

When Does Cost System Sophistication Improve Financial Performance? The Moderating Role of Service Diversity

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Abstract

The paper deals with the role of service diversity in shaping the financial performance benefits of cost system sophistication (CSS) among non-manufacturing firms. Prior research has treated service diversity mainly as a direct antecedent of costing system design, generally with inconsistent, non-significant results, leaving unclear whether diversity instead functions as a boundary condition of CSS's financial consequences. Survey data from 204 UK non-manufacturing firms are analyzed using hierarchical moderated regression, supported by heteroskedasticity-consistent standard errors, a 5,000-resample bootstrap, simple slopes, and Johnson-Neyman analysis. CSS is found to be positively associated with financial performance overall, and this association is significantly strengthened by service diversity ($b = 0.023$, $p = 0.032$). Simple slopes analysis shows that the CSS-performance association is not distinguishable from zero at low service diversity but becomes significant and substantially larger at mean and high diversity levels. The Johnson-Neyman technique identifies a threshold of service diversity of approximately 2.69 on a five-point scale, above which CSS's association with performance becomes statistically significant; approximately 60 percent of the sample exceeds this threshold. These findings reposition service diversity as a boundary condition of CSS's performance consequences rather than a determinant of its adoption, extending contingency-based costing research toward an interaction-fit perspective, and offer a plausible explanation for the inconsistent direct-effect findings reported in prior studies.

Keywords: Cost System Sophistication, Financial Performance, Service Diversity, Moderation, Contingency Theory, Interaction Fit, Non-Manufacturing Firms.

JEL Classification: M41, M10, L84

1. Introduction

Cost system sophistication (CSS) refers to the extent to which a firm's costing system uses multiple cost pools and both volume- and non-volume-based cost drivers to assign indirect costs, rather than relying on simplified, volume-based allocation (Al-Omiri & Drury, 2007; Drury & Tayles, 2005). Contingency-based research has extensively examined which contextual factors predict CSS adoption, but results remain inconsistent: the same factors, competition, cost structure, organizational size, are significant in some studies and non-significant in others (Schoute, 2009; Diavastis, 2025).

Contingency theory holds that no costing system design is universally optimal; its value depends on fit with the firm's operating context (Otley, 2016). Applied to CSS, this implies that its financial performance benefits should not be assumed unconditional but should depend on features of the firm's environment that determine how much value additional costing detail provides.

Service diversity, the extent to which a firm offers services with differing resource consumption patterns, is a natural candidate boundary condition. Under low diversity, even simple costing systems assign costs reasonably accurately, limiting the incremental value of sophistication. Under high diversity, simple systems are more prone to cross-subsidize costs across services, and a sophisticated system should better correct this distortion, generating a larger financial benefit.

Despite this logic, prior studies have examined service diversity almost exclusively as an antecedent of CSS rather than as a moderator of its performance consequences, typically finding null direct effects (Diavastis, 2025). This pattern raises the possibility that diversity's true role is not as a cause of CSS but as a condition determining when CSS pays off financially, a possibility not yet directly tested.

This study addresses this question using survey data from 204 UK non-manufacturing firms, previously used to test a mediation-based model of CSS's antecedents and consequences. The central research question is: does service diversity condition the relationship between CSS and financial performance? The study's contribution is threefold. Theoretically, it repositions service diversity from an antecedent of costing design to a boundary condition of CSS's performance consequences, extending contingency-based costing research toward an interaction-fit perspective (Gerdin & Greve, 2004). Empirically, it provides a direct test of the CSS $\times$ service diversity interaction using hierarchical moderated regression, robust inference, bootstrapping, and Johnson-Neyman analysis. Practically, it offers UK non-manufacturing firms specific guidance on when investment in costing sophistication is likely to be financially worthwhile.

Non-manufacturing firms are a particularly informative setting because they typically carry a higher share of indirect to direct costs than manufacturing firms, raising the stakes of cost distortion when services are diverse, while having received comparatively little direct empirical attention in the CSS literature.

2. Literature Review

Cost system sophistication is typically operationalized as a composite of the number of cost pools, the number of cost drivers, and the balance between volume- and non-volume-based drivers (Al-Omiri & Drury, 2007; Drury & Tayles, 2005). This continuum-based measure is preferred over a binary activity-based costing (ABC) adoption dummy because it captures sophistication among firms that have not formally adopted ABC, avoiding classification based solely on an inconsistently applied label (Al-Omiri & Drury, 2007). Cohen and Kaimenaki (2011) similarly show that the detail, cost-behavior disaggregation, and reporting frequency of a costing system, not the ABC label itself, drive the perceived quality of cost information. The theoretical case for CSS rests on the trade-off between

measurement costs and error costs that Cooper (1988) first articulated: a more sophisticated system costs more to operate but reduces the costs of decisions based on distorted cost information, with the optimal sophistication level differing across firms according to context.

Contingency studies of CSS's determinants report persistently inconsistent findings. Schoute (2009) found that competition and cost structure predicted CSS in a mixed Dutch sample, while Drury and Tayles (2005) and Ismail and Mahmoud (2012) found no significant effects in UK and Egyptian manufacturing samples. Hadid and Hamdan (2022) found that firm size's relationship with CSS operates indirectly through product diversity rather than as a simple direct effect. Diavastis (2025), studying Greek hotels, found that firm size, cost structure, and information technology predicted CSS, while competition, service diversity, and business strategy did not. This inconsistency has prompted several explanations, including measurement differences, sectoral differences, and model under-specification (Hadid & Hamdan, 2022); a recent meta-analysis by Ahmed (2023) similarly finds that management tenure predicts accounting system sophistication only once measurement type, sector, and firm size are modeled as moderators, illustrating that contingency factors in this literature often behave as boundary conditions rather than direct predictors.

A smaller literature examines CSS's consequences for performance, generally finding a more consistent pattern for operational than for financial outcomes. Ittner et al. (2002) linked ABC use to improved manufacturing performance without a consistent direct financial effect; Cagwin and Bouwman (2002) and Maiga and Jacobs (2007) report similar asymmetries. Uyar and Kuzey (2016) found that cost system design affected firm performance only indirectly, through management accounting practices as a mediator, consistent with the view that CSS's financial benefits depend on additional conditions being met, whether mediating mechanisms or moderating boundary conditions. More recent evidence continues this pattern: Nartey (2025), studying small and medium enterprises in Ghana, finds that ABC adoption is associated with both operational and financial performance, but the financial association is the less robust of the two once innovation attributes are accounted for. Daowadueng et al. (2023) find that costing system design choices mediate the strategic-orientation-to-cost-information-use relationship only under an exploration, rather than exploitation, strategic orientation. In a non-manufacturing setting, Diavastis (2024) finds that management accounting practices are associated with hotel financial performance only in conjunction with accounting information system user satisfaction, a further example of a costing-related practice's financial consequences depending on a second, jointly operating factor.

Service diversity has been examined almost exclusively as a direct antecedent of costing design. The underlying logic, following Cooper (1988), is that diversity increases the potential for cross-subsidization under simple costing, strengthening the case for sophistication. Despite this logic, direct tests have frequently found no significant diversity-CSS association, including in Diavastis's (2025) recent evidence and in this research programme's own companion sample. Mazbayeva et al. (2022), studying Kazakhstani poultry firms, find that product diversity's effect on ABC adoption depends on accountants' participation in costing system design, showing that even within the antecedent framing,

diversity's role is increasingly modeled as conditional rather than direct. Schoute (2011) similarly tests product diversity as a direct antecedent of ABC adoption, and Hoozée and Ngo (2018) examine how managers' participation in costing system design shapes their perceived contribution to process improvement, rather than how diversity shapes financial consequences. Schmidt et al. (2023) show computationally that cross-subsidization depends jointly on cost hierarchy structure and specific allocation choices, not diversity alone, suggesting diversity's consequences may depend on interaction with the costing system already in place rather than operating as an independent antecedent, a mechanism consistent with the pattern of null direct-effect findings documented above. A recent systematic review by Sanchez-Rebull et al. (2023) finds that interest in ABC and its determinants continues to grow without a corresponding convergence in findings on why some firms adopt sophisticated costing and others do not.

Gerdin and Greve (2004) distinguish selection, mediation, and interaction (moderation) forms of contingency fit, building on the earlier typology of Drazin and Van de Ven (1985). A selection form tests only whether context predicts design; a mediation form additionally tests whether design predicts performance through identifiable mechanisms; an interaction form tests whether a contextual factor changes the strength of the relationship between practice and performance. Fisher (1995) notes that management accounting research has historically applied the interaction form less often than the selection form, despite it being most directly consistent with contingency theory's core proposition that fit, not the practice itself, determines performance. Within costing research specifically, interaction-fit models remain comparatively rare; Maiga et al. (2014) apply an interaction design to cost control systems and information technology integration predicting manufacturing plant financial performance, though their interaction combines two management practices rather than a practice with a contextual characteristic such as service diversity. Henri and Wouters (2020) similarly show that management control practices for product innovation depend jointly on each other and on environmental unpredictability, illustrating that interdependence- and interaction-based designs remain an active area of contingency-based management accounting research more broadly, even where costing systems specifically remain under-represented within it. Slapnicar et al. (2022) use an interaction design to show that performance feedback's effect on task engagement depends on individuals' achievement motive, a further recent example of interaction-fit designs applied productively outside the costing domain.

A companion study using the same dataset finds that CSS is directly and indirectly associated with financial performance in a mediation model. Consistent with this baseline and with the operational-performance evidence reviewed above, CSS is expected to be positively associated with financial performance on average:

- **H1:** Cost System Sophistication is Positively Associated with Financial Performance.

The central, novel argument of this paper concerns not whether CSS predicts performance on average but when it does so most strongly. Under low service diversity, even simple costing systems produce little distortion, so the incremental value of sophistication is limited. Under high

diversity, simple systems more readily cross-subsidize costs, and sophistication should more reliably correct pricing, resource allocation, and evaluation decisions (Cooper, 1988; Schmidt et al., 2023). This is a boundary-condition argument, not an antecedent argument: service diversity is not proposed to cause firms to adopt sophisticated costing, but to determine how much financial value an already-sophisticated system generates once it exists.

- **H2:** Service diversity positively moderates the relationship between cost system sophistication and financial performance, such that the positive association becomes stronger as service diversity increases.

Figure 1 summarizes the proposed model.

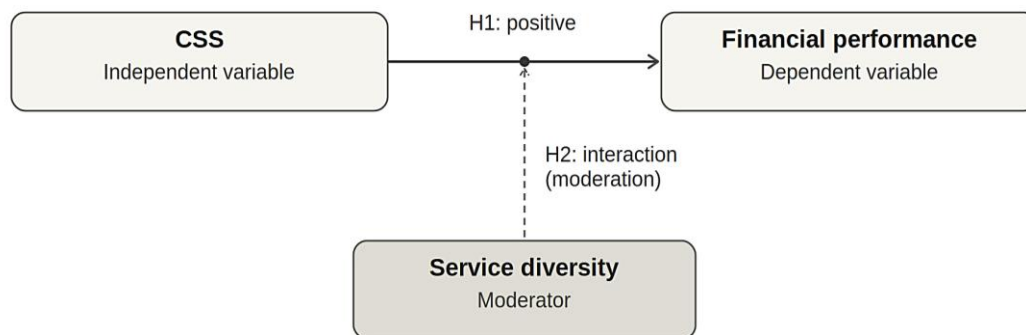


Figure (1): Conceptual research model.

3. Aims

This study aims to determine whether service diversity moderates the relationship between cost system sophistication and financial performance among non-manufacturing firms, testing this question with survey data from 204 UK non-manufacturing firms using hierarchical moderated regression supported by robust and bootstrapped inference, simple slopes analysis, and the Johnson-Neyman technique.

4. Methods

Research Setting and Sample:

The population comprised medium and large UK non-manufacturing firms (≥ 50 employees, $\geq$ £25 million annual sales), sampled from the FAME database across thirteen UK Standard Industrial Classification service sections. This population was chosen because non-manufacturing firms carry a structurally higher proportion of indirect to direct cost than manufacturing firms, sharpening the theoretical stakes of the study's central question. From a sampling frame of 2,969 firms, 2,000 questionnaires were distributed; 263 were returned (13.15% response rate), of which 219 were usable (10.95% effective response rate). Of these, 204 business units had an operating costing system and

complete data on all study variables, with zero missing values among these 204 cases. Non-response bias was assessed by comparing early and late respondents on core demographic and survey measures; no significant differences were found.

Data Collection:

Data were collected via a cross-sectional postal and online survey administered to a single, knowledgeable respondent per business unit, typically a finance director, financial controller, or management accountant. Constructs were measured identically to a companion study using the same dataset, allowing direct comparability between the two papers' results. Participation was voluntary and anonymous.

Measurement:

Cost system sophistication (CSS) was measured as a composite of the number of cost pools, the number of cost drivers, and the split between volume- and non-volume-based drivers in use, following Al-Omiri and Drury (2007). Service diversity was measured with a four-item, five-point Likert scale; financial performance was measured with a three-item, five-point Likert scale capturing perceived improvement in profitability and related financial outcomes. Organizational size was measured using log-transformed employee count. Competition and differentiation strategy, included as controls, were measured with multi-item five-point Likert scales.

Service diversity and financial performance were each estimated as reflective latent factors in a confirmatory factor analysis alongside the two reflective control constructs (N = 192 listwise). Table 1 reports standardized loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) for each construct. The measurement model showed acceptable, though not uniformly strong, fit: $\chi^2(71) = 196.87$, $p < .001$, CFI = .935, TLI = .916, GFI = .902, RMSEA = .096. Discriminant validity was assessed via the heterotrait-monotrait ratio (HTMT); all construct pairs fell below the conservative .85 threshold (range .68–.81).

Table (1): Measurement model: reliability and convergent validity

Construct / item	Standardized loading range	Cronbach's α	CR	AVE
Service diversity (4 items)	0.74–0.86	0.884	0.886	0.661
Financial performance (3 items)	0.79–0.90	0.883	0.888	0.726
Competition (4 items)	0.78–0.82	0.870	0.870	0.627
Differentiation strategy (3 items)	0.82–0.86	0.872	0.874	0.698

Statistical Analysis:

Hierarchical moderated ordinary least squares (OLS) regression was used to test H1 and H2. Moderated regression on composite indicator scores is the standard, transparent technique for testing a single, focal interaction hypothesis, and it supports directly the diagnostic techniques central to this study's approach: HC3 robust standard errors, non-parametric bootstrapping, simple slopes analysis, and the Johnson-Neyman technique.

CSS and service diversity were mean-centred prior to constructing the interaction term, reducing non-essential multicollinearity between the interaction term and its constituent variables. Three models were estimated hierarchically: Model 1 regressed financial performance on control variables only; Model 2 added CSS and service diversity as main effects; Model 3 added the CSS $\times$ service diversity interaction term.

Statistical significance of the interaction was assessed using conventional OLS standard errors, heteroskedasticity-consistent (HC3) robust standard errors, and a 5,000-resample non-parametric bootstrap with both percentile and bias-corrected confidence intervals. Where the interaction was significant, simple slopes of CSS on financial performance were estimated at low (mean $-$ 1 standard deviation), mean, and high (mean $+$ 1 standard deviation) service diversity, and the Johnson-Neyman technique was used to identify the precise range of service diversity over which CSS's conditional effect is statistically significant at the conventional 0.05 level.

Control Variables:

Organizational size was included because larger firms may have more resources to both develop sophisticated costing systems and achieve strong financial performance for reasons unrelated to costing practice, such as economies of scale. Competition was included because competitive intensity has been linked, with mixed results, both to costing sophistication and to performance pressure directly. Differentiation strategy was included because firms competing on differentiation may systematically differ in both their costing practices and their financial performance for strategic reasons distinct from costing system design itself. Each control was retained on this a priori theoretical basis, established before estimation and not revised afterwards.

5. Ethics Policies in Human Research

Participation in the survey was voluntary and anonymous, and ethical approval for the wider research programme from which this dataset is drawn was obtained from the author's institutional research ethics committee prior to data collection, in accordance with the Declaration of Helsinki. Respondents were informed of the purpose of the study, how their data would be used and stored, and that their identities and their firms' identities would remain confidential; informed consent was obtained from all participants prior to survey completion. Respondents were recruited from the FAME database of medium and large UK non-manufacturing firms and were contacted directly by post and online; each business unit was represented by a single knowledgeable respondent, typically a finance director, financial controller, or management accountant. No personally identifying information is reported in this study, and the underlying data are held under confidentiality commitments given at the time of collection.

6. Results

All 204 cases retained had complete data on cost system sophistication, service diversity, financial performance, and all control variables, so no additional case-wise deletion was necessary. Table 2

reports descriptive statistics and correlations. Cost system sophistication showed moderate positive skew (0.91) and negative excess kurtosis (-0.50); service diversity and financial performance showed mild positive skew (0.38 and 0.44 respectively) and mild negative kurtosis, within generally acceptable ranges for OLS estimation. Cook's distance identified 17 of 204 cases exceeding the conventional $4/n$ threshold; the maximum Cook's distance observed was 0.071, below the 1.0 threshold conventionally used to flag individually influential cases, so no case was excluded as an outlier.

Table (2): Descriptive statistics and correlations ($n = 204$)

Variable	Mean	SD	1	2	3	4	5
1. CSS	4.35	5.30	—				
2. Service diversity	3.00	0.87	0.64**	—			
3. Financial performance	2.88	0.94	0.64**	0.65**	—		
4. Size (ln employees)	6.49	1.47	0.49**	0.51**	0.43**	—	
5. Competition	3.14	0.95	0.59**	0.71**	0.62**	0.49**	—
6. Differentiation strategy	3.04	1.06	0.59**	0.68**	0.60**	0.42**	0.69**

** $p \leq 0.01$ (two-tailed). Size is the natural logarithm of number of employees.

Service diversity and financial performance were measured with validated, multi-item reflective scales; reliability and validity statistics are reported in Table 1. Cronbach's alpha exceeded 0.88 for both constructs (service diversity $\alpha = 0.884$; financial performance $\alpha = 0.883$), and average variance extracted exceeded the conventional 0.50 threshold for both, though only financial performance exceeded 0.70 (AVE = 0.726); service diversity's AVE (0.661) clears the convergent-validity threshold but not the stricter 0.70 benchmark.

Common method bias was assessed using two complementary diagnostics. Harman's unrotated single-factor test on the full set of multi-item reflective indicators used across this research programme's measurement model (31 items across eight reflective constructs) produced a first, unrotated factor accounting for 51.1% of total variance, exceeding the conventional 50% caution threshold. A confirmatory single-common-factor model, in which all 14 items used in the primary model's reflective constructs were forced to load on one latent factor, was compared against the hypothesised four-factor measurement model reported in Table 1. The single-factor model fit substantially worse ($\chi^2 (77) = 472.50$, CFI = .795, TLI = .758, RMSEA = .164) than the four-factor model ($\chi^2 (71) = 196.87$, CFI = .935, TLI = .916, RMSEA = .096), $\Delta\chi^2 (6) = 275.6$, $p < .001$.

All bivariate correlations among the study variables were positive and significant at $p \leq 0.01$ (Table 2). Variance inflation factors (VIF) for the moderated regression model, computed after mean-centring, ranged from 1.19 (interaction term) to 2.67 (service diversity main effect), well below the conventional threshold of 5.

Table (3): Hierarchical moderated regression predicting financial performance

Predictor	Model 1	Model 2	Model 3	HC3 p (Model 3)
Constant	0.428	1.871***	1.777***	—
Size (ln employees)	0.084*	0.013	0.017	0.647
Competition	0.348***	0.183*	0.178*	0.046
Differentiation strategy	0.268***	0.115	0.121	0.120
CSS (centred)		0.051***	0.037**	0.017
Service diversity (centred)		0.259**	0.252**	0.018
CSS × Service diversity			0.023*	0.035
R ²	0.455	0.540	0.550	
Adjusted R ²	0.446	0.528	0.537	
ΔR ²	—	0.085***	0.011*	

Unstandardised coefficients shown. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$ (conventional OLS, two-tailed). $n = 204$. HC3 column reports heteroskedasticity-robust p-values for Model 3.

The interaction remained significant under heteroskedasticity-consistent (HC3) robust standard errors ($b = 0.023$, robust $SE = 0.011$, $p = 0.035$). A non-parametric bootstrap with 5,000 resamples produced a percentile 95% confidence interval of $[0.0017, 0.0420]$ and a bias-corrected 95% confidence interval of $[0.0027, 0.0430]$ for the interaction coefficient, both excluding zero.

Table (4): Simple slopes: conditional effect of CSS on financial performance

Service diversity level	B	SE	t	p	95% CI
Low (2.13)	0.018	0.020	0.91	0.365	$[-0.021, 0.056]$
Mean (3.00)	0.037	0.014	2.76	0.006	$[0.011, 0.064]$
High (3.87)	0.057	0.012	4.64	< 0.001	$[0.033, 0.081]$

$n = 204$. Service diversity measured on a 1–5 scale (mean = 3.00, $SD = 0.87$).

The Johnson-Neyman technique identified a single meaningful transition point at service diversity = 2.69 on the 1–5 scale (a second mathematical root fell far outside the scale's possible range). Below this threshold, CSS's association with financial performance was not statistically significant; above it, the association was significant and grew steadily stronger as service diversity increased further. Approximately 60.3% of the sample reported service diversity above this threshold.

Table (5): Robustness of the CSS × service diversity interaction

Predictor	Model A (no controls)	Model B (full controls)	Model C (+ indirect cost ratio)
Size (ln employees)	—	0.017	0.019
Competition	—	0.178*	0.170*
Differentiation strategy	—	0.121	0.117
Indirect cost ratio	—	—	0.354
CSS (centred)	0.046***	0.037**	0.036**
Service diversity (centred)	0.310***	0.252**	0.246**
CSS × Service diversity	0.022*	0.023*	0.021*
R ²	0.516	0.550	0.553
Adjusted R ²	0.509	0.537	0.537

Table (6): Robustness of the CSS $\times$ service diversity interaction to alternative inference methods

Specification	Interaction b	SE	p
Conventional OLS SE (primary)	0.023	0.010	0.032
HC3 heteroskedasticity-robust SE	0.023	0.011	0.035
Bootstrap (5,000 resamples, percentile 95% CI)	0.022	0.010	[0.0017, 0.0420]
Bootstrap (bias-corrected 95% CI)	0.022	0.010	[0.0027, 0.0430]

n = 204 for all specifications.

Table 5 summarises three robustness specifications for the CSS $\times$ service diversity interaction. The interaction remained positive and statistically significant at the conventional 0.05 level across all three specifications ($p = 0.041$, 0.032 , and 0.043 respectively), and the coefficient magnitude changed only modestly (0.019 – 0.023).

7. Discussion

This study tested whether service diversity conditions the relationship between cost system sophistication and financial performance, rather than whether diversity determines sophistication directly. The results support both hypotheses: CSS is positively associated with financial performance on average (H1), and this association is significantly strengthened by service diversity (H2). This result holds under conventional OLS, under heteroskedasticity-consistent HC3 standard errors, and under a 5,000-resample non-parametric bootstrap alike; it is further corroborated by simple slopes that show a clear, monotonic strengthening of the CSS-performance association from low to high service diversity, and is precisely quantified by the Johnson-Neyman threshold at service diversity = 2.69.

These findings bear directly on the antecedent-versus-boundary-condition distinction developed in the literature review above. Diavastis (2025) and this research programme's own companion study both find no significant direct relationship between service diversity and CSS; taken at face value, a direct-effect reading of these results might suggest that diversity simply does not matter for costing system design in non-manufacturing contexts. The present results suggest a different, and arguably more useful, interpretation: diversity does not predict whether a firm develops a sophisticated costing system, but it does predict whether that sophistication, once present, pays off financially. It is important not to overstate this reinterpretation: this study does not directly test whether the specific null diversity-CSS findings in the literature would have been significant had they instead been specified as moderation models, since those studies' original data are not available for reanalysis here; the claim is a plausible, theoretically motivated reading of a broader pattern, not a demonstrated resolution of that pattern.

The magnitude of the moderation is also worth discussing substantively. The simple slope of CSS on financial performance more than triples between mean service diversity ($b = 0.037$) and high service diversity ($b = 0.057$), and is not statistically distinguishable from zero at low service diversity. The Johnson-Neyman threshold, at service diversity = 2.69 out of 5, falls below the sample mean of 3.00, meaning a majority, though not an overwhelming majority, of firms in this sample operate in the

region where CSS's financial performance association is statistically supported; a substantial minority, roughly two in five firms, do not.

This pattern also speaks to the operational-versus-financial asymmetry noted in the literature review: prior studies (Ittner et al., 2002; Cagwin & Bouwman, 2002) have more reliably found CSS-related operational benefits than financial ones. If CSS's financial performance benefit is genuinely conditional on service diversity, then studies pooling firms across a range of service diversity levels without testing for this interaction would be expected to detect a weaker, more inconsistent average financial effect than the operational effects that may hold more uniformly across the sample, exactly the asymmetric pattern this literature has documented. The finding also connects to Daowadueng et al.'s (2023) evidence that costing system design choices mediate the strategic-orientation-to-cost-information-use relationship only under an exploration, rather than exploitation, strategic orientation. Read alongside the present results, both studies point toward the same broader conclusion: costing system design's consequences, whether measured as information use or as financial performance, are not uniform across firms but conditional on specific, identifiable features of the firm's context.

This study makes three contributions. First, it repositions service diversity from an antecedent of cost system sophistication to a boundary condition of its performance consequences, relocating it, in Gerdin and Greve's (2004) terms, from the selection form of fit to the interaction form of fit. Second, the study extends contingency-based costing research methodologically from the selection and mediation forms that dominate this literature toward an interaction-fit perspective, applying HC3 robust inference, non-parametric bootstrapping, simple slopes, and Johnson-Neyman analysis not used in prior mediation-based studies of this dataset. Third, the study provides new evidence from UK non-manufacturing firms, a setting in which service diversity and the potential for cost cross-subsidisation are especially relevant given these firms' typically higher indirect cost intensity relative to manufacturing firms, and a setting that has received comparatively little direct empirical attention in the CSS literature.

In direct answer to the practical question this paper poses, CSS is most clearly financially worthwhile when a firm's service diversity is at or above the Johnson-Neyman threshold identified above (service diversity $\geq$ approximately 2.69 on a five-point scale, a level roughly 60% of this sample met or exceeded); below that threshold, this study's evidence does not support an expectation of a detectable financial return specifically, whatever other benefits a sophisticated costing system may still offer. For finance function leaders, these results suggest a re-ordering of priorities when justifying a costing system investment to a board or ownership group: a stronger, more defensible business case would explicitly assess the firm's current service diversity as part of the investment appraisal, since this study's evidence suggests that diversity, not firm size or competitive intensity, is the more direct signal of whether the investment is likely to show up in financial performance.

Several limitations qualify these findings. The cross-sectional design precludes causal inference; the moderation results describe a statistical pattern consistent with the proposed theoretical account, not a demonstrated causal mechanism, and this study does not use causal language to describe them,

consistent with Maiga's (2014) broader observation that self-selection and endogeneity concerns pervade the costing-performance literature. All constructs were measured via a single respondent's self-report per business unit; Harman's single-factor test is not reassuring on its own (51.1% of total variance), though a confirmatory single-factor model fit markedly worse than the hypothesised four-factor measurement model ($\Delta\chi^2 (6) = 275.6, p < .001$), providing stronger, though not definitive, countervailing evidence. The measurement model's fit was also only partial on RMSEA (.096), which exceeds the conventional .08 threshold, even though CFI (.935) and TLI (.916) both meet conventional standards. Financial performance was measured perceptually rather than with objective accounting data. The study uses the same underlying sample as three companion studies from the same research programme; while the present research question and the specific CSS $\times$ service diversity interaction tested are novel relative to those studies, this sample overlap is disclosed here explicitly. Finally, the study is confined to UK non-manufacturing firms, limiting generalisability to other countries and to manufacturing firms, where indirect cost intensity is typically lower.

Future research should replicate this interaction in other national and sectoral samples, ideally using longitudinal or matched-pair designs capable of strengthening causal claims; test whether the same moderation pattern holds using product, rather than service, diversity in manufacturing samples; and examine whether other contextual factors already established as CSS antecedents, such as competition or cost structure, similarly function as boundary conditions of CSS's performance consequences rather than, or in addition to, functioning as its antecedents.

8. Conclusion

This study tested whether service diversity moderates the relationship between cost system sophistication and financial performance among 204 UK non-manufacturing firms, a question distinct from the mediation-based antecedent-and-consequence models examined in this research programme's companion studies. Cost system sophistication was positively associated with financial performance overall, and this association was significantly strengthened by service diversity, robust to heteroskedasticity-consistent standard errors and bootstrapped inference. Simple slopes and Johnson-Neyman analysis showed that this association is not statistically detectable at low service diversity but becomes significant above a service diversity threshold of approximately 2.69 on a five-point scale, a level exceeded by roughly 60% of the sample.

These findings reposition service diversity as a boundary condition of cost system sophistication's financial performance consequences, rather than merely a determinant of its adoption, and provide a specific, quantitative answer to the practical question of when costing sophistication pays off: cost system sophistication is associated with stronger financial performance most reliably when service diversity is comparatively high, and this association is not statistically distinguishable from zero when service diversity is low. This is a statistical association documented in a cross-sectional sample, not a demonstrated causal effect, and is described in that more limited sense throughout. More broadly, the study illustrates the value of testing contingency variables as boundary conditions of a practice's

consequences, not only as candidate causes of the practice itself, an approach that this literature has applied comparatively rarely to costing systems specifically.

Author Contributions:

- Conceptualization: Hanadi Mohammed Alshamlan.
- Data curation: Hanadi Mohammed Alshamlan.
- Formal analysis: Hanadi Mohammed Alshamlan.
- Investigation: Hanadi Mohammed Alshamlan.
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- Writing – original draft: Hanadi Mohammed Alshamlan.
- Writing – review & editing: Hanadi Mohammed Alshamlan.

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