INFRASTRUCTURE UNDER STRESS: WATER SERVICE AND CONNECTION CHALLENGES IN EASTERN EUROPE AND CENTRAL ASIA DURING THE 2008-2009 CRISIS

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Abstract

This paper examines the impact of the 2008–2009 global financial crisis on water service quality challenges experienced by firms in Eastern Europe and Central Asia. Using data from the World Bank's BEEPS IV and V surveys, this study analyzes applications for new water connections, the proportion of firms experiencing insufficient water supply, and the frequency and duration of service disruptions during and after the global financial crisis. The results indicate a significant decline in the number of manufacturing and service sector firms applying for new water connections during the post-Crisis period. However, there was no statistically significant difference in the proportion of manufacturing firms reporting insufficient water supply for production between the two periods. In terms of service disruptions, the number of incidents of inadequate water supply decreased significantly in the years following the crisis. On average, firms reported 6.06 incidents during the Crisis period, compared to 3.84 post-crisis. Similarly, the average duration of each incident declined from 17.67 hours during the Crisis to 10.31 hours afterward—a statistically significant reduction. These findings suggest that while new water connection applications declined—likely due to reduced business formation, post-Crisis—firms faced more frequent and prolonged water supply issues during the Crisis period compared to the post-Crisis period.

Keywords: *crisis, manufacturers, manufacturing, service sector, water, EECA, Eastern Europe, Central Asia*

Clasificare JEL : *Q25, L95, O52, P28, H54*

1. Introduction and context of the study

The 2008-2009 global financial crisis (GFC) represented a watershed moment for infrastructure investment worldwide, with profound and lasting effects on water infrastructure across Eastern Europe and Central Asia (EECA). The crisis exacerbated pre-existing challenges in the region's water supply and sanitation sectors, exposing critical funding shortfalls, governance deficits, and institutional weaknesses. These factors, combined with shifting investment priorities and deteriorating economic conditions, undermined efforts to maintain and expand water infrastructure, thereby threatening service quality and broader socioeconomic development.

A substantial body of literature underscores the central role of infrastructure investment in economic recovery and sustainable growth, particularly in developing and transition economies. Lin and Doemeland (2012) emphasize infrastructure as a catalyst for global growth, highlighting water infrastructure's potential to generate high economic returns and improve health and living standards. Lin (2013) further elaborates that infrastructure spending can simultaneously stimulate demand in advanced economies while addressing crucial service gaps in developing countries, thereby supporting global trade and capital flows. However, the GFC's fiscal tightening and capital market disruptions severely constrained the ability of EECA countries to finance water infrastructure, magnifying infrastructure deficits.

Governance and regulatory stability emerge as pivotal factors influencing infrastructure investment outcomes. Worenklein (2003) stresses the need for stable regulatory environments to sustain investor confidence, a condition significantly undermined by the crisis. Post-crisis austerity measures and fiscal consolidation efforts curtailed municipal investment, as detailed by Kollatz-Ahnen and Roick (2018), thereby limiting resources available for water infrastructure maintenance

and expansion. The vulnerability of infrastructure projects to external economic and institutional shocks, highlighted by Moschouli et al. (2019), further complicates project implementation in the region.

The crisis also shifted infrastructure financing dynamics. With shrinking public budgets, many EECA countries increasingly sought private sector involvement through public-private partnerships (PPPs). Yet, as Malik and Kaur (2020) and Filho, Ogasavara, and Amatucci (2024) note, PPPs in the post-crisis context carried significant risks—including delays, cost overruns, and demand shortfalls—while success depended heavily on institutional strength and regulatory clarity, often insufficient in EECA. Bayliss, Romero, and Waeyenberge (2021) caution that reliance on private finance can mask underlying fiscal pressures, a concern amplified by the budgetary constraints many EECA governments faced after the crisis.

Innovative financing mechanisms offer potential pathways to overcome these challenges. Lessons from India's experience (Agrawal, 2020) and the emphasis on tapping global capital markets (Chen & Kubik, 2007) highlight strategies to diversify funding and improve investment resilience. However, declining private sector participation in emerging markets, documented by Mawejje (2024), underscores persistent barriers to effective water infrastructure financing in the region.

Finally, the crisis precipitated deterioration in water infrastructure service delivery, disproportionately affecting vulnerable populations, as observed in post-Soviet and other EECA countries (Claborn, 2020). This underscores the critical importance of inclusive infrastructure policies that prioritize social equity alongside economic efficiency.

This paper explores the multifaceted impact of the 2008-2009 global financial crisis on water infrastructure investment, governance, and service outcomes in EECA countries. By synthesizing existing literature, it aims to identify key challenges and policy lessons for enhancing infrastructure resilience and advancing sustainable development in the region's water sector in a post-crisis context.

2. Literature Review

The literature on global infrastructure investment—particularly in the wake of the 2008–2009 Global Financial Crisis (GFC)—emphasizes infrastructure's central role in stimulating economic recovery, improving competitiveness, and addressing long-term development challenges. The recurring theme is the growing complexity of infrastructure financing and delivery, particularly in developing regions and emerging markets, where investment gaps remain substantial, especially in sectors such as transportation, power, and utilities.

Several scholars argue that infrastructure investment is both an economic stimulus and a long-term growth driver. Lin and Doemeland (2012) advocate for large-scale infrastructure investment in developing countries as a means of generating high economic returns and stimulating global demand. Lin (2013) reinforces this view, emphasizing that infrastructure investments help combat unemployment and low demand in advanced economies while addressing severe service gaps in developing regions. These investments also contribute to global trade by increasing demand for capital goods, especially from high-income countries. Similarly, Schwartz, Andres, and Dragoiu (2009) demonstrate that infrastructure investment in Latin America can create substantial short-term employment, especially through rural road projects, although they warn of risks related to poor planning, affordability, and corruption.

Despite widespread recognition of infrastructure's importance, the post-GFC environment presented major challenges for financing and governance. Gundes (2022) and Kollatz-Ahnen and Roick (2018) discuss how urbanization, climate change, and new technological demands have intensified the need for infrastructure, even as government budgets have become more constrained. This has led to increased reliance on private finance and public-private partnerships (PPPs), a trend reinforced by Rial and Sakrak (2019), who argue that well-structured PPPs are critical for post-pandemic recovery, though they caution that these arrangements involve complex long-term contracts and fiscal risks.

Nevertheless, reliance on private capital is not without challenges. Worenklein (2003) highlights the importance of regulatory stability and investor confidence, particularly in infrastructure sectors like power, where long-term commitments and clear policy environments are essential. Mawejje (2024) finds that private sector participation in infrastructure has declined in emerging markets due to unresolved risks and institutional weaknesses. Similarly, Biswal (2021) notes that many developing countries lack the governance capacity to manage private investment effectively, resulting in investor hesitation. Malik and Kaur (2020), through a comparative analysis of global PPP cases, underscore frequent issues such as delays, cost overruns, and demand shortfalls.

These concerns are echoed by Bayliss, Romero, and Waeyenberge (2021), who critique private finance models by examining PPPs in Senegal and Brazil. While some benefits are observed, the authors find that these projects often depend heavily on government and donor subsidies, challenging the notion that private finance can independently close infrastructure funding gaps. Filho, Ogasavara, and Amatucci (2024) similarly argue that the success of project finance, FDI, and PPPs hinges on strong institutions, clear regulations, and sound risk management—conditions often missing in lower-income countries.

To address these gaps, several studies propose innovative financing approaches. Agrawal (2020) highlights India's experience, advocating for the use of diaspora capital, municipal bonds, and regional connectivity improvements to close the funding gap. Chen and Kubik (2007) also recommend financial innovation, suggesting that tapping global capital markets and reducing political inefficiencies can help attract private investment for infrastructure development.

The literature further acknowledges that the urgency of crisis-driven spending may compromise long-term planning. Legacy (2017) critiques the tendency of post-crisis infrastructure policy to prioritize speed over strategy, leading to poorly planned projects that may not meet future needs. Dimitriou and Field (2019) expand on this by calling for adaptive and strategic infrastructure decision-making that incorporates sustainability, local context, and technological innovation. They caution against simplistic "infrastructure gap" narratives that neglect project quality and long-term resilience.

Empirical research confirms that infrastructure's impact on economic performance depends heavily on its quality and governance. Palei (2015) links effective infrastructure—especially in transport and electricity—to national competitiveness, emphasizing the importance of integrated industrial policy. Alizadeh et al. (2022) identify governance and planning gaps in Australia's urban infrastructure, calling for more inclusive and transparent planning processes, especially for Indigenous communities. Similarly, Thusi and Mlambo (2023) link infrastructure underdevelopment in Africa to persistent poverty and unemployment, citing low investment as a key barrier to growth and regional integration.

Some studies explore the broader social consequences of infrastructure collapse. Claborn (2020) draws parallels between Venezuela, Zimbabwe, and former Soviet states, showing how economic collapse leads to deteriorating infrastructure—especially in healthcare and utilities—and disproportionately harms marginalized populations. Ngowi et al. (2006) emphasize the continued difficulty of financing infrastructure in developing countries, even in the era of globalization, and stress the need for construction industries to take on a greater role in project financing.

Moschouli et al. (2019) provide insight into how external economic conditions affect infrastructure delivery. They show that post-2008 European transport projects were increasingly influenced by broader financial and institutional environments, making successful project execution less dependent on internal controls and more reliant on favorable macroeconomic factors.

Taken together, the literature identifies several critical themes:

1. Strategic Importance of Infrastructure**:** Infrastructure is essential for economic recovery, competitiveness, and long-term growth. Investments in sectors like power, transport, and utilities yield high returns and stimulate job creation and trade.

2. Challenges of Private Financing**:** While PPPs and private capital are increasingly promoted, they carry risks related to governance, transparency, and fiscal sustainability. Successful implementation depends on institutional strength and effective regulatory frameworks.

3. Need for Governance and Planning Reform**:** Weak institutions and inadequate planning undermine infrastructure outcomes, especially in developing countries. Improving governance capacity, stakeholder inclusion, and regulatory clarity is essential.

4. Risks of Crisis-Driven Infrastructure Investment**:** Urgency in times of economic crisis may lead to poorly conceived projects. Strategic, adaptive planning that considers long-term sustainability is needed.

5. Innovative and Diversified Financing Models**:** New financing approaches, including diaspora bonds, municipal finance, and global capital markets, are vital to closing infrastructure gaps without overburdening public finances.

6. Social Equity and Resilience**:** Infrastructure failures disproportionately impact vulnerable communities. Inclusive, equitable, and resilient infrastructure strategies are needed to ensure broader developmental benefits.

This body of literature provides a robust framework for analyzing how infrastructure systems respond to global crises. It also offers policy lessons for improving infrastructure financing, planning, and governance in both developed and developing contexts.

3. Data and methodology

This study uses the World Bank/European Bank for Reconstruction and Development joint surveys, which are called BEEPS surveys (i.e., Business Environment and Enterprise Performance Surveys). The Beeps IV survey was done in 2008 and 2009, and Beeps V was done in 2011 through 2016. There are 32 countries included in the surveys. These are Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Russia, Tajikistan, Ukraine, Uzbekistan, Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, FYR Macedonia, Greece, Hungary, Kosovo, Mongolia, Montenegro, Poland, Romania, Serbia, Slovak Republic, Slovenia, and Turkey.

The BEEPS IV data are used as the "Crisis Period" data, and the BEEPS IV data are used as the "Post-Crisis Period" data. First, we compare the two periods concerning the percentage of firms that applied for a new water connection over the last two years. We use the chi-squared test to compare the two periods. We have both manufacturing firm data and service sector data for this variable. Then, we compare the two periods concerning the percentage of manufacturing firms that experienced insufficient water supply for production during the year. Again, we use the chi-squared test to compare the two periods. After that, we use the Mann-Whitney-Wilcoxon test to compare the two periods concerning the number of incidents of insufficient water supply experienced by manufacturers (per month). Finally, we use the Mann-Whitney-Wilcoxon test to compare the two periods concerning the duration of the incident of insufficient water supply experienced by manufacturers (in hours).

During the Crisis period, there were 5,018 responses from manufacturing firms and 3,831 from service sector firms. In the post-Crisis period, these numbers increased to 6,466 and 3,934 responses, respectively. The number of firms responding to the "number of incidents" question was much smaller. There were 475 responses from manufacturing firms during the Crisis period, increasing to 578 in the post-Crisis period.

4. Empirical results

Table 1 shows the results of the chi-squared tests comparing the percentage of firms that applied to obtain a water connection (over the past two years) during the Crisis and Post-Crisis periods. Panel A shows the results for manufacturing firms, and Panel B shows the results for service firms.

Panel A shows that 6.99% of manufacturing firms applied to obtain a water connection (over the past two years) during the Crisis period, while the corresponding percentage is 5.89% during the post-Crisis period. The chi-squared test statistic value is 5.7542, and the p-value is 0.0164. Therefore, significantly fewer manufacturing firms applied for a new water connection during the post-Crisis period.

Panel B shows that 10.18% of service sector firms applied to obtain a water connection (over the past two years) during the Crisis period, while the corresponding percentage is 7.47% during the post-Crisis period. The chi-squared test statistic value is 17.7031, and the p-value is <0.0001. Therefore, significantly fewer service sector firms applied for a new water connection during the post-Crisis period.

Table 1. Submitted an Application to Obtain a Water Connection (last two years)?

Panel A. Manufacturing Firm

	Crisis Period		Post-Crisis Period	
	N	**%**	**N**	**%**
Yes	351	6.99	381	5.89
No	4,667	93.01	6,085	94.11
Total	5,018	100	6,466	100
Statistic	**df**	**Value**	**Prob**	
Chi-Squared	1	5.7542	0.0164	

Panel B. Service Firm

	Crisis Period		Post-Crisis Period	
	N	**%**	**N**	**%**
Yes	390	10.18	294	7.47
No	3,441	89.82	3,640	92.53
Total	3,831	100	3,934	100
Statistic	**df**	**Value**	**Prob**	
Chi-Squared	1	17.7031	<0.0001	

These findings are due to the immense impact of the Global Crisis on the rate of business formation worldwide. Since the rate of business formation went down just after the crisis, there were fewer applications for a new water connection.

Table 2 shows the results of the chi-Squared tests comparing the percentage of manufacturing firms that experienced insufficient water supply for production during the Crisis and Post-Crisis periods. In the dataset, there was no corresponding data for the service sector; therefore, we only focus on manufacturing firms in this table.

Table 2. Manuf. Experienced Insufficient Water Supply for Production this Year?

	Crisis Period		Post-Crisis Period	
	N	%	N	%
Yes	548	11.00	657	10.71
No	4,434	89.00	5,479	89.29
Total	4,982	100	6,136	100
Statistic	**df**	**Value**	**Prob**	
Chi-Square	1	0.2431	0.6220	

The table shows that 11.00% of manufacturing firms experienced an insufficient water supply for production during the Crisis, while the corresponding percentage is 10.71% during the post-Crisis period. The chi-squared test statistic value is 0.2431, and the p-value is 0.6220. Therefore, there was no statistically significant difference in the percentage of manufacturing firms that experienced insufficient water supply for production between the two periods.

Table 3 shows the results of the Mann-Whitney-Wilcoxon test comparing the number of incidents of insufficient water supply per month during the Crisis and Post-Crisis periods. Again, in the dataset, there was no corresponding data for the service sector; therefore, we only focus on manufacturing firms in this table.

Table 3. Incidents of Insufficient Water Supply per Month for Manuf. Firms

	Crisis Period			Post-Crisis Period			Mann-W.
Variables	**N**	**Mean**	**Std**	**N**	**Mean**	**Std**	**p-value**
Number of incidents	475	6.0589	24.393	578	3.8391	9.5311	0.0106

The table shows that, on average, 6.0589 incidents per month occurred during the Crisis Period, while the corresponding number is 3.8391 during the post-Crisis period. The p-value is 0.0106. Therefore, there was a statistically significant decline in the number of incidents of insufficient water supply a few years after the crisis ended. In other words, there were more frequent water supply problems during the Crisis period when compared to the post-Crisis period.

Table 4 shows the results of the Mann-Whitney-Wilcoxon test comparing the duration of insufficient water supply incidents during the Crisis and Post-Crisis periods. Again, in the dataset, there was no corresponding data for the service sector; therefore, we only focus on manufacturing firms in this table.

Table 4. Duration of the Incident of Insufficient Water Supply for Manuf. Firms

	Crisis Period			Post-Crisis Period			Mann-W.
Variables	**N**	**Mean**	**Std**	**N**	**Mean**	**Std**	**p-value**
Duration of the incident (hours)	369	17.667	48.885	438	10.311	29.792	<0.0001

The table shows that, on average, each incident took 17.667 hours to be resolved during the Crisis Period, while the corresponding number is 10.311 hours during the post-Crisis period. The p-value is <0.0001. Therefore, there was a statistically significant decline in the duration of the incident of insufficient water supply a few years after the crisis ended. In other words, water supply problems took more time to be resolved during the Crisis period when compared to the post-Crisis period.

5. Conclusion

This study investigates the impact of the 2008–2009 global financial crisis on water service access and disruptions experienced by firms in Eastern Europe and Central Asia. We utilize data from the World Bank's BEEPS IV survey to represent the "Crisis Period" and BEEPS V for the "Post-Crisis Period," comparing the two across four key indicators.

The first measure examines the proportion of firms applying for new water connections, which serves as a proxy for business formation. Given the global decline in business formation following the crisis, a decrease in new connection applications was anticipated. Consistent with expectations, the findings reveal a significant decline in applications during the post-Crisis period for both manufacturing and service sector firms.

The second measure assesses the proportion of manufacturing firms experiencing insufficient water supply for production. While a higher incidence of supply issues was expected during the crisis, government interventions may have mitigated the impact. The results indicate no statistically significant difference between the two periods in this measure.

The third measure considers the frequency of water supply disruptions among manufacturers. As predicted, firms reported a higher number of incidents during the crisis, an average of 6.06 incidents, compared to 3.84 incidents post-crisis. This difference is statistically significant and suggests increased vulnerability during times of economic stress.

The final measure focuses on the duration of these disruptions. It was expected that water supply problems would take longer to resolve during the crisis due to budget constraints and shifting policy priorities. The data supports this hypothesis, showing a significant reduction in average duration from 17.67 hours during the crisis to 10.31 hours afterward.

In summary, the findings suggest that while new water connection applications declined in the aftermath of the crisis—likely due to reduced business activity—firms experienced more frequent and prolonged water supply issues during the Crisis period. These results highlight the potential for global financial crises to negatively impact infrastructure services. As such, policymakers should consider proactive measures to safeguard essential utilities like the water supply during periods of economic instability.

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