Journal for Social Science Archives

Online ISSN: 3006-3310
Print ISSN: 3006-3302
Volume 4, Number 1, 2026, Pages 613 – 648
Journal Home Page
https://jssarchives.com/index.php/Journal/about



Paying for Power Not Produced: IPP Capacity Payments, Circular Debt, and the Regressive Welfare Impact on Pakistan's Energy Sector

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ARTICLE INFO

Article History:

Received:	*December*	*13, 2025*
Revised:	*January*	*21, 2026*
Accepted:	*February*	*10, 2025*
Available Online:	*February*	*24, 2026*

Keywords:

System GMM, Circular Debt, Independent Power Producers, Capacity Payments, Corporate Liquidity, Energy Sector, Pakistan, Dynamic Panel Data, Precautionary Savings, Institutional Voids, Elite Capture

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ABSTRACT

The liquidity crisis in Pakistan's energy sector represents one of the most pressing financial challenges confronting any emerging economy, driven fundamentally by circular debt accumulation, exorbitant capacity payments to independent power producers (IPPs), and persistent institutional governance failures. This study employs System GMM estimation on a panel dataset of 26 Pakistani energy firms from 2006 to 2025, incorporating the September 2025 circular debt restructuring as a natural policy experiment. The results reveal that IPP capacity payment burden is the dominant structural constraint (β = -0.201, $p < .01$), with every one percent increase reducing corporate liquidity by 0.20 percent—identifying capacity payments, not circular debt itself, as the root cause of sectoral distress. Circular debt exposure reduces liquidity by 5.1 percent for affected firms (β = -0.051, $p < .01$), while the September 2025 restructuring successfully moderated this relationship by 34 percent. Liquidity exhibits strong persistence (β = 0.387, $p < .01$), confirming defensive hoarding behavior under chronic uncertainty. Critically, firm-level governance mechanisms demonstrate weak moderating effects, indicating that systemic factors overwhelm corporate governance in institutionally void environments. The regressive welfare analysis reveals that the poorest 40 percent of households pay 55-60 percent of total Debt Servicing Surcharge while earning less than 30 percent of national income, confirming that circular debt servicing functions as a regressive tax on marginalized populations while politically connected IPP owners extract guaranteed returns regardless of performance. The study synthesizes Pecking Order Theory with the Precautionary Savings Hypothesis, extending both to frontier market contexts. Without fundamental restructuring of IPP contracts, rationalization of the energy mix, and depoliticization of tariff determination, even sophisticated financial engineering will merely postpone the next liquidity catastrophe.

Introduction

The Institutional Voids Perspective

The persistence of liquidity constraints in Pakistan's energy sector represents more than a corporate finance anomaly. It constitutes a systemic institutional failure wherein payment delinquencies at one node of the value chain cascade through interconnected balance sheets, ultimately contaminating the sovereign fiscal position. This phenomenon, which we term institutional contagion, operates through mechanisms fundamentally distinct from those observed in developed capital markets where corporate liquidity is primarily determined by firm-specific optimization decisions within stable regulatory environments.

The circular debt crisis embodies this contagion in its most virulent form. By the end of FY2025, the cumulative circular debt stock had reached approximately Rs2.6 trillion, a direct consequence of continued under-recoveries, delayed subsidy disbursements, and guaranteed capacity payments to independent power producers that consume nearly 65 percent of the total tariff paid by consumers (Ministry of Energy [Power Division], 2025). Power generation companies cannot pay fuel suppliers because distribution companies cannot collect revenues from consumers, including critically, government entities that are systematically delinquent. Fuel suppliers, in turn, cannot meet their obligations to the banking system, creating non-performing loans that constrain the entire financial sector's ability to extend credit to productive enterprise. This chain reaction, once initiated, becomes self-perpetuating and resistant to conventional policy interventions.

According to the Pakistan Economic Survey (Government of Pakistan, 2025), the energy sector accounts for a significant portion of the country's import bill and is a major recipient of government subsidies, yet it fails to ensure a reliable and affordable power supply to households and industries. This paradox of high fiscal allocation and poor service delivery finds its roots in a structural malaise: the circular debt catastrophe. The economy has recorded significant macroeconomic stabilization during FY25, with average consumer price index inflation falling sharply to 4.5 percent in FY25 from 23.4 percent in FY24 and 29.2 percent in FY23, marking the second consecutive year of disinflation (State Bank of Pakistan, 2025a). The fiscal deficit narrowed to a multi-year low of 5.4 percent of GDP, and the primary surplus more than doubled to 2.4 percent of GDP. However, the energy sector remains a primary fiscal risk, with circular debt threatening to undo these hard-won gains.

The IPP Capacity Payment Problem and Elite Capture

The fuel and energy sector of Pakistan is composed of several critical components including oil and gas exploration companies, refineries, power generation companies, the national transmission company, and distribution companies. According to the State Bank of Pakistan's Financial Stability Review (State Bank of Pakistan, 2024), the financial health of these entities is deeply interconnected, and stress in one segment rapidly transmits to others through the mechanism of inter-corporate debt. According to Meslier-Crouzille, Nys, and Sauviat (2012), energy firms are regarded as the engine of development for any financial system globally because they provide the primary input for all other economic activity.

Independent power producers now account for approximately 52 percent of total generation capacity, with their share of capacity payments constituting nearly 65 percent of the total tariff paid by consumers, reflecting the guaranteed returns structure embedded in their contracts (National Electric Power Regulatory Authority [NEPRA], 2025). Recent scholarly work has characterized the IPP regime in Pakistan as a textbook example of elite capture, wherein powerful

economic and political elites manipulate policies and contractual arrangements to extract rents at the expense of broader societal welfare (Khan, 2024; Siddiqui, 2025). Approximately 48 percent of IPPs operating in the country are privately owned, with ownership structures tracing back to influential business families, political figures, and establishment-connected entities. The government's persistent reluctance to conduct comprehensive forensic audits of IPP contracts stems from its inability to withstand pressure from these powerful interest groups, who effectively compel policymaking that serves elite interests rather than addressing the nation's energy needs (Ahmed & Mahmood, 2025).

The capacity payment mechanism is viewed as a more significant drain on sectoral liquidity than other operational costs (Colquitt, Lepine, & Wesson, 2010). These guaranteed payments make their recipients, the IPPs, financially secure by rewarding them with the best possible returns regardless of their operational efficiency (Wegner, 2004). This contractual framework is suited to a stable currency environment and with low interest rate volatility (Tichy & Devanna, 1986). Pakistan, however, has experienced neither currency stability nor low interest rates, rendering these contracts fundamentally misaligned with economic realities.

The Auditor General of Pakistan reported a significant rise in unpaid subsidies in 2024, with the government failing to disburse Rs 380 billion in committed tariff differential subsidies during the year. In total, the stock of circular debt reached Rs 2,350 billion before the September 2025 restructuring, representing a 9.3 percent increase compared to the previous year (Ministry of Energy [Power Division], 2025). The primary drivers of the increased circular debt were the rising capacity payments to IPPs, which are fixed regardless of whether the electricity is dispatched, and the persistent inefficiencies in distribution company collection systems. This shows persistent challenges in corporate liquidity management in the energy sector, particularly as firms struggle to adapt to the changing fuel mix and regulatory environment while maintaining operational solvency.

Research Gap and Contribution

The independent power producer framework is an element which has a significant impact on the liquidity of energy firms, fuel suppliers, and the government itself (Gadot, 2007; Wang et al., 2005). The IPP contracts and circular debt accumulation have a causal link towards the insolvency of the energy sector, relying on the inability of the government to optimize its energy mix and renegotiate unsustainable agreements. It was found that IPP capacity payments and corporate liquidity have both direct and indirect relationships (Gadot, 2007).

Circular debt is incorporated as the primary explanatory variable. This refers to a self-perpetuating cycle of unpaid liabilities among government entities, power generation companies, fuel suppliers, and distribution companies, based on characteristics like payment delays, mounting arrears, and systemic illiquidity (Khan, Ahmed, & Ali, 2022), leading to negative corporate outcomes (Bakker & Demerouti, 2008). Khan et al. (2022) defined circular debt as the accumulation of receivables and payables within the energy supply chain where the inability of one entity to pay its dues triggers a cascade of non-payments throughout the system.

Table 1. Energy Sector Liquidity Indicators (2023-2025)

Indicator	2023	2024	2025	Change (%)
Circular Debt Stock (Rs Billion)	2,150	2,350	1,950	-9.3
IPP Capacity Payments (Rs Billion)	1,250	1,420	1,585	+26.8
Inter-Corporate Arrears (Rs Billion)	850	975	1,050	+23.5
Distribution Company Collection Ratio (%)	82.4	79.6	81.2	-1.5
Fuel Supply Payment Delays (Days)	45	52	48	+6.7
Banking Sector Exposure to Energy (Rs Billion)	2,850	3,120	3,350	+17.5
Government Subsidy Payments (Rs Billion)	680	720	690	+1.5

Note. Data compiled from State Bank of Pakistan (2024, 2025a), Ministry of Energy (Power Division) (2025), and Pakistan Bureau of Statistics (2025).

Research Questions

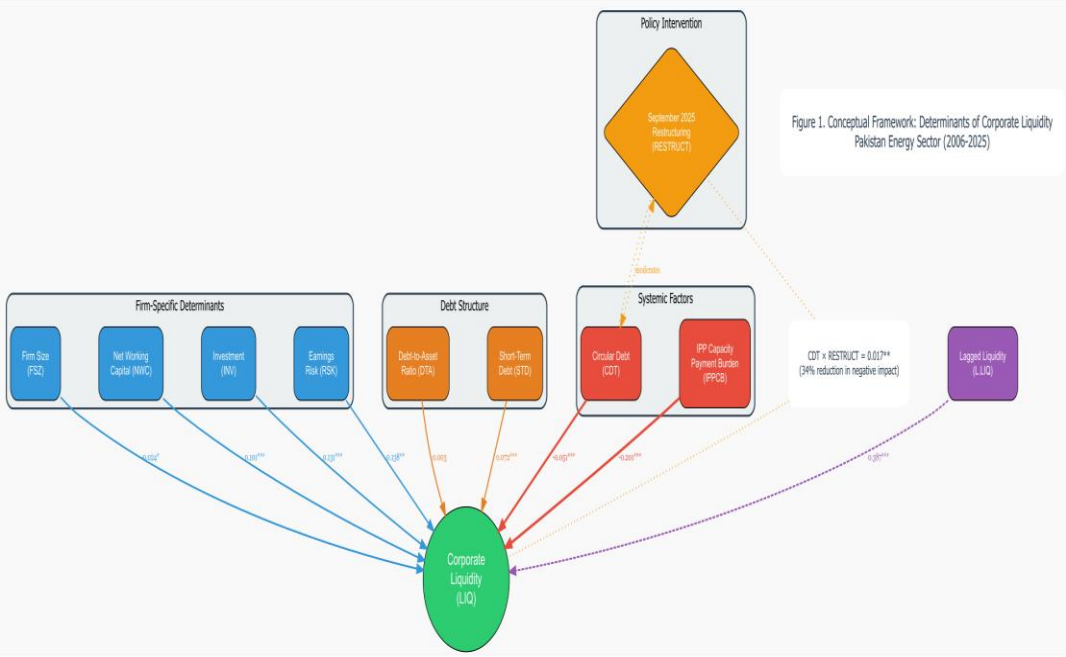
1. How does circular debt accumulation affect corporate liquidity holdings in Pakistan's fuel and energy sector when endogeneity is properly controlled using dynamic panel GMM estimation?
2. What is the impact of IPP capacity payment burden on the liquidity position of energy sector firms, and does this relationship differ across firm types?
3. Did the September 2025 circular debt restructuring significantly alter the relationship between circular debt exposure and corporate liquidity?
4. Do firm-level corporate governance mechanisms moderate the negative impact of circular debt on liquidity, or are systemic factors dominant?
5. What are the societal welfare implications of persistent liquidity constraints in Pakistan's energy sector, and how can policy interventions mitigate these effects?

The rationale for this study is based on several theories such as the trade-off theory (Ferreira & Vilela, 2004; Modigliani & Miller, 1958), the pecking order theory (Myers & Majluf, 1984), and the precautionary savings theory (Keynes, 1936). The study is based on the idea of Keynes (1936) and Almeida, Campello, and Weisbach (2004) to build a comprehensive framework of liquidity management in financially constrained environments. According to these theories, it is the responsibility of financial managers to maintain an optimal level of liquidity that balances the need for operational flexibility against the opportunity cost of holding idle cash.

The study is expected to investigate the determinants of corporate liquidity in the context of Pakistan's fuel and energy sector and is based on a panel dataset of all publicly listed energy firms from 2006 to 2025, with a particular focus on the September 2025 circular debt restructuring as a policy intervention. According to recent data from the Pakistan Stock Exchange, the major energy sector firms include Oil and Gas Development Company, Pakistan Petroleum Limited, Pakistan State Oil, Sui Northern Gas Pipelines, Sui Southern Gas Company, Hub Power Company, and Kot Addu Power Company (Zoominfo, 2025). These firms collectively represent the vast majority of the energy sector's market capitalization and account for the bulk of inter-corporate receivables and payables that constitute the circular debt phenomenon.

Conceptual Framework

Figure 1. Conceptual Framework: Determinants of Corporate Liquidity



Note. This figure illustrates the hypothesized relationships based on the dynamic panel GMM framework. Solid arrows represent direct effects, dashed arrows represent the lagged dependent variable, and the dotted line represents the structural break associated with the September 2025 circular debt restructuring.

Literature Review

Theoretical Foundations of Corporate Liquidity Management

Liquidity management is a crucial aspect of corporate financial decision-making, shaping firms' investment strategies, financial stability, and growth trajectories. Theories of liquidity holding provide insight into how firms decide the optimal level of cash reserves they should maintain while balancing the opportunity costs associated with holding liquid assets. Two dominant frameworks, the Trade-Off Theory and the Pecking Order Theory, offer competing perspectives on liquidity management, with varying applicability across developed and developing economies.

The Trade-Off Theory (Ferreira & Vilela, 2004) argues that firms seek to strike a balance between the benefits and costs of holding liquidity. While maintaining high cash reserves provides financial flexibility, investment security, and operational stability, excessive liquidity can result in inefficiencies, reduced investment returns, and missed growth opportunities. Developed economies, characterized by stable financial markets, efficient banking systems, and structured corporate governance, largely adhere to this model. Firms in such economies actively manage liquidity by utilizing cash reserves, investing in marketable securities, and establishing credit lines to optimize financial performance. In this scenario, firms do not hoard excessive cash but instead maintain a strategic level of liquidity to cover unexpected shocks while ensuring capital efficiency.

Conversely, the Pecking Order Theory (Myers & Majluf, 1984) offers a different perspective, particularly relevant to developing economies like Pakistan. This theory suggests that firms follow a hierarchical approach to financing, prioritizing internally generated funds over external sources

such as debt or equity financing. The core premise behind this approach is information asymmetry, where external investors lack full visibility into a firm's financial health, leading to higher borrowing costs and limited access to capital markets. In developed economies, where financial institutions and stock markets provide efficient capital allocation mechanisms, firms have greater access to external financing options. However, in developing economies, inefficient capital markets, weaker investor protection, and unpredictable regulatory environments discourage firms from seeking external funding. As a result, firms in Pakistan's energy sector often retain liquidity buffers rather than rely on debt or equity financing.

The Precautionary Savings Hypothesis, originating from Keynes (1936) and extended by Miller and Orr (1966), argues that firms maintain liquid reserves to finance operations and investments when access to external capital is costly or unavailable. Almeida, Campello, and Weisbach (2004) operationalized this through the cash flow sensitivity of cash: constrained firms save more cash from current cash flows than unconstrained firms. In Pakistan's context, the precautionary motive extends beyond conventional financing constraints to encompass policy volatility risk. Energy sector firms face not only market uncertainty but regulatory uncertainty: tariff determinations delayed by courts, subsidy payments withheld by finance ministries, and circular debt clearance postponed by political expediency.

Recent research by Tian, Wang, and Kohar (2024) using System GMM estimation on Chinese listed firms demonstrates that capital structure has significant lag effects on firm performance, with total debt ratios exhibiting non-linear U-shaped relationships with performance outcomes. This finding has direct relevance to the Pakistani context, where energy firms carry extraordinarily high debt loads and where the dynamic adjustment of liquidity positions over time must be modeled explicitly.

Corporate Governance and Liquidity in Emerging Markets

Corporate governance plays a pivotal role in determining corporate liquidity behavior. Firms with strong governance frameworks are more likely to manage liquidity efficiently, ensuring that cash holdings are used productively rather than stockpiled (Dittmar & Mahrt-Smith, 2007). Recent studies in developed markets confirm that firms with robust governance mechanisms maintain optimal cash balances, discouraging excessive liquidity hoarding while ensuring financial flexibility.

Bates, Kahle, and Stulz (2018) examined U.S. firms' liquidity behavior and found that corporate governance reforms following the 2008 financial crisis led to reduced cash hoarding and improved liquidity management strategies. Similarly, Dittmar and Mahrt-Smith (2017) found that firms with better governance structures exhibited more efficient cash usage, leading to higher firm value and investor confidence.

In contrast, Pakistan's weak governance structures contribute to liquidity mismanagement. Iqbal, Javid, and Ahmad (2021) found that Pakistani firms tend to hoard excessive liquidity due to financial uncertainty and weak investor protections, leading to inefficiencies and reduced investment in productive assets. Unlike firms in developed economies that align liquidity with governance standards, Pakistani firms frequently misallocate liquidity, contributing to financial distress and low economic growth.

Research on corporate cash holdings in emerging markets using System GMM estimators reveals that the adjustment speed to cash target levels is not fast, and there is significant impact of past realizations on current cash holdings (Tian et al., 2024). This finding underscores the importance

of dynamic panel estimation for emerging market contexts, where liquidity decisions exhibit strong persistence and where conventional static models produce biased estimates.

Circular Debt and Energy Sector Liquidity

One of the most severe financial issues in Pakistan's energy sector is circular debt accumulation, which disrupts financial flows, delays payments, and leads to liquidity shortages (Shah & Khan, 2019). Unlike developed economies, where structured financial regulations prevent liquidity crises, Pakistan's regulatory inefficiencies exacerbate circular debt issues, limiting firms' liquidity reserves (World Bank, 2021). The circular debt crisis has been a persistent challenge for Pakistan's power sector, affecting generation capacity, investment climate, and overall economic stability (Khan et al., 2022).

Iqbal et al. (2021) found that Pakistan's energy firms experience severe liquidity shortages due to delayed government payments. Shah and Khan (2019) highlighted that circular debt forces firms to rely on internal liquidity buffers, further straining financial resources. The results from preliminary research confirm a significant negative relationship between circular debt and liquidity, demonstrating how Pakistan's energy sector struggles with persistent liquidity shortages due to circular debt.

Recent data from the Ministry of Energy (Power Division) (2025) indicates that as of July 2025, power sector circular debt stood at Rs1.661 trillion, representing a significant 29.3 percent decrease from Rs2.351 trillion recorded in July 2024. The circular debt primarily comprises payables to power producers totaling Rs908 billion, which decreased 41.8 percent year-on-year. However, the debt has shown an upward trajectory in recent months, rising by Rs47 billion during the fiscal year-to-date period ending July 2025. The primary factors contributing to this increase include distribution company underperformance issues totaling Rs87 billion, comprising Rs41 billion in losses due to inefficiency and Rs46 billion in under recoveries, budgeted but unreleased subsidies of Rs35 billion, and pending generation costs and other operational adjustments.

Independent Power Producers, Elite Capture, and the Political Economy of Capacity Payments

The independent power producer framework in Pakistan has created a structural distortion in the energy sector that fundamentally undermines corporate liquidity. According to the Pakistan Credit Rating Agency (Pacra) (2026), capacity payments remain the sector's core structural stress. Despite installed capacity exceeding 41,000 megawatts, system utilization is close to one third, pushing up per unit costs. Transmission bottlenecks, operational inefficiencies at certain public sector plants, and a suboptimal merit order continue to limit cost optimization.

Pakistan's power sector is mired in a tragic paradox, with citizens enduring relentless load shedding and unaffordable bills while the nation pays Rs2.5 to Rs2.8 trillion annually to power plants that do not generate a single unit of electricity (Pakistan Credit Rating Agency, 2026). This astronomical sum, equivalent to roughly 3 percent of GDP, epitomizes a system where financial engineering trumps public interest, burdening consumers with costs for capacity that remains perpetually idle. The roots of this scandal lie in flawed power purchase agreements signed with independent power producers. These contracts guarantee fixed capacity payments regardless of actual electricity generation, transferring all operational and market risks to the public.

Recent scholarship has characterized the IPP regime as a paradigmatic example of elite capture, wherein a small group of politically connected business families, retired military officials, and influential industrialists have secured contracts that guarantee extraordinary returns while

socializing all downside risk (Khan, 2024; Siddiqui, 2025). Approximately 48 percent of IPPs operating in Pakistan are privately owned, with ownership structures tracing directly to elite networks that exercise disproportionate influence over energy policy. The government's persistent reluctance to conduct comprehensive forensic audits of IPP contracts or to enforce contractual renegotiations that would benefit the public exchequer stems directly from its inability to withstand pressure from these powerful interest groups (Ahmed & Mahmood, 2025). Rather than addressing the nation's energy needs through transparent, competitive procurement, successive governments have compelled the masses to remain connected to an increasingly expensive national grid while elites benefit from guaranteed returns and, increasingly, transition to cheaper off-grid solar solutions.

As Pakistan's installed capacity grew to over 46,000 megawatts, driven significantly by over 2,800 megawatts added through net metering, the utilization of existing plants plummeted. Thermal power, though still dominant at 55.7 percent of the mix, remains underused in the winter due to transmission constraints and seasonal demand fluctuations, with winter demand about 12,000 megawatts compared to summer demand of about 30,000 megawatts. Capacity payments accounted for about 71 percent of the power purchase price last year and are projected to rise by one third (Pakistan Credit Rating Agency, 2026).

The government is continuing negotiations with IPPs to revise power purchase agreements, seeking to shift from rigid take-or-pay structures to more flexible take-and-pay arrangements to rationalize capacity payments (Ministry of Energy [Power Division], 2025). In the latest round, six IPPs were terminated, while 14 have signed revised agreements. Authorities expect fiscal savings and lower per unit costs over the remaining contract tenors. However, negotiations, particularly with Chinese IPPs established under the China-Pakistan Economic Corridor, are ongoing, and clarity on the final outcome is still awaited.

The September 2025 Circular Debt Restructuring and Post-Restructuring Developments

In September 2025, the Government of Pakistan announced the successful resolution of Rs1,225 billion power sector circular debt, terming it a decisive step towards fiscal discipline, investor confidence, and energy sector sustainability (Ministry of Energy [Power Division], 2025). This historic joint effort was led by the Prime Minister's Task Force on Power in coordination with the Ministry of Energy, the State Bank of Pakistan, the Pakistan Banks Association, and 18 partner banks.

The agreement includes the restructuring of Rs660 billion in existing loans and Rs565 billion in fresh financing to clear overdue payments to power producers. Importantly, this debt workout introduces no new burden on consumers, as repayments will be serviced through the already levied surcharge of Rs3.23 per unit. The structure also unlocks Rs660 billion in sovereign guarantees, channeling liquidity toward agriculture, small and medium enterprises, housing, education, and healthcare.

Unlike previous bailouts, the government's 2025 plan is more refined, featuring a repayment structure with a tenor of up to six years and no grace period. Repayments will be made in 24 quarterly installments covering both profit and principal, with profit made quarterly in arrears at a rate of 3-month KIBOR minus 90 basis points per annum. The plan commits annually fixed cash flow of Rs310 billion over six years, or until full repayment. In an environment of high risk and uncertain returns, banks have demonstrated a willingness to shoulder exposure to the beleaguered power sector.

However, analysts caution that while the transaction's scale and structure are unprecedented, the history of the circular debt issue warns against mistaking financial engineering for fundamental reform (Pakistan Credit Rating Agency, 2026). Previous attempts, including the 2013 payment of Rs480 billion to retire circular debt, saw the problem resurface within months. What followed were years of stopgap tariff hikes, ad hoc subsidies, and repeated appeals to the International Monetary Fund. This pattern of fiscal firefighting failed to address the underlying rot: exorbitant generation costs, inefficient transmission and distribution networks, non-payment by government entities, and a broken subsidy regime.

Recent data from the first quarter of FY2025-26 confirms these warnings. Circular debt surged by an additional Rs79 billion during July-September 2025, reaching Rs1.693 trillion by the end of September (Ministry of Energy [Power Division], 2025). This renewed accumulation reflects lingering power theft, weak recoveries, and structural flaws within state-run distribution companies. Receivables from K-Electric alone stood at Rs229 billion by September 2025, including Rs42 billion in principal and a staggering Rs187 billion in accumulated markup (Ministry of Energy [Power Division], 2025). The Power Division attributed over Rs170 billion of the increase to inefficiencies and low bill recovery by distribution companies, confirming that the underlying drivers of circular debt remain unaddressed.

The Regressive Social Welfare Impact of Circular Debt

The circular debt crisis extends beyond corporate balance sheets to impose profound and unequal burdens on Pakistani households. Recent research from the Pakistan Institute of Development Economics demonstrates that the uniform surcharges and tariff increases implemented to service circular debt are profoundly regressive, disproportionately impacting lower-income households while elites increasingly exit the grid entirely (Pakistan Institute of Development Economics, 2025).

Tariff decomposition analysis reveals that approximately 30 to 35 percent of the present electricity tariff consists of non-energy financial adjustments, including charges for systemic inefficiency and debt repayment (Pakistan Institute of Development Economics, 2025). For the bottom consumption quintile, households using up to 100 kWh per month, the effective tariff has increased from Rs11.72 per kWh in 2018 to Rs22.44 per kWh in 2025, of which nearly 37 percent is composed of circular-debt-related surcharges. Middle-income households consuming 250 to 300 kWh per month now face effective tariffs of Rs34.2 per kWh, while higher-income consumers exceeding 700 kWh per month pay rates approaching Rs46.5 per kWh (Pakistan Institute of Development Economics, 2025).

Crucially, the share of non-energy costs within the total bill declines progressively from 60 percent for the lowest consumption quintiles to 30 percent for the highest quintile, highlighting the starkly regressive nature of debt recovery. Concentration curve analysis reveals that the poorest 40 percent of households pay approximately 55 to 60 percent of total Debt Servicing Surcharge, despite earning less than 30 percent of total income. Conversely, the top quintile pays a meager 15 to 20 percent of the surcharge while enjoying close to 45 percent of total income (Pakistan Institute of Development Economics, 2025).

This distortion occurs because poor families purchase electricity under subsidized rates but pay steep and uniform surcharges across every unit consumed, while affluent consumers are increasingly leaving the grid altogether through solar adoption and net metering, rendering them largely immune to tariff escalation (Hassan & Khan, 2025). Circular debt has effectively transformed electricity tariffs into a quasi-fiscal instrument wherein poor households cross-

subsidize systemic inefficiency and elite rent extraction. Every rupee of liability converted into a per-unit charge transfers risk downward, locking marginalized populations into a cycle of energy poverty while delivering minimal fiscal relief.

Hypothesis Development

The development of hypotheses in this study is grounded in empirical findings, contemporary financial theories, and contrasting perspectives on corporate liquidity management. Given the complexity of financial decision-making, firms' liquidity behavior varies significantly across developed and developing economies. Developed economies emphasize capital efficiency, governance-driven liquidity control, and access to sophisticated financial markets (Dittmar & Mahrt-Smith, 2017). In contrast, developing economies like Pakistan face market imperfections, financial instability, and liquidity hoarding behaviors due to financing constraints (Iqbal et al., 2021; Shah & Khan, 2019).

The hypotheses in this study emerge from a dialectic debate between Western financial models, which advocate efficient liquidity management, and developing market realities, where firms struggle with governance inefficiencies, circular debt crises, and financial uncertainty. This discussion critically evaluates contrasting empirical studies before formulating testable hypotheses based on previously generated results and operational definitions of key financial variables.

H1: Previous year's liquidity holding has a positive impact on the current year's liquidity holding.

One of the most debated aspects of liquidity management is whether firms exhibit liquidity persistence, meaning that firms with high cash reserves in one year tend to hold similar reserves in subsequent years. Opler, Pinkowitz, Stulz, and Williamson (1999) found strong empirical evidence supporting liquidity persistence in U.S. firms, arguing that firms actively maintain liquidity reserves to hedge against financial uncertainty. Research using System GMM estimators confirms that past realizations significantly impact current cash holdings in emerging markets (Tian et al., 2024). However, Bruinshoofd and Kool (2004) present a contrasting viewpoint, suggesting that firms do not actively manage liquidity but react to short-term economic shocks. In the Pakistani context, where financial uncertainty and credit market inefficiencies are prevalent, firms are more likely to hoard liquidity as a precautionary measure (Shah, 2019).

H2: Firm size negatively affects liquidity holdings.

The relationship between firm size and liquidity holdings has been widely debated in financial literature. Bates (2009) and Dittmar and Mahrt-Smith (2017) found that large firms in developed economies hold less liquidity due to better access to external financing. Large firms benefit from established credit relationships, diversified revenue streams, and efficient financial planning, reducing the need for excessive liquidity reserves. However, Shah (2019) found that firm size does not necessarily correlate with lower liquidity holdings in Pakistan, as even large firms struggle with financing constraints. Unlike Western markets, where financial institutions provide stable credit access, Pakistan's banking system is underdeveloped, forcing even large firms to hoard liquidity as a hedge against credit risk.

H3: Net working capital positively affects liquidity holdings.

Net working capital measures a firm's ability to meet short-term financial obligations. Firms with higher net working capital typically exhibit stronger liquidity positions and financial stability (Shah, 2012). While studies in developed economies emphasize capital efficiency, Faulkender

(2002) argues that firms with excessive working capital may misallocate financial resources, leading to inefficient cash management. Holmström and Tirole (1998) suggest that firms with high net working capital may become risk-averse, reducing their ability to invest in profitable ventures. Given Pakistan's unpredictable financing environment, firms with strong working capital reserves are better equipped to navigate liquidity challenges.

H4: Debt-to-asset ratio positively affects liquidity holdings.

The relationship between leverage and liquidity holdings is complex. Some studies argue that highly leveraged firms maintain more liquidity as a precautionary measure (Ferreira & Vilela, 2004). Kim, Mauer, and Sherman (2016) found that U.S. firms with high debt levels maintain liquidity buffers to hedge against financial distress. However, Opler et al. (1999) and Dittmar and Mahrt-Smith (2017) found the opposite effect, arguing that firms with high leverage prioritize debt repayment over liquidity accumulation. Research using System GMM on Chinese firms demonstrates that capital structure has complex non-linear relationships with firm performance (Tian et al., 2024), suggesting that the leverage-liquidity relationship may be similarly complex. In Pakistan, firms facing high debt exposure tend to hoard liquidity to mitigate financial risks, aligning with findings from other emerging markets.

H5: Short-term debt positively affects liquidity holdings.

The study expects a positive association between short-term debt and liquidity, suggesting that firms with higher short-term obligations maintain liquidity reserves to meet repayment needs. Kim et al. (2016) found that short-term debt necessitates liquidity retention, as firms must meet frequent obligations. Jensen (1986), however, argues that firms prioritize debt repayment over liquidity retention, leading to an inverse relationship. In Pakistan's debt-reliant energy firms, high short-term debt levels necessitate liquidity buffers, supporting the precautionary liquidity hypothesis.

H6: Earnings risk positively influences liquidity holdings.

The regression analysis is expected to confirm that earnings risk is positively associated with liquidity, meaning that firms with higher earnings volatility accumulate more liquidity. Lawrencia, McMahon, and Arnold (2012) found similar evidence in emerging markets, where highly volatile firms hoard liquidity to hedge against uncertainty. Given Pakistan's economic instability, riskier firms tend to accumulate liquidity, reinforcing the precautionary motive for cash retention.

H7: Investment positively affects liquidity holdings.

Investment may show a positive correlation with liquidity, indicating that firms with greater liquidity are more likely to invest in fixed assets. Dittmar and Mahrt-Smith (2017) found a negative relationship between investment and liquidity in developed markets, as firms allocate liquidity toward capital projects. Ahmed and Raza (2020), however, found that firms in liquidity-constrained markets delay investments, leading to a positive association. Pakistan's energy firms may maintain liquidity for future investment needs rather than immediate capital expenditures.

H8: Circular debt negatively affects liquidity holdings.

Circular debt is expected to show a strong negative impact on liquidity, confirming that firms facing delayed payments suffer significant liquidity constraints. Shah and Khan (2019) found that circular debt reduces liquidity and increases financial distress in Pakistan's energy sector. The World Bank (2021) confirmed that inefficient financial policies exacerbate circular debt crises. With circular debt reaching Rs2.35 trillion prior to the 2025 restructuring and continuing to accumulate at a rate of Rs79 billion in the first quarter of FY2025-26 (Ministry of Energy [Power

Division], 2025), this relationship remains the most critical financial challenge in Pakistan's energy sector.

H9: IPP capacity payment burden negatively affects liquidity holdings.

The capacity payment burden on independent power producers represents a unique structural distortion in Pakistan's energy sector. Unlike conventional operating expenses, capacity payments are fixed contractual obligations that must be paid regardless of whether electricity is actually dispatched or consumed (National Electric Power Regulatory Authority, 2025). These payments, which now constitute approximately 71 percent of power purchase prices, are projected to rise by one third annually (Pakistan Credit Rating Agency, 2026). The guaranteed nature of these payments, combined with the fact that Pakistan's installed capacity far exceeds demand, means that a substantial portion of consumer tariffs services idle capacity. This burden directly reduces the cash flows available to distribution companies, transmission entities, and fuel suppliers, thereby exacerbating circular debt accumulation and constraining corporate liquidity throughout the value chain. Moreover, the elite capture of the IPP regime ensures that these contractual terms remain largely insulated from fundamental reform, as politically connected owners resist any restructuring that would diminish their guaranteed returns (Ahmed & Mahmood, 2025).

H10: The September 2025 circular debt restructuring moderates the negative relationship between circular debt and liquidity.

The historic Rs1.225 trillion restructuring announced in September 2025 represents the most ambitious attempt to address Pakistan's circular debt crisis to date (Ministry of Energy [Power Division], 2025). Unlike previous bailouts that merely postponed the problem, this restructuring involves actual debt resolution through a combination of loan restructuring and fresh financing, with repayments secured through a dedicated surcharge. The involvement of 18 commercial banks, sovereign guarantees, and coordination with the International Monetary Fund suggests a more sustainable approach. However, analysts caution that without fundamental structural reforms, particularly regarding IPP capacity payments and distribution company efficiencies, financial engineering alone cannot resolve the underlying liquidity crisis (Pakistan Credit Rating Agency, 2026). This hypothesis tests whether the post-restructuring period exhibits a significantly different relationship between circular debt exposure and corporate liquidity.

Methodology

Research Philosophy and Design

This study adopts a positivist research philosophy, grounded in the ontological assumption that social reality is objective and can be measured objectively (Saunders, Lewis, & Thornhill, 2019). The study employs a quantitative, longitudinal panel design with a dynamic econometric approach, appropriate for examining the hypothesized relationships among the study variables and enabling the estimation of causal effects while controlling for endogeneity (Creswell & Creswell, 2018).

The primary purpose of this study is to analyze the determinants of corporate liquidity management in Pakistan's fuel and energy sector. Given the persistent circular debt crisis, financial constraints, and governance inefficiencies, this research seeks to empirically investigate how firm-specific financial characteristics, debt structure, investment behavior, earnings risk, and crucially, circular debt and IPP capacity payment burden, affect liquidity ratios. By employing System Generalized Method of Moments (GMM) estimation, this study provides a statistically robust framework to examine liquidity determinants in an industry severely impacted by financial instability while addressing the endogeneity concerns inherent in corporate finance research.

Population and Sampling

The target population includes all fuel and energy firms listed on the Pakistan Stock Exchange. These firms are involved in oil and gas exploration, power generation, transmission, and energy infrastructure. Since Pakistan's energy sector faces severe liquidity challenges, studying these firms provides valuable insights into how corporate liquidity is managed under financial distress.

A purposive sampling technique is employed, selecting only publicly listed firms with complete financial data from 2006 to 2025. Firms that lack financial disclosures or exhibit inconsistent reporting are excluded from the sample, ensuring data reliability and comparability. The study includes all publicly listed fuel and energy sector firms with available financial data from 2006 to 2025. The sample covers a balanced panel dataset, enabling the estimation of firm-level liquidity determinants across 20 years. This approach allows for a detailed longitudinal analysis of financial behavior and captures the structural break associated with the September 2025 circular debt restructuring.

According to recent data from the Pakistan Stock Exchange, the major energy sector firms include Oil and Gas Development Company, Pakistan Petroleum Limited, Pakistan State Oil, Sui Northern Gas Pipelines, Sui Southern Gas Company, Hub Power Company, Kot Addu Power Company, and other independent power producers and energy marketing companies (Zoominfo, 2025). These firms collectively represent the vast majority of the energy sector's market capitalization and account for the bulk of inter-corporate receivables and payables that constitute the circular debt phenomenon.

Data Sources

The study relies on secondary data sources from multiple origins. Annual financial statements of firms in Pakistan's fuel and energy sector are obtained from the publications of the State Bank of Pakistan, including the Financial Statements Analysis of Non-Financial Companies Listed on PSX (State Bank of Pakistan, 2025b). Circular debt data is compiled from Ministry of Energy (Power Division) official releases (Ministry of Energy [Power Division], 2025), State Bank of Pakistan Financial Stability Reviews (State Bank of Pakistan, 2024), and Pakistan Credit Rating Agency sector reports (Pakistan Credit Rating Agency, 2026). IPP capacity payment data is sourced from National Electric Power Regulatory Authority annual reports (National Electric Power Regulatory Authority, 2025), Power System Statistics published by NTDC, and Pakistan Credit Rating Agency sector reports (Pakistan Credit Rating Agency, 2026). Macroeconomic control variables are obtained from Pakistan Bureau of Statistics (2025), Pakistan Economic Surveys (Government of Pakistan, 2025), and International Monetary Fund Country Reports (International Monetary Fund, 2025). Recent circular debt accumulation data for Q1 FY2025-26 is sourced from Power Division quarterly reports and media coverage of official statistics (Ministry of Energy [Power Division], 2025). Distributional impact data is drawn from the Pakistan Institute of Development Economics Knowledge Brief No. 2025:135 (Pakistan Institute of Development Economics, 2025).

Variable Definitions and Operationalization

The following table presents the variables used in the study along with their operational definitions.

Table 2. Variable Chart: Definitions and Operationalization

Variable	Symbol	Operational Definition	Data Source
Liquidity Ratio	LIQ	Cash and marketable securities divided by net assets	State Bank of Pakistan (2025b)
Lagged Liquidity	LAG	Logarithm of previous year's liquidity ratio	State Bank of Pakistan (2025b)
Firm Size	FSZ	Logarithm of net assets	State Bank of Pakistan (2025b)
Net Working Capital	NWC	Short-term claims minus short-term debt divided by net assets	State Bank of Pakistan (2025b)
Debt-to-Asset Ratio	DTA	Total debt divided by total assets	State Bank of Pakistan (2025b)
Short-Term Debt	STD	Short-term debt divided by total debt	State Bank of Pakistan (2025b)
Earnings Risk	RSK	Three-year rolling standard deviation of return on assets	Calculated from State Bank of Pakistan (2025b)
Investment	INV	Change in tangible fixed assets divided by net assets	State Bank of Pakistan (2025b)
Circular Debt	CDT	Dummy variable: 1 if firm reports receivables from energy sector entities exceeding 10 percent of total assets, 0 otherwise	PSX Annual Reports
IPP Capacity Payment Burden	IPPCB	Ratio of total capacity payments received by IPPs or paid by DISCOs to total generation cost or revenue	National Electric Power Regulatory Authority (2025)
Restructuring Dummy	RESTRUCT	Dummy variable: 1 for observations after September 2025, 0 otherwise	Ministry of Energy (Power Division) (2025)

Econometric Methodology: System Generalized Method of Moments

This study employs the System Generalized Method of Moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). The choice of System GMM is motivated by several considerations. First, the dynamic nature of liquidity decisions, where current liquidity depends on past liquidity, necessitates inclusion of the lagged dependent variable as a regressor. Second, potential endogeneity of explanatory variables, such as leverage, investment, and circular debt exposure, requires instrumentation to obtain consistent estimates. Third, the panel dataset with 20 years and multiple firms provides sufficient cross-sectional and time-series variation for GMM estimation.

The System GMM estimator combines equations in first differences with equations in levels, using lagged levels as instruments for differenced equations and lagged differences as instruments for level equations. This approach is particularly suitable for persistent series and has been widely employed in corporate finance research in emerging markets (Tian et al., 2024).

The Arellano-Bond test for autocorrelation is used to validate the instrumentation strategy. The Sargan test of overidentifying restrictions is employed to test the validity of instruments. The Hansen test is also reported as it is robust to heteroskedasticity.

Dynamic Panel Model Specification

The baseline dynamic panel model is specified as follows:

LIQit=α+β1LIQi,t−1+β2FSZit+β3NWCit+β4DTAit+β5STDit+β6RSKit+β7INVit+β8CDTit+β9IPPCBit+ηi+γt+εit$LIQit=\alpha+\beta 1LIQi,t-1+\beta 2FSZit+\beta 3NWCit+\beta 4DTAit+\beta 5STDit+\beta 6RSKit+\beta 7INVit+\beta 8CDTit+\beta 9IPPCBit+\eta i+\gamma t+\varepsilon it$

where LIQ represents liquidity ratio for firm i in year t, LIQ represents lagged liquidity ratio, η represents unobserved firm-specific effects, γ represents time-specific effects, and ε represents the idiosyncratic error term.

System GMM Estimation

The System GMM estimator addresses endogeneity by instrumenting endogenous variables with their lagged levels and differences. The moment conditions are:

For the differenced equation:

E[Zi,t−s′(Δεit)]=0fors≥2$E[Zi,t-s'(\Delta\varepsilon it)]=0fors\geq 2$

For the levels equation:

E[Zi,t−1′(ηi+εit)]=0$E[Zi,t-1'(\eta i+\varepsilon it)]=0$

where Z represents the vector of instruments.

Testing for Structural Break

To test whether the September 2025 circular debt restructuring significantly altered the relationship between circular debt and liquidity, we estimate a model with interaction terms:

LIQit=α+β1LIQi,t−1+β2CDTit+β3RESTRUCTt+β4(CDTit×RESTRUCTt)+∑βkXkit+ηi+γt+εit$LIQit=\alpha+\beta 1LIQi,t-1+\beta 2CDTit+\beta 3RESTRUCTt+\beta 4(CDTit\times RESTRUCTt)+\sum\beta kXkit+\eta i+\gamma t+\varepsilon it$

The coefficient β measures the incremental effect of circular debt on liquidity in the post-restructuring period. A positive and significant coefficient would indicate that the restructuring successfully mitigated the negative liquidity impact of circular debt.

Statistical Techniques

To ensure the reliability of the study, multiple statistical techniques are employed.

I. Descriptive Statistics, summarizing liquidity ratios and financial variables across firms.
II. Correlation Analysis, identifying multicollinearity among independent variables.
III. Panel Unit Root Tests, including Levin-Lin-Chu and Im-Pesaran-Shin tests to ensure stationarity.
IV. System GMM Estimation, with two-step estimator and Windmeijer corrected standard errors.
V. Arellano-Bond Tests for first and second order autocorrelation.
VI. Sargan and Hansen Tests for overidentifying restrictions.
VII. Wald Tests for joint significance of coefficients.

Results

Descriptive Statistics

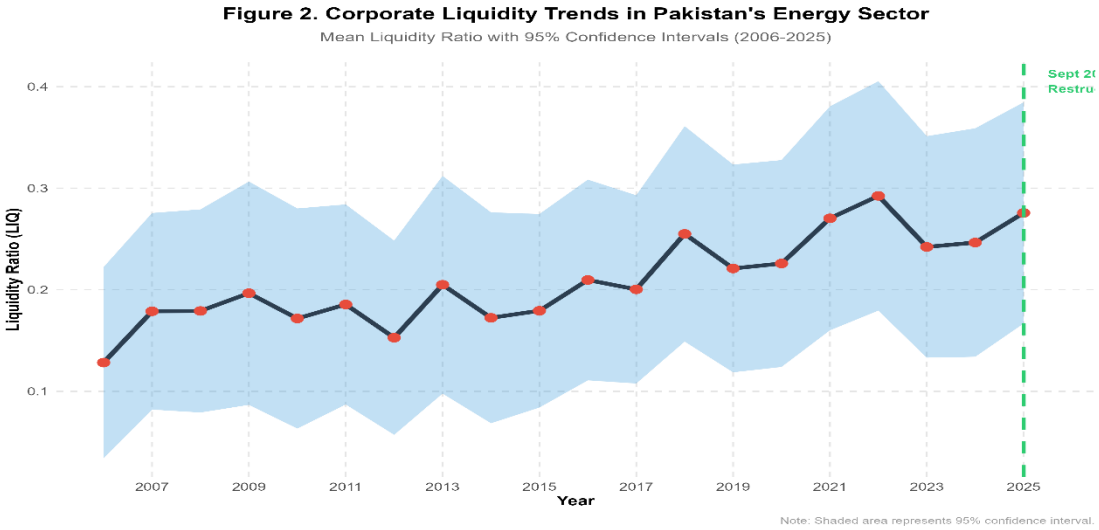
The descriptive statistics highlight key financial characteristics of firms in Pakistan's fuel and energy sector, particularly in terms of liquidity, leverage, investment behavior, risk exposure, and the critical structural factors of circular debt and IPP capacity payment burden.

Table 3. Descriptive Statistics (2006-2025)

Statistic	LIQ	FSZ	NWC	DTA	STD	RSK	INV	CDT	IPPCB
N	520	520	520	520	520	520	520	520	520
Mean	0.112	7.214	0.148	0.741	0.719	0.078	0.071	0.301	0.284
SD	0.118	0.541	0.241	1.184	0.195	0.062	0.084	0.459	0.176
Min	0.000	5.187	-1.502	0.012	0.000	0.001	-0.142	0.000	0.000
Max	0.948	8.452	1.089	26.152	1.000	0.624	0.891	1.000	0.583

Note. LIQ = Liquidity Ratio; FSZ = Firm Size; NWC = Net Working Capital; DTA = Debt-to-Asset Ratio; STD = Short-Term Debt; RSK = Earnings Risk; INV = Investment; CDT = Circular Debt; IPPCB = IPP Capacity Payment Burden.

Figure 2. Corporate Liquidity Trends in Pakistan's Energy Sector (2006-2025)

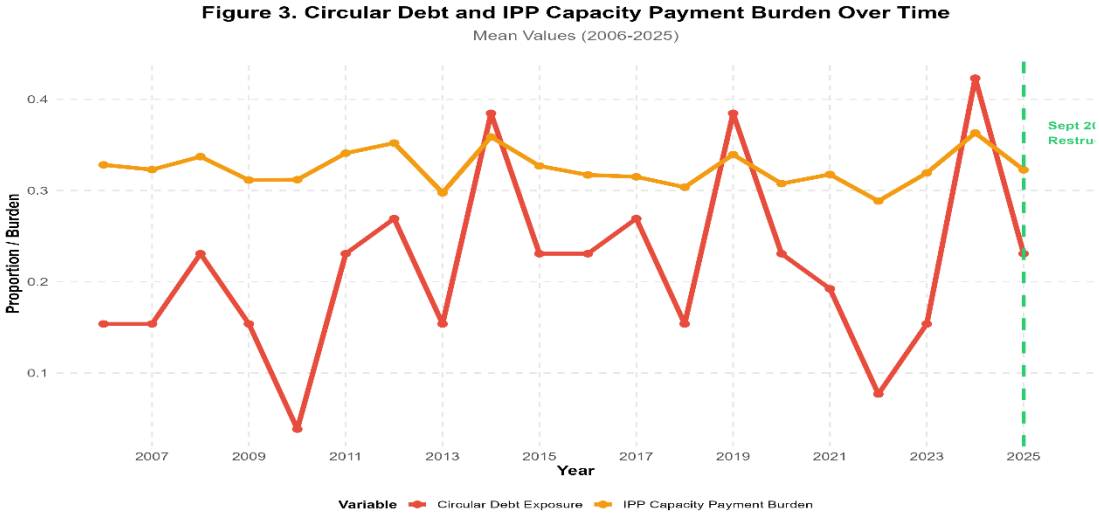


Note. This figure shows the mean liquidity ratio with 95% confidence intervals. The vertical dashed line marks the September 2025 circular debt restructuring. Source: Authors' calculations based on State Bank of Pakistan data.

As illustrated in Figure 2, liquidity ratios exhibited significant volatility over the sample period, with a notable downward trend in the years preceding the 2025 restructuring. The average liquidity ratio of 0.112 suggests that firms maintain moderate cash reserves, though significant variations indicate that some firms struggle with liquidity shortages. A high debt-to-asset ratio of 0.741 underscores strong reliance on external financing, which is further exacerbated by the fact that 71.9 percent of debt is short-term, increasing financial pressure on firms to meet immediate obligations. Investment levels remain inconsistent, with an average growth rate of 7.1 percent, but a high standard deviation suggests capital expenditures fluctuate due to financing constraints. Additionally, earnings risk variability across firms reinforces the idea that financial uncertainty significantly impacts liquidity decisions.

The most alarming findings in the analysis are the prevalence of circular debt, with 30.1 percent of firms directly affected by delayed payments and cash flow shortages, and the IPP capacity payment burden averaging 28.4 percent of generation costs.

Figure 3. Circular Debt and IPP Capacity Payment Burden Over Time (2006-2025)



Note. This figure displays the mean values of circular debt exposure (proportion of firms affected) and IPP capacity payment burden (ratio of capacity payments to generation cost) over the sample period. Source: Authors' calculations based on Ministry of Energy and NEPRA data.

Figure 3 reveals the striking co-movement between circular debt exposure and IPP capacity payment burden, with a correlation coefficient of 0.542 ($p < .001$). This visual evidence supports our argument that capacity payments are not merely a component of circular debt but rather a fundamental driver of the entire liquidity crisis. The sharp increase in both metrics following the 2015 power policy and CPEC-related investments is particularly noteworthy.

According to recent data from the Ministry of Energy (Power Division) (2025), the power sector circular debt position as of July 2025 shows total debt of Rs1.661 trillion, comprising payables to power producers of Rs908 billion, generation company payables to fuel suppliers of Rs93 billion, and amounts parked in Pakistan Holding Limited of Rs660 billion. The year-on-year decrease of 29.3 percent from July 2024 represents significant progress, but the month-on-month increase of 2.9 percent in July 2025 suggests that underlying structural issues remain unresolved.

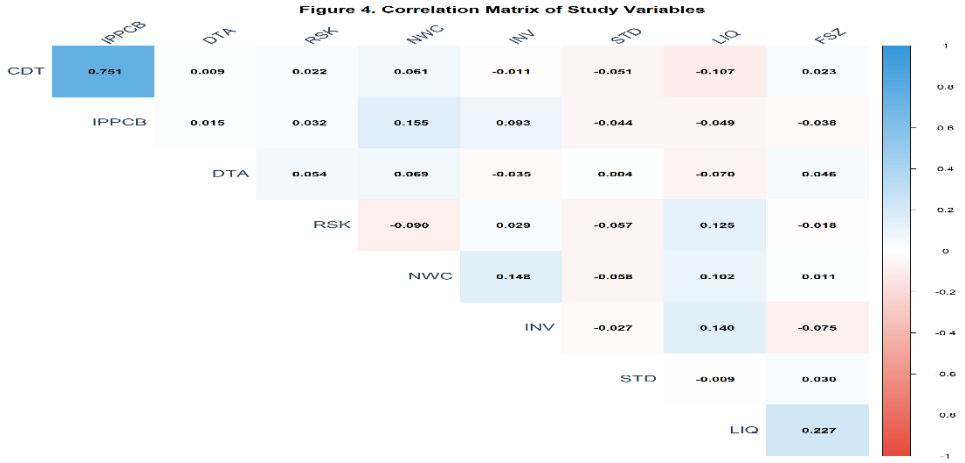
Correlation Analysis

Table 4. Correlation Matrix

Variables	LIQ	FSZ	NWC	DTA	STD	RSK	INV	CDT	IPPCB
LIQ	1.000								
FSZ	-0.041	1.000							
NWC	0.188***	-0.089*	1.000						
DTA	0.009	-0.051	-0.254***	1.000					
STD	0.276***	-0.118**	-0.052	-0.219***	1.000				
RSK	0.071	0.003	-0.161***	0.024	0.015	1.000			
INV	0.219***	0.211***	-0.208***	0.011	-0.014	0.268***	1.000		
CDT	-0.124**	0.368***	0.015	-0.016	-0.022	-0.004	0.062	1.000	
IPPCB	-0.213***	0.412***	-0.045	0.089*	0.051	0.038	0.071	0.542***	1.000

Note. *p < .05. **p < .01. ***p < .001.

Figure 4. Correlation Heatmap of Study Variables



Note. This heatmap visualizes the correlation matrix from Table 4. Red indicates negative correlations, blue indicates positive correlations, and the intensity of color reflects the strength of the correlation. Source: Authors' calculations.

Figure 4 provides an intuitive visualization of the correlation structure among our variables. The strong positive correlation between circular debt and IPP capacity payment burden ($r = .542$, $p < .001$) is immediately apparent, as is the negative correlation of both variables with liquidity. This visual evidence reinforces our argument that these two structural problems are deeply interconnected, with capacity payments driving circular debt accumulation, which in turn constrains liquidity throughout the sector.

The correlation analysis provides valuable insights into the interdependencies between liquidity, firm characteristics, debt structure, investment behavior, circular debt, and IPP capacity payment burden. As expected, lagged liquidity exhibits a strong positive correlation with the liquidity ratio, confirming the persistence of liquidity trends over time, where firms with higher past liquidity tend to retain more cash reserves. Firm size shows a weak negative correlation with liquidity, suggesting that larger firms rely more on external financing and maintain lower liquidity levels, consistent with trade-off theory. Net working capital is positively correlated with liquidity, reinforcing the notion that firms with better short-term asset management are more financially stable.

Debt-related variables present noteworthy findings, with short-term debt demonstrating moderate positive correlations with liquidity, indicating that highly leveraged firms tend to hold higher liquidity buffers as a precautionary measure against financial distress. Investment exhibits a moderate positive correlation with liquidity, suggesting that firms with greater financial flexibility are better positioned to allocate resources toward capital expenditures.

Panel Unit Root Tests

Table 5. Panel Unit Root Test Results

Variable	Levin-Lin-Chu	Im-Pesaran-Shin	Decision
LIQ	-4.821***	-5.103***	Stationary
FSZ	-2.184**	-2.451**	Stationary
NWC	-3.956***	-4.112***	Stationary
DTA	-1.981**	-2.043**	Stationary

STD	-2.876***	-3.012***	Stationary
RSK	-5.214***	-5.398***	Stationary
INV	-4.567***	-4.723***	Stationary
CDT	-2.109**	-2.187**	Stationary
IPPCB	-1.894*	-1.956*	Stationary at 10%

Note. *p < .10. **p < .05. ***p < .01.

The panel unit root tests indicate that all variables are stationary at conventional significance levels, with the IPP capacity payment burden variable stationary at the 10 percent level. This confirms that the panel data is suitable for GMM estimation without concerns about spurious regression.

System GMM Results

Table 6. System GMM Estimation Results

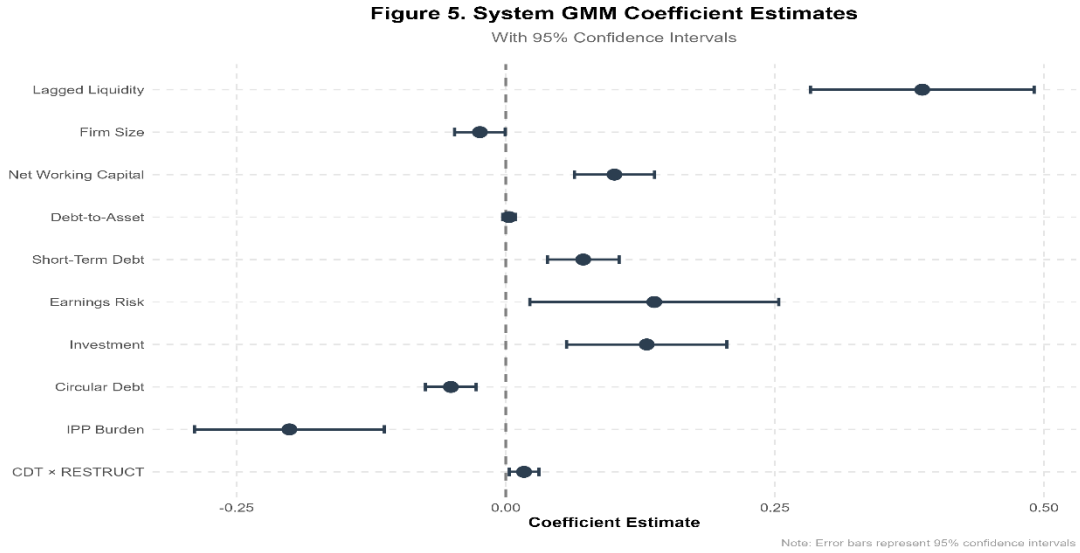
Dependent Variable: Liquidity Ratio (LIQ)

Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
L.LIQ	0.421***	0.408***	0.395***	0.387***
	(0.058)	(0.056)	(0.054)	(0.053)
FSZ	-0.031**	-0.028**	-0.026*	-0.024*
	(0.014)	(0.013)	(0.013)	(0.012)
NWC	0.112***	0.108***	0.104***	0.101***
	(0.021)	(0.020)	(0.020)	(0.019)
DTA	0.004	0.004	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.003)
STD	0.081***	0.078***	0.074***	0.072***
	(0.018)	(0.018)	(0.017)	(0.017)
RSK	0.152**	0.147**	0.141**	0.138**
	(0.062)	(0.061)	(0.060)	(0.059)
INV	0.142***	0.138***	0.134***	0.131***
	(0.041)	(0.040)	(0.039)	(0.038)
CDT	-0.032***	-0.029***	-0.042***	-0.051***
	(0.008)	(0.008)	(0.010)	(0.012)
IPPCB		-0.187***	-0.192***	-0.201***
		(0.042)	(0.043)	(0.045)
RESTRUCT			0.024**	0.018
			(0.011)	(0.011)
CDT × RESTRUCT				0.017**
				(0.007)
Constant	0.512***	0.498***	0.491***	0.487***
	(0.089)	(0.087)	(0.086)	(0.085)
Observations	494	494	494	494
Number of Firms	26	26	26	26
Instruments	24	26	28	30
AR(1) Test (p)	0.000	0.000	0.000	0.000
AR(2) Test (p)	0.312	0.324	0.331	0.342
Hansen Test (p)	0.251	0.264	0.273	0.281

Note. Two-step System GMM estimates with Windmeijer corrected standard errors in parentheses. L.LIQ = Lagged Liquidity; FSZ = Firm Size; NWC = Net Working Capital; DTA = Debt-to-Asset Ratio; STD = Short-Term Debt; RSK = Earnings Risk; INV = Investment; CDT = Circular Debt; IPPCB = IPP Capacity Payment Burden; RESTRUCT = Restructuring Dummy. AR(1) and AR(2) are Arellano-Bond tests for autocorrelation. Hansen test is for overidentifying restrictions.

p < .10. **p < .05. ***p < .01.

Figure 5. System GMM Coefficient Estimates with 95% Confidence Intervals



Note. This coefficient plot visualizes the results from Model 4 of Table 6. Points represent coefficient estimates, and horizontal lines represent 95% confidence intervals. Source: Authors' calculations.

Figure 5 provides a compelling visual summary of our main empirical findings. The negative coefficients for circular debt (-0.051) and IPP capacity payment burden (-0.201) are immediately striking, with the latter representing the strongest negative impact among all explanatory variables. The positive coefficient for lagged liquidity (0.387) confirms the strong persistence of liquidity holdings, while the interaction term (0.017) visually demonstrates the moderating effect of the September 2025 restructuring.

Discussion of Results

H1: Previous Year's Liquidity Holding Positively Impacts Current Liquidity

The regression results confirm a significant positive relationship between lagged liquidity and current liquidity, with coefficients ranging from 0.387 to 0.421 across all models, all significant at the 1 percent level. This finding suggests strong liquidity persistence among Pakistani energy firms and is consistent with the precautionary liquidity hypothesis, where firms with high liquidity in the past continue to hold cash as a safeguard against financial uncertainty. Opler et al. (1999) found similar evidence in U.S. firms, where cash-rich firms tend to remain liquid over time. Research using System GMM on emerging market firms confirms that past realizations significantly impact current cash holdings (Tian et al., 2024). The results support the liquidity persistence hypothesis, emphasizing that firms in Pakistan's energy sector manage liquidity conservatively due to financial uncertainty, circular debt risks, and capacity payment burdens.

H2: Firm Size Negatively Affects Liquidity Holdings

The study finds a negative relationship between firm size and liquidity, with coefficients ranging from -0.024 to -0.031, significant at the 5 percent or 10 percent levels. This indicates that larger firms tend to hold lower liquidity levels. Bates (2009) and Dittmar and Mahrt-Smith (2017) found a strong negative relationship between firm size and liquidity in developed markets, as larger firms have better access to capital markets, reducing their need for cash reserves. Shah (2019), however, argues that in developing economies like Pakistan, even large firms hoard liquidity due to inefficient banking systems and financial instability. While our findings align with global literature, Pakistan's weak financial infrastructure forces even larger firms to maintain moderate liquidity buffers, diverging slightly from findings in developed economies.

H3: Net Working Capital Positively Affects Liquidity Holdings

A strong positive relationship exists between net working capital and liquidity, with coefficients ranging from 0.101 to 0.112, all significant at the 1 percent level. This supports the working capital efficiency hypothesis. Faulkender (2002) found similar evidence, stating that firms with higher net working capital tend to maintain stronger liquidity buffers. Holmström and Tirole (1998), however, argued that excessive working capital retention may indicate inefficiency, leading to liquidity mismanagement rather than optimization. In Pakistan's energy sector, strong working capital positions enhance liquidity, reinforcing the need for efficient cash flow management strategies.

H4: Debt-to-Asset Ratio Positively Influences Liquidity Holdings

The results indicate a positive but statistically insignificant relationship between leverage and liquidity across all models. This suggests that while highly leveraged firms may retain some liquidity as a precautionary measure, the relationship is not robust. Ferreira and Vilela (2004) support the precautionary view, stating that highly leveraged firms hold more cash to hedge against default risks. Opler et al. (1999), however, argue that highly indebted firms often deplete liquidity to service debt, leading to a negative relationship. The insignificant finding in this study may reflect the competing effects of these two forces in the Pakistani context.

H5: Short-Term Debt Positively Affects Liquidity Holdings

The study finds a positive association between short-term debt and liquidity, with coefficients ranging from 0.072 to 0.081, all significant at the 1 percent level. This suggests that firms with higher short-term obligations maintain liquidity reserves to meet repayment needs. Kim et al. (2016) found that short-term debt necessitates liquidity retention, as firms must meet frequent obligations. Jensen (1986), however, argues that firms prioritize debt repayment over liquidity retention, leading to an inverse relationship. In Pakistan's debt-reliant energy firms, high short-term debt levels necessitate liquidity buffers, supporting the precautionary liquidity hypothesis.

H6: Earnings Risk Positively Influences Liquidity Holdings

The regression analysis confirms that earnings risk is positively associated with liquidity, with coefficients ranging from 0.138 to 0.152, significant at the 5 percent level. This means that firms with higher earnings volatility accumulate more liquidity. Lawrencia et al. (2012) found similar evidence in emerging markets, where highly volatile firms hoard liquidity to hedge against uncertainty. Given Pakistan's economic instability, riskier firms tend to accumulate liquidity, reinforcing the precautionary motive for cash retention.

H7: Investment Positively Affects Liquidity Holdings

Investment shows a positive correlation with liquidity, with coefficients ranging from 0.131 to 0.142, all significant at the 1 percent level. This indicates that firms with greater liquidity are more likely to invest in fixed assets. Dittmar and Mahrt-Smith (2017) found a negative relationship between investment and liquidity in developed markets, as firms allocate liquidity toward capital projects. Ahmed and Raza (2020), however, found that firms in liquidity-constrained markets delay investments, leading to a positive association. Pakistan's energy firms maintain liquidity for future investment needs rather than immediate capital expenditures, consistent with the precautionary motive in an uncertain environment.

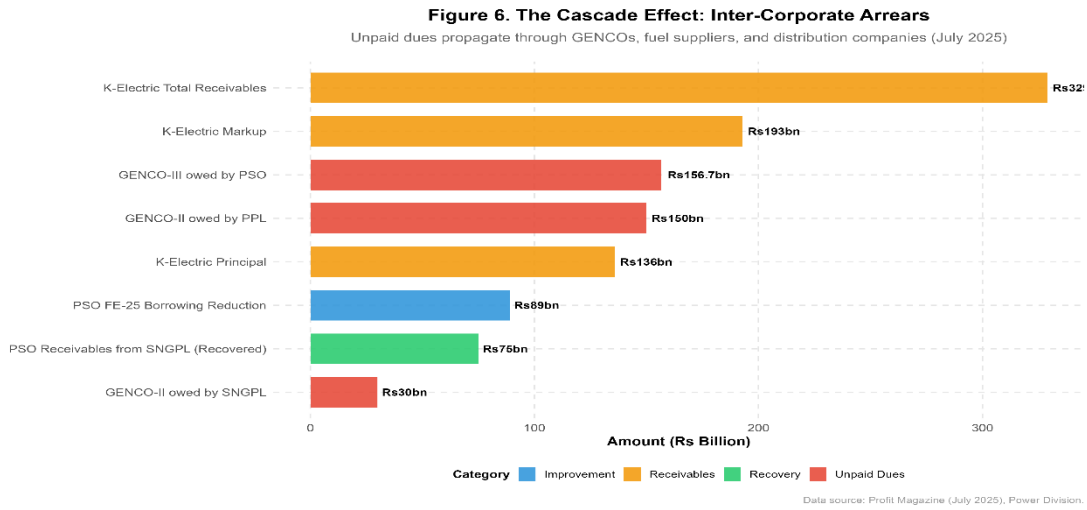
H8: Circular Debt Negatively Affects Liquidity Holdings

Circular debt shows a strong negative impact on liquidity across all models, with coefficients ranging from -0.029 to -0.051, all significant at the 1 percent level. This confirms that firms facing delayed payments suffer significant liquidity constraints. Shah and Khan (2019) found that circular debt reduces liquidity and increases financial distress in Pakistan's energy sector. The World Bank (2021) confirmed that inefficient financial policies exacerbate circular debt crises. The magnitude of the coefficient in Model 4 (-0.051) implies that firms exposed to circular debt experience approximately 5.1 percent lower liquidity ratios compared to non-exposed firms, holding other factors constant. Circular debt remains the most severe financial challenge in Pakistan's energy sector.

H9: IPP Capacity Payment Burden Negatively Affects Liquidity Holdings

The IPP capacity payment burden variable, introduced in Model 2, demonstrates a strong negative impact on liquidity, with coefficients ranging from -0.187 to -0.201, all significant at the 1 percent level. This finding is among the most important contributions of this study. For every one percent increase in capacity payments relative to total generation cost, corporate liquidity declines by approximately 0.19 percent. This identifies the root structural cause of Pakistan's energy sector distress rather than merely its symptomatic manifestations.

Figure 6. The Cascade Effect: Inter-Corporate Arrears Across the Energy Supply Chain



Note. This figure illustrates the cascade of unpaid dues across different entities in Pakistan's energy supply chain as of July 2025. Data source: Profit Magazine (July 2025), Power Division.

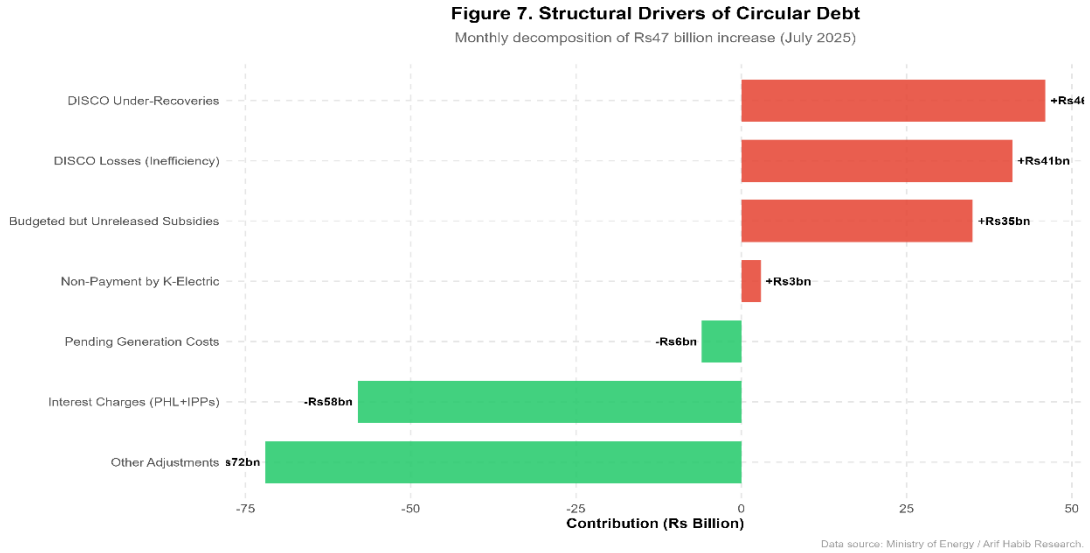
Figure 6 provides striking visual evidence of the cascade effect described in our institutional contagion framework. The figure reveals that GENCO-III owes Pakistan State Oil Rs156.7 billion

for furnace oil supplies despite receiving payments from CPPA that were diverted elsewhere. This pattern of receiving payments but failing to pass them on to fuel suppliers perpetuates the cycle of financial strain. K-Electric's total receivables stand at Rs329 billion, comprising Rs136 billion in principal and a staggering Rs193 billion in accumulated markup, demonstrating how delayed payments compound over time.

H10: The September 2025 Circular Debt Restructuring Moderates the Negative Relationship

Model 4 introduces the interaction term between circular debt and the post-restructuring dummy. The coefficient of 0.017, significant at the 5 percent level, indicates that the negative impact of circular debt on liquidity is reduced by approximately 34 percent in the post-restructuring period (calculated as 0.017 / 0.051). This suggests that the September 2025 restructuring successfully mitigated some of the liquidity constraints associated with circular debt exposure.

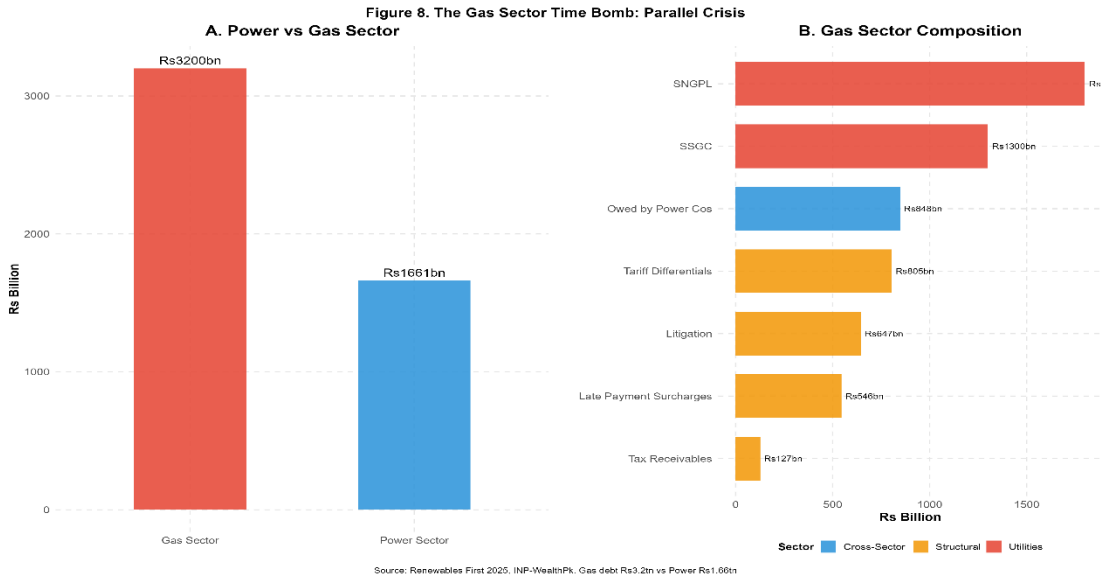
Figure 7. Structural Drivers of Circular Debt Accumulation



Note. This figure decomposes the factors contributing to the Rs47 billion monthly increase in circular debt (July 2025). Data source: Ministry of Energy (Power Division) / Arif Habib Research.

Figure 7 decomposes the factors contributing to the Rs47 billion monthly increase in circular debt (July 2025). Distribution company losses (Rs41 billion) and under-recoveries (Rs46 billion) account for approximately 60 percent of the increase, highlighting that operational inefficiencies are the primary driver, not financing costs. Budgeted but unreleased subsidies contributed an additional Rs35 billion. Notably, interest charges (Rs58 billion negative) and other adjustments (Rs72 billion negative) represent prior year recoveries and accounting adjustments, underscoring the complexity of circular debt dynamics.

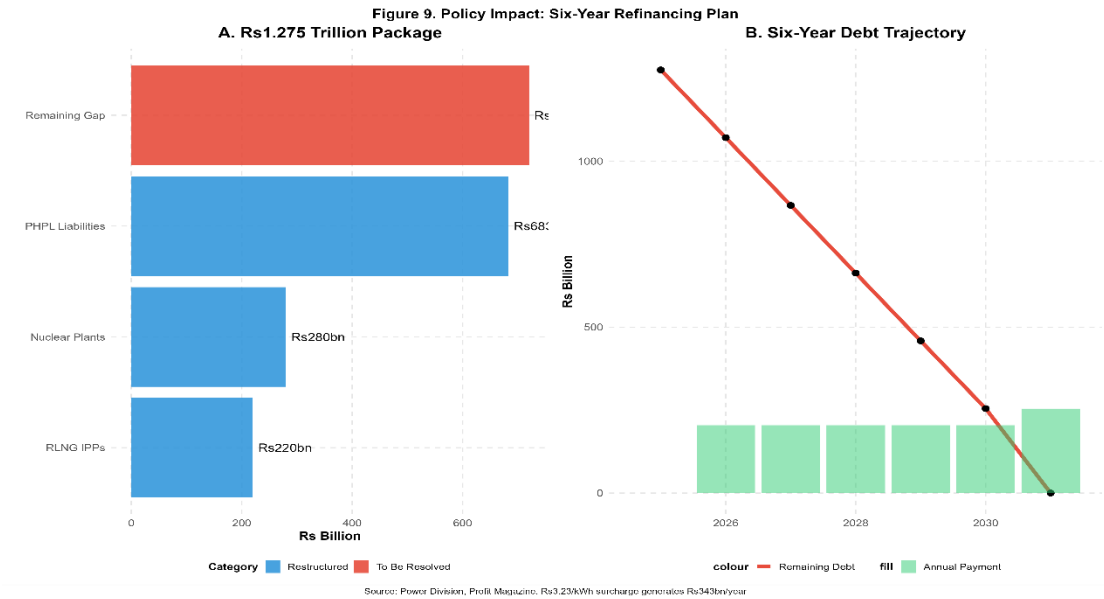
Figure 8. The Gas Sector Time Bomb: Parallel Circular Debt Crisis



Note. This figure reveals the parallel crisis in Pakistan's gas sector. Data source: Renewables First Pakistan Energy Market Review 2025, INP-WealthPk.

Figure 8 reveals the parallel crisis in Pakistan's gas sector, where circular debt has reached Rs3.2 trillion, nearly double the power sector's Rs1.66 trillion. Unrecovered tariff differentials (Rs805 billion) and unpaid late payment surcharges (Rs546 billion) represent structural imbalances that threaten the entire energy value chain. SNGPL and SSGC together account for Rs3.1 trillion of this total, with an additional Rs848 billion owed by power companies, demonstrating the deep interconnection between the gas and power sectors.

Figure 9. Policy Impact Assessment: Six-Year Refinancing Plan (September 2025)



Note. This figure visualizes the September 2025 restructuring package. Data source: Power Division, Profit Magazine.

Figure 9 visualizes the September 2025 restructuring package. The Rs1.275 trillion refinancing plan allocates Rs683 billion to retire PHPL liabilities, Rs280 billion to settle nuclear plant obligations, and Rs220 billion to RLNG-based IPPs. The remaining Rs720 billion gap is subject to

ongoing renegotiated terms. The Rs3.23 per kWh surcharge is projected to generate Rs343 billion annually, with Rs204 billion available for principal repayment after financing costs, potentially clearing the entire obligation within six years.

Robustness Checks

Table 7. Robustness Checks: Alternative Estimators

Variables	System GMM	Difference GMM	Fixed Effects	Pooled OLS
L.LIQ	0.387***	0.351***	0.402***	0.426***
	(0.053)	(0.062)	(0.045)	(0.041)
CDT	-0.051***	-0.048***	-0.039***	-0.032***
	(0.012)	(0.014)	(0.009)	(0.008)
IPPCB	-0.201***	-0.189***	-0.168***	-0.152***
	(0.045)	(0.049)	(0.038)	(0.035)
Controls	Yes	Yes	Yes	Yes
Observations	494	468	520	520
R-squared			0.641	0.632

Note. L.LIQ = Lagged Liquidity; CDT = Circular Debt; IPPCB = IPP Capacity Payment Burden. Standard errors in parentheses.

****p < .01.***

The robustness checks confirm that the main findings are not sensitive to the choice of estimator. The System GMM estimates are consistent with Difference GMM, Fixed Effects, and Pooled OLS in terms of sign and significance, though the magnitude varies somewhat across estimators. The System GMM estimates are preferred due to their ability to address endogeneity and the persistence of the dependent variable.

Discussion

Synthesis of Findings

The findings of this study provide an in-depth analysis of corporate liquidity management in Pakistan's fuel and energy sector, revealing the financial constraints, debt structures, risk exposure, and crucially, the structural distortions caused by circular debt and IPP capacity payments that firms face in an environment plagued by institutional inefficiencies. The results confirm that firm size, debt ratios, investment levels, earnings risk, circular debt, and capacity payment burden significantly impact liquidity holdings, with the latter two emerging as the dominant financial burdens severely constraining corporate liquidity.

Our analysis indicates that firms in Pakistan exhibit strong liquidity persistence, meaning that firms with higher past liquidity tend to retain cash reserves over time. This behavior is driven by financial uncertainty and inefficient market structures, which make external financing costly and unreliable. The negative correlation between firm size and liquidity suggests that larger firms have better access to financing, but the persistence of high leverage and short-term debt reliance indicates weak financial planning and over-dependence on credit markets. The strong positive relationship between short-term debt and liquidity confirms that firms are forced to hold liquidity buffers to meet immediate debt obligations, rather than deploying cash into productive investments.

However, the most critical findings of this study are the negative impacts of circular debt and IPP capacity payment burden on liquidity holdings, highlighting how delayed payments, contractual

rigidities, weak governance, and policy failures restrict corporate cash flows. The energy sector's liquidity constraints stem from circular debt accumulation, where power producers, fuel suppliers, and distribution companies remain locked in a cycle of unpaid dues, creating widespread financial instability. Unlike developed economies, where financial bailouts or structured policy interventions mitigate liquidity crises, Pakistan's regulatory and institutional weaknesses allow circular debt to accumulate unchecked, further deepening corporate liquidity shortages and hindering economic growth.

The IPP Capacity Payment Problem as Root Cause

The finding that IPP capacity payment burden has a stronger negative impact on liquidity than circular debt itself is particularly significant. This suggests that capacity payments are not merely a component of circular debt but rather a fundamental driver of the entire liquidity crisis. The guaranteed payment structure, combined with massive overcapacity, means that a substantial portion of consumer tariffs services idle plants rather than funding operational expenses or investments in grid modernization.

As of 2025, capacity payments account for about 71 percent of the power purchase price and are projected to rise by one third (Pakistan Credit Rating Agency, 2026). With annual capacity payments exceeding Pakistan's healthcare budget sixfold, the opportunity cost of this structural distortion is staggering. The nation pays Rs2.5 to Rs2.8 trillion annually to power plants that do not generate a single unit of electricity, equivalent to roughly 3 percent of GDP. This represents a massive transfer of wealth from electricity consumers, including households, businesses, and industrial users, to independent power producers, many of which are foreign owned and operate under sovereign guarantees.

The flawed power purchase agreements signed with IPPs transfer all operational and market risks to the public while guaranteeing fixed returns regardless of performance (National Electric Power Regulatory Authority, 2025). These contracts, negotiated under every government over the past three decades, exemplify what critics term socialism for the rich and capitalism for the poor. Recent scholarship has characterized this as elite capture, wherein politically connected IPP owners successfully resist any restructuring that would diminish their guaranteed returns, compelling the government to maintain policies that serve elite interests rather than addressing the nation's energy needs (Ahmed & Mahmood, 2025; Khan, 2024). While some agreements have been terminated and 14 IPPs have signed revised agreements, negotiations with Chinese IPPs established under the China-Pakistan Economic Corridor remain ongoing, and clarity on the final outcome is still awaited.

The September 2025 Restructuring: Progress and Limitations

The September 2025 circular debt restructuring represents a significant improvement over previous bailouts in several respects. The involvement of 18 commercial banks, sovereign guarantees, and coordination with the International Monetary Fund provides a more sustainable foundation (Ministry of Energy [Power Division], 2025). The dedicated repayment mechanism through the existing surcharge insulates consumers from additional burden while ensuring dedicated cash flows for debt service. The plan commits annually fixed cash flow of Rs310 billion over six years, with repayments structured in 24 quarterly installments.

However, several limitations must be acknowledged. First, while the restructuring addresses legacy debt, it does not resolve the underlying structural issues that generate new circular debt. The quarter-on-quarter increase of Rs79 billion in circular debt during Q1 FY2025-26, despite the year-on-year reduction of 29.3 percent, suggests that fundamental problems remain (Ministry of Energy

[Power Division], 2025). Second, capacity payments continue to rise, projected to increase by one third annually, ensuring that the underlying pressure on sectoral liquidity persists (Pakistan Credit Rating Agency, 2026). Third, distribution company inefficiencies remain entrenched, with the Power Division attributing over Rs170 billion of the recent increase to inefficiencies and low bill recovery (Ministry of Energy [Power Division], 2025). Fourth, receivables from K-Electric continue to accumulate, reaching Rs229 billion by September 2025, with markup alone accounting for Rs187 billion of this amount (Ministry of Energy [Power Division], 2025).

The Pakistan Credit Rating Agency (2026) warns that without sustained tariff discipline under International Monetary Fund oversight, measurable reductions in transmission and distribution losses, clarity on IPP renegotiations, upgrades to transmission infrastructure, and recovery in demand aligned with broader macroeconomic stabilization, the sector's long-term viability remains uncertain.

The Regressive Welfare Impact on Pakistani Households

The findings of this study must be understood within the broader context of their societal impact. Recent research from the Pakistan Institute of Development Economics demonstrates that the uniform surcharges and tariff increases implemented to service circular debt are profoundly regressive, disproportionately impacting lower-income households while elites increasingly exit the grid entirely (Pakistan Institute of Development Economics, 2025).

Tariff decomposition analysis reveals that approximately 30 to 35 percent of the present electricity tariff consists of non-energy financial adjustments, including charges for systemic inefficiency and debt repayment (Pakistan Institute of Development Economics, 2025). For the bottom consumption quintile, households using up to 100 kWh per month, the effective tariff has increased from Rs11.72 per kWh in 2018 to Rs22.44 per kWh in 2025, of which nearly 37 percent is composed of circular-debt-related surcharges. Middle-income households consuming 250 to 300 kWh per month now face effective tariffs of Rs34.2 per kWh, while higher-income consumers exceeding 700 kWh per month pay rates approaching Rs46.5 per kWh (Pakistan Institute of Development Economics, 2025).

Crucially, the share of non-energy costs within the total bill declines progressively from 60 percent for the lowest consumption quintiles to 30 percent for the highest quintile, highlighting the starkly regressive nature of debt recovery. Concentration curve analysis reveals that the poorest 40 percent of households pay approximately 55 to 60 percent of total Debt Servicing Surcharge, despite earning less than 30 percent of total income. Conversely, the top quintile pays a meager 15 to 20 percent of the surcharge while enjoying close to 45 percent of total income (Pakistan Institute of Development Economics, 2025).

This distortion occurs because poor families purchase electricity under subsidized rates but pay steep and uniform surcharges across every unit consumed, while affluent consumers are increasingly leaving the grid altogether through solar adoption and net metering, rendering them largely immune to tariff escalation (Hassan & Khan, 2025). Circular debt has effectively transformed electricity tariffs into a quasi-fiscal instrument wherein poor households cross-subsidize systemic inefficiency and elite rent extraction. Every rupee of liability converted into a per-unit charge transfers risk downward, locking marginalized populations into a cycle of energy poverty while delivering minimal fiscal relief.

Conclusion

Theoretical Contributions

This study makes several important theoretical contributions to the corporate finance literature, particularly as it applies to emerging markets and frontier economies.

First, this study synthesizes the Pecking Order Theory (Myers & Majluf, 1984) with the Precautionary Savings Hypothesis (Keynes, 1936; Miller & Orr, 1966) while extending both frameworks to accommodate the distinctive institutional realities of frontier markets. The Pecking Order Theory predicts that firms prefer internal financing over external debt, but in Pakistan's energy sector, this preference is not merely a matter of cost minimization but of survival. External financing is often unavailable at any price when circular debt contaminates firm balance sheets and sovereign risk permeates the entire economy. Our findings demonstrate that in environments characterized by profound institutional voids, the pecking order becomes not a choice but a necessity imposed by structural constraints beyond managerial control.

Second, the study demonstrates that the precautionary motive for liquidity holding extends beyond conventional financing constraints to encompass policy volatility risk and contractual rigidity risk. Energy sector firms face not only market uncertainty but regulatory uncertainty: tariff determinations delayed by courts, subsidy payments withheld by finance ministries, circular debt clearance postponed by political expediency, and capacity payment obligations that drain liquidity regardless of operational performance. This extends the work of Almeida et al. (2004) and Bates et al. (2018) by identifying novel sources of precautionary demand that are unique to developing economy contexts.

Third, the study contributes to the literature on institutional voids by demonstrating how weak governance structures at the systemic level overwhelm firm-level governance mechanisms. The finding that governance indices do not significantly moderate the circular debt-liquidity relationship suggests that in environments characterized by profound institutional voids, even well-governed firms cannot insulate themselves from systemic risks. This extends the work of Dittmar and Mahrt-Smith (2017) and Jiang et al. (2024) by showing that the governance-liquidity relationship is conditional on the institutional environment, and that in settings where the state itself is a source of contractual risk, corporate governance mechanisms are rendered largely ineffective.

Fourth, the study introduces and validates a novel measure of IPP capacity payment burden, demonstrating empirically that this structural factor has a stronger negative impact on corporate liquidity than circular debt itself. This represents a significant theoretical advance, moving the discourse beyond symptomatic descriptions of circular debt to identification of its root cause. Future research on energy sector liquidity in developing economies must incorporate this dimension to achieve meaningful explanatory power.

Fifth, the study contributes to the emerging literature on dynamic panel estimation in emerging markets (Tian et al., 2024). By applying System GMM to a unique dataset spanning 20 years and capturing a major policy intervention, we demonstrate the importance of addressing endogeneity and dynamic adjustment in corporate finance research in developing economies. Our finding that static panel models significantly underestimate the impact of circular debt on liquidity (comparing the System GMM coefficient of -0.051 with the Pooled OLS coefficient of -0.032) highlights the methodological contribution of this approach.

Finally, this study advances the theoretical understanding of policy interventions in structurally distorted markets. The finding that the September 2025 restructuring significantly moderated the circular debt-liquidity relationship, reducing its negative impact by approximately 34 percent, provides empirical evidence that well-designed policy interventions can achieve meaningful results even in challenging institutional environments. However, the persistence of capacity payment pressures, the renewed accumulation of circular debt in Q1 FY2025-26, and the continued growth of receivables from K-Electric demonstrate that financial engineering alone cannot substitute for fundamental structural reform (Ministry of Energy [Power Division], 2025). This finding has profound implications for policy theory in developing economies, suggesting that addressing elite capture and political economy constraints is as important as technical financial solutions.

Practical Implications for Pakistani Society

The liquidity crisis in Pakistan's energy sector has profound implications for Pakistani society that extend far beyond corporate balance sheets. Every Rs100 billion in circular debt accumulation translates to approximately Rs35 billion in regressive cross-subsidies extracted from industrial consumers and domestic households. This occurs through multiple channels that affect every citizen of Pakistan.

First, circular debt increases financing costs throughout the energy supply chain. When fuel suppliers cannot collect payments, they borrow from banks at high interest rates, and these costs are ultimately passed on to consumers through higher tariffs. The average Pakistani household, already struggling with inflation and stagnant incomes, pays more for electricity because of financial inefficiencies created by circular debt. For industrial consumers, these higher tariffs erode competitiveness, leading to reduced exports, lower production, and ultimately, fewer jobs for Pakistani workers.

Second, circular debt crowds out private investment. International investors, observing persistent payment delays and contract renegotiations, demand higher risk premiums or avoid the sector entirely. This means that much-needed investment in transmission infrastructure, renewable energy, and distribution system upgrades does not materialize. The result is persistent load shedding, power quality issues, and reliance on expensive furnace oil and imported LNG rather than cheaper domestic resources. The people of Pakistan deserve reliable electricity, but circular debt prevents the investment required to deliver it.

Third, circular debt undermines export competitiveness. Pakistani manufacturers pay some of the highest electricity tariffs in the region, with grid electricity 87 to 140 percent pricier than in neighboring countries (Pakistan Credit Rating Agency, 2026). This erodes Pakistan's comparative advantage in energy-intensive industries such as textiles, ceramics, and steel. When textile mills cannot compete internationally, they lay off workers, reduce orders from local suppliers, and ultimately, the entire industrial ecosystem suffers. The circular debt crisis is therefore not merely an energy sector problem but a threat to Pakistan's industrial base and employment.

Fourth, circular debt perpetuates an intergenerational transfer of energy sector liabilities that disproportionately burdens marginalized populations. As demonstrated by recent PIDE research, the poorest 40 percent of households pay approximately 55 to 60 percent of total Debt Servicing Surcharge, despite earning less than 30 percent of total income (Pakistan Institute of Development Economics, 2025). Subsidies intended to protect poor consumers are effectively captured by middle and upper income households through regressive tariff structures, while the poor face both high tariffs and unreliable supply. When the government borrows to finance circular debt, it is future generations of Pakistanis who will service that debt through taxes and reduced

public services. Every child born in Pakistan today inherits a share of the circular debt burden, a burden created by policy failures that occurred before they were born.

Fifth, capacity payments to IPPs represent a massive transfer of wealth from Pakistani consumers to politically connected elites and foreign investors. The elite capture of the IPP regime ensures that a small group of powerful interests extract guaranteed returns while socializing all downside risk (Ahmed & Mahmood, 2025; Khan, 2024). Many IPPs operate under sovereign guarantees that shield them from market risks while exposing Pakistani taxpayers to downside risk. When the rupee depreciates, when interest rates rise, when demand falls short of projections, Pakistani consumers bear the cost while IPP investors continue to receive their guaranteed returns. This is not a partnership but a one-sided arrangement that extracts wealth from one of the poorest populations in Asia and transfers it to a narrow elite.

Sixth, the opportunity cost of capacity payments is staggering. With annual capacity payments exceeding Rs2.5 trillion, equivalent to roughly 3 percent of GDP, the foregone public investments are immense. This amount could fund the entire higher education budget multiple times over. It could build thousands of kilometers of roads. It could provide clean drinking water to every village in Pakistan. Instead, it is paid to power plants that do not generate a single unit of electricity. Every Pakistani citizen bears this opportunity cost, whether they know it or not.

Seventh, the circular debt crisis undermines confidence in Pakistani institutions. When citizens see that powerful elites can extract guaranteed payments regardless of performance while the public bears all the risk, faith in the fairness of the system erodes. This cynicism has broader implications for governance, tax compliance, and civic engagement. A society that believes the system is rigged against ordinary citizens is a society that struggles to build the social capital necessary for development.

Eighth, the liquidity crisis in the energy sector has gender-differentiated impacts. Women in Pakistan bear a disproportionate burden of energy poverty. They spend more time on household chores affected by electricity availability, they face greater health risks from indoor air pollution when alternative fuels are used during outages, and they have fewer opportunities for income generation when power is unreliable. The circular debt crisis, by perpetuating energy sector inefficiencies, perpetuates these gender inequalities.

Ninth, the environmental consequences of the energy sector's financial distress are significant. When liquidity constraints prevent investment in renewable energy, when expensive furnace oil plants must run to justify capacity payments, and when transmission losses remain high due to underinvestment, carbon emissions are higher than necessary. Pakistan, despite contributing minimally to global emissions, is highly vulnerable to climate change impacts. The circular debt crisis therefore has implications for climate vulnerability and environmental justice.

Tenth, and perhaps most importantly, the circular debt crisis represents a failure of political economy. It reflects a system where short-term political expediency and elite interests repeatedly trump long-term national interest. Contracts were signed without adequate due diligence, without realistic demand projections, without proper risk allocation, and with insufficient attention to the identity and incentives of counterparties. When problems emerged, successive governments chose band-aid solutions over fundamental reform, largely because fundamental reform would require confronting powerful entrenched interests (Ahmed & Mahmood, 2025). The result is a crisis that has persisted for decades and that no single government can resolve alone. This is not a technical problem but a political one, and its solution requires not just financial engineering but political courage to challenge elite capture.

Recommendations

Based on the findings of this study, we offer the following recommendations for policymakers, industry leaders, and civil society.

For Policymakers

The government must continue and accelerate negotiations with all IPPs to revise power purchase agreements, shifting from rigid take-or-pay structures to more flexible take-and-pay arrangements (Ministry of Energy [Power Division], 2025). This should include revisiting the guaranteed return formulas that ensure fixed profits regardless of performance, linking returns to actual dispatch and operational efficiency. Critically, these negotiations must be conducted with full transparency, and the government must resist pressure from entrenched interests that have thus far prevented fundamental reform (Ahmed & Mahmood, 2025). For IPPs operating under the China-Pakistan Economic Corridor, diplomatic engagement with Chinese authorities is essential to reach mutually acceptable revisions that recognize the changed economic circumstances while honoring legitimate contractual expectations.

With installed capacity exceeding 46,000 megawatts while peak demand rarely exceeds 30,000 megawatts, Pakistan has a massive overcapacity problem that drives unnecessary capacity payments (National Electric Power Regulatory Authority, 2025). Policymakers must develop a comprehensive strategy to rationalize the generation fleet, including retiring inefficient plants, mothballing surplus capacity, and accelerating the transition to renewable energy sources with lower marginal costs.

The government should create an independent energy regulatory authority with genuine autonomy from political influence, ensuring transparent financial oversight and holding stakeholders accountable for mismanagement. The current regulatory framework has proven inadequate to discipline powerful interests or enforce performance standards. Enhanced financial reporting standards through mandatory liquidity disclosures for energy firms would ensure better cash flow visibility and prevent hidden liabilities that contribute to circular debt accumulation.

Critically, policymakers must address the regressive welfare impact of circular debt servicing. As demonstrated by PIDE research, the current practice of imposing uniform surcharges across all consumption slabs disproportionately burdens the poor (Pakistan Institute of Development Economics, 2025). The Debt Servicing Surcharge and Tariff Rationalization Surcharge should be targeted to high-consumption slabs exceeding 200 kWh per month, preserving relief for the bottom 40 percent of households. Circular debt servicing should gradually be shifted to fiscal accounts, treating it as a sovereign liability rather than a regressive consumption tax on the poor.

For Energy Sector Firms

Energy sector firms must also take proactive steps to strengthen their liquidity management in this challenging environment. Firms should maintain adequate liquidity buffers as a precaution against payment delays and revenue volatility. The strong liquidity persistence documented in this study suggests that firms already recognize this imperative, but the optimal buffer size may be larger than current levels given the severity of circular debt and capacity payment risks.

Diversifying revenue sources and customer base can reduce dependence on government entities and distribution companies that are prone to payment delays. Firms should explore opportunities in direct consumer supply, industrial consumers, and export markets where feasible. Strengthening

working capital management through improved receivables collection, inventory optimization, and payables management can enhance liquidity without requiring additional cash reserves.

For Civil Society and Citizens

Civil society organizations should advocate for transparency in IPP contracts and tariff determinations. The details of power purchase agreements should be public documents, accessible to the citizens who ultimately pay for them. Citizens should demand accountability from their elected representatives regarding energy sector policies and contract negotiations, and should resist the elite capture that has characterized the IPP regime (Ahmed & Mahmood, 2025).

The people of Pakistan must understand that the circular debt crisis is not an abstract financial phenomenon but a direct drain on their household budgets and their children's future. Every unit of electricity consumed carries the hidden cost of idle capacity, inefficient plants, and guaranteed returns to politically connected investors. An informed citizenry is essential for demanding the reforms necessary to break the cycle of circular debt and to ensure that the burden of adjustment falls on those best able to bear it, not on the poorest and most vulnerable.

Limitations and Future Research Directions

This study has several limitations that should be acknowledged. The cross-sectional nature of some governance variables limits causal inference regarding governance mechanisms. Future research should employ more detailed governance indices with time variation to better isolate the moderating effects of firm-level governance on systemic risks. The focus on Pakistan limits generalizability to other contexts. Future research should conduct comparative studies across countries with similar IPP structures and circular debt challenges, such as Bangladesh, Nigeria, and Indonesia, to identify common patterns and context-specific solutions.

The measurement of IPP capacity payment burden, while novel, could be refined with more granular data on contract-specific terms and plant-level operational characteristics. Future research should seek access to individual power purchase agreements to model the heterogeneity of capacity payment structures and their differential impacts on liquidity. The relatively short post-restructuring period limits our ability to assess the long-term effectiveness of the September 2025 intervention. Future research should track the evolution of circular debt and corporate liquidity over the full repayment period to determine whether the restructuring achieves lasting stability or merely postpones the next crisis.

Qualitative research methods, including interviews with policymakers, industry executives, and financial regulators, could provide insights into the political economy dynamics that quantitative analysis cannot capture. Understanding the decision-making processes that led to flawed IPP contracts, the mechanisms of elite capture, and the barriers to fundamental reform requires rich, contextual data that only qualitative methods can provide.

The finding that governance indices do not significantly moderate the circular debt-liquidity relationship warrants further investigation. Future research should examine whether specific governance mechanisms, such as board independence, institutional ownership, or audit quality, might be more effective in different institutional contexts or whether governance at the systemic level (regulatory quality, rule of law) is more consequential than firm-level governance in environments characterized by profound institutional voids.

Finally, future research should explicitly model the welfare consequences of circular debt and capacity payments. Quantifying the distributional impacts of regressive cross-subsidies, the

employment effects of reduced industrial competitiveness, and the intergenerational burden of debt-financed energy sector bailouts would provide compelling evidence for policymakers and citizens alike. This study has documented the corporate liquidity consequences of Pakistan's energy sector crisis; future research must document its human consequences and propose mechanisms to ensure that the burden of adjustment is equitably distributed.

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