Policy Uncertainty, Corporate Digitalization, and Firm Performance: Evidence from Listed Manufacturing Firms

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Abstract. Corporate digital transformation is a critical pathway for the reform and upgrading of traditional manufacturing industries and an essential means for firms to address increasingly complex external environments. Using a sample of listed manufacturing firms from China's Shanghai and Shenzhen A-share markets from 2015 to 2019, this study employs a two-way fixed-effects panel data model to empirically examine the impact of digitalization on firm performance and the moderating role of policy uncertainty. The findings reveal that, digitalization significantly and negatively affects firm performance. Moreover, policy uncertainty exacerbates the adverse impact of digitalization on firm performance, with this effect being significant only in non-state-owned enterprises, while no significant impact is observed in state-owned enterprises. This study provides empirical evidence to the ongoing discourse on the "digitalization paradox."

Keywords: Policy Uncertainty, Digitalization, Firm Performance, Manufacturing Enterprises.

1 Introduction

Some studies have found that digitalization can enhance firm performance by improving operational efficiency and market responsiveness, optimizing human capital structure and business processes, strengthening internal control, and promoting information flow [1]. However, other studies reveal that digitalization investments not only fail to achieve revenue growth but may also lead firms into financial distress [2], a phenomenon referred to as the “digitalization paradox.” Moreover, heightened policy uncertainty amplifies external risks, particularly market risks. For firms pursuing exploratory strategic transformations, this uncertainty further elevates operational risks [3], potentially hindering the successful implementation of digital transformation initiatives.

Using listed manufacturing firms on China’s Shanghai and Shenzhen A-share markets from 2015 to 2019 as research samples, this study explores the impact of digitalization on firm performance from the new perspective of policy environment fluctuations and provides recommendations for governments, industries, and enterprises to address the practical challenges of the "digitalization paradox."

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2 Theoretical Assumption

Since the emergence of research on corporate digital transformation, some scholars have challenged the "IT productivity paradox." Studies indicate that digital transformation primarily enhances the performance of enterprises in industries highly reliant on digital technologies, while traditional sectors such as manufacturing have not experienced significant benefits [4]. In industries such as information and communication technology, software development, and the internet, digital transformation substantially improves operational efficiency and market competitiveness. These industries typically possess a strong technological foundation, enabling them to leverage digital technologies effectively to optimize production processes and enhance management efficiency, thereby driving performance growth. However, traditional industries, including manufacturing and real estate, heavily dependent on conventional production models, face substantial costs and challenges in adapting to new technologies and transforming business models. Consequently, the impact of digital transformation on performance improvement in these sectors remains limited. Based on the above analysis, this study proposes Hypothesis 1.

H1: Digitalization in manufacturing firms negatively affects performance.

Firms continuously operate in a dynamic external environment where macroeconomic policy changes can profoundly impact those undergoing strategic transformations. Such firms inherently face higher risks, and increased policy uncertainty amplifies the likelihood of strategic transformation failures, making the associated costs and probabilities difficult to estimate, thereby deteriorating firm performance and increasing crises [3]. Furthermore, research indicates that private enterprises and small and micro businesses are often unable to effectively leverage the advantages of digital transformation in their operations, while heightened economic uncertainty exacerbates financing constraints and other negative impacts [5]. Based on the above analysis, this study proposes Hypotheses 2 and 3.

H2: Policy uncertainty amplifies the negative impact of digitalization on performance.

H3: Policy uncertainty worsens the negative impact of digitalization in non-state-owned firms but has no significant effect in state-owned firms.

3 Research Design

3.1 Sample Selection and Data Sources

This study uses data from listed manufacturing firms on China's Shanghai and Shenzhen stock markets (2015-2019). The sample was screened as follows: firms under ST, *ST, or PT treatment were excluded; only firms listed before 2015 were selected; those with missing data during the observation period were removed, and extreme outliers were excluded. The final sample consists of 1,948 data points. Continuous variables were winsorized at the 1% and 99% levels to reduce outlier effects. Financial data came

from the CSMAR database, digitalization measures were derived from annual report analysis. The China policy uncertainty index was sourced from Baker et al.'s website.

3.2 Variable Definitions

3.2.1 Dependent Variables

Firm performance is measured using Return on Assets (*ROA*), reflecting the efficiency of average assets. The formula is:

$$ROA = \frac{Net\ Profit}{\left[\frac{(Total\ Assets\ at\ End\ of\ Year + Total\ Assets\ at\ End\ of\ Previous\ Year)}{2}\right]} \quad (1)$$

3.2.2 Independent Variables

The independent variable, corporate digitalization level, is measured from two dimensions: digital infrastructure (*DigFix*) and digital technology levels (*DigInv*). Data are gathered from the annual reports of manufacturing listed companies [6], focusing on their disclosed investments in digital infrastructure and technological development. The data selection criteria include the investment in digital fixed assets (e.g., computers, electronic devices) and the investment in digital intangible assets (e.g., purchased software) during the study period. The digitalization level is measured by dividing the digital investment by the firm's main business income.

$$DigFix = \frac{Investment\ in\ Digital\ Fixed\ Assets}{Main\ Business\ Revenue} \quad (2)$$

$$DigInv = \frac{Investment\ in\ Digital\ Intangible\ Assets}{Main\ Business\ Revenue} \quad (3)$$

3.2.3 Moderating Variables

The moderating variable, policy uncertainty (*PU*), is measured using the annual average of the monthly policy uncertainty index for China from 2015 to 2019, as estimated by Baker [7]. The index is based on text analysis, with keywords such as "China," "government authorities," "policy expenditure," "interest rate changes," and "policy reform." Articles related to policy uncertainty events published in the South China Morning Post are identified, and the number of relevant articles is compared to the total number of articles published in the same month to obtain the monthly economic policy uncertainty index for China. This index is widely used in academic research and provides an accurate and credible reflection of the volatility in China's policy environment.

3.2.4 Control Variables

Based on existing literature, the following control variables are selected: leverage (*Lev*), firm size (*Size*), firm growth (*Grow*), ownership structure (*Soe*), ownership concentration (*Balance*), Big Four audit (*Audit*), CEO-Chairman duality *(Dual*), audit opinion (*Opinion*), Tobin's Q ratio (*TobinQ*).

3.3 Research Model

To examine the impact of corporate digitalization on firm performance, this study constructs the two-way fixed effects model shown in Equation (4), incorporating both time (μ_t) and firm fixed effects (ν_i). To explore the moderating effect of policy uncertainty on the above relationship, the model specified in Equation (5) is developed.

$$Perform_{it} = \alpha + \beta Dig_{it} + \gamma' Controls_{it} + \mu_t + \nu_i + \varepsilon_{it} \quad (4)$$

$$Perform_{it} = \alpha + \beta Dig_{it} + \delta PU_{it} + \theta Interact_{it} + \gamma' Controls_{it} + \mu_t + \nu_i + \varepsilon_{it} \quad (5)$$

In these models, i represents the firm, t represents the time period, β denotes the coefficient measuring the effect of corporate digitalization on firm performance, and θ represents the coefficient capturing the moderating effect of policy uncertainty.

4 Results and Discussion

4.1 Digitalization and Firm Performance

Table 1 presents the effects of digital fixed asset investment and digital intangible asset investment on firm performance. The regression coefficient for digital fixed asset investment is -0.186, significant at the 1% level, while the coefficient for digital intangible asset investment is -0.39, significant at the 10% level. This indicates that, regardless of whether digital transformation is measured through fixed asset investment or intangible asset investment, corporate digitalization significantly negatively impacts firm performance. These findings provide further evidence for the "digitalization paradox" identified in existing literature, thereby supporting Hypothesis 1.

Table 1. Regression Results of Corporate Digitalization and Firm Performance

	(1) Perform	(2) Perform
Digfix	-0.186***	
	(-2.869)	
Diginv		-0.390*
		(-1.790)
Constant	0.417***	0.392**
	(2.593)	(2.446)
Controls	YES	YES
Year	YES	YES
Individual	YES	YES
N	1948	1948
Adj. R^2	0.206	0.198

* p < 0.1, ** p < 0.05, *** p < 0.01 t statistics in parentheses

This result suggests that, in the early stages of digital transformation in the manufacturing sector, neither increased investment in digital infrastructure nor heightened investment in digital technology research and development can produce positive short-

term effects on firm performance. On the contrary, high investment costs, substantial risks associated with digital transformation, and longer payback periods may negatively impact firm performance within a short time frame of a few years. This phenomenon is also consistent with observations from Accenture's 2019 global survey [8].

4.2 Policy Uncertainty, Digitalization and Firm Performance

Table 2 reports the moderating effect of policy uncertainty on the relationship between corporate digitalization and firm performance, as well as the influence of ownership structure on this moderating effect. The results indicate that the interaction term between policy uncertainty and digital fixed asset investment has a regression coefficient of -0.0004, significant at the 5% level, while the interaction term between policy uncertainty and digital intangible asset investment has a regression coefficient of -0.002, significant at the 1% level. These findings suggest that, regardless of whether digital transformation is measured through fixed asset investment or intangible asset investment, policy uncertainty exacerbates the negative impact of corporate digitalization on firm performance, supporting Hypothesis 2.

Table 2. Regression Results of the Moderating Effect of Policy Uncertainty

Variables	(1) Perform	(2) Perform	(3) Soe=1 Perform	(4) Soe=0 Perform	(5) Soe=1 Perform	(6) Soe=0 Perform
Digfix	-0.282***		-0.012	-0.318***		
	(-3.169)		(-0.151)	(-2.743)		
Diginv		-0.890***			-0.952	-1.027***
		(-2.679)			(-0.911)	(-2.904)
PU	2.08e-05**	2.02e-05*	2.79e-06	2.6e-05*	1.24e-05	2.9e-05**
	(2.018)	(1.927)	(0.192)	(1.820)	(0.834)	(2.016)
Digfix*PU	-0.0004**		0.000	-0.001**		
	(-2.524)		(0.654)	(-2.409)		
Diginv*PU		-0.002***			0.003	-0.002***
		(-2.595)			(1.129)	(-2.609)
Constant	0.519***	0.483***	0.075	0.588***	0.078	0.587***
	(3.199)	(3.018)	(0.298)	(2.814)	(0.335)	(2.825)
Controls	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Individual	YES	YES	YES	YES	YES	YES
N	1948	1948	464	1484	464	1484
Adj. R^2	0.213	0.206	0.247	0.220	0.248	0.214

* p < 0.1, ** p < 0.05, *** p < 0.01 t statistics in parentheses

Further analysis reveals that in the state-owned subsample (Soe=1), neither the interaction terms nor the regression coefficients of corporate digitalization are significant. In contrast, in the privately-owned subsample (Soe=0), both the interaction terms and the regression coefficients are significantly negative, regardless of whether

digitalization is measured through fixed asset investment or intangible asset investment. This indicates that digital transformation, in both fixed assets and intangible assets, more negatively affects the performance of privately-owned firms. Policy uncertainty exacerbates the adverse effect of digitalization on the performance of privately-owned firms but has no significant effect on state-owned firms, thus supporting Hypothesis 3.

5 Conclusion

In corporate practice, the application of advanced digital technologies like cloud computing, big data, IoT, mobile internet, and AI often fails to improve productivity or firm performance. This study examines the relationship between policy uncertainty, corporate digitalization, and firm performance using data from listed manufacturing firms in China's Shanghai and Shenzhen stock exchanges (2015–2019). Key findings include: (1) Increased investment in digital fixed and intangible assets negatively impacts firm performance. (2) Policy uncertainty exacerbates this negative impact; the higher the uncertainty, the greater the adverse effect of digitalization. (3) This effect is significant for non-state-owned enterprises but not for state-owned ones

Based on these findings, the following recommendations are proposed: For governments, enhance long-term, systematic planning for manufacturing digital transformation, introduce targeted policies, and establish high-quality public information platforms to foster a supportive environment. For the manufacturing industry, strengthen communication channels among government, enterprises, and supply chain participants to drive digital transformation momentum, set industry benchmarks, and build a healthy transformation ecosystem. For enterprises, focus on understanding policies, reducing information silos, and maintaining government relationships to adapt strategies based on policy changes. Seek government support and business opportunities, improve performance, and accelerate the development of core technologies. Address the digitalization paradox by optimizing processes, innovating management, and upgrading technology to ensure transformation benefits.

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