

Understanding and addressing digital inequalities Conference

The Impact of Connectivity on Inequalities: A Comparative Study across Nations

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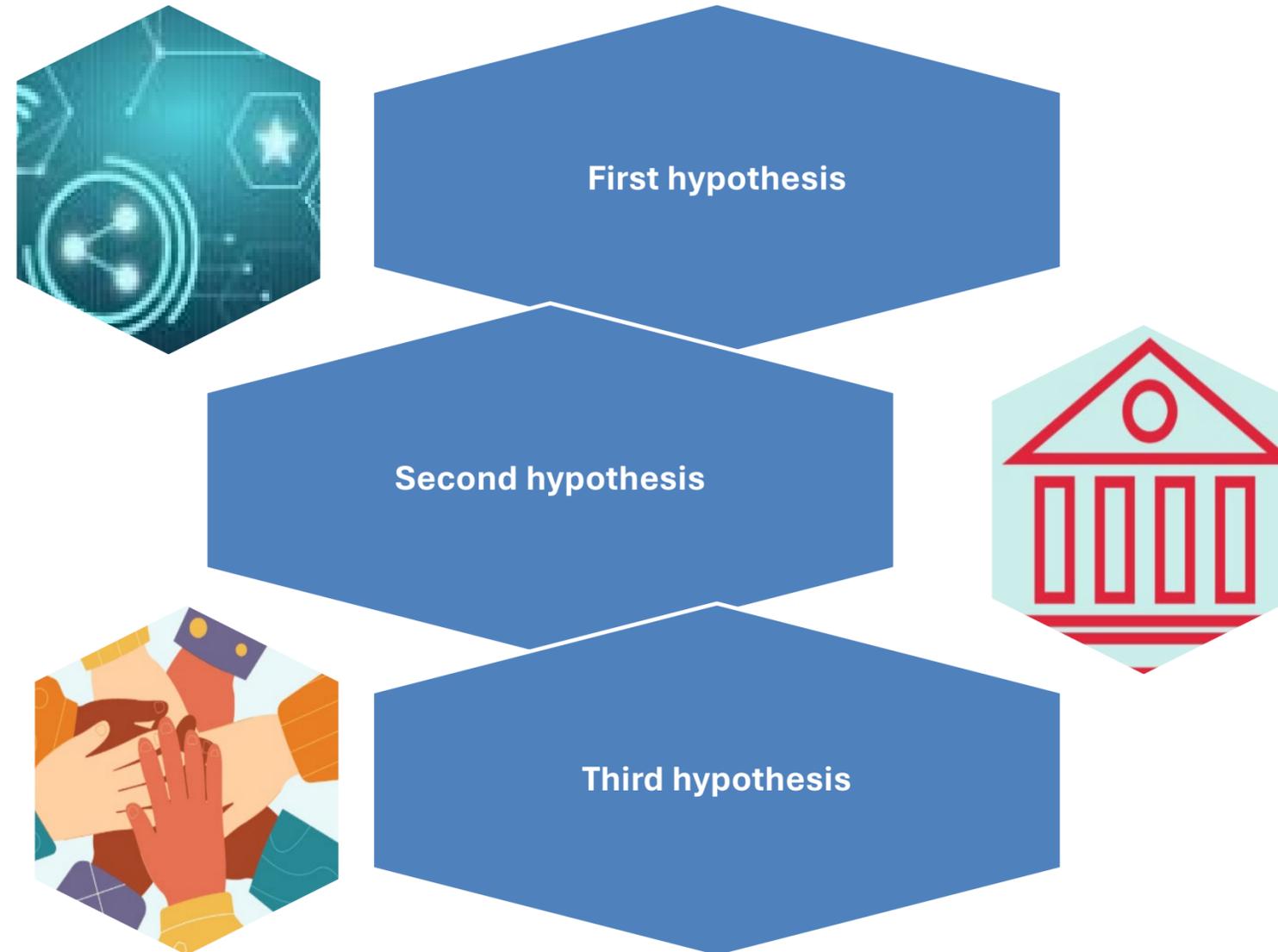
The impact of Connectivity on Inequalities: A Comparative Study across Nations

- Research question
- Data
- Variables
- Methodology
- Principal Results
- Conclusions

Research question and hypothesis



Research question



Research questions and hypothesis



To what extent and how has digitalization, understood as the expansion of connectivity (Internet access, fixed broadband subscriptions, and mobile services), impacted the evolution of economic inequality in different countries between 2017 and 2023?



First hypothesis

Second hypothesis



Third hypothesis

Research questions and hypothesis



To what extent and how has digitalization, understood as the expansion of connectivity (Internet access, fixed broadband subscriptions, and mobile services), impacted the evolution of economic inequality in different countries between 2017 and 2023?



H1: More digital access → less inequality.

H2: The effect depends on institutional and structural factors.



H3: In countries with more inclusive access, inequalities are lower.

Country selection and Dataset

25

Countries

European countries that are part of the OECD

Democracies
(Democracy Index)

Sufficient data
availability for analysis



Comparisons between countries with strong institutional and economic inequalities lead to distorted results and erroneous inferences about growth and poverty (Hanushek & Woessmann, 2015; Rodrik, 2005; Deaton (2010))

Selected countries

Countries that are part of the European Union (EU): Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden

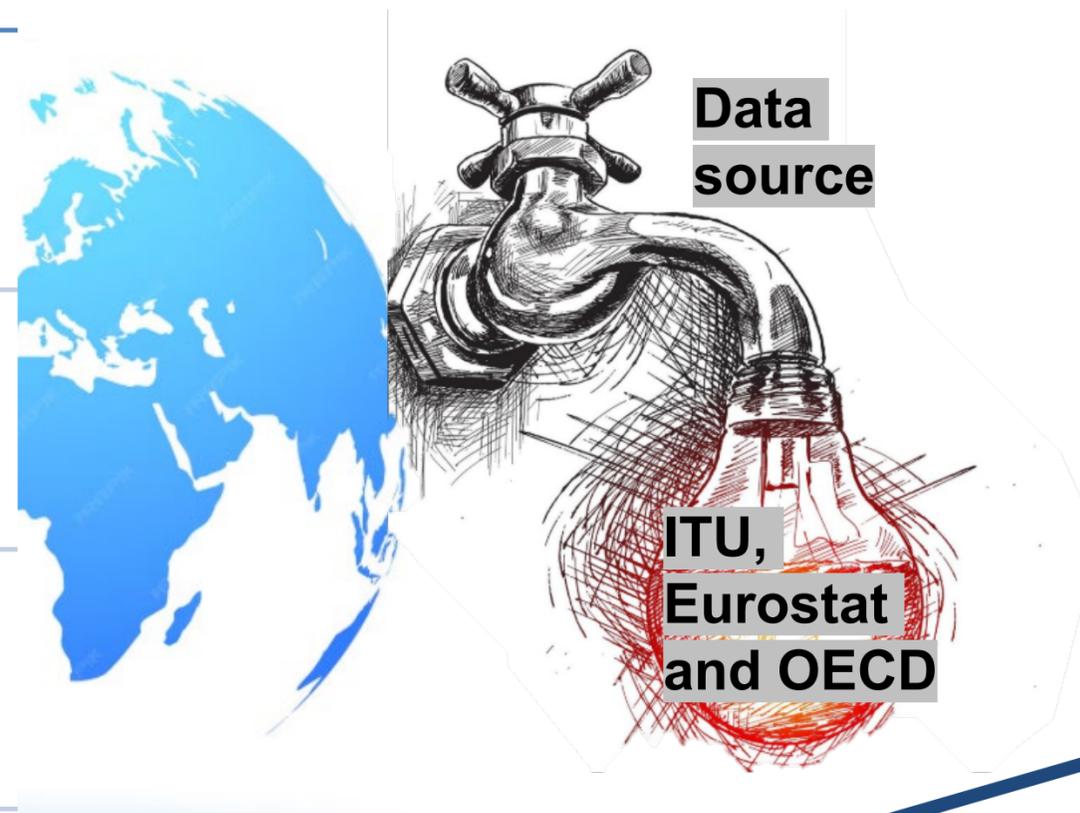
Countries that are only on the European continent (not EU members): Iceland, Norway, Switzerland

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2017

2023

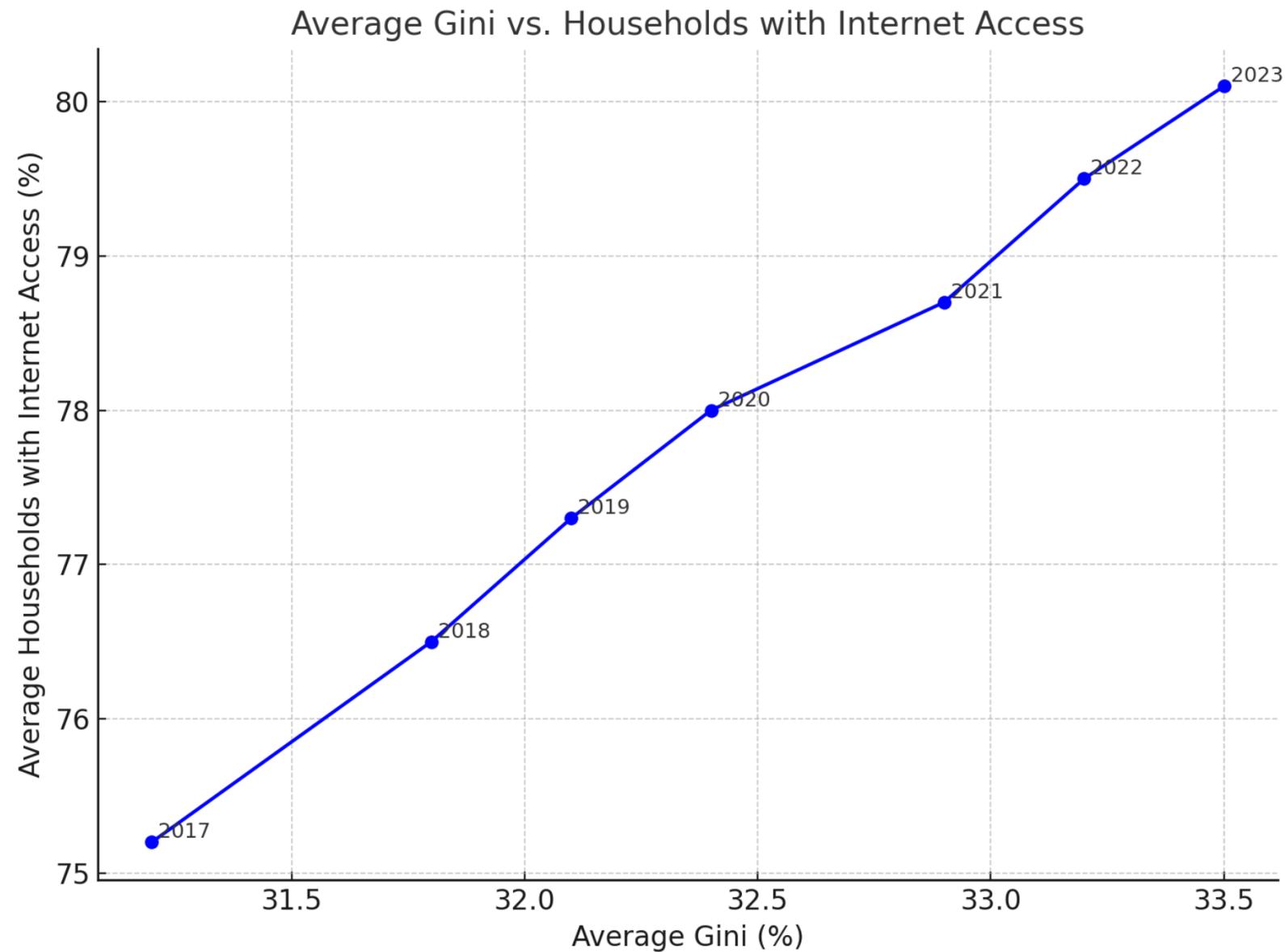
Variables

Indipendent variables: Connectivity	Dipendent variables: Inequality	Control variables	Instrumental variables
Households with internet access	Gini index	Per capita GDP growth	Share of communication expenditure over total expenditure
Fixed broadband subscriptions	Income share held by highest 10%	Percentage of the population aged 0-14	Share of communication expenditure over GDP
Mobile cellular subscriptions	Income share held by highest 20%	Urbanization rate	Growth of the share of communication expenditure
	Income share held by lowest 10%	Ratio of tax revenues to GDP	
	Income share held by lowest 20%	Percentage of the service sector on total economy	

Methodology

Phase	Description
1. Data Collection and Preparation	Importing and cleaning data from various sources; merging datasets by country and year; removing duplicates and irrelevant observations; coding countries and ordering the database.
2. Construction and Imputation of Key Variables	Calculating and renaming income distribution variables (such as s010, s020, s80100, s90100) and the Gini index; importing and saving digitalization variables (hh_internet, fx_sub/fb_sub, mob_sub, tu_density); handling missing data using regressions and predicted values.
3. Descriptive Analysis and Basic Regressions	Descriptive analysis of main variables (e.g., annual mean, distributions); panel regression models (RE, FE) to assess the relationship between digitalization and income inequality; specification tests (Hausman, xtoverid) and autocorrelation checks.
4. Advanced Analysis (IV, GMM, Causality Tests)	Applying instrumental variable (IV) models to address endogeneity (using instruments such as comm_exp, comm_gdp); implementing dynamic models (GMM, xtabond2) with lagged variables; performing Granger-causality tests to assess causal relationships.

Principal results



Despite growing income inequality, internet access has been steadily improving, which could indicate advancements in technology and infrastructure. While income inequality is increasing slowly, internet access is improving consistently across the years.

Principal results

Variable	Coefficient	Std. Error	z	P-value	95% Confidence Interval
hh_internet	0.0003989	0.0003708	1.08	0.282	[-0.0003279, 0.0011257]
gdp_pp_growth	-0.0003183	0.000317	-1.00	0.315	[-0.0009397, 0.000303]
pop014	0.3366817	0.347901	0.97	0.333	[-0.3451918, 1.018555]
urb_rate	-0.0013614	0.0009794	-1.39	0.164	[-0.003281, 0.0005581]
taxrev_gdp	0.0003507	0.0011199	0.31	0.754	[-0.0018442, 0.0025455]
perc_ser	0.0967703	0.085381	1.13	0.257	[-0.0705734, 0.264114]
Constant	0.3746862	0.0922839	4.06	0.000	[0.1938131, 0.5555593]

Main Regression Results for Random Effects Model

- The **Random Effects (RE)** model is preferred based on the Hausman test results, but most of the variables, including **household internet access**, **GDP growth**, and others, do not show significant effects on the **Gini index** (income inequality).
- Although **internet access** (hh_internet) is included in the model, it does not appear to significantly impact **income inequality** in this dataset, based on the statistical significance levels.

Principal results

Variable	F Statistic	p-value	Interpretation
gini hh_internet	557.641	0.0000	Presence of autocorrelation
gini fx_sub	634.374	0.0000	Presence of autocorrelation
gini mob_sub	727.523	0.0000	Presence of autocorrelation

Wooldridge Autocorrelation Test Results

The first-order autocorrelation found indicates that the current values of the variables (e.g., Gini index) are highly dependent on their past values.

This makes it necessary to use estimation approaches that correct for seriality.

Lags	Chi-sq statistic	df (degrees of freedom)	P-value
2	557.641	1	0.0000

The **Granger Causality Test** suggests that household internet access has a causal relationship with income inequality (Gini). This means that past values of hh_internet can help predict the evolution of income inequality in certain countries.

Principal results

Variable	(1) Gini on Household Internet Access ()	(2) Gini on Fixed Broadband Subscriptions ()
Lagged Gini ()	0.693*	0.764*
	(0.184)	(0.112)
Digital Access (Contemporaneous)		
	-0.0005*	
	(0.0002)	
		0.0000
		(0.0009)
Digital Access (Lagged)		
	0.0001	
	(0.0003)	
		-0.0005
		(0.0009)
	(0.1161)	(0.0720)

GMM with 23 countries and 22 years

This dynamic panel analysis uses the System GMM estimator to address endogeneity and inequality persistence. Results show that income inequality is highly persistent, with past inequality being the main predictor. Greater household internet access reduces inequality, while broadband subscriptions have no effect. The youth population lowers inequality in the short term but raises it in the long term; GDP growth and urbanization are mostly insignificant. Diagnostic tests (AR (2) and Hansen) support model validity, though Hansen results may be affected by instrument proliferation

Principal results

Variable	Coefficient	Robust Std. err.	z-statistic	P-value
(Instrumented)	-0.000372*	(0.000216)	-1.72	0.086
	0.000765*	(0.000225)	3.40	0.001
(Youth Population)	-0.005991*	(0.002145)	-2.79	0.005
(Urbanization Rate)	0.001385	(0.000912)	1.52	0.129
(Tax Revenue/GDP)	-0.001574*	(0.000518)	-3.04	0.002
(Service Employment)	-0.033968	(0.042659)	-0.80	0.426

IV with 23 countries and 22 years

The IV analysis confirms that communication expenditure is a valid and strong instrument for household internet access, addressing endogeneity issues. Results indicate that greater internet access slightly and marginally reduces income inequality. Higher tax revenue significantly lowers inequality, while GDP growth increases it. A larger youth population also reduces inequality, whereas urbanization and service sector employment are not significant.

Implications for policies



Infrastructure investments



Policies for digital skills



Digital inclusion in social plans



Continuous monitoring of digital inequalities

Research contributions, limitations and future prospects

Research contributions

- **Impact of Internet Use on Income Inequality:** This study explores how digital variables impact **income inequality**.
- **Advanced Statistical Techniques:** The research employs advanced econometric models, including **panel data regressions, GMM, and IV** techniques. The use of **Granger causality** tests further strengthens the predictive analysis.
- **Comprehensive Data Coverage:** By integrating data from multiple sources, the study offers a rich, cross-country comparison of factors that affect income inequality.
- **Policy Relevance:** The findings contribute to the ongoing debate on how **digital inclusion** can serve as a lever to reduce inequality.

Limitations

- **Data Limitations:** The research relies on **cross-country panel data**, which may lead to unobserved heterogeneity.
- **Generalizability:** The findings, while robust within the European context, may not be directly applicable to non-European countries.

Future prospects

- **Extended Analysis:** Future studies could extend this analysis to non-European countries.
- **Technological Interventions:** Future research might explore the **impact of specific technological policies**, such as digital skills training or broadband subsidies, on bridging the digital divide and reducing inequality.
- **Further Investigation of Causal Mechanisms:** The study establishes that digital variables can predict income inequality in some countries, but further work could investigate the **mechanisms** by which this occurs, such as changes in education, employment, or economic productivity driven by increased access to technology.

References

Hanushek, E. A., & Woessmann, L. (2015). The knowledge capital of nations: Education and the economics of growth. MIT Press

Rodrik, D. (2005). Why we learn nothing from regressing economic growth on policies (NBER Working Paper No. 10749). National Bureau of Economic Research. <https://doi.org/10.3386/w10749>

Deaton, A. (2010). Instruments, randomization, and learning about development. Journal of Economic Literature, 48(2), 424–455. <https://doi.org/10.1257/jel.48.2.424>

Thank you