentralization hypothesis, this thesis adds country-year measures of political decentralization from the Varieties of Democracy (V-Dem) project (Coppedge et al., 2025). V-Dem provides annually updated indicators of political institutions for a large global sample. I use measures capturing whether subnational governments exist, whether they are elected, and whether they can operate without interference from unelected bodies.

All four V-Dem indicators are merged with each reactor project by ISO3 country code and the year in which construction begins. Using institutions measured at project start is consistent with the idea that planning and early execution phases are particularly sensitive to the institutional environment.

In addition to Benson's baseline decentralization measure, I estimate net lead time using three closely related V-Dem indicators that unpack the "division of power" concept. The baseline measure is V-Dem's Division of power index, which captures whether elected local and regional governments exist and can operate without interference from unelected bodies. I estimate this baseline measure alongside three more targeted indicators capturing specific dimensions of subnational governance: (1) the local government index, (2) the regional government index, and (3) the regional offices relative power component, which quantifies the extent to which elected regional bodies dominate unelected ones. All measures are tested in separate specifications, with and without reactor-model fixed effects.

4.2.2 Fiscal decentralization (OECD subnational expenditure share)

This subsection examines whether fiscal decentralization is associated with longer net lead times in the OECD subsample, recognizing that the small sample and limited number of country clusters constrain precision and causal interpretation. Building on this decentralization framework, the OECD fiscal analysis examines legislative constraints (veto points) as an institutional moderator of coordination and bargaining frictions.

Fiscal decentralization is measured by using the OECD Fiscal Decentralization Database ("Revenue and spending shares of state and local government"). I use consolidated subnational expenditure as a share of consolidated total general government expenditure (Table 5; 1965–2023) (OECD, n.d.). "Consolidated" means that transfers between government levels are removed so spending is not double counted. The resulting expenditure share reflects what state and local governments spend themselves rather than funds passed through. Higher values indicate greater expenditure decentralization, but the measure should be interpreted as a proxy for one dimension of fiscal decentralization rather than as a complete measure of fiscal autonomy.

4.3 Samples (global vs OECD) and data limitations

Because key covariates are not observed for all countries and years, the empirical analysis relies on two partially overlapping samples. The global reactor-level sample is used for baseline tests of the political decentralization hypothesis. Analyses that require the OECD fiscal decentralization measure are estimated on the subset of reactor projects observed in OECD-covered country-years. This subsection clarifies how both samples are defined and which limitations follow from differences in data availability.

4.3.1 Global sample: identification strategy and baseline model

The unit of observation is a reactor construction project, matched to country-year covariates by ISO3 country code and the construction start year. Political institutional variables are therefore interpreted as the institutional environment at project start, which is the relevant timing for regulatory design and governance decisions that plausibly shape subsequent construction duration.

4.3.2 OECD estimation sample (fiscal decentralization and robustness)

Fiscal decentralization is measured using the OECD subnational expenditure share (state + local expenditure as a share of general government expenditure). Since this series is not available globally and has limited historical coverage, the analysis is estimated on the subset of reactor projects for which the fiscal decentralization variable is observed in the relevant country-year. As in the global sample, the merge uses ISO3 and construction star-year.

Two restrictions are particularly important. First, in the merged reactor dataset the OECD fiscal decentralization measure is observed only for projects with construction start years 1965–2021, so reactors starting construction outside this range cannot enter the OECD fiscal decentralization analysis. Second, the OECD estimations rely on the common set of observations with non-missing values for the dependent variable, endogenous variables, instruments, controls, and fixed-effect identifiers; together with the OECD coverage restriction this leads to a small number of country clusters. While the broader OECD-coverage subsample contains 19 countries, the preferred specification is estimated on 16 country clusters. Because the preferred OECD specification is estimated on only 16 country clusters, later sections place primary weight on wild cluster bootstrap p-values, treat conventional clustered p-values as secondary, and evaluate IV results additionally using first-stage and weak-identification diagnostics.

4.3.3 Implications and key data limitations

The sample split implies different scopes of interpretation. The political decentralization estimates leverage broader cross-country variation in political decentralization, while the fiscal decentralization estimates only apply to the OECD-covered country-years and should be interpreted as OECD-context relationships, not global ones.

A second limitation concerns measurement. V-Dem decentralization measures capture the distribution of political authority across government levels, whereas the OECD measure captures expenditure decentralization. Expenditure shares do not fully reflect revenue autonomy, tax assignment, or borrowing powers, and cross-country comparability can be influenced by differences in functional responsibilities assigned to subnational governments. Accordingly, the OECD indicator is best interpreted as a proxy for the relative size of subnational government spending, rather than a complete measure of fiscal autonomy.

Overall, these coverage constraints motivate the two-track empirical design: a global baseline for political decentralization and an OECD-focused analysis for fiscal decentralization, with explicit attention to external validity and inference in the smaller OECD subsample.

4.4 Summary statistics (main variables)

Table 1: Summary statistics (global sample and OECD subsamples)

	Global	OECD coverage	OECD fis. decen. (est.)
ln(Net Lead Time)	4.411 (0.388)	4.423 (0.391)	4.420 (0.390)
ln(GDP per capita) (z-score)	0.874 (0.551)	1.170 (0.271)	1.174 (0.274)
Polyarchy (z-score)	0.743 (1.154)	1.373 (0.618)	1.368 (0.626)
V-Dem division of power (z-score)	0.062 (0.974)	0.547 (0.592)	0.540 (0.600)
Investor-owned utility (IOU)	0.343 (0.472)	0.515 (0.496)	0.517 (0.497)
Federal constitution indicator	0.500 (0.500)	0.474 (0.500)	0.467 (0.500)
Expected lead time, conditional on design ($\ln(\widehat{LT})$)	4.411 (0.255)	4.470 (0.264)	4.465 (0.261)
OECD subnational expenditure share (z-score)	–	−0.176 (0.885)	−0.168 (0.892)
Legislative constraints on the executive (z-score)	–	1.133 (0.648)	1.126 (0.656)
Observations	590	365	353
Countries	31	16	16
Start year (min)	1953	1965	1965
Start year (max)	2015	2009	2009

This table reports summary statistics (means and standard deviations) for the main variables used in the empirical analysis across three samples. The first column summarizes the global sample used for the baseline political decentralization specifications. The second column restricts the data to the OECD subsample with non-missing values for the OECD fiscal decentralization and institutional variables shown, and the third column corresponds to fiscal decentralization estimation sample after applying the full set of regression restrictions (including the removal of reactor-model singletons), leaving 16 country clusters. Compared with the global sample, the OECD subsamples have higher mean income and higher polyarchy scores, while mean log net lead times are similar across samples. The OECD columns cover a narrower start-year window (1965–2009) because these realized samples impose additional listwise restrictions; in practice, post-2009 OECD-covered observations are excluded above all because the dependent variable is missing, and the design-based expected lead time measure is also unavailable for nearly all of them.

5 Empirical strategy

5.1 Baseline specification (Benson eq. (5) style)

My empirical strategy follows the baseline specification in Benson (2022), Equation (5). The unit of observation is a nuclear power plant construction project *i* that begins construction in country *c* in year *y*. The main dependent variable is the project's net construction lead time, measured in months net of suspended construction periods. In the analysis, lead times are modelled in logs to reduce skewness and allow a proportional interpretation of the estimated coefficients.

Baseline estimating equation (Benson, 2022, Eq. 5):

$$\ln(LT_i) = \beta_1 \ln(GDPpc_{c,y}) + \beta_2 Dem_{c,y} + \beta_3 Dec_{c,y} + \sum_{x \in X} \xi_{x,i} + \gamma_2 \mathbf{1}\{IOU_i\} + \gamma_1 \ln(\widehat{LT}_i) + \delta_m + \varepsilon_i$$

In this equation, LT_i is the net construction lead time of project i; $GDPpc_{c,y}$ is GDP per capita in country c and year y; $Dem_{c,y}$ denotes democracy (Polyarchy); and $Dec_{c,y}$ denotes political decentralization (measured either by a federal constitution indicator or a continuous decentralization index, depending on the specification). The term $\Sigma\xi_{x,i}$ denotes the event-exposure controls, namely the under-construction indicators for Three Mile Island, Chernobyl, Fukushima, and major regime-change episodes during construction. Benson also allows accident effects to differ in the accident country via interaction terms (TMI×USA and Chernobyl×Soviet Union). IOU_i is an indicator for investor-owned utility ownership. $\ln(\widehat{LT}_i)$ is the design-based expected lead time component, that is, the predicted construction duration based on observable reactor design characteristics ('expected lead time, conditional on design'). δ_m are reactor-model fixed effects, and ε_i is the error term."

A key component in Benson's framework is controlling for the design-related component of lead times $\ln(\widehat{LT}_i)$. The paper therefore includes a design-based expected lead time term, interpreted as the predicted component of construction duration conditional on reactor design. While the underlying design-characteristics data are restricted, the predicted values used in the main regressions are available for replication, which allows the baseline results to be reproduced without access to all restricted inputs. Taken together, the inclusion of both the predicted lead time $\ln(\widehat{LT}_i)$ and reactor model fixed effects serves as a combined approach for addressing design-related heterogeneity. The $\widehat{LT}_i$variable offers a continuous, project-specific estimate based on observable design features, helping to control for variation in technical complexity across projects. Meanwhile, reactor model fixed effects go a step further by comparing only within the same reactor design category, effectively removing all between-model variation. This dual approach ensures that any estimated relationship between decentralization and lead times is not simply driven by differences in technology or design choices. A central feature of Benson's baseline approach is that it does not include country fixed effects in the main global specification. The identification therefore relies primarily on cross-country differences in decentralization and democracy, conditional on the included controls and fixed effects. Instead of year fixed effects, the specification accounts for time-relevant regulatory shocks through the nuclear-accident indicators and regime-change controls. Because the key institutional variables vary at the country-year level, inference is based on clustered standard errors at the country level, accounting for within-country correlation in unobserved determinants of lead times.

This baseline specification (Eq. 5) provides the template for the replication section and for subsequent extensions in this thesis. Later analyses build on it by substituting alternative decentralization measures, adjusting fixed effects structures when required by the identification strategy, and extending the framework to additional mechanisms while keeping the institutional and regulatory-shock logic consistent with the original model.

5.2 Benson's IV design: instruments and identifying assumptions

In the IV setup, the core 'under construction' indicators capture whether a project was under construction during major events such as Three Mile Island, Chernobyl (with a separate USSR and

USA interaction terms), Fukushima, or a regime change episode. A key concern is endogenous selection into treatment: projects with longer durations are mechanically more likely to still be under construction when an event occurs, which would bias estimates. To address this, Benson instruments each event-exposure indicator using a nonlinear function of the construction start date. Specifically, for each event he estimates a binary probit model of selection into treatment ('under construction' at the event date) on the date construction began and uses the predicted probability of being under construction at the event date as the instrument (assigning zero to reactors that began construction after the event). He argues the exclusion restriction is plausible because the events are unanticipated and the resulting instruments have a nonlinear, stepwise relationship with time that is unlikely to proxy for other smooth trends.

5.3 Fixed effects, clustering, inference choices

A central modelling choice in Benson's baseline specification is the inclusion of reactor-model fixed effects (δ_m). These fixed effects absorb time-invariant differences across reactor designs, so the estimated institutional coefficients are identified from comparisons within the same reactor model rather than across fundamentally different designs. The baseline global specification does not include country fixed effects because decentralization and democracy vary only slowly over time, so country fixed effects would absorb most of the usable institutional variation. The trade-off is that identification then relies primarily on cross-country differences, so the estimates should be interpreted as conditional associations rather than fully causal effects. Since such changes are relatively infrequent and often incremental, the remaining identifying variation would be limited. Clustering at the country level is appropriate because institutional variables are shared across projects within a country-year and because unobserved determinants of nuclear project performance (e.g., regulatory capacity, procurement institutions, and contracting norms) are plausibly correlated within countries.

In specifications with few country clusters, conventional cluster-robust inference can be unreliable. I therefore place primary weight on wild cluster bootstrap p-values in the OECD subsample and treat conventional clustered p-values as secondary. For IV specifications, I also assess credibility using first-stage strength and weak-identification diagnostics.

6 Results

6.1 Replication of Benson's 2022 main results

Table 2: Predictors of Reactor Design Standardization (Replication of Benson 2022, Table VI)

	Dependent variable: Standardized model (=1)		
	(1)	(2)	(3)
GDP per capita (z)	1.93	0.93	5.15
	(1.30)	(-0.18)	(1.64)
Democracy (Polyarchy, z)	0.75	3.43***	2.57**
	(-0.97)	(3.23)	(2.21)
Federalism (1 if federal constitution)	0.94		
	(-0.10)		
Decentralization ($Dec_{c,y}$; one SD increase)		0.67	1.31
		(-1.21)	(0.46)
Population (log)			2.76**
			(2.21)
Number of utilities in country (log)			0.26**
			(-2.02)
Investor-owned utility (IOU)	0.19**	0.31*	1.04
	(-2.36)	(-1.77)	(0.05)
Time trend (Year construction began)	1.12***	1.17***	1.09**
	(3.59)	(5.27)	(2.33)
N	774	626	626

Exponentiated coefficients (odds ratios); test statistics in parentheses.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 2 replicates Benson (2022) Table VI on the predictors of reactor design standardization. The dependent variable is a binary indicator, Standardized model, which equals 1 if a reactor project uses a standardized reactor design (i.e., a design that is reused across multiple builds) and 0 otherwise. This outcome is relevant for the broader lead time question because standardization is commonly argued to improve project delivery by reducing re-design and learning costs, thereby contributing to shorter construction durations.

The models are estimated using logit (logistic) regressions. Following the original paper, the table reports exponentiated coefficients (odds ratios), with test statistics in parentheses. Odds ratios above 1 indicate higher odds that the reactor model is standardized; odds ratios below 1 indicate lower odds. Across all three specifications, the replicated coefficients and sample sizes match the published results (within rounding), confirming that this non-restricted part of the analysis is reproduced correctly. The time trend is positive and statistically significant in all columns, indicating that standardization becomes more likely for reactors whose construction began in later years.

Columns (1) to (3) also illustrate that decentralization is operationalized in two ways: a federal constitution dummy in column (1) and a continuous decentralization index $Dec_{c,y}$ (based on the RAI self-rule measure) in columns (2) and (3). Neither decentralization measure shows a robust or consistent association with standardization across specifications. In contrast, democracy (Polyarchy) is strongly positively associated with standardization in columns (2) and (3). The investor-owned utility indicator is positive and significant in columns (1) and (2). In the most extensive specification (3), population is positively associated with standardization and the number of utilities in a country is negatively associated, consistent with the idea that more fragmented utility landscapes are linked to less standardization.

Table 3: Politically Constrained Design (Replication of Benson 2022, Table VII)

	(1)	(2)	(3)
GDP per capita (z)	12.2%*	13.1%	-2.15%
	(1.79)	(1.51)	(-0.41)
Democracy (Polyarchy, z)	1.11%	-0.35%	4.57%
	(0.40)	(-0.10)	(1.10)
Federalism (1 if federal constitution)	-0.31%		
	(-0.05)		
Decentralization ($Dec_{c,y}$; one SD increase)		0.12%	-1.07%
		(0.03)	(-0.23)
Capacity (100 MW(e) increase)			3.94%***
			(3.73)
N	612	513	513
Adj. R^2	0.074	0.063	0.269

Coefficients are percent effects; test statistics in parentheses.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3 replicates Benson (2022), Table VII, which tests the first mechanism ("politically constrained design") proposed in the paper underlying the decentralization lead time relationship. The dependent variable is $\ln(\widehat{LT}_i)$ i.e., the predicted component of log lead times attributed to the design channel in Benson's setup. All three specifications are estimated by OLS with standard errors clustered at the country level; inference is based on a nonparametric bootstrap (1,000 replications), following the replication code.

The coefficients are reported in percentage terms rather than log points. Specifically, the table applies the transformation $100 \cdot (\exp(\hat{\beta})-1)$, so each coefficient can be read as the approximate percent change in $\widehat{LT}$ associated with a one-unit increase in the corresponding regressor (with standardized covariates interpreted as a one standard deviation change). The replicated coefficients, t-statistics, and sample sizes match Benson (2022) (within rounding), confirming that this non-restricted component of the mechanism analysis is reproduced correctly.

Across specifications, the decentralization measures (federal constitution in column (1) and the continuous decentralization index $Dec_{c,y}$ in columns (2) - (3)) are not statistically distinguishable from zero. In contrast, reactor capacity (100 MW(e) increase) in column (3) is positive and precisely estimated, indicating that larger reactors are associated with higher predicted lead times through the design channel. Overall, the replication reproduces Benson's conclusion that the politically constrained design mechanism does not provide strong evidence for decentralization affecting lead times via this predicted design component in these specifications.

Table 4: Regulatory Delays (Replication of Benson 2022, Table VIII)

	(1)	(2)	(3)	(4)
TMI accident	17.7%***	19.4%**	20.1%***	23.6%***
	(3.20)	(2.31)	(4.13)	(3.10)
TMI accident × USA	37.0%***	40.2%***	31.4%***	35.1%***
	(3.98)	(3.47)	(5.07)	(4.17)
Chernobyl disaster	2.8%	-2.5%	13.2%*	6.0%
	(0.29)	(-0.22)	(1.92)	(0.85)
Chernobyl disaster × Soviet Union	-31.6%***	*Not estimable*	-31.7%***	*Not estimable*
	(-2.92)		(-3.63)	
Fukushima Daiichi disaster	-11.9%	-18.1%	9.9%	0.8%
	(-0.73)	(-0.86)	(1.49)	(0.10)
Regime change	31.8%**	19.1%	50.3%***	48.1%**
	(2.39)	(1.04)	(3.13)	(2.10)
GDP per capita (ln, z)	-0.9%	4.5%	-9.2%**	-11.4%**
	(-0.20)	(1.34)	(-2.38)	(-2.34)
Democracy (Polyarchy, z)	-4.1%	-6.9%	1.0%	0.4%
	(-1.50)	(-1.64)	(0.41)	(0.12)
Decentralization (federal constitution)	7.1%		22.6%***	
	(1.08)		(5.00)	
Decentralization ($Dec_{c,y}$; one SD increase)		1.4%		9.8%***
		(0.40)		(3.17)
Investor-owned utility (IOU)	-10.4%**	-10.5%**	-16.0%***	-14.9%***
	(-2.44)	(-2.44)	(-6.05)	(-3.41)
Expected LT, conditional on design ($\widehat{LT}$)	0.85%***	0.86%***	0.68%***	0.71%***
	(5.32)	(4.94)	(8.17)	(7.30)
Reactor model fixed effects	Yes	Yes	No	No
N	556	476	590	500
adj. R^2	0.720	0.740	0.663	0.660

Coefficients in percent; test statistics in parentheses.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4 replicates Benson (2022), Table VIII, which tests the paper's Hypothesis 2 on regulatory delays as a channel affecting net construction lead times. The models are estimated using two-stage least squares with country-clustered standard errors. In line with the original study, columns (1) and (2) include reactor-model fixed effects, while columns (3) and (4) omit these fixed effects. All coefficients are reported in percentage terms using the transformation $100 \cdot (\exp(\hat{\beta})-1)$, and the reported test statistics correspond to the transformed estimates.

Across specifications, the regulatory shock indicators (TMI, Chernobyl, Fukushima) are economically meaningful and in several cases statistically significant. The Three Mile Island (TMI) indicator is positive in all four columns and the interaction term TMI × USA is also positive and precisely estimated, suggesting substantially larger net lead times for U.S. projects in the post-TMI period. The interaction term Chernobyl × Soviet Union is negative and statistically significant in the specifications where it is identified, while the Fukushima indicator is not robustly different from zero across columns. Regime change is positive and statistically significant in three of the four models, consistent with political instability being associated with longer net construction lead times. The investor-owned utility (IOU) indicator is negative and significant across all specifications.

The decentralization measures differ by specification: columns (1) and (3) use a federal-constitution dummy, while columns (2) and (4) use the continuous decentralization index $Dec_{c,y}$. The decentralization estimate is small and statistically indistinguishable from zero in the fixed effects specification using $Dec_{c,y}$ in model (2) but becomes positive and statistically significant when reactor-model fixed effects are omitted in model (4). Finally, the control "Expected LT, conditional on design" ($\widehat{LT}_i$) is positive and highly significant throughout, indicating that the predicted design-related component of lead times is strongly associated with realized net lead times even in the regulatory-delay IV setup. Overall, the replication reproduces Benson's reported coefficients, test statistics, and sample sizes for the non-restricted part of the analysis.

Table 5: Estimation Results of Eq. (6) (Replication of Benson 2022, Table IX)

	(1)	(2)	(3)	(4)
Expected LT, conditional on design				
1% increase in cLT_i	0.91%***	0.88%***	0.85%***	
	(13.04)	(9.60)	(11.03)	
Expected LT × Democracy				
$\cdots$ × one standard deviation increase in $Dem_{c,y}$		0.01	-0.00	
		(1.00)	(-0.06)	
Expected LT × Decentralization				
$\cdots$ × 1 if country has a federal constitution		0.03%		
		(0.26)		
$\cdots$ × one standard deviation increase in $Dec_{c,y}$			0.01%	
			(1.01)	
Expected LT × East Asia				
1% increase in cLT_i in East Asia				0.49%***
				(4.15)
Expected LT × Western Bloc				
1% increase in cLT_i in the Western Bloc				0.97%***
				(11.13)
Expected LT × Eastern Bloc				
1% increase in cLT_i in the Eastern Bloc				1.06%***
				(4.03)
Expected LT × Global South				
1% increase in cLT_i in the Global South				1.70%***
				(3.90)
GDP per capita				
One standard deviation increase in $\ln(GDPpc_{c,y})$	-15.7%	-19.7%	-15.1%	-10.3%
	(-0.95)	(-1.14)	(-0.92)	(-0.63)
Investor-owned utility				
IOU_i	-6.5%	-6.5%	-4.3%	-6.3%
	(-1.14)	(-1.15)	(-0.71)	(-1.13)
Reactor family fixed effects	✓	✓	✓	✓
Country fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Nuclear accidents and regime change	✓	✓	✓	✓
Observations	571	571	483	571
Adjusted R^2, within effects	0.344	0.348	0.311	0.362

Test statistics in parentheses.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5 replicates Benson (2022), Table IX and reports the estimation results for Eq. (6), which examines how realized log net lead times relate to expected lead times conditional on design, $\ln(\widehat{LT}_i)$, and whether this relationship varies systematically with political institutions and country groupings. The baseline effect of $\ln(\widehat{LT}_i)$ captures the extent to which the predicted design-related component of lead time translates into realized construction duration. The subsequent columns introduce interaction terms between $\ln(\widehat{LT}_i)$ and democracy as well as decentralization. Benson introduces interaction terms that link region to lead time in model (4). Column (4) adds interactions that allow the relationship to vary by geopolitical region; consistent with Benson's discussion, the main statistically salient regional deviation is for East Asia.

Consistent with the paper, all specifications include reactor-family fixed effects, country fixed effects, and year fixed effects, so identification comes from within-country and within-reactor-family variation over time rather than time-invariant country characteristics or global time trends. The table further controls for nuclear accident shocks and regime change, matching the original empirical design. Overall, the replication reproduces Benson's published Table IX closely in terms of coefficient signs, magnitudes, sample sizes, and the general pattern of statistical significance. One entry, however, appears inconsistent with the reproduced estimation output: in column (3), the t-statistic for the expected lead time × decentralization interaction is 1.01 in the replication output, whereas the published table reports 10.1. This thesis therefore reports the reproduced value and treats the difference as an apparent table-level inconsistency rather than as a minor rounding discrepancy. Apart from this specific issue, the replication remains exactly aligned with the published results and does not alter the substantive interpretation of Table IX.

Table 6: Replication of Benson (2022), Table X: Learning Parameters Estimated from Eqs. (7) and (8)

	(1)	(2)	(3)	(4)
Cumulative experience				
$\sinh^{-1}(Exp_{i,f})$	0.004	-0.020	-0.073***	-0.110***
	(0.13)	(-0.68)	(-3.38)	(-5.81)
Cumulative experience × Democracy				
... × *one standard deviation increase in* $Dem_{c,y}$	0.015*	-0.000	0.029***	0.009
	(1.81)	(-0.02)	(2.99)	(0.77)
Cumulative experience × Decentralization				
... × *1 if country has a federal constitution*	-0.004		-0.049*	
	(-0.13)		(-1.79)	
... × *one standard deviation increase in* $Dec_{c,y}$		0.014		0.019*
		(1.36)		(1.70)
Reactor family fixed effects	✓	✓		
Year fixed effects			✓	✓
Country fixed effects	✓	✓	✓	✓
Additional controls per Eqs. (7) and (8)	✓	✓	✓	✓
Observations	595	503	601	509

Notes: Dependent variable: $\ln(LT_i)$. Untransformed regression coefficients are reported, with test statistics in parentheses.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6 replicates Benson's Table X and reports the learning-curve estimates used to test the paper's Hypothesis 4 ("resetting the learning curve"). The dependent variable is the logarithm of net construction lead time. Following Benson (2022), the learning-curve parameter is interpreted using $ln\,(Y) = \alpha + \beta ln\,(Exp_t) + \varepsilon_t$, with the implied learning rate defined as $LR = 1 - 2^{\beta}$. The percentage change in the outcome is associated with a doubling of cumulative experience. To examine whether political institutions shape learning, the table includes interactions between cumulative experience and democracy ($Dem_{c,y}$, measured by the standardized Polyarchy index) as well as interactions with decentralization (either a federal constitution indicator or the standardized self-rule index $Dec_{c,y}$). Columns (1) and (2) estimate specifications with reactor-family and country fixed effects and correspond to Benson's Eq. (7), which captures within-family learning-by-doing. Columns (3) and (4) omit reactor-family fixed effects, add year fixed effects alongside country fixed effects, and correspond to Eq. (8), which compares reactor families with different levels of cumulative experience.

Overall, the replication closely reproduces Benson's reported coefficients and inference, although a small number of estimates differ slightly from the published Table X values at the final digits without affecting the substantive interpretation. The baseline experience term is close to zero in the reactor and family country fixed effects specifications but becomes negative and statistically significant once year fixed effects are included model (3) and (4), indicating that greater accumulated experience is associated with shorter lead times in those specifications. The interaction with democracy is positive in column (3), suggesting that the learning effect varies with the level of democracy in that specification.

Nuclear construction operates at very low volumes compared to technologies such as solar cells. Builds are repeated far less frequently and there are sometimes long intervals between projects. Experience accumulation may therefore be slower and more easily offset by design changes, regulatory updates, or supply-chain disruptions. This may help explain why standard learning-curve interpretations apply less cleanly to nuclear builds than to mass-produced technologies.

6.2 Political decentralization and construction lead times

Table 7: Political decentralization and net construction lead times: alternative measures

	Division of power		Local gov. elections		Regional gov. elections		Regional power	
	(1) No FE	(2) FE	(3) No FE	(4) FE	(5) No FE	(6) FE	(7) No FE	(8) FE
Division of power	0.156***	0.135**						
	(0.041)	(0.052)						
Local government index			0.484***	0.356				
			(0.137)	(0.270)				
Regional government index					0.355***	0.267**		
					(0.095)	(0.103)		
Regional offices' relative power							0.181***	0.142***
							(0.039)	(0.044)
TMI (uc_tmi)	0.207***	0.164***	0.168**	0.157**	0.233***	0.180***	0.225***	0.196***
	(0.058)	(0.046)	(0.076)	(0.057)	(0.073)	(0.064)	(0.061)	(0.064)
TMI × USA (uc_tmi_USA)	0.365***	0.321***	0.407***	0.347***	0.313***	0.297***	0.277***	0.283***
	(0.076)	(0.077)	(0.080)	(0.080)	(0.094)	(0.092)	(0.072)	(0.085)
Chernobyl (uc_chern)	0.083	0.030	0.069	0.023	0.124	0.047	0.143*	0.050
	(0.067)	(0.094)	(0.077)	(0.111)	(0.081)	(0.104)	(0.079)	(0.108)
Chernobyl × USSR (uc_chern_SUN)	-0.156*	-0.330***	—	—	—	—	—	—
	(0.092)	(0.103)						
Fukushima dummy (uc_fd)	0.029	-0.167	0.043	-0.182	0.051	-0.156	0.110*	-0.149
	(0.067)	(0.171)	(0.063)	(0.188)	(0.082)	(0.163)	(0.065)	(0.160)
Regime change	0.409***	0.323***	0.346**	0.298**	0.265	0.237	0.129	0.135
	(0.130)	(0.100)	(0.155)	(0.120)	(0.187)	(0.141)	(0.259)	(0.185)
ln GDP per capita (z)	-0.108*	-0.018	-0.160***	-0.025	-0.098*	-0.013	-0.092**	-0.038
	(0.063)	(0.039)	(0.060)	(0.050)	(0.057)	(0.040)	(0.044)	(0.029)
Polyarchy (z)	-0.111***	-0.119***	-0.117***	-0.138**	-0.098***	-0.109**	-0.098***	-0.096**
	(0.035)	(0.041)	(0.041)	(0.066)	(0.037)	(0.040)	(0.030)	(0.040)
IOU	-0.185***	-0.094**	-0.178***	-0.105**	-0.170**	-0.078*	-0.278***	-0.154***
	(0.065)	(0.043)	(0.065)	(0.040)	(0.071)	(0.044)	(0.076)	(0.054)
Predicted lead time ($\ln LT_{\text{hat}}$)	0.678***	0.906***	0.710***	0.882***	0.655***	0.854***	0.669***	0.794***
	(0.093)	(0.157)	(0.129)	(0.169)	(0.097)	(0.151)	(0.090)	(0.168)
Constant	1.517***		1.096**		1.358***		1.595***	
	(0.398)		(0.524)		(0.393)		(0.382)	
Reactor-model FE	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	31	31	27	27	27	27	26	26

Table 7 reports instrumental-variable (2SLS) estimates of the association between political decentralization and log net nuclear construction lead times using the baseline IV setup and clustered standard errors at the country level. Across all specifications, the political decentralization measure enters positively, suggesting that higher decentralization is associated with longer project lead times.

Because reactor design is a first-order determinant of construction duration, specifications that include reactor-model fixed effects provide the more conservative benchmark. Accordingly, when results differ across fixed effects and no fixed effects specifications, I treat the fixed effects estimates as the preferred benchmark for controlling reactor-model heterogeneity, while also weighing them against the weaker IV diagnostics that arise in some fixed effects models.

In addition to Benson's baseline decentralization measure, I estimate political decentralization using three closely related V-Dem indicators that unpack the "division of power" concept. The baseline measure is V-Dem's Division of Power index, which summarizes whether elected local and regional governments exist and can operate without interference from unelected bodies. To identify which layer drives the relationship most strongly, I also use the local government index, the regional government index, and the regional offices relative power, which captures the extent to which elected regional offices dominate unelected ones.

The division of power index is positive and statistically significant both without reactor-model fixed effects and with fixed effects. The estimated coefficient is of similar magnitude across the two variants, indicating that the association is not driven solely by between-reactor-model differences. In substantive terms (given standardization), a one-standard-deviation increase in the division of power index is associated with a meaningful increase in expected log net lead times.

The local and regional elections indices (models 3 - 8) also enter with positive coefficients. For the local measure model (models 3 + 4), the estimate is statistically significant in the specification without reactor-model fixed effects but becomes weaker once reactor-model fixed effects are included. This pattern suggests that part of the local government index may reflect systematic differences across reactor models and deployment environments; after absorbing those differences, the remaining within-model variation provides less independent identifying variation for the local government index.

For the regional government index (models 5 + 6) the positive effect is stable and statistically significant in both specifications. The regional dimension is more stable across specifications. This consistency provides the strongest correlational evidence among the alternative political decentralization measures that the regional dimension is linked to delivery timelines, even after controlling for reactor-model differences.

Finally, the regional offices relative power component (models 7 + 8), a building block behind regional government measures, also enters positively and remains statistically significant both with and without reactor-model fixed effects. This component-level evidence reduces concern that the result is driven by a single aggregate index and instead suggests that the association is visible in related regional subcomponents.

Across specifications, several control coefficients are stable and align with expectations. The democracy control (Polyarchy) is consistently negative and statistically significant, indicating that more democratic systems (holding decentralization and other covariates constant) are associated with shorter lead times in these specifications. The IOU measure is generally negative and often highly significant, indicating that projects with greater investor-owned utility involvement tend to have shorter lead times than otherwise comparable projects. The predicted lead time control $\ln(\widehat{LT}_i)$ is positive and highly significant throughout, indicating that baseline design-related variation is strongly related to realized lead times, with decentralization measures adding explanatory power beyond the baseline.

The uncertainty-shock indicators (TMI, Chernobyl, etc.) and regime change controls behave less uniformly across columns, which is not unexpected given the limited number of clusters and the fact that some shocks are rare or highly collinear in particular subsamples. In several models the Chernobyl-Soviet interaction term is omitted due to collinearity, reflecting insufficient independent variation once the full set of controls is included.

A key caveat is that instrument strength is not uniformly high across specifications. In particular, the Kleibergen–Paap diagnostics indicate that some fixed effects models can be comparatively weak identified, especially when the number of clusters is modest and the specification is rich. This is most evident in the division-of-power model with reactor-model fixed effects, where the Kleibergen–Paap rk Wald F statistic is relatively low and the under identification test is borderline. Accordingly, coefficient magnitudes and standard errors in the weaker-identified specifications should be interpreted with caution. At the same time, the positive decentralization association appears across multiple measures and specifications, including those with stronger diagnostics.

6.2.1 Interpretation of the baseline political decentralization results

A potential concern is that the decentralization measures are relatively highly correlated, meaning they capture related institutional features. This does not make the analysis redundant; instead, it indicates that the decentralization association is not driven by a single operationalization but appears across several related measures. The table therefore contributes in two ways.

First, the estimated association is generally positive across the alternative decentralization measures, although the strength of the evidence varies across specifications and should be interpreted in light of the IV diagnostics.

Second, the regional dimension is the most stable across specifications. Both the regional government index and the regional offices relative power component show consistent evidence in models with and without reactor-model fixed effects. This pattern is consistent with the view that governance frictions relevant for nuclear project delivery are most acute where regional actors have meaningful autonomy and veto potential.

Overall, Table 7 points to a positive association between political decentralization and longer nuclear project lead times in the IV framework, but the strength of the evidence varies across specifications. The regional measures (regional government index, regional offices relative power) show the most stable positive pattern across the reported models. At the same time, the instrument diagnostics and occasional collinearity-driven omissions are a reminder to interpret the effect size with caution.

6.2.2 Heterogeneity by utility ownership

Table 8: Heterogeneity by Utility Ownership

Dependent variable: $\ln(LT_{\text{net}})$
Estimator: IV 2SLS with model fixed effects; standard errors clustered by country

Panel A. Second-stage coefficients

	Coef.	Cluster SE
Under construction: TMI shock	0.144***	(0.044)
Under construction: TMI shock (USA)	0.336***	(0.071)
Under construction: Chernobyl shock	0.047	(0.100)
Under construction: Chernobyl shock (SUN)	−0.372***	(0.123)
Under construction: Fukushima shock	−0.166	(0.177)
Regime change	0.265**	(0.096)
Log GDP per capita (z)	−0.051	(0.043)
Polyarchy (z)	−0.113***	(0.033)
Decentralization (z)	0.171***	(0.052)
IOU	−0.023	(0.044)
Decentralization (z) × IOU	−0.143***	(0.049)
Federal	0.031	(0.052)
$\ln(\widehat{LT})$	0.893***	(0.174)

Panel B. Marginal Effects of Decentralization at Selected IOU Values

	Marginal effect	Delta SE	Delta p	Wild bootstrap
IOU = 0.0	0.171	0.052	0.001	0.016
IOU = 0.5	0.099	0.044	0.024	0.022
IOU = 1.0	0.028	0.049	0.571	0.559

Panel C. Wild Cluster Bootstrap Test for Interaction

Decentralization (z) × IOU: $t(30) = -2.920$; wild bootstrap $p = 0.0505$

Model statistics	
Observations	556
Countries (clusters)	31
Model fixed effects (categories)	70
Centered R^2	0.567
Kleibergen–Paap LM (p)	7.824 (0.0052)
Kleibergen–Paap Wald F	9.774

Notes: The model is estimated by IV 2SLS with model fixed effects and standard errors clustered by country. Panel A reports second-stage coefficients with cluster-robust standard errors in parentheses; $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Under-construction shock indicators are instrumented using probability-overlap instruments. Panel B reports average marginal effects of decentralization evaluated at IOU values of 0, 0.5, and 1. Delta-method standard errors and p-values are from `margins`. Wild cluster bootstrap p-values use `boottest` with Webb weights and 9,999 replications.

Table 8 examines whether the decentralization-lead time relationship varies with utility ownership, using the investor-owned utility (IOU) measure defined at the start of construction based on the lead utility. IOU = 1 indicates an investor-owned utility, IOU = 0 indicates a state-owned utility, and IOU = 0.5 captures mixed ownership.

The ownership distinction is motivated by a financing-incentives channel: nuclear projects are capital-intensive and revenues arrive primarily after completion, so longer construction increases financing exposure. If investor-owned utilities face tighter financing constraints or stronger cost-of-capital pressure, they may have stronger incentives to maintain schedule discipline, which could attenuate decentralization-related delays. Consistent with this interpretation, the interaction between decentralization and IOU is negative, implying that the decentralization-associated delay penalty diminishes as projects shift from state ownership toward investor ownership. The estimated marginal effect of decentralization is economically large and statistically significant for state-owned and mixed-ownership projects (about 18.6% higher net lead times at IOU = 0 and about 10.4% at IOU = 0.5), while it is small and statistically indistinguishable from zero at IOU = 1. Wild cluster bootstrap inference yields the same pattern for the marginal effects, while the interaction test itself is borderline at the five percent level, so the ownership heterogeneity should be described conservatively. Overall, the results suggest that decentralization-related delays are most pronounced in state-led projects, whereas investor ownership is associated with a weaker decentralization penalty.

6.2.3 Democratic accountability and the decentralization-lead time relationship

Table 9: Decentralization, Democracy, and Nuclear Construction Lead Times

Dependent variable: $\ln(LT_{\text{net}})$
Estimator: IV 2SLS with model fixed effects; standard errors clustered by country

Panel A. Second-stage coefficients

	Coef.	Cluster SE
Under construction: TMI shock	0.169***	(0.041)
Under construction: TMI shock (USA)	0.340***	(0.074)
Under construction: Chernobyl shock	0.030	(0.094)
Under construction: Chernobyl shock (SUN)	−0.281**	(0.125)
Under construction: Fukushima shock	−0.099	(0.152)
Regime change	0.328***	(0.098)
Log GDP per capita (z)	−0.006	(0.038)
Decentralization (z)	0.149***	(0.046)
Polyarchy (z)	−0.138***	(0.036)
Decentralization (z) × Polyarchy (z)	−0.093**	(0.035)
Federal	−0.016	(0.051)
IOU	−0.084**	(0.039)
$\ln(\widehat{LT})$	0.858***	(0.151)

Panel B. Marginal Effect of Decentralization at Selected Polyarchy Values

	Marginal effect	Delta SE	Delta p	Wild bootstrap
Polyarchy (z) = −1	0.242	0.055	0.000	0.001
Polyarchy (z) = 0	0.149	0.046	0.001	0.011
Polyarchy (z) = 1	0.056	0.060	0.354	0.498

Panel C. Wild Cluster Bootstrap Test for Interaction

Interaction test: $t(30) = -2.646$; wild bootstrap $p = 0.0115$

Model statistics	
Observations	556
Countries (clusters)	31
Model fixed effects (categories)	70
Centered R^2	0.593
Kleibergen–Paap LM (p)	7.039 (0.0080)
Kleibergen–Paap Wald F	7.956

Notes: The model is estimated by IV 2SLS with model fixed effects and standard errors clustered by country. Panel A reports second-stage coefficients with cluster-robust standard errors in parentheses; $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Under-construction shock indicators are instrumented using probability-overlap instruments. Panel B reports average marginal effects of decentralization evaluated at Polyarchy (z) values of −1, 0, and 1. Delta-method standard errors and p-values are from `margins`. Wild cluster bootstrap p-values use `boottest` with Webb weights and 9,999 replications.

Table 9, Decentralization × Polyarchy, reports whether the association between political decentralization and net nuclear construction lead times depend on the level of democracy, measured by the V-Dem Polyarchy index. The IV estimates indicate a negative interaction between decentralization and Polyarchy, implying that the decentralization-related increase in net lead times becomes smaller as countries become more democratic. The interaction is statistically significant under conventional country-clustered inference (Panel A) and the same qualitative conclusion holds under wild cluster bootstrap inference with Webb weights (Panel B). At one standard deviation below the mean Polyarchy level, a one-standard-deviation increase in decentralization is associated with an increase of about 0.242 in log net lead time (roughly 27%).

At the mean Polyarchy level, the marginal effect is about 0.149 (roughly 16%). At one standard deviation above the mean Polyarchy level, the marginal effect falls to about 0.056 (roughly 6%) and is not statistically distinguishable from zero. Overall, the pattern is consistent with an accountability based interpretation of democracy: decentralization is most strongly associated with longer net lead times in less democratic contexts, while in more democratic settings the estimated decentralization penalty becomes much smaller.

6.3 Fiscal decentralization in the OECD sample

6.3.1 OECD baseline

Table 10: OECD baseline: fiscal decentralization and lead times

	(1)	(2)	(3)	(4)
Estimator	OLS	OLS	2SLS	2SLS
Reactor-model FE	No	Yes	No	Yes
Instrumented shock indicators	No	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Fiscal decentralization	0.1718*	0.1218	0.0895	-0.0469
	(0.0231)	(0.0211)	(0.0659)	(0.0229)
Wild bootstrap p-value	0.0537	0.2581	0.5772	0.3743
Observations	353	353	353	353
KP underidentification p-value	–	–	0.1262	0.1285
KP weak-ID F	–	–	2.972	0.522

Notes: Cluster-robust standard errors in parentheses. Significance stars are based on wild cluster bootstrap p-values: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. All columns use the identical OECD common sample ($N = 353$; 16 country clusters). In columns (3) and (4), the shock indicators are treated as endogenous and instrumented using the probability-overlap instruments. KP underidentification and weak-identification diagnostics are reported separately for the IV models.

Table 10 presents the baseline in the OECD fiscal decentralization subsample, comparing OLS specifications with Benson-style 2SLS models that instrument potentially endogenous shock-exposure indicators using the corresponding predicted-probability instruments, as described in Section 5.2. To ensure that differences across columns reflect specification changes rather than shifts in sample composition, all four models are estimated on an identical common sample (N = 353), defined by the most restrictive specification (2SLS with reactor-model fixed effects) and then imposed on the remaining columns.

Higher fiscal decentralization is expected to be associated with longer nuclear construction lead times due to heightened coordination and bargaining frictions. The OLS specifications show a positive coefficient on the standardized subnational expenditure share in both columns, but because the OECD sample contains only 16 country clusters, inference is based primarily on wild cluster bootstrap p-values rather than conventional clustered p-values. Under this more conservative standard, only the OLS specification without reactor-model fixed effects remains marginally significant, while the fixed effects OLS estimate is not statistically distinguishable from zero. In the 2SLS models, interpretation also depends on the weak-identification diagnostics reported later: the no fixed effects estimate is statistically indistinguishable from zero, while the fixed effects estimate changes sign and remains too fragile to treat as confirmatory. Taken together, these patterns indicate that the hypothesized positive relationship receives support only in the simplest OLS specification, whereas the more conservative 2SLS framework yields estimates that are sensitive and not consistent with the expected sign. This suggests that baseline evidence for a positive association between fiscal decentralization and net nuclear construction lead times is fragile in the OECD sample. One possibility is that the OECD subnational expenditure share is an imperfect proxy for the specific coordination and bargaining frictions relevant for nuclear project delivery, so measurement limitations may weaken or distort the relationship. Even relatively small intergovernmental transfers or co-financing arrangements may generate coordination and bargaining frictions, but these may not be visible in an expenditure-share measure that captures aggregate subnational spending rather than the structure of project-specific fiscal linkages.

6.3.2 Institutional veto points and fiscal decentralization (OECD)

Table 11: Fiscal decentralization × veto points (OECD): interaction and marginal effects

	(1) FE OLS	(2) FE 2SLS
Panel A. Main coefficients		
Fiscal decentralization (FD)	0.030	-0.052
	(0.019)	(0.030)
Veto points (centered)	-0.025	-0.072
	(0.114)	(0.115)
FD × veto points	-0.178***	0.062
	(0.035)	(0.113)
Observations	353	353
Country clusters	16	16
Reactor-model fixed effects	Yes	Yes
Shock dummies	Yes	Yes
Controls	Yes	Yes
KP underidentification p-value		0.0878
KP rk Wald F statistic		0.822
Panel B. Marginal effects and wild bootstrap p-values		
Marginal effect of FD at p25	0.017	-0.048
Wild boot. p-value	0.3007	0.5304
Marginal effect of FD at p50	0.007	-0.045
Wild boot. p-value	0.7050	0.4918
Marginal effect of FD at p75	-0.013	-0.038
Wild boot. p-value	0.8794	0.4198
Wild boot. p-value: FD × veto points	0.3478	0.5494

Notes: Dependent variable is log net construction lead time. Cluster-robust standard errors are reported in parentheses. Stars on coefficient rows are based on conventional country-clustered p-values ($^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$). Wild cluster bootstrap p-values use Webb weights with 9,999 replications and are reported separately; in the OECD sample, these bootstrap p-values are the primary basis for inference. Both columns include the full set of shock indicators, log GDP per capita, Polyarchy, IOU status, and predicted log lead time. In column (2), the shock indicators are treated as endogenous and instrumented using the corresponding predicted-probability instruments. Reactor-model fixed effects are included in both columns.

Table 11 examines whether the association between fiscal decentralization and net nuclear construction lead times in the OECD varies with institutional veto points, proxied by legislative constraints on the executive (V-Dem). In the fixed effects OLS specification, the interaction between fiscal decentralization and veto points is negative and conventionally statistically significant, so the point estimates imply that the slope of fiscal decentralization becomes more negative as veto points increase. However, because the OECD sample contains only 16 country clusters, primary weight is placed on wild cluster bootstrap inference, which does not reject the null for either the interaction term or the marginal effects evaluated at the 25th, 50th, and 75th percentiles of veto points. In the fixed effects 2SLS specification, the interaction is small and imprecisely estimated; moreover, the OECD IV results are weakly identified and should be interpreted with particular caution. Overall, the OECD evidence does not provide robust support for the hypothesis that veto points systematically moderate the relationship between fiscal decentralization and nuclear construction lead times.

7 Robustness and diagnostics

7.1 Robustness of the political decentralization result

Table 12: Political decentralization results: robustness checks (Models 1–8)

	(1) DivPow base	(2) DivPow base+FE	(3) DivPow +FD	(4) DivPow +FD+FE	(5) LocElec base	(6) LocElec base+FE	(7) LocElec +FD	(8) LocElec +FD+FE
V-Dem division of power	0.092*	0.100	0.093*	0.102				
	(0.055)	(0.081)	(0.054)	(0.082)				
OECD subnational exp share			0.093	-0.044*			0.094	-0.051*
			(0.060)	(0.023)			(0.063)	(0.025)
Local government index					0.182	0.373	0.202	0.386
					(0.222)	(0.317)	(0.207)	(0.320)
Regional government index								
Regional offices relative power								
Observations	365	353	365	353	365	353	365	353

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Political decentralization results: robustness checks (Models 9–16)

	(9) RegElec base	(10) RegElec base+FE	(11) RegElec +FD	(12) RegElec +FD+FE	(13) RegPwr base	(14) RegPwr base+FE	(15) RegPwr +FD	(16) RegPwr +FD+FE
V-Dem division of power								
OECD subnational exp share			0.090	-0.046*			0.080*	-0.046*
			(0.057)	(0.022)			(0.048)	(0.022)
Local government index								
Regional government index	0.161	0.082	0.147	0.090				
	(0.142)	(0.213)	(0.132)	(0.215)				
Regional offices relative power					0.109*	0.127	0.101**	0.133
					(0.056)	(0.140)	(0.050)	(0.141)
Observations	365	353	365	353	353	341	353	341

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In additional robustness checks, I re-estimate the political decentralization specifications on the OECD subsample and augment the baseline models with a fiscal decentralization control (OECD subnational expenditure share). Across all four political decentralization measures (division of power, local elections, regional elections, and regional offices relative power), the point estimates remain positive and are of comparable magnitude when moving from the OECD baseline to the specification including fiscal decentralization. However, statistical significance generally deteriorates, consistent with substantial overlap between political and fiscal decentralization in OECD countries. Adding fiscal decentralization increases multicollinearity and reduces precision, so that several coefficients become imprecisely estimated even though they do not change direction or magnitude. Importantly, inference in these OECD specifications must be treated cautiously for two additional reasons:

First, the OECD subsample includes only 16 country clusters. In several specifications, Stata reports that the cluster-robust covariance matrix is not full rank. This implies that some cluster-robust test statistics, most notably the Hansen overidentification test, are not well-defined in these models and should not be interpreted.

Second, identification diagnostics are weaker in parts of the OECD sample, meaning that the first stage may not provide strong variation in some specifications. Taken together, these robustness checks suggest that the estimated political decentralization coefficients remain positive in the OECD subsample, but the evidence is too imprecise to treat sign stability alone as strong confirmation. At the same time, in the OECD subsample the limited cluster count, collinearity with fiscal decentralization, and occasionally weaker first-stage strength substantially reduce the precision and reliability of hypothesis tests.

7.2 Instrument / first-stage diagnostics

Table 14: IV diagnostics across replication and extension specifications

Specification	N	Clust.	KP rk LM	LM p	KP rk Wald F
Benson replication (federal-constitution measure): reactor-model FE	556	31	9.134	0.0025	12.041
Benson replication (federal-constitution measure): no fixed effects	590	31	11.854	0.0006	31.294
Political decentralization extension (V-Dem division of power): reactor-model FE	556	31	3.605	0.0576	3.851
Fiscal decentralization extension (OECD expenditure share): reactor-model FE	353	16	2.310	0.1285	0.522

Notes: KP rk LM tests underidentification; KP rk Wald F summarizes weak-instrument robustness in heteroskedastic/clustered settings.

Table 14 summarizes first-stage identification diagnostics for the main IV specifications. The Kleibergen–Paap rk LM underidentification test evaluates whether the excluded instruments are jointly relevant for the endogenous shock indicators, while the Kleibergen–Paap rk Wald F statistic assesses instrument strength under heteroskedasticity and clustering. Because these diagnostics are evaluated conditional on the included controls and fixed effects, differences across specifications are interpreted as changes in first-stage instrument performance. They therefore provide the basis for assessing the credibility of the IV estimates in both the replication benchmark and the thesis extensions.

In the global replication specifications IV models, the probability-overlap instruments are sufficiently relevant to identify the endogenous shock indicators. In the preferred specification with reactor-model fixed effects, the underidentification test is rejected and the KP rk Wald F statistic of 12.041 indicates acceptable, though not especially strong, instrument strength conditional on that specification. The corresponding IV specification without reactor-model fixed effects yields substantially higher KP rk Wald F values, suggesting stronger first-stage relevance; however, because the robust moment covariance matrix is not full rank in this case, the associated model tests should be interpreted cautiously.

In the specification that adds political decentralization, first stage strength deteriorates relative to the replication benchmark. The Kleibergen–Paap diagnostics weaken materially: the underidentification test is only borderline and the KP rk Wald F statistic falls below conventional rule-of-thumb thresholds. These IV estimates should therefore be treated as weakly identified. Accordingly, the political decentralization IV results are interpreted conservatively and as a complementary analysis that helps assess the stability of the main results.

Instrument performance is weakest in the OECD subsample. With a smaller estimation sample and fewer country clusters, underidentification cannot be rejected and the KP rk Wald F statistic is low, indicating weak instrument concerns. In addition, collinearity leads to the omission of one shock component and its corresponding instrument, further reducing effective variation. The OECD sample IV estimates are therefore treated with particular caution: because the preferred OECD specifications rely on only 16 country clusters, inference places primary weight on wild cluster bootstrap p-values, while IV credibility is sepreraly assessed using first-stage strength and weak-identification diagnostics.

8 Conclusion

8.1 Summary of main empirical findings

This thesis replicates and extends the core pattern in Benson (2022) that political decentralization is associated with longer net nuclear construction lead times. In the extension, the estimated relationship remains positive across several closely related V-Dem measures, suggesting that the result is not tied to a single operationalization of decentralization. At the same time, the evidence is most stable for the regional dimension, because the regional elections and regional offices relative power measures remain positive across specifications and retain stronger support than the local component once reactor-model fixed effects are included.

For ownership, the marginal effect of decentralization is large for state-owned projects and mixed-ownership projects but becomes small and statistically indistinguishable from zero for investor-owned utilities. Wild cluster bootstrap inference supports the same marginal effect pattern, while the interaction test is borderline, so the ownership heterogeneity should be described cautiously.

For democracy, the interaction with V-Dem Polyarchy indicates that decentralization related increases in lead times are largest in less democratic contexts and shrink as democracy rises. The marginal effect is sizeable at low Polyarchy, remains positive at the mean, and becomes small and not statistically distinguishable from zero at high Polyarchy, with the same qualitative conclusion held under wild bootstrap inference.

The OECD evidence is fragile. The OLS specifications are consistent with the hypothesized positive relationship between fiscal decentralization and lead times, but the preferred IV estimates are weakly identified, imprecise, and specification-sensitive, including a sign reversal in the fixed effects model. Accordingly, the OECD IV evidence should be treated as inconclusive rather than confirmatory. The mechanism test for fiscal decentralization interacted with veto points also does not survive wild bootstrap inference with 16 clusters, and the IV interaction is small and imprecise, with marginal effects statistically indistinguishable from zero across the veto point distribution.

8.2 Implications for nuclear project delivery considering the literature

The results reinforce a central point in the nuclear construction and cost literature: schedule performance is a key determinant of feasibility. Because nuclear projects are capital intensive and costs are front-loaded, longer lead times increase interest during construction and worsen perceived project risk, which can raise the cost of capital and undermine viability (Berthélemy & Escobar Rangel, 2015; Benson, 2022). Recent policy syntheses echo this mechanism by emphasizing that nuclear project economics are highly sensitive to financing conditions and the cost of capital, making credible delivery during construction central to investment decisions (OECD/NEA, 2024; IEA, 2025).

From a governance perspective, the decentralization results fit naturally with arguments from the broader megaproject literature that delivery failures often arise from coordination burdens, complex approval sequences, and accountability gaps in multi-actor environments (Flyvbjerg et al., 2003). In decentralized systems, additional decision arenas can increase transaction costs and create more opportunities for delay through bargaining, legal contestation, and sequential permitting constraints (Benson, 2022; Niehaus, 2025). Evidence from public works also points in this direction, showing that implementation performance can differ systematically across government levels and that fragmented responsibility can be associated with weaker time performance (Guccio et al., 2014). Interpreted through this lens, decentralization is not inherently harmful, but it can amplify delivery risk when intergovernmental coordination is weak or when responsibilities for oversight, financing, and dispute resolution are not clearly defined.

The empirical patterns in this thesis also suggest that institutional context shapes how decentralization translates into construction performance. The weaker decentralization penalty in investor-owned utility projects is consistent with the idea that ownership and market structure can affect incentives and constraints related to schedule discipline, risk management, and financing pressure, which can buffer or amplify the costs of institutional fragmentation (Benson, 2022; OECD/NEA, 2024). The interaction with democracy similarly suggests that political accountability and administrative capacity can influence whether dispersed authority becomes a practical obstacle or can be managed through predictable procedures and credible dispute resolution. This is consistent with broader discussions of state capacity, veto points, and accountability gaps in infrastructure delivery (Flyvbjerg et al., 2003; Niehaus, 2025; Benson, 2022).

The implication for policy is therefore not a simple recommendation to centralize. Instead, decentralized states that aim to build nuclear at scale may need stronger coordination capacity and clearer governance. Especially important are stable regulatory processes, early conflict resolution mechanisms, and a credible assignment of responsibilities across levels of government. The project management and construction literature emphasizes additional delivery levers that complement institutional reforms. Design maturity before construction, schedule discipline, quality assurance embedded in project planning and learning through repetitive builds of a stable design are repeatedly highlighted as practical drivers of better time performance (Berthélemy & Escobar Rangel, 2015; National Academies of Sciences, Engineering, and Medicine, 2023; OECD/NEA, 2020). These mechanisms also help interpret why international performance differs strongly even when engineering constraints are similar, and why standardization and accumulated program experience can be pivotal in shortening lead times (Lovering et al., 2016; Grubler, 2010).

Finally, the financing literature clarifies that de-risking frameworks can lower the cost of capital, but they cannot substitute for delivery capability. Institutions such as contracts for difference or regulated asset base style approaches primarily work by reallocating revenue and construction risk to create more predictable cash flows, which can improve financing conditions (OECD/NEA, 2024; IEA, 2025; IAEA, 2024). However, financing frameworks do not eliminate construction risk; they largely determine how construction and market risks are allocated across stakeholders, and in practice these risks are ultimately borne by consumers and/or taxpayers rather than being eliminated (OECD/NEA, 2024). In this sense, financing frameworks and institutional capacity are complements. Credible delivery improves financing and improved financing can support delivery, but neither can fully compensate for failure in the other (OECD/NEA, 2024; OECD/NEA, 2020).

8.3 Limitations

First, the decentralization results should be interpreted as evidence about systematic associations rather than fully identified causal effects of decentralization itself. The instrumental variable strategy follows Benson's framework and is designed to address endogeneity in specific project shock exposure indicators, but decentralization is not instrumented, so unobserved institutional and political factors correlated with decentralization could still contribute to the estimated relationship (Benson, 2022). This limitation is particularly relevant because nuclear projects are embedded in broader national policy environments. These environments may jointly shape decentralization and delivery.

Second, decentralization is difficult to measure objectively. The V-Dem indicators used in the extension capture related dimensions of subnational authority (Coppedge et al., 2025) and tend to be correlated, which makes it difficult to disentangle their independent effects. This supports the interpretation that the overall signal is not driven by a single measure, but it also reduces precision and makes it more difficult to attribute the estimated relationship to a single institutional subdimension. While the decomposition into local and regional components is informative, it still reflects a broader institutional bundle rather than a perfectly isolated mechanism (Benson, 2022).

Third, inference in the OECD subsample remains constrained by the small number of country clusters. With 16 clusters, conventional cluster-robust p-values can be unstable, statistical power is limited, and some standard IV diagnostics can be difficult to interpret in fixed effects settings. With only 16 country clusters, inference in the OECD subsample is based primarily on wild cluster bootstrap p-values rather than conventional clustered p-values; for IV specifications, first-stage and weak-identification diagnostics are also central, and null results should not be overinterpreted as strong evidence of the absence of effects.

Finally, the dependent variable measures net construction duration from start to commissioning. Political and institutional frictions may also operate before construction begins, including during licensing, siting, litigation, and political bargaining. These delays are not captured in the net lead time measure. The analysis therefore captures an important part of project delivery performance, but it does not assess the full institutional influence over the broader timeline of nuclear project development from pre-construction to commissioning (Benson, 2022).

9 References

Benson, A. G. (2022). Global divergence in nuclear power plant construction: The role of political decentralization. Nuclear Technology, 208(6), 947–989. https://doi.org/10.1080/00295450.2021.1991762

Benson, A. G. (2022). Global NPP database: Data and replication materials [Data set]. GitHub. https://github.com/a-g-benson/Global-NPP-Database

Coppedge, M., Gerring, J., Knutsen, C. H., Lindberg, S. I., Teorell, J., Altman, D., Angiolillo, F., Bernhard, M., Cornell, A., Fish, M. S., Fox, L., Gastaldi, L., Gjerløw, H., Glynn, A., Good God, A., Grahn, S., Hicken, A., Kinzelbach, K., Krusell, J., … Ziblatt, D. (2025). V-Dem Country-Year Dataset v15 [Data set]. Varieties of Democracy (V-Dem) Project. https://doi.org/10.23696/vdemds25

Coppedge, M., Gerring, J., Knutsen, C. H., Lindberg, S. I., Teorell, J., Altman, D., Angiolillo, F., Bernhard, M., Cornell, A., Fish, M. S., Fox, L., Gastaldi, L., Gjerløw, H., Glynn, A., Good God, A., Grahn, S., Hicken, A., Kinzelbach, K., Marquardt, K. L., … Ziblatt, D. (2025). V-Dem codebook v15 [Codebook]. Varieties of Democracy (V-Dem) Project. https://doi.org/10.23696/vdemds25

OECD. (2025). Government at a glance 2025. OECD Publishing. https://doi.org/10.1787/0efd0bcd-en

Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (2003). Megaprojects and risk: An anatomy of ambition. Cambridge University Press. https://doi.org/10.1017/CBO9781107050891

Oates, W. E. (1972). Fiscal federalism. Harcourt Brace Jovanovich.

Arden, J. (2025, November 20). The sovereign signal: Nuclear energy as strategic infrastructure. American Affairs, 9(4). https://americanaffairsjournal.org/2025/11/the-sovereign-signal-nuclear-energy-as-strategic-infrastructure/

Guccio, C., Pignataro, G., & Rizzo, I. (2014). Do local governments do it better? Analysis of time performance in the execution of public works. European Journal of Political Economy, 34, 237–252. https://doi.org/10.1016/j.ejpoleco.2014.01.010

Berthélemy, M., & Escobar Rangel, L. (2015). Nuclear reactors' construction costs: The role of lead-time, standardization and technological progress. Energy Policy, 82, 118–130. https://doi.org/10.1016/j.enpol.2015.03.015

Grubler, A. (2010). The costs of the French nuclear scale-up: A case of negative learning by doing. Energy Policy, 38(9), 5174–5188. https://doi.org/10.1016/j.enpol.2010.05.003

Lovering, J. R., Yip, A., & Nordhaus, T. (2016). Historical construction costs of global nuclear power reactors. Energy Policy, 91, 371–382. https://doi.org/10.1016/j.enpol.2016.01.011

Gilbert, A., Sovacool, B. K., Johnstone, P., & Stirling, A. (2017). Cost overruns and financial risk in the construction of nuclear power reactors: A critical appraisal. Energy Policy, 102, 644–649. https://doi.org/10.1016/j.enpol.2016.04.001

Mustafayev, I., & Akbarov, O. (2025, December 7). The nuclear energy race: The West's three-pillar failure in leadership. Yale Journal of International Affairs, 21(1). https://www.yalejournal.org/publications/the-nuclear-energy-race-the-wests-three-pillar-failure-in-leadership-mldlc

Niehaus, J. (2025, May). From vetocracy to capacity: Rebalancing state power and stakeholder interests in American infrastructure development (Final report No. SM03). Safety and Mobility Advancements Regional Transportation and Economics Research Center, Morgan State University. https://www.morgan.edu/Documents/ACADEMIA/CENTERS/ntc/SMARTER/Year%201%20Core%20Projects/SM03_Final%20Report_V2.pdf

OECD Nuclear Energy Agency. (2024). Effective frameworks and strategies for financing nuclear new build (NEA No. 7684). OECD Publishing. https://www.oecd-nea.org/upload/docs/application/pdf/2024-09/nea_publication_2_2024-09-18_16-50-13_471.pdf

OECD Nuclear Energy Agency. (2020). Unlocking reductions in the construction costs of nuclear: A practical guide for stakeholders (NEA No. 7530). OECD Publishing. https://doi.org/10.1787/33ba86e1-en

International Energy Agency. (2025, January 16). The Path to a New Era for Nuclear Energy. IEA. https://www.iea.org/reports/the-path-to-a-new-era-for-nuclear-energy

International Atomic Energy Agency. (2024). Climate change and nuclear power 2024: Financing nuclear energy in low carbon transitions (CCANP-24). International Atomic Energy Agency. doi:10.61092/iaea.sgyh-rjoq.

National Academies of Sciences, Engineering, and Medicine. (2023). Laying the foundation for new and advanced nuclear reactors in the United States. The National Academies Press. https://doi.org/10.17226/26630

International Atomic Energy Agency. (n.d.). PRIS glossary: Construction start date. Power Reactor Information System (PRIS). Retrieved February 27, 2026, from https://pris.iaea.org/pris/glossary.aspx

Global Energy Observatory, Google, KTH Royal Institute of Technology in Stockholm, Enipedia, & World Resources Institute. (2018). Global Power Plant Database (Version 1.3.0) [Data set]. World Resources Institute. Retrieved February 27, 2026, from https://datasets.wri.org/datasets/global-power-plant-database

Chen, D., & Chen, H. W. (2013). Using the Köppen classification to quantify climate variation and change: An example for 1901–2010. Environmental Development, 6, 69–79. https://doi.org/10.1016/j.envdev.2013.03.007

Bolt, J., & van Zanden, J. L. (2024). Maddison Project Database 2023 (Version 1.0) [Data set]. DataverseNL. https://doi.org/10.34894/INZBF2

Marshall, M. G., Gurr, T. R., & Jaggers, K. (2018). Polity IV Project: Political regime characteristics and transitions, 1800–2017 (Polity IV dataset version 2017) [Data set]. Center for Systemic Peace. Retrieved February 27, 2026, from https://www.systemicpeace.org/inscrdata.html

Hooghe, L., Marks, G., Schakel, A. H., Niedzwiecki, S., Chapman-Osterkatz, S., & Shair-Rosenfield, S. (2021). Regional authority index (RAI) v.3 [Data set]. European University Institute, Robert Schuman Centre for Advanced Studies (EUI Research Data). https://hdl.handle.net/1814/70298

Regional Authority Index (RAI) Project. (2021). Codebook RAI-MLG: Regional Authority Index (RAI v.3) [Codebook]. https://garymarks.web.unc.edu/wp-content/uploads/sites/13018/2021/04/Codebook-RAI-MLG_april-2021-1.pdf

OECD. (n.d.). OECD Fiscal Decentralisation Database: Consolidated government expenditure as percentage of total general government expenditure (consolidated) (Table 5; 1965–2023) [Data set]. Retrieved February 27, 2026, from https://www.oecd.org/en/data/datasets/oecd-fiscal-decentralisation-database.html

Nucleopedia contributors. (2024, July 29). Liste der Kernkraftwerke. Nucleopedia. https://de.nucleopedia.org/index.php?title=Liste_der_Kernkraftwerke&oldid=21149

S&P Global. (2025, December 17). Platts Nucleonics Week publishing schedule for the holiday period [Subscriber note]. https://www.spglobal.com/energy/en/pricing-benchmarks/our-methodology/subscriber-notes/121725-platts-nucleonics-week-publishing-schedule-for-the-holiday-period

10 Appendix

10.1 Key variables and coding

This appendix documents the key variables used in the empirical analysis and explains how they are coded and merged into the thesis dataset (AGB_Global_NPP_Database_thesis.dta). The unit of observation is reactor *i*, defined as a nuclear power plant construction project. Country-level variables are assigned based on the year construction began (construction_start_year) and the country in which construction began (iso_3166_a3).

Dependent variable: nuclear construction lead times

The main outcome is the (net) construction lead time (ln_LT_net), measured in months from construction start to commercial operation, net of any formally recorded suspended periods. Regressions use the natural logarithm of net lead time to reduce skewness and to interpret coefficients approximately as proportional changes.

Core institutional variables

The thesis extends Benson (2022) by measuring political decentralization using indicators from the Varieties of Democracy project. These country-year measures are merged onto the reactor-level dataset using the ISO3 code (iso_3166_a3) and the construction start year (construction_start_year).

Political decentralization is captured primarily by the V-Dem "division of power" index (V-Dem indicator v2x_feduni; Stata variable dec_vdem), which ranges from 0 to 1, with higher values indicating a greater dispersion of authority to subnational actors. For interpretability across specifications, a standardized version is used in the main analysis (Stata variable dec_vdem_z, computed as a z-score over all non-missing observations in the thesis dataset). To isolate local and regional components, the analysis also uses the V-Dem local government index (elected local government dimension; Stata variable v2xel_locelec), the V-Dem regional government index (v2xel_regelec; Stata variable v2xel_regelec), and a measure of regional offices relative power (V-Dem indicator v2elrgpwr, standardized as Stata variable v2elrgpwr_z). These alternative measures are used to assess whether the association appears more strongly for particular dimensions of decentralization, while recognizing that the indicators are closely related and do not fully isolate separate mechanisms.

Democracy and veto points

Democratic institutions are measured using V-Dem's "Polyarchy" index of electoral democracy (standardized as Stata variable polyarchy_z). Constraints on executive authority are captured by legislative constraints on the executive (standardized as Stata variable lg_legcon_z). In the OECD heterogeneity analysis, legislative constraints are mean-centered within the OECD subsample prior to constructing interaction terms (mean-centered variable lg_legcon_c).

Fiscal decentralization (OECD subsample)

Fiscal decentralization is constructed from OECD Table 5 ("Revenue and spending shares of state and local government"). The thesis builds a country-year measure of the total subnational expenditure share (state plus local) and merges it to reactor observations using the ISO3 code and the construction start year. The resulting measure is the subnational expenditure share of total general government expenditure (Stata variable fd_exp_oecd, expressed as a percentage), along with a standardized version (Stata variable fd_exp_oecd_z). The indicator oecd_sample equals 1 when the reactor's country-year observation can be matched to non-missing OECD fiscal decentralization data and 0 otherwise.

Ownership, economic, and design controls

Utility ownership follows Benson's coding convention (1 for investor-owned, 0 for state-owned, and 0.5 for mixed ownership). Because the mixed category is placed midway between the two extremes, this control should be interpreted as a replication-consistent simplification rather than a fully flexible ownership specification. Economic conditions are controlled for using log GDP per capita matched to the construction start year and standardized (Stata variable ln_GDPpc_z). Design-based expected construction duration is controlled for using a predicted log lead time generated from a first-stage regression on detailed reactor design characteristics (Stata variable ln_LT_hat).

Regulatory-shock indicators and instrumental variables

Baseline specifications control for whether a reactor was under construction during major external shocks. These under-construction indicators enter the outcome equation as binary exposures and are treated as endogenous in instrumental-variables specifications. The indicators capture exposure to Three Mile Island (Stata variables uc_tmi and uc_tmi_USA for the United States-specific indicator), Chernobyl (Stata variables uc_chern and uc_chern_SUN for the Soviet Union/SUN-specific indicator), Fukushima Daiichi (Stata variable uc_fd), and episodes of major regime change (Stata variable regime_change, defined as under construction, including suspended periods—during an episode of major regime change).

Following Benson's procedure, each exposure is instrumented using a predicted probability of exposure constructed from a probit model in which selection into exposure is a nonlinear function of the construction start date. Reactors that begin construction after the event date receive a predicted exposure probability of zero. The excluded instruments are the corresponding predicted probabilities (Stata variables pr_uc_tmi, pr_uc_tmi_USA, pr_uc_chern, pr_uc_chern_SUN, pr_uc_fd, and pr_regime_change).

Fixed effects and clustering

Reactor-model fixed effects are used to absorb time-invariant differences across reactor designs (model fixed effects; implemented via the model identifier in the dataset). Singleton models are dropped mechanically when fixed effects are included. Standard errors are clustered at the country level using the ISO3 country code (iso_3166_a3).

10.2 Stata replication and extension guide

This appendix documents the order in which the Stata do-files should be executed to reproduce the replication results and the thesis extensions. The workflow is divided into two parts: first, the replication of the main Benson (2022) results; second, the extension analyses developed in this thesis. All analyses were run in Stata 19.5 SE.

Replication of Benson (2022)

The replication part reproduces the main non-restricted Benson-style results reported in Chapter 6.1. It should be run in the following order:

Data preparation

Folder: ...\NPP Database\Do Files\Data Prep\main.do

This file prepares the main analysis dataset used for the replication exercise.

Econometric analysis

Folder: ...\NPP Database\Do Files\Analysis\econometrics.do

This file runs the replication estimations based on the prepared dataset and produces the main replication results.

Thesis extension

The extension part reproduces the thesis-specific data preparation, estimation, diagnostics, and summary statistics. It should be run in the following order:

Data preparation

Folder: ...\NPP Database\Do Files\Thesis\Thesis_dataprep.do

This file prepares the thesis dataset used for the extension analyses, including the construction and merging of the additional decentralization variables and the OECD subsample variables.

Political decentralization estimation

Folder: ...\NPP Database\Do Files\Thesis\Thesis_H1_estimation.do

This file runs the political decentralization extension models.

Fiscal decentralization estimation

Folder: ...\NPP Database\Do Files\Thesis\Thesis_H2_OECD_estimation.do

This file runs the fiscal decentralization models for the OECD subsample.

IV diagnostics

Folder: ...\NPP Database\Do Files\Thesis\Thesis_iv_diagnostics.do

This file produces the instrumental-variable diagnostic output discussed in the thesis.

Summary statistics

Folder: ...\NPP Database\Do Files\Thesis\Thesis_summary_statistics.do

This file produces the summary statistics used in the data section and appendix.

Practical note

If the NPP Database folder is stored in a different location on another computer, only the root path at the beginning of the do-files needs to be adjusted. The execution order remains the same.