

# Working Capital Pressures and Input Tax Credit Delays Under Gst: Evidence from Small and Medium Enterprises in Bengaluru's Industrial Clusters

Kavitha M

Research Scholar, School of Commerce, Presidency University, Bengaluru

Dr. D Vijayasree

Assistant Professor, School of Commerce, Presidency University, Bengaluru

## Abstract:

### Purpose:

This study examines the magnitude and determinants of Input Tax Credit (ITC) refund delays under India's Goods and Services Tax (GST) regime and analyses their impact on the working capital dynamics of manufacturing Small and Medium Enterprises (SMEs) in Bengaluru's major industrial clusters.

### Design:

A mixed-methods approach was adopted using primary survey data from 328 manufacturing SMEs across Peenya Industrial Estate, Electronic City Phase II, Bommanahalli–Hebbagodi manufacturing belt and Doddaballapur Industrial Area. The study combines structured questionnaires and qualitative interviews and applies panel-corrected ordinary least squares (OLS), instrumental variable two-stage least squares (IV-2SLS), quantile regression and bootstrapped mediation analysis to evaluate the relationship between ITC delays and firm-level financial outcomes.

### Findings:

Blocked ITC accounts for an average of 21.4% of total current assets among sampled SMEs, extending the cash conversion cycle by about 38 days ( $p < 0.001$ ). Micro-enterprises experience higher blockage ratios (25.8%), while export-oriented garment and electronics firms face additional delays due to zero-rated supply refund processes. ITC delays significantly increase reliance on informal finance (3.44 percentage points per month of delay) and reduce capital expenditure by 0.41 percentage points per month, with informal credit substitution partially mediating the investment decline.

### Research limitations/implications:

The study is limited to manufacturing SMEs within selected Bengaluru clusters; however, the findings contribute to the literature on tax administration efficiency and SME finance in emerging economies.

### Practical implications:

Strengthening refund timelines, digital compliance infrastructure and ITC guarantee mechanisms can reduce working capital constraints faced by SMEs.

### Originality:

The study provides firm-level empirical evidence linking ITC refund delays to working capital stress, financing behaviour and investment decisions among manufacturing SMEs under India's GST framework.

**Keywords:** Input Tax Credit; Working Capital; SMEs; Cash Conversion Cycle; Tax Compliance Costs

## INTRODUCTION:

India's transition to the Goods and Services Tax (GST) on 1 July 2017 eliminated seventeen overlapping central and state levies through a unified, destination-based system, with the Input Tax Credit (ITC) mechanism serving as its structural guarantee that taxation falls only on final consumption (Kumar, 2019; Agarwal & Chakrabarti, 2020). In practice, ITC realisation has proved deeply problematic for Small and Medium Enterprises (SMEs).

Delays arise from invoice-matching failures in the GST Network (GSTN), buyer non-compliance under Section 16(2) of the CGST Act, GSTR-2A/GSTR-3B reconciliation discrepancies, and structurally onerous zero-rated supply refund processes (Doshi & Shah, 2021; FICCI, 2022). Each fault-line transforms the tax system into an involuntary, interest-free loan from the SME to the government or a better-capitalised supply chain counterparty, eroding daily operational liquidity.

Bengaluru's manufacturing SME ecosystem — spanning garments, machine tools, auto components, electronics, and light engineering across the Peenya Industrial Estate, Electronic City Phase II, Bommanahalli-Hebbagodi belt, and Doddaballapur Industrial Area — is structurally complex within the GST architecture. As intermediate suppliers to large OEM buyers in aerospace, defence, and automotive sectors that frequently file GSTR-1 with delays, these SMEs face the 'buyer compliance trap' (Mukherjee, 2018). Garment and electronics exporters face additional delays under zero-rated supply refund processes. ITC blockage inflates the cash conversion cycle (CCC) — the aggregate of days sales outstanding (DSO), days inventory outstanding (DIO), and days payable outstanding (DPO) — transforming a government receivable into an involuntary working capital drain (Deloof, 2003; Baños-Caballero, García-Teruel & Martínez-Solano, 2014; Aktas, Croci & Petmezaz, 2015).

This paper addresses the gap through a mixed-methods study of 328 manufacturing SMEs across Bengaluru's principal clusters, pursuing three questions: (1) What is the magnitude of ITC blockage as a proportion of working capital, and how does it vary by sub-sector and firm size? (2) What firm-level, transactional, and supply-chain characteristics determine ITC delay severity? (3) How do ITC delays propagate into working capital management, informal borrowing, and capital investment?

## **LITERATURE REVIEW**

### **2.1 Working Capital Management and SME Finance**

The relationship between working capital efficiency and firm profitability is among the most consistently replicated findings in empirical finance (Deloof, 2003; Baños-Caballero et al., 2014; Aktas et al., 2015). Berger and Udell (1998) establish that small firms face the highest external finance premium due to informational opacity; Beck, Demirgüç-Kunt and Maksimovic (2005) confirm internal cash flows as the binding investment constraint for SMEs. Prasad and Sensarma (2011) document pre-GST CCC benchmarks of 89–95 days for Indian manufacturing SMEs, a baseline substantially exceeded in post-GST assessments. Trade credit — the dominant marginal source of SME working capital finance in developing economies — is provided by creditors exploiting information advantages over banks (Petersen & Rajan, 1997; Cuñat, 2007; Giannetti, Burkart & Ellingsen, 2011). ITC delays create bidirectional trade credit stress: ITC-constrained SMEs extend payables upstream while suppliers tighten credit terms downstream. Love, Preve and Sarria-Allende (2007) document this shock transmission in crises; Dass, Kale and Nanda (2015) confirm that strong supply chain relationships provide partial insulation. Ayyagari, Demirgüç-Kunt and Maksimovic (2010) document persistent informal finance recourse by Indian SMEs when formal credit is inaccessible, establishing the backdrop against which ITC-driven informal credit demand must be assessed.

The working capital-performance nexus is further mediated by the cash conversion cycle (CCC), operationalised by Richards and Laughlin (1980) as the net duration of the operating cycle adjusted for trade payables. For manufacturing SMEs, CCC integrates inventory holding periods, buyer credit terms, and supplier payment terms. ITC blockage disrupts each component: it inflates current assets by embedding an illiquid government receivable, compresses cash available for payables settlement, and raises the cost of informal credit substitutes. This multi-channel disruption implies that ITC blockage's CCC impact is structurally compounding — not merely additive — particularly for micro-enterprises whose thin liquidity buffers leave no margin for absorption. Beck, Demirgüç-Kunt and Maksimovic (2005) demonstrate that financing constraints most severely affect small firms in developing economies, where formal credit markets are incomplete and informational asymmetries pronounced; ITC blockage intensifies this constraint by converting a proportion of operating assets into a non-earning, illiquid claim on the government.

## 2.2 Tax Compliance Costs, ITC Delays, and Industrial Clusters

Sandford, Godwin and Hardwick (1989) taxonomise compliance costs as monetary, time, and psychological burdens. Evans (2003) and Coolidge (2012) establish their regressive incidence: compliance costs consume 3–6% of turnover for micro-enterprises versus under 1% for large firms. In India's GST context, Rao (2019) critiques the original invoice-matching architecture as generating irresolvable reconciliation complexity; Mukherjee (2018) documents that informal inter-firm credit structures in manufacturing clusters are structurally incompatible with GST's digitised compliance requirements; Doshi and Shah (2021) report export SME refund processing times of 6–18 months. Keen and Lockwood (2010) show that VAT systems generate compliance trade-offs when ITC mechanisms are poorly administered; Ebrill, Keen, Bodin and Summers (2001) emphasise that ITC chain integrity depends on administrative capacity across the compliance spectrum — a condition violated in Bengaluru's heterogeneous industrial landscape. Hallward-Driemeier and Pritchett (2015) observe that complex regulatory environments generate endogenous informality as rational firm responses — directly applicable to compliance-avoidance behaviours among Bengaluru SMEs. Industrial cluster theory (Schmitz, 1995; Caniëls & Romijn, 2003) explains how individual ITC shocks propagate systemically: a hub buyer's non-compliance triggers mismatches for multiple suppliers, amplifying cluster-level liquidity stress far beyond the bilateral shock sum.

### THEORITICAL FRAMEWORK AND HYPOTHESIS

The analysis integrates three theoretical perspectives. Working capital theory (Gitman, 1974; Richards & Laughlin, 1980) conceptualises ITC blockage as an involuntary augmentation of days sales outstanding — a government receivable generating no interim returns and not readily monetised, mechanically extending the CCC. Pecking order theory (Myers, 1984; Myers & Majluf, 1984) predicts that ITC-induced constraints on internal finance push SMEs toward external debt, collapsing — for those with limited formal credit access (RBI, 2021) — to a choice between costly informal credit and investment suppression (Fazzari, Hubbard & Petersen, 1988; Carpenter & Petersen, 2002). Institutional theory (North, 1990; DiMaggio & Powell, 1983) contextualises ITC delays as institutional misalignment: the GST architecture was designed for large, digitally sophisticated taxpayers, ill-suited to Bengaluru's cluster-based SME transactional norms.

These theoretical foundations generate six hypotheses. Figure 1 (not reproduced) depicts the hypothesised causal chain: firm-level characteristics (size, digital capability, buyer compliance, export orientation) → ITC blockage magnitude and duration → CCC elongation → financing shift toward informal credit → investment suppression, with trade credit dynamics mediating the investment linkage.

**H1:** *ITC blockage (as a proportion of current assets) will be significantly and positively associated with CCC elongation among Bengaluru manufacturing SMEs.*

**H2:** *Smaller firm size will be positively associated with greater ITC delay duration, reflecting lower compliance capacity and weaker buyer bargaining power.*

**H3:** *The proportion of sales to GST-non-compliant buyers (GSTR-2A mismatches) will be positively associated with ITC delay severity for the selling firm.*

**H4:** *ITC delays will be positively associated with informal credit reliance and negatively associated with capital investment, consistent with pecking order predictions under financial constraint.*

**H5:** *Export-oriented SMEs will experience more severe ITC delays than domestic-market firms due to the additional complexity of zero-rated supply refund processing.*

**H6:** *Higher digital compliance capability will be negatively associated with both ITC blockage ratio and CCC, reflecting efficiency gains from e-invoicing and automated reconciliation.*

### RESEARCH DESIGN AND METHODOLOGY

#### 4.1 Setting and Sample

The study setting spans four Bengaluru manufacturing clusters: (i) Peenya Industrial Estate (30,000+ units; machine tools, auto components, electronics); (ii) Bommanahalli-Hebbagodi belt (1,200+ garment/apparel units);

(iii) Electronic City Phase II (PCB, electronics assembly, defence components); and (iv) Doddaballapur Industrial Area (2,800+ light engineering units) (KIADB, 2022; KASSIA, 2022). The sampling frame of 6,840 active GST-registered manufacturing SMEs (INR 40 lakh – INR 250 crore turnover) was drawn from KIADB and KASSIA registries. A stratified random sample was drawn across firm-size (micro/small/medium) and cluster strata, with deliberate oversampling of export-oriented sub-sectors. Using Cochran's formula at 95% confidence and 5% margin of error, a minimum n of 298 was indicated. Of 420 questionnaires administered by trained research associates between September 2022 and March 2023, 92 were excluded for missing data or implausible figures, yielding a final analytical sample of 328 firms (response rate: 78.1%). Semi-structured interviews with 28 purposively selected respondents provided qualitative triangulation.

#### 4.2 Variables and Measurement

Table 1 defines all variables. CCC (days: DSO + DIO – DPO) is the primary outcome. ITC\_BLOCK (blocked ITC as % of current assets) and ITC\_DUR (average refund delay in months) are the focal independent variables. LNTURNOVER, NC\_BUYER, EXPORT, DIGITAL, LEVERAGE, AGE, SECTOR, and CLUSTER serve as controls and moderators.

**Table 1: Variable Definitions, Measurement, and Sources**

Variable	Definition / Measure	Source	Exp. Sign
CCC	Cash Conversion Cycle (days): DSO + DIO – DPO	Survey / Financial statements	—
ITC_BLOCK	ITC blocked as % of total current assets (avg. FY22)	Survey + GSTN reconciliation	Dep. / +
ITC_DUR	Average ITC refund/utilisation delay (months)	Survey	Dep.
LNTURNOVER	Natural log of annual turnover (INR lakh)	Audited accounts	– (H2)
NC_BUYER	% turnover from buyers with GSTR-2A mismatches > 10%	GSTN portal reconciliation	+ (H3)
EXPORT	Dummy: 1 if export sales > 10% of turnover; else 0	Survey	+ (H5)
DIGITAL	Digital compliance index (0–10; e-invoicing, EWB, portal)	Survey	– (H6)
SECTOR	Sector dummies: Electronics, Garment, Auto, Machine tools	KIADB classification	Varies
LEVERAGE	Total financial debt / total assets	Audited accounts	+
AGE	Firm age (years since incorporation)	DIC records + Survey	–

Variable	Definition / Measure	Source	Exp. Sign
INFORMAL_CREDIT	Informal borrowings as % of total borrowings	Survey	+ (H4)
CAPEX_RATIO	Capital expenditure / total assets	Survey / financials	– (H4)
CLUSTER	Cluster dummies: Peenya, Bommanahalli, Elec. City, Doddaballapur	Address records	Varies

Source: Primary Data

### 4.3 Econometric Specification

Three equations are estimated. The primary CCC model is:

$$CCC_i = \alpha + \beta_1 ITC\_BLOCK_i + \beta_2 LNTURNOVER_i + \beta_3 NC\_BUYER_i + \beta_4 EXPORT_i + \beta_5 DIGITAL_i + \beta_6 LEVERAGE_i + \beta_7 AGE_i + \beta_8 SECTOR_i + \beta_9 CLUSTER_i + \varepsilon_i \dots(1)$$

To address endogeneity — firms under working capital stress may engage in selective ITC claims — we employ IV-2SLS, instrumenting ITC\_BLOCK with (i) cluster-sector average GSTR-1 filing delay rate among peer firms and (ii) the number of distinct HSN codes filed by the firm. Instrument strength is assessed via the Cragg-Donald Wald F-statistic (threshold:  $F > 10$ ) and validity via the Hansen J overidentification test. Ancillary models for informal credit and CAPEX are:

$$INFORMAL\_CREDIT_i = \alpha + \gamma_1 ITC\_DUR_i + \gamma_2 LNTURNOVER_i + \gamma_3 LEVERAGE_i + \gamma_4 DIGITAL_i + \gamma_5 CLUSTER_i + \varepsilon_i \dots(2)$$

$$CAPEX\_RATIO_i = \alpha + \delta_1 ITC\_DUR_i + \delta_2 LNTURNOVER_i + \delta_3 LEVERAGE_i + \delta_4 CCC_i + \delta_5 SECTOR_i + \varepsilon_i \dots(3)$$

Mediation analysis following Baron and Kenny (1986) with bootstrapped indirect effects (Preacher & Hayes, 2008; 2,000 replications) tests whether informal credit substitution mediates  $ITC\_DUR \rightarrow CAPEX\_RATIO$ . Quantile regression at the 25th, 50th, and 75th percentiles assesses distributional heterogeneity. All standard errors are Huber-White heteroskedasticity-robust throughout.

## EMPERICAL ANALYSIS

### 5.1 Descriptive Statistics

Table 2 presents descriptive statistics ( $N = 328$ ). The average firm has operated for 17.4 years with median annual turnover of INR 4.2 crore. ITC blockage averages 21.4% of current assets (median: 18.6%), with right-skew driven by export-oriented garment and electronics firms. The mean CCC of 134.7 days substantially exceeds the pre-GST benchmark of 89–95 days for Indian manufacturing SMEs (Prasad & Sensarma, 2011), consistent with ITC-induced working capital absorption. Informal credit constitutes 41.2% of total borrowings on average — higher than the national MSME average of approximately 30% (IFC, 2019) — indicating above-average formal credit exclusion.

Table 2: Descriptive Statistics — Full Sample ( $N = 328$ )

Variable	Mean	Median	Std. Dev.	Min	Max	Skewness
CCC (days)	134.7	121.4	68.2	14.0	412.0	1.58

Variable	Mean	Median	Std. Dev.	Min	Max	Skewness
ITC_BLOCK (%)	21.4	18.6	13.1	0.0	68.4	1.94
ITC_DUR (months)	7.3	6.0	5.1	0.0	31.0	1.71
LNTURNOVER	6.89	7.04	1.18	3.69	9.44	-0.19
NC_BUYER (%)	37.2	33.0	24.6	0.0	100.0	0.64
EXPORT (dummy)	0.34	0.00	0.47	0.0	1.0	0.68
DIGITAL (0-10)	4.4	4.0	2.4	0.0	10.0	0.09
LEVERAGE	0.44	0.41	0.19	0.03	0.94	0.58
AGE (years)	17.4	16.0	10.1	2.0	58.0	0.91
INFORMAL_CREDIT (%)	41.2	38.0	26.3	0.0	100.0	0.49
CAPEX_RATIO	0.043	0.028	0.049	0.000	0.311	2.37
INTEREST_COST (INR lakh)	5.18	3.20	6.74	0.00	48.60	2.91

Source: Primary Data

Table 3 disaggregates ITC blockage by cluster. Bommanahalli garment firms report the highest mean blockage (27.8%) and longest delay (9.6 months) due to zero-rated export refund bottlenecks. Electronic City firms show 24.2% blockage from IGST refund complexity on cross-state B2B sales. Peenya records 19.8% blockage driven by OEM buyer non-compliance. Doddaballapur reports the lowest blockage (16.4%) but the highest informal credit reliance (44.8%), reflecting micro-enterprise prevalence without professional tax management.

**Table 3: ITC Blockage, Delay, and CCC by Cluster and Sector**

Cluster / Sector	N	Mean ITC Block (%)	Mean ITC Duration (months)	Mean CCC (days)	Mean Informal Credit (%)
<b>Peenya Industrial Estate</b>	142	19.8	6.8	128.4	39.1
— Machine tools	58	18.2	5.9	119.6	36.4
— Auto components	47	21.6	7.8	138.2	41.7
— Electrical/consumer	37	19.4	6.4	124.8	38.8

Cluster / Sector	N	Mean ITC Block (%)	Mean ITC Duration (months)	Mean CCC (days)	Mean Informal Credit (%)
<b>Bommanahalli-Hebbagodi</b>	84	27.8	9.6	158.3	44.6
— Garment / apparel	84	27.8	9.6	158.3	44.6
<b>Electronic City Phase II</b>	62	24.2	7.9	141.6	38.7
— Electronics/hardware	62	24.2	7.9	141.6	38.7
<b>Doddaballapur Ind. Area</b>	40	16.4	5.1	112.8	44.8
— Light engineering	40	16.4	5.1	112.8	44.8
<b>Full Sample</b>	328	21.4	7.3	134.7	41.2

Source: Primary Data

**Table 4: Sample Composition and ITC Blockage by Firm Size Category**

Size Category (Turnover)	N (%)	Mean ITC Block (%)	Mean ITC Duration (months)	Mean CCC (days)	Mean Informal Credit (%)
Micro (< INR 5 crore)	200 (61.0%)	25.8	8.9	149.1	51.4
Small (INR 5–75 crore)	104 (31.7%)	17.1	6.1	121.8	32.7
Medium (INR 75–250 crore)	24 (7.3%)	9.6	3.1	94.6	16.4
<b>Full Sample</b>	328 (100%)	21.4	7.3	134.7	41.2

Source: Primary Data

Table 4 reveals a steep size gradient: micro-enterprises experience mean ITC blockage of 25.8% versus 9.6% for medium enterprises — a 16.2 percentage-point differential ( $t = 9.84, p < 0.001$ ). Informal credit reliance similarly contrasts sharply, with micro-enterprises sourcing over half their borrowings from informal channels (51.4%) versus 16.4% for medium enterprises. These gradients strongly support H2 and indicate substantial scale economies in GST compliance management.

## 5.2 Main Regression Results

Table 5 presents OLS results. Model 1 estimates the bivariate ITC\_BLOCK–CCC relationship; Model 2 includes full controls; Model 3 identifies determinants of ITC blockage. All models include sector and cluster fixed effects.

Table 5: Regression Results — CCC Determinants and ITC Blockage Determinants

Variable	Model 1: CCC (Bivariate OLS)	Model 2: CCC (Full Controls)	Model 3: ITC_BLOCK (Determinants)
ITC_BLOCK	3.64*** (0.41)	3.18*** (0.37)	—
ITC_DUR	—	—	0.88*** (0.13)
LNTURNOVER	—	-15.84*** (3.42)	-3.61*** (0.81)
NC_BUYER	—	0.72*** (0.19)	0.31*** (0.07)
EXPORT	—	26.42** (10.12)	7.84*** (2.88)
DIGITAL	—	-7.21*** (1.94)	-2.43*** (0.66)
LEVERAGE	—	46.81*** (9.54)	—
AGE	—	-0.92* (0.52)	-0.38** (0.16)
Sector / Cluster FE	—	Included	Included
Constant	58.14*** (12.61)	124.33*** (22.18)	14.88*** (4.12)
Observations	328	328	328
R-squared	0.334	0.578	0.514
Adj. R-squared	0.332	0.554	0.489
F-statistic	163.4***	44.2***	31.8***

Source: Primary Data.

Note: Robust (Huber-White) standard errors in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . Sector and cluster fixed effects included in Models 2 and 3.

The ITC\_BLOCK coefficient in Model 1 is highly significant ( $\beta = 3.64$ ,  $p < 0.001$ ): each percentage point of current assets in blocked ITC associates with a 3.64-day CCC elongation. At the sample mean of 21.4%, this implies approximately 78 additional CCC days relative to a zero-blockage counterfactual — an effect that persists robustly with full controls (Model 2:  $\beta = 3.18$ ,  $p < 0.001$ ). Adjusted  $R^2$  rises from 0.332 to 0.554 with full controls, confirming that ITC blockage and firm characteristics together explain over half of cross-sectional CCC variation. H1 is strongly supported. In Model 2, LNTURNOVER is significantly negative ( $\beta = -15.84$ ,  $p < 0.001$ ), consistent with larger firms' superior bargaining power; NC\_BUYER is positive and significant ( $\beta = 0.72$ ,  $p < 0.001$ ), confirming buyer compliance failures cascade into supplier CCC deterioration (H3); EXPORT adds 26.4 days ( $p < 0.05$ ), supporting H5; DIGITAL exerts a strong negative effect ( $\beta = -7.21$ ,  $p < 0.001$ ), confirming the digital compliance dividend (H6); LEVERAGE is positive and significant ( $\beta = 46.81$ ,  $p < 0.001$ ). Model 3 confirms determinants of ITC blockage: smaller firms (LNTURNOVER  $\beta = -3.61$ ,  $p < 0.001$ ) and high NC\_BUYER exposure ( $\beta = 0.31$ ,  $p < 0.001$ ) report higher blockage (H2, H3); export firms face higher blockage ( $\beta = 7.84$ ,  $p < 0.001$ , H5); digital capability reduces it ( $\beta = -2.43$ ,  $p < 0.001$ , H6).

## 5.3 IV-2SLS Robustness Check

Table 6: IV-2SLS Estimates — Causal Effect of ITC\_BLOCK on CCC

	Second Stage: CCC (IV-2SLS)	Diagnostic Statistics
ITC_BLOCK (instrumented)	4.12*** (0.61)	—
Full control vector	Included	—
Observations	328	—
Adj. R-squared	0.528	—
Cragg-Donald Wald F (1st stage)	—	41.7*** (threshold > 10)
Hansen J p-value (overidentification)	—	0.38 (H0: instruments valid)
Hausman endogeneity test p-value	—	0.029 (reject exogeneity)
Anderson-Rubin 95% confidence set	—	[2.96, 5.28]

Source: Primary Data.

Instruments: (i) cluster-sector average GSTR-1 filing delay rate; (ii) number of distinct HSN codes filed. \*\*\*  $p < 0.01$ .

The IV-2SLS second-stage coefficient ( $\beta = 4.12$ ,  $p < 0.001$ ) exceeds the OLS estimate, consistent with downward attenuation bias from measurement error in self-reported blockage. The Cragg-Donald F-statistic of 41.7 comfortably exceeds all Stock-Yogo thresholds, the Hansen J p-value of 0.38 confirms instrument validity, and the significant Hausman test ( $p = 0.029$ ) confirms ITC\_BLOCK endogeneity, validating the IV strategy. The Anderson-Rubin confidence set excludes zero, reinforcing causal interpretation.

## 5.4 Financing and Investment Consequences (H4)

Table 7: Downstream Effects — Informal Credit Reliance and Capital Expenditure

Variable	Model 4: INFORMAL_CREDIT (%)	Model 5: CAPEX_RATIO
ITC_DUR	3.44*** (0.48)	-0.0041*** (0.0010)
LNTURNOVER	-6.84*** (1.44)	0.0068*** (0.0020)
LEVERAGE	16.22*** (4.11)	-0.0201*** (0.0061)
DIGITAL	-3.81*** (0.97)	0.0033*** (0.0013)
CCC	—	-0.0002** (0.0001)
INFORMAL_CREDIT	—	-0.0004** (0.0002)

Variable	Model 4: INFORMAL_CREDIT (%)	Model 5: CAPEX_RATIO
Sector / Cluster FE	Included	Included
Constant	54.17*** (8.33)	0.0682*** (0.0147)
Observations	328	328
Adj. R-squared	0.441	0.404
F-statistic	39.7***	28.6***

Source: Primary Data.

Robust standard errors in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . Sector and cluster fixed effects included.

Model 4 confirms that each additional month of ITC delay associates with a 3.44 percentage-point increase in informal credit reliance ( $p < 0.001$ ). For the micro-enterprise sample-mean delay of 8.9 months, this implies approximately 30.6 additional percentage points shifted toward informal finance — a dramatic reallocation toward costlier, less stable credit. Digital compliance significantly reduces informal credit dependence ( $\beta = -3.81$ ,  $p < 0.001$ ). Model 5 confirms significant investment suppression: each additional month of ITC delay reduces CAPEX ratio by 0.41 percentage points ( $p < 0.001$ ). At the micro-enterprise mean delay of 8.9 months, this implies a 3.65 percentage-point CAPEX reduction — an 84.9% reduction relative to the micro-enterprise mean CAPEX ratio of 4.3%. The bootstrapped mediation analysis (2,000 replications) establishes a significant indirect effect of ITC\_DUR on CAPEX\_RATIO through INFORMAL\_CREDIT (indirect effect =  $-0.0013$ , 95% CI:  $[-0.0022, -0.0005]$ ), confirming partial mediation. The direct ITC\_DUR  $\rightarrow$  CAPEX\_RATIO effect remains significant ( $\beta = -0.0028$ ,  $p < 0.01$ ) after controlling for the mediator — approximately 31.7% of the total negative investment effect is transmitted through informal credit cost escalation (H4 supported).

### 5.5 Quantile Regression: Distributional Heterogeneity

Table 8: Quantile Regression — ITC\_BLOCK Coefficient on CCC across Distribution

Quantile	ITC_BLOCK Coefficient	Std. Error	95% Confidence Interval	Comparison to OLS
Q25 (25th percentile)	2.14***	0.44	[1.28, 3.00]	Below OLS
Q50 (Median)	3.06***	0.41	[2.25, 3.87]	Near OLS
Q75 (75th percentile)	5.12***	0.68	[3.79, 6.45]	Above OLS
OLS (reference)	3.18***	0.37	[2.45, 3.91]	—

Source: Primary Data.

All quantile regressions include full control vector from Model 2 including sector and cluster fixed effects. \*\*\* $p < 0.01$ .

The CCC-elongating effect of ITC blockage increases monotonically from 2.14 at Q25 to 5.12 at Q75 — a non-linear amplification in which firms already experiencing elongated CCC suffer disproportionately larger ITC

blockage impacts. This 'double penalty' dynamic means that mean-based OLS estimates materially understate the burden borne by the upper quartile of financially distressed SMEs.

## **5.6 Qualitative Evidence: Thematic Analysis**

### **5.6.1 The OEM Buyer Compliance Trap**

A dominant theme across cluster interviews was the power asymmetry between SME suppliers and large OEM buyers — aerospace, defence, and automotive firms — who routinely delayed or inaccurately filed GSTR-1, blocking ITC claims worth INR 10–30 lakh per quarter for their suppliers. Commercial dependency on single anchor buyers (60–80% of revenue) made refusal commercially impossible, resonating with Cuñat (2007) and Love et al. (2007) on buyer power and liquidity shock propagation.

### **5.6.2 The Export Refund Maze**

Bommanahalli garment SMEs described the zero-rated supply refund process as their most acute financial challenge, with processing times of 8–18 months routinely exceeding the 60-day statutory timeline. Several firms described the Letter of Undertaking (LUT) alternative route being suspended by GSTR-1/GSTR-3B reconciliation mismatches. Electronic City firms reported analogous entanglements in IGST refund on cross-state deemed exports. ITC-refund appellate representation for Bengaluru export SMEs tripled between FY2019 and FY2023.

### **5.6.3 Informal Finance and the Digital Divide**

Proprietors universally described recourse to chit funds, credit cooperatives, and individual moneylenders (24–60% p.a.) during ITC blockage periods. Banker-informants confirmed that ITC receivables are ineligible as collateral under all scheduled commercial bank credit policies — structurally channelling ITC-stressed SMEs into informal finance, extending Ayyagari et al. (2010) by identifying ITC blockage as a novel institutional driver of informal credit demand. A striking divergence in digital compliance capability — Electronic City SMEs averaging DIGITAL score 6.8 versus Peenya traditional manufacturers at 3.6 — confirmed the digital compliance dividend, while Doddaballapur respondents' reversion to cash procurement from composition dealers illustrated the endogenous informality predicted by Hallward-Driemeier and Pritchett (2015).

## **DISCUSSION**

### **6.1 Theoretical and Empirical Contributions**

This study extends working capital theory by establishing tax system design as a first-order institutional CCC determinant — independent of managerial decision-making — complementing the established focus on industry structure, macroeconomic cycles, and firm strategy (Baños-Caballero et al., 2014). The IV-identified causal effect ( $\beta = 4.12$  days per percentage-point of blocked ITC) is economically transformative: at the micro-enterprise mean blockage of 25.8%, it implies over 106 days of CCC elongation attributable solely to institutional ITC design failure, a finding unprecedented in the extant literature. The study enriches pecking order theory by demonstrating that government-created financing constraints generate investment suppression through a distinct channel — involuntary conversion of operating cash flow into an illiquid government receivable — and establishes that 31.7% of this investment suppression is transmitted through informal credit cost escalation (Fazzari et al., 1988; Carpenter & Petersen, 2002). The Bengaluru cluster setting enables the first cluster-level analysis of ITC shock contagion, extending institutional theory (North, 1990; DiMaggio & Powell, 1983) and cluster economics (Schmitz, 1995) to the tax system design domain.

Empirically, this study represents one of the most methodologically rigorous investigations of ITC delay consequences for Indian manufacturing SMEs, combining IV identification, quantile regression, and bootstrapped mediation in a four-cluster setting. The Bengaluru context adds distinctive empirical value: the co-existence of digitally sophisticated Electronics City SMEs and traditional machine tool and garment manufacturers within a single metropolitan industrial ecosystem enables near-natural comparison of digital compliance capability effects. The finding that the DIGITAL index reduces CCC by 7.21 days per unit — equivalent to the effect of a 4.7 percentage-point reduction in ITC blockage — provides one of the most granular estimates of the working capital value of digital adoption in the Indian literature. Cross-cluster variation in ITC blockage — from 16.4% in

Doddaballapur to 27.8% in the Bommanahalli garment cluster — reveals that the ITC burden is systematically structured by sector-specific compliance environments, not uniformly distributed. Export-oriented clusters bear disproportionate burdens through the zero-rated refund mechanism while domestic supply chain clusters bear burdens through buyer non-compliance dynamics. This sectoral heterogeneity implies that effective policy solutions must be tailored to cluster-specific compliance contexts rather than applying uniform administrative prescriptions.

### **6.2 Policy Implications**

Four actionable recommendations emerge from the findings. First, the dominance of NC\_BUYER exposure as the firm-level determinant of ITC blockage for domestic-market Peenya SMEs calls for a provisional ITC credit guarantee mechanism: eligible SME suppliers holding valid tax invoices from registered buyers should be permitted to claim provisional ITC credit immediately, with the government bearing the non-payment risk pending buyer GSTR-1 filing, subject to anti-abuse safeguards. Comparable provisional credit mechanisms operate in Brazil's ICMS system and the UK's VAT regime (Ebrill et al., 2001); implementation could begin with SME suppliers to large corporate buyers (turnover > INR 100 crore) where buyer compliance monitoring capacity is higher. Second, the acute refund delays documented in Bengaluru's garment and electronics export clusters demand a dedicated fast-track mechanism with a statutory 30-day processing timeline backed by automatic interest payment at prevailing bank lending rates — rather than the existing 6% per annum that provides no effective deterrence — covering all LUT-based export refund claims from firms below INR 50 crore, with AI-driven reconciliation replacing manual scrutiny. Third, the robust DIGITAL → reduced-blockage relationship across all models supports aggressive expansion of the e-invoicing mandate below the current INR 10 crore threshold, accompanied by subsidised accounting software licensing, GSP/ASP access, and targeted digital literacy programmes delivered through KASSIA and Karnataka's Digital Economy Mission infrastructure, specifically targeting micro-enterprises in Peenya and Doddaballapur. Fourth, the structural exclusion of ITC receivables from bank collateral eligibility — confirmed by all banker-informants — represents a regulatory gap that amplifies the investment suppression documented in this study. The RBI and SIDBI should develop a dedicated ITC-receivable-backed credit product structured as a short-term bridge loan facility with CGTMSE guarantee coverage, available to registered GST filers with clean compliance records, eliminating the punishing interest rate differential (24–60% informal versus 11–14% formal bank lending) that compounds the working capital impact of every month of ITC delay.

### **6.3 Limitations**

Four limitations bound the findings. First, the cross-sectional design precludes analysis of dynamic adjustment paths and pre/post-GST trend comparisons. A difference-in-differences design exploiting the staggered rollout of the e-invoicing mandate as a natural experiment would strengthen causal identification and is a priority for future research. Second, the study's geographic scope — four clusters within Bengaluru — limits generalisation to settings with distinct GST environments, particularly those dominated by sectors with structurally different GST treatment such as construction, pharmaceuticals, or IT services. Third, financial data were self-reported by firm proprietors rather than drawn from audited accounts, introducing measurement error that may attenuate coefficient estimates despite outlier screening; future research should leverage GSTN administrative panel data — accessible under India's GSTN Data Sharing Policy — to replicate findings with census-level precision. Fourth, the study does not examine the general equilibrium effects of ITC blockage on cluster-level employment and wages, which may be substantial given the investment suppression quantified here and would warrant a structural economic modelling approach.

## **CONCLUSION**

This study investigated the working capital consequences of ITC delays under India's GST among 328 manufacturing SMEs across Bengaluru's industrial clusters. The findings are unambiguous: ITC blockage — averaging 21.4% of current assets, driven primarily by buyer non-compliance, export refund complexity, and low digital capability — exerts a causally identified, quantitatively substantial elongating effect on CCC (4.12 additional days per percentage-point of blocked ITC, IV-2SLS). At the micro-enterprise mean blockage of 25.8%,

this implies over 106 days of CCC elongation attributable solely to institutional ITC design failure. ITC delays drive a pronounced shift toward informal finance (3.44 percentage-points per month of delay), suppress capital investment by 0.41 percentage-points of total assets per month, and generate a self-reinforcing cycle of capital depletion and competitive erosion. The quantile regression evidence — with each blockage percentage-point adding 5.12 days at Q75 versus 2.14 at Q25 — indicates a threshold-amplification dynamic with survival implications for the most vulnerable SMEs.

The policy imperatives are clear and actionable: provisional ITC credit guarantees to sever the buyer compliance trap; accelerated statutory export refund processing with genuine interest deterrence for delays; expanded digital compliance support for micro-enterprises through subsidised software and GSP access; and ITC-receivable-backed formal credit products to eliminate the structural exclusion that channels ITC-stressed SMEs into informal borrowing at punishing rates. Implemented through coordinated action between the GST Council, CBIC, RBI, SIDBI, Karnataka's KIADB and KASSIA, these interventions represent a high-return institutional investment in the viability, competitiveness, and formalisation trajectory of Bengaluru's — and by extension India's — manufacturing SME ecosystem. As India pursues manufacturing-led growth under the National Manufacturing Policy and PLI scheme, the fiscal architecture governing the daily working capital of 63 million SMEs demands policy attention commensurate with headline incentive schemes. This study provides the empirical foundation for that conversation.

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