Hawker Stall Sustainability in Singapore: An Exploratory Microeconomic Analysis of Cost Pressure, Pricing Flexibility, Daily Performance and Cultural Integration

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Singapore hawker centres are more than sources of affordable food. They are part of daily life and culture. Working alongside these are food-delivery platforms, providing convenience and reach, altering the economics of hawker production and consumption. This study investigates how cost pressure, pricing flexibility, daily performance and cultural integration relate to the perceived economic sustainability of hawker stalls, while examining consumer valuations separately. Likert-scale questionnaires were administered to 30 hawker operators and 30 consumers across 3 hawker centres using a cross-sectional, exploratory design. Hawker responses were used to create four composite indices, which were tested against the sustainability index using Pearson correlation and ordinary least-squares regression in Stata 18. To assess consistency, a reduced-model sensitivity analysis was also conducted. Since hawker and consumer responses were not connected, the datasets were analysed separately. Bivariate analysis found that cost pressure and cultural integration were negatively associated with sustainability, while pricing flexibility and daily performance were positively associated. Although the regression produced an extremely high R^2 of .9969, this should not be interpreted as evidence of a strong model. The mean variance inflation factor was 12.25, and the sustainability and pricing-flexibility scales shared substantial item content. The fit was therefore likely inflated by severe multicollinearity and construct overlap. Coefficients changed considerably between specifications, the cost-pressure coefficient varying sixfold. These findings are hypothesis-generating rather than confirmatory. They suggest pricing capacity deserves attention in hawker policy; however, reliable inference requires a larger sample, matched seller-consumer observations and a sustainability measure independent of the predictors.

Keywords: Hawker centres, Singapore, Food-delivery platforms, Platform economy, Microeconomics, OLS regression, Construct validity, Multicollinearity

Introduction

Background and Context

Hawker centres are social spaces, not just economic institutions. They offer relatively inexpensive prepared food and help integrate the food cultures of the Chinese, Malay, Indian and other communities of Singapore. In 2020, hawker culture was recognised by UNESCO and added to the Representative List of the Intangible Cultural Heritage of Humanity, describing hawker centres as Singapore's dining rooms, where people from diverse backgrounds come together to eat and interact[1]. This emphasises that hawker activity brings value beyond the revenue each hawker earns.

This sector is institutionally unusual. Hawkers evolved from informal street-side trade, but now operate on planned premises under licensing, hygiene regulation, tenancy agreements and public-policy programmes. Kong and Wong argue that hawker culture has developed through the daily decisions made by hawkers and customers, and the government policies determining hawker operations[2,3]. Similarly, Tam explains that state planning transformed informal street-food vending into a regulated symbol of Singaporean culture, influencing which foods and traditions are viewed as authentic and culturally valuable[4]. This creates an unusual economic structure: culturally rooted small businesses operate within Singapore's highly formalised economy. Studies from different countries show that street vendors often struggle to protect their incomes while complying with local regulations[5–7]. However, these vending sectors are usually far less formal than Singapore's hawker system. Singapore therefore provides a useful comparison, but is not a typical example of informal street-food vending[8].

Online ordering and delivery platforms have changed how consumers discover and purchase food. For hawkers, these

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platforms can increase visibility and provide access to customers beyond the hawker centre, while consumers benefit from reduced travelling and waiting time. However, the adoption of these services creates additional costs, including commissions, registration conditions, packaging, additional labour and differences between online and in-person menu prices. Hawkers also become dependent on the platform's ranking system to remain visible. Research shows that delivery platforms can increase restaurant sales while reducing the share of revenue retained by the restaurant through commissions and fees[9,10]. The benefits received by sellers therefore depend on the platform's contract and fee structure, rather than on the number of orders[11]. These platforms operate as two-sided markets because they must attract both sellers and consumers. As a result, a pricing system that increases total transactions does not necessarily improve the financial position of individual sellers[12–15]. Other studies show that platform use changes the costs and reach of small food businesses[16], creates disputes between platforms and restaurant partners[17], and is affected by regulations on commission rates[18]. In Singapore, government digitalisation programmes have helped hawkers evaluate and adopt online-ordering services. Platform adoption is therefore a matter of public policy instead of just a private business decision[19,20].

Problem Statement and Rationale

The main issue is that "more orders" does not equal "more welfare for sellers". After accounting for platform charges, packaging, promotion, refunds and additional preparation pressure, a delivery channel can raise gross revenue while reducing contribution margin. Likewise, consumers may benefit from convenience while paying higher delivered prices and forgoing the social interaction that comes with dining at a hawker centre. The relevant comparison is therefore not delivery versus no-delivery, but net economic and social value creation for sellers and for consumers under each channel.

Hawker culture, tourism, entrepreneurship, succession and public policy have all been documented in existing work[4,21–23]. It should be stated plainly that Singapore's digitalisation programmes have themselves addressed platform charges directly rather than ignoring them: the Alliance for Action on online ordering examined sustainable fee structures, commission options and a common-acquirer model, and subsequent programmes have supported hawker onboarding[19,20]. The gap this paper addresses is therefore not an absence of policy attention to commissions. It is the absence of a single empirical framework at the level of the individual stall that relates operating cost pressure, pricing capacity, daily performance, cultural integration and perceived consumer value to one measured sustainability outcome. The international platform literature has largely studied restaurants rather than heritage-regulated hawker stalls[9–11,16,24], and the Singapore hawker literature has been predominantly qualitative, historical or policy-oriented[2–4,22,23]. This paper addresses that gap using primary survey indices and an exploratory OLS model. It is offered as a hypothesis-generating exercise, not as a confirmatory test.

Significance and Purpose

The study makes three contributions. First, it treats hawker sustainability as an outcome that can be measured at the microeconomic level, rather than only as a heritage concern. Secondly, it acknowledges that cultural and community values generate external benefits that are not monetised through stall revenue but are economically relevant. Thirdly, it offers a framework for comparing physical-centre and platform channels without assuming that digitalisation is necessarily beneficial. This is significant because public programmes aim simultaneously at preserving hawker culture, improving productivity and widening digital access[1,20,21]. A fourth contribution, arising from the analysis itself, is methodological: the paper reports in detail how a composite-index design of this kind can produce an apparently excellent statistical fit that turns out to be a property of the instrument rather than of the economy, and what would be needed to avoid it.

Objectives

The primary research question is: to what extent do operating cost pressure, price flexibility, daily profit/production performance, and cultural integration explain variation in the perceived economic sustainability of hawker stalls in Singapore? Four subsidiary questions follow, each with a directional expectation where theory supports one. The first questions the relationship between cost pressure and sustainability; the contribution-margin logic below implies a negative association. The second questions the association between greater price flexibility and higher sustainability, since a stall able to manipulate price and quantity can protect its margin when input costs rise. The third questions the relationship between daily operating performance and sustainability, expecting a positive association. Finally, the fourth question asks about the relevance of culture when financial variables are considered. No direction is stated, since cultural embeddedness may support repeat demand and may also constrain price and menu changes, and there is no theoretical reason to expect a simple linear relationship between cultural integration and economic sustainability.

The fifth question was what motivated the study and shaped its discussion. Based on the perspectives of sellers and consumers, when does food delivery create greater net value than physical hawker-centre transactions? The dataset has no deliv-

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ery cost or margin variables (e.g. commission rate, delivery-specific revenue, packaging cost or net delivery margin) and no matching between seller and consumer records, so it is not tested in this analysis. This is addressed later as a framework and a design specification for future work.

Scope and Limitations

The regression uses just 30 hawker observations. The consumer value perception index belongs to a separate set of 30 consumer responses recorded in different rows of the data, so it cannot enter the same person-level regression. The analysis is cross-sectional and associative; no causal analysis is performed and no causal claim is made. The indices are constructed composite measures and may produce mechanical correlation between conceptually related items across scales, an issue examined at length in the Results. The geographic distribution, stall types, ethnic groups, operator ages and delivery-platform participation of the sample are reported below and would need to be explicitly balanced in future data collection.

Theoretical Framework

Four ideas are brought together in the conceptual framework, and Figure 1 sets out the hypothesised relationships between them. The first is the fundamental business principle that where revenue and contribution margin exceed variable and fixed costs, the stall is profitable. The second is price elasticity and pricing power: a firm able to change its prices or product mix is better placed to withstand shocks to input costs. The third is two-sided platform economics: delivery platforms bring consumers and sellers together but hold the power to reallocate surplus through commission rates, visibility requirements and delivery charges [12–14]. The fourth is externality and cultural-value theory: hawker centres generate benefits for community, identity, tourism and heritage which are not captured in the market price [1,2,22].

The third and fourth ideas must be kept analytically separate from the first two. Monetised revenue and unmonetised cultural externality are different quantities, and the measurement framework below is designed so that cultural value does not become a second proxy for financial sustainability. Whether it succeeds is examined in the Results, where the honest answer is that it may not have.

The NEA workgroup identified low margins, manpower limits, long hours, an ageing workforce, the public image of the trade and rising operating pressures as threats to continuity [21]. Tarulevicz's account of "hawkerpreneurs" shows innovation can revitalise the trade while reshaping what hawking means [23]; Henderson and colleagues show hawker centres serve as local food infrastructure and a visitor attraction [22]; and Tam documents how authenticity and distinction operate within them [4]. Together these point to a multi-dimensional sustainability model rather than a purely profit-based one.

The platform-economics literature supplies the mechanism by which a channel grows while seller welfare falls. In a two-sided market the platform internalises cross-side network effects and sets an asymmetric price structure, so the side with less elastic participation bears more of the charge [12,13]; later work shows superficially different fee structures can be economically equivalent, which matters when a commission is repackaged as a service or visibility fee [14,15]. Empirically, delivery platforms raise restaurant sales while commissions and contract terms determine whether the restaurant retains the gain [9–11], and regulating those commissions shifts platform, restaurant and consumer outcomes [18]. Governance frictions with small restaurant partners are documented in comparable Asian markets [17], platform choice has been studied on the consumer side [24], and platformisation alters the spatial and cost structure of small food businesses [16]. This literature concerns restaurants rather than hawkers, which is precisely why extending it to a heritage-regulated, licence-bound stall economy is worth attempting.

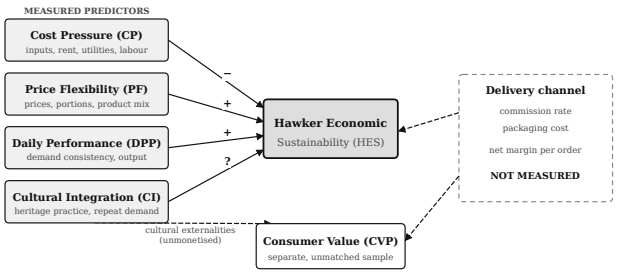

Figure. 1 Hypothesised relationships in the conceptual framework. Solid arrows denote associations estimated in this study; dashed arrows denote relationships discussed but not tested. Signs indicate the directional expectation stated in the Objectives, and "?" denotes that no directional expectation was set. The consumer sample is not matched to the hawker sample, so no path between CVP and HES is estimated. The dataset contains no delivery cost or margin variable, so the fifth research question is not tested here.

A Contribution-Margin Scheme for the Delivery Question

The delivery comparison can be made concrete, and separated from gross order value, with a simple contribution-margin scheme. For a single order, the net contribution to the stall may be written as:

$$\pi = p(1-c) - v - k - \lambda r - w$$

where p is the price charged on that channel, c the platform commission rate, v the ingredient and consumables cost, k the

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packaging cost, r the value lost per refunded or cancelled order weighted by its probability λ, and w the incremental labour and congestion cost of preparing and handing over the order. A delivery order is worth accepting when π is positive, and delivery improves stall economics relative to the counterfactual only when the delivery order's contribution exceeds that of any physical-channel order it displaces rather than supplements. This makes explicit why order growth and seller welfare can diverge: c, k, λ and w all rise with the delivery channel, while p is constrained by what customers will accept to pay for a hawker meal. The present dataset does not contain p, c, v, k, λ or w for any stall. This scheme is therefore presented as a measurement specification for future work, and no parameter of it is estimated here.

Methodology Overview

This study adopts a case-study design which is exploratory, cross-sectional and mixed methods. Structured Likert-scale questionnaires provide the quantitative indices, with optional open-ended prompts covering cost, delivery, labour and cultural issues. The results presented in this paper are the quantitative results of the hawker sample only. The qualitative component was designed and its questions administered, but the open-ended responses have not been coded or analysed for this paper; the procedure by which they would be coded is described below and is clearly identified as planned rather than completed work.

Methods

Research Design

It is a descriptive, non-experimental and exploratory design. It compares patterns of hawker operators and consumers at hawker centres in Singapore, in a selected purposeful sample. This is suitable because the research question is asking about what is happening, how they perceive it and the channel they will choose to use, as this is not something that the researcher can ethically and practically change. This is an OLS regression analysis of the conditional associations between the HES index and the four hawker-level predictors. That is an estimation to explain the pattern of this sample, and hypothesise what will happen in other samples later on, not to set effects.

Research Approach

The quantitative component is primary and is based on structured questionnaires. The survey also included follow-up questions that allowed responders to explain their experiences with delivery platforms, rising costs, business succession and the cultural relevance of hawker food and culture. These responses could then be organised into themes and then used in a future mixed-methods analysis, which would help explain the statistical findings; however, this analysis was not conducted in the study. The inclusion of these responses does not make the study qualitative, as the main findings are based on quantitative data. Instead, these responses preserve valuable cultural context for a sector that is closely shaped by tradition and community.

Participants or Sample

The field strategy identified three venues differing in location, institutional type and customer base, named and described under Data Collection below. Hawker operators were purposively and conveniently sampled, with an effort to obtain variation in cuisine type, operator age, gender, ethnic background, stall tenure, price range and use of delivery platforms. Consumers were sampled independently at the same locations. Sixty respondents were obtained in total: 30 hawker records and 30 consumer records. The venue set is narrow in ways set out under Data Collection below, and convenience recruitment additionally favours operators with the time and inclination to answer a survey during trading hours. The sampling was not random and the results must not be viewed as nationally representative. The realised distribution of the sampled characteristics is reported in Table 2 so that readers can assess sample composition and possible selection bias directly.

Data Collection

Data were collected through a self-administered, in-person online questionnaire completed by the respondent at the venue. Each core construct is measured by five Likert-type items scored from 1 to 5, so each index has a possible minimum of 5 and a possible maximum of 25, with the total across the five items representing the index. Questions to consumers cover convenience, willingness to pay, food variety, delivery usage, affordability, and perceived cultural value, while questions for vendors cover pricing decisions, input costs, rent and fees, daily demand and profitability, delivery-platform experience, workload, and cultural consistency. Each survey took approximately 8-12 minutes and was conducted outside peak service hours, at the venue.

Data Provenance and Availability

The fieldwork was conducted by the author in seven consecutive days from 2nd to 8th April 2026 with the instrument reproduced in Appendix A. Ten hawker operators and ten consumers were sampled from each of the three venues: Yue Hua Food Court from Depot Heights Shopping Centre (Telok Blangah area of the Bukit Merah planning area in the Central Region of Singapore); Hawker's Street @ The Clementi Mall (Clementi planning area in the West Region of Singapore); and

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Telok Blangah Food Centre (Telok Blangah area of the Bukit Merah planning area in the Central Region of Singapore).

The selection of research sites creates two important limitations. First, two of the three venues are located within the same planning area, meaning the geographical coverage is narrower than the use of "three venues" may suggest. Second, the sample mainly represents private food courts rather than public hawker centres. Telok Blangah Food Centre is the only publicly operated venue, while Yue Hua Food Court and Hawker's Street @ The Clementi Mall are privately managed food courts located within retail premises. Therefore, 20 of the 30 stall operators surveyed work in private food courts. This distinction is important because public hawker centres and private food courts have different rent, tenancy and service-charge systems. As the cost-pressure index includes questions about rent and service charges, these institutional differences create an uncontrolled source of variation in the results. As a result, the sample should not be described solely as hawker-centre vendors. This is because it consists of cooked-food vendors mainly from private food courts, with the term "hawker" being used in that broader sense throughout the study.

Any participant available outside peak service hours and willing to take part was eligible; no stall type or cuisine was excluded, and surveys were conducted at each venue until ten operators had completed the instrument. The vendors that declined to participate were not recorded, meaning the response rate cannot be calculated, and the extent of self-selection within the sample cannot be measured. Future repetitions of this study should therefore maintain a refusal log to record how many potential participants were approached but chose not to respond.

The instrument was presented as an online survey, with each item on the instrument being required to be answered, so not a single item was left blank, no index was missing a value and no imputation or exclusion was required. The open-ended questions were also answered. All values in the analysed dataset were neither simulated, generated, imputed, edited or re-ordered prior to analysis. A de-identified item-level dataset, an item-level codebook, and the specific version of the questionnaire used are available upon request from the author; the Stata do-file used to reproduce all of the tables included in this paper are also available.

Variables and Measurements

Table 1 defines each variable, its role in the analysis and its operational meaning.

The consumer CVP observations are not paired with the hawker HES observations. CVP is therefore not used as a predictor in the hawker regression; including it would result in zero complete cases. This separation must be maintained analytically, and can only be corrected by an explicit matched centre-level or stall-level design in future studies. The CI construct is referred to throughout this paper as cultural integration, defined as the extent to which a stall's recipes, reputation and customer relationships are embedded in community and heritage practice. No alternative term is used for it anywhere in the manuscript.

Table 1 Variables, roles and operational meanings.

Variable	Role	Operational meaning
HES index	Dependent variable	Composite measure of the perceived economic sustainability and continuity of the hawker business.
CP index	Independent variable	Cost pressure from ingredients, rent, utilities, labour, platform charges and related expenses. A high score denotes greater pressure.
PF index	Independent variable	Ability to adjust menu prices, portions, product mix or channels without unacceptable demand loss.
DPP index	Independent variable	Daily profit/production performance, including demand consistency, output and operating return.
CI index	Independent variable	Cultural integration and embeddedness of the stall within community and heritage practices.
CVP index	Consumer-side outcome, reported separately	Consumer value perception covering price, quality, convenience, experience and cultural value. Not matched to hawker records and not used in the regression.

Index Construction and Scoring

Every index is the unweighted sum of its five items, each scored 1 = strongly disagree, 2 = disagree, 3 = neutral or uncertain, 4 = agree, 5 = strongly agree, giving a range of 5 to 25. All five indices were computed in the same way, with no weighting and no standardisation before summation. Items were written so that agreement indicates more of the named construct: agreement with a cost-pressure item indicates greater cost pressure, and agreement with a price-flexibility item indicates greater flexibility. Consequently a high CP score denotes an unfavourable condition while a high PF, DPP, CI or HES score denotes a favourable one, and the signs of the correlations in Table 4 must be read with that in mind. Exactly one item was reverse coded before summation. The fifth cultural-integration item (CI5), which states that delivery orders provide less cultural or community interaction than in-person dining, is worded in the opposite direction to the other four in that index and was recoded as $(6 - \text{CI5})$, mapping 1 to 5 and 5 to 1, before the CI total was calculated. Every CI figure in this paper — Tables 3, 4, 5 and 7 — is computed from the index built with the reverse-coded item. No CP, PF, DPP or HES item was reverse coded. The recoding preserves the 5 to 25 range, so all five indices remain on a common scale. Because every question was required, all five items in every section were answered by every respondent, so each index total came from a complete set of five items and no imputation or missing-value rule was needed. The full item

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wording is in Appendix A so that the scoring is exactly repeatable.

One measurement concern belongs here rather than in the discussion. The cultural integration index combines cultural preservation, customer valuation of cultural identity, cross-group interaction, cultural reputation as a driver of repeat demand, and the perception that delivery reduces cultural interaction — arguably distinct facets rather than one construct. The reverse coding of CI5 fixes its wording without settling its substance: the first four items describe the stall and its customers, while CI5 describes the delivery channel, and whether a respondent who sees little cultural difference between channels is thereby less culturally embedded is an assumption, not a finding. Without item-level dimensionality evidence there is no basis for claiming the five items form one scale under either coding, and the CI results below should be read as a composite of related items rather than measurement of a single construct. This is the same caution that the instability of the CI coefficient in Table 7 independently supports.

Reliability and Validity

Internal consistency was not computed. Cronbach's alpha[25] and item-total correlations should be reported for every multi-item index; they were planned but not carried out, and item-level responses were retained without item-level analysis. This is a substantive limitation, not a formality: without internal-consistency, item-total and dimensionality evidence there is no basis for showing that the sustainability and pricing-flexibility indices measure distinct constructs, and the extremely high correlation between them is entirely consistent with the possibility that they do not. Every interpretation resting on the composite indices is weakened accordingly, and they should be treated as provisional summative scores rather than validated scales.

Content validity is supported to the extent that the questionnaire items were derived from the literature on hawker cost pressure, pricing, labour, cultural value and digitalisation[1,19–21]. Of three further credibility procedures considered — pilot testing, member checking of response summaries, and triangulation across sources — only triangulation was carried out, and only on the consumer responses, which were checked against one another and against the policy and literature sources cited here. The operator responses were not triangulated, member checked or pilot tested, so the hawker-side measurement, where the entire regression sits, rests on a single uncorroborated self-report per respondent. Preserving the questionnaire, coding guide, dataset and Stata commands supports dependability, and these are available as stated above. Confirmability requires distinguishing respondents' evidence from the researcher's interpretation, and the Results below are reported before any interpretation is offered.

Procedure

Responses were exported from the survey platform, assigned anonymous identifiers and compiled into a single dataset; because the platform required every item, no completeness check or manual data entry was involved. The one reverse-coded item was recoded as described above and index totals were then calculated. Hawker and consumer respondent types were kept as separate analytic groups. Scatter plots and Pearson correlations were examined for the hawker subsample before the OLS model was estimated. Residual and specification diagnostics followed. The open-ended responses were collected and anonymised but have not been coded or compared with the statistical results in this paper.

Data Analysis

The main model is $\mathrm{HES}_i = \beta_0 + \beta_1 \mathrm{CP}_i + \beta_2 \mathrm{PF}_i + \beta_3 \mathrm{DPP}_i + \beta_4 \mathrm{CI}_i + \varepsilon_i$. Descriptive statistics summarise the scale distributions. Pearson correlations assess bivariate relationships. OLS coefficients estimate the association of each predictor with HES while holding the others constant, subject to the severe qualification about multicollinearity set out in the Results. Statistical significance is assessed at $\alpha = .05$, and p-values between .05 and .10 are described as marginal rather than significant. Diagnostics include variance inflation factors, the Breusch–Pagan/Cook–Weisberg test, the Shapiro–Wilk test of residual normality, residual-versus-fitted inspection and the Ramsey RESET test. Because the four predictors are strongly intercorrelated, the model was additionally re-estimated on reduced sets of predictors so that the stability of each coefficient across specifications could be assessed directly; these results are reported in Table 7. Analysis was conducted in Stata/MP 18.0[26].

For the qualitative material, six stages of thematic analysis are proposed should that component be completed in future work: familiarisation, initial coding, grouping of related codes, theme review, theme definition, and comparison with the quantitative results. Candidate coding categories include "commission burden", "additional reach", "packaging and labour", "digital capability", "customer convenience" and "loss of community experience". No thematic analysis has been performed for this paper.

Ethical Considerations and IRB Approval

Participation was voluntary. Before starting, respondents were given a brief information statement explaining the study, the time commitment, the use of the data, and their right to stop at any time without repercussions. Names, stall licence numbers, phone numbers and exact financial information are not published. Responses carry anonymous identifiers and are kept in password-protected files. Questions about revenue and

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profit allowed banded ranges or a "prefer not to answer" option. Data collection was arranged so as not to hinder business operations, and quotations from open-ended answers would be used only with permission.

The study collected survey responses from stall operators and consumers and therefore falls within the scope of institutional review. No institutional review board approval was obtained before data collection. The work was carried out independently as secondary-school research without access to an institutional review body, and the requirement was not identified at the design stage. This is stated rather than omitted, because it is a limitation in how the study was conducted and not a matter of reporting. The safeguards that were applied are those described above: participation was voluntary and could be ended at any point without consequence, an information statement preceded the questionnaire, questions on revenue and profit allowed banded or declined answers, and responses are held under anonymous identifiers in password-protected files. No identifiable personal data are reported anywhere in this paper: no respondent is named, no stall is identified, and no response can be traced to an individual operator or customer. Should the journal require review before publication, the author will seek it through the route indicated in the submission guidelines.

Results

Sample Structure and Sample Profile

The dataset comprises 60 observations. The hawker sustainability and predictor indices occupy the first 30 rows and the consumer value observations the last 30 rows. Because no row contains both an HES and a CVP value, a combined individual-level model is not estimable. Table 2 reports the composition of the hawker sample against the characteristics the sampling design sought to vary, so that readers can judge sample composition and possible selection bias before interpreting the regression.

Three features bear on interpretation. The sample leans towards Chinese-cuisine stalls (40.0%) and operators aged 50 or over (56.7%); the latter is consistent with the ageing workforce the NEA workgroup identified[21], though a purposive sample of thirty cannot evidence that. Tenure is spread evenly across bands, so neither new entrants nor long-established stalls dominate. Most importantly, although 56.7% of operators use a delivery platform, only four report delivery exceeding a quarter of orders. The sample thus holds almost no variation at the high-delivery end — an independent reason the fifth research question could not have been answered here even had delivery cost and margin variables been recorded.

Table 3 reports the descriptive statistics for all indices.

Table 2 Profile of the hawker sample (n = 30).

Characteristic	Distribution across the 30 hawker respondents: n (%)
Venue	Yue Hua Food Court 10 (33.3); Telok Blangah Food Centre 10 (33.3); Hawker's Street @ The Clementi Mall 10 (33.3)
Venue type	Privately operated food court 20 (66.7); public food centre 10 (33.3)
Planning area	Bukit Merah, Central Region 20 (66.7); Clementi, West Region 10 (33.3)
Cuisine / stall category	Chinese 12 (40.0); Malay 5 (16.7); Indian 5 (16.7); Western 4 (13.3); drinks and dessert 4 (13.3)
Years operating	Under 5 years 7 (23.3); 5–9 years 8 (26.7); 10–19 years 9 (30.0); 20 years or more 6 (20.0)
Operator age band	Under 40 6 (20.0); 40–49 7 (23.3); 50–59 9 (30.0); 60 or over 8 (26.7)
Gender of operator	Male 18 (60.0); female 12 (40.0)
Average meal-price band	Under S$5 8 (26.7); S$5–6.99 15 (50.0); S$7 or more 7 (23.3)
Uses any delivery platform	Yes 17 (56.7); no 13 (43.3)
Delivery share of orders	0% 13 (43.3); 1–10% 7 (23.3); 11–25% 6 (20.0); over 25% 4 (13.3)

Note. Categories are those recorded in Section A of the instrument (Appendix A). Percentages are of the 30 hawker respondents and may not total 100 owing to rounding; venue, venue-type and planning-area rows count operators, not venues. Fieldwork ran from 2 to 8 April 2026, with ten operators sampled at each venue by design. The thirteen operators reporting no delivery-platform use are the same thirteen reporting a zero delivery share. The sample was purposive and is not representative of the cooked-food stall population of Singapore.

Table 3 Descriptive statistics for all indices.

Measure	n	Mean	SD	Minimum	Maximum
HES index (hawker sample)	30	14.87	3.92	9	22
CP index	30	17.70	2.93	12	23
PF index	30	14.80	4.33	8	23
DPP index	30	11.07	4.53	5	20
CI index	30	16.60	2.47	12	21
CVP index (separate consumer sample)	30	19.63	3.17	14	25

Note. All indices are summed five-item scales with a possible range of 5 to 25, each item scored 1 to 5. The CI index is computed with item CI5 reverse coded, as described under Index construction and scoring. The hawker and consumer samples are separate sets of 30 respondents and are not matched.

Correlation Analysis

All four hawker predictors correlate strongly with HES. CP is negatively related to HES ($r = -.9267$, $p < .001$), PF positively related ($r = .9949$, $p < .001$), DPP positively related ($r = .8642$, $p < .001$) and CI negatively related ($r = -.9026$, $p < .001$). The predictors are also highly correlated with one another, most notably CP with CI ($r = .9697$), which means the regression coefficients cannot be interpreted as independent effects. Table 4 reports the full matrix.

Table 4 Pearson correlation matrix for the hawker sample.

Variable	HES	CP	PF	DPP	CI
HES	1.000				
CP	−0.927	1.000			
PF	0.995	−0.896	1.000		
DPP	0.864	−0.864	0.861	1.000	
CI	−0.903	0.970	−0.869	−0.859	1.000

Note. n = 30. All reported pairwise correlations were significant at $p < .001$ in the Stata output. A high CP score denotes greater cost pressure, an unfavourable condition, which is why CP correlates negatively with HES.

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OLS Regression Model

The four-predictor OLS model was significant at $p < .001$ ($F(4,25) = 2016.16$) and explained 99.69% of the observed variance in HES ($R^2 = .9969$; adjusted $R^2 = .9964$; root MSE = .2347). PF was the largest positive predictor (B = 0.7741, SE = 0.0246, t = 31.45, $p < .001$). CP was negatively associated with HES (B = −0.1657, SE = 0.0680, t = −2.44, p = .022). With the other predictors held constant, DPP was not significant but close to the .05 level (B = −0.0420, p = .058), and CI was also negative and not significant at .05 (B = −0.1302, p = .088). Table 5 reports the model. These coefficients are presented for completeness and are not interpreted as independent effects; the reasons are given in the two sections that follow.

Table 5 Four-predictor OLS regression of HES (n = 30).

Predictor	B	SE	t	p	95% CI
Constant	8.969	0.999	8.98	<.001	[6.911, 11.027]
CP	−0.166	0.068	−2.44	.022	[−0.306, −0.026]
PF	0.774	0.025	31.45	<.001	[0.723, 0.825]
DPP	−0.042	0.021	−1.99	.058	[−0.085, 0.001]
CI	−0.130	0.073	−1.77	.088	[−0.281, 0.021]

Note. $F(4,25) = 2016.16$, $p < .001$; $R^2 = .9969$; adjusted $R^2 = .9964$; root MSE = .2347. These coefficients should not be interpreted as independent effects; see Table 7 and the section on measurement overlap.

Model Diagnostics

There was no evidence of heteroskedasticity (Breusch–Pagan/Cook–Weisberg $\chi^2(1) = 0.00$, p = .9725). Residual normality was not rejected (Shapiro–Wilk W = 0.9592, p = .2951). The Ramsey RESET test gave no evidence of omitted nonlinear combinations of fitted values ($F(3,22) = 0.21$, p = .8912). Multicollinearity is severe, with variance inflation factors of 20.85 for CP, 17.35 for CI, 5.97 for PF and 4.81 for DPP, and a mean VIF of 12.25. Table 6 reports the collinearity diagnostics. No Durbin–Watson statistic was produced because these are cross-sectional data and are not ordered in time; the statistic is not meaningful for this design.

These diagnostics must be read against the sample size. With n = 30 and four predictors there are 25 residual degrees of freedom, at which the Breusch–Pagan, Shapiro–Wilk and RESET tests all have low power: a non-significant result is weak evidence that an assumption holds, not confirmation of it, and each test could miss a real violation of moderate size. Residual-versus-fitted plots showed no systematic pattern, but 30 residuals cannot rule out mild heteroskedasticity or curvature. Influential-observation diagnostics matter more here than the formal tests, since in a 30-observation model a few points can move a coefficient materially; leverage values, DFBETAs and Cook's distances should accompany any future estimation and are not available for the present one. The variance inflation factors carry the real weight. Conventional VIF cut-offs are contested and a high VIF is not automatically disqualifying[27], but a mean of 12.25 with two predictors above 17, in a model whose outcome shares item content with one of its predictors, is not a borderline case.

Table 6 Collinearity diagnostics for the four-predictor model.

Predictor	Tolerance	VIF
CP	0.048	20.85
CI	0.058	17.35
PF	0.167	5.97
DPP	0.208	4.81

Note. Mean VIF = 12.25.

Sensitivity of the Coefficients to Model Specification

Because the predictors are strongly intercorrelated, the four-predictor coefficients cannot be read as independent effects. To show how far each coefficient depends on the specification rather than on the data, the model was re-estimated on reduced sets of predictors. Table 7 reports seven specifications.

Four things follow from Table 7, each limiting what the headline model can be said to show. First, the cost-pressure coefficient ranges from −0.166 to −0.988, a factor of six, driven entirely by which other predictors are included. Its sign is stable in every specification, so the direction of the association is reasonably robust; its magnitude is not, so no numerical interpretation — any statement about how much sustainability changes per unit of cost pressure — is defensible here. Second, the daily-performance coefficient changes sign: −0.042 with both CP and PF in the model, +0.025 with PF but not CP (model 5), and +0.212 without PF, against a bivariate correlation with HES of +.864. The negative multivariate coefficient is therefore a suppression artefact of DPP's correlations with PF (r = .861) and CP (r = −.864), not evidence that stronger daily performance accompanies weaker sustainability.

Third, cultural integration is not significant in any specification and also changes sign, from −0.130 in the full model to +0.036 when PF is removed, where p = .937. The CI coefficient carries no interpretable information and no substantive claim about cultural integration should be drawn from the regression. Fourth, and most consequentially, price flexibility alone accounts for 98.98% of the variance in HES; adding the other three predictors raises R^2 by 0.71 percentage points. The four-predictor model is in effect a model of one predictor — and that predictor shares substantial item content with the outcome, which is examined next.

Explaining the Model Fit: Measurement Overlap

An R^2 of .9969 obtained from 30 observations of self-reported Likert scales is not a sign of a good model, and this paper does

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Table 7 Sensitivity of coefficients to model specification (n = 30).

Model	CP	PF	DPP	CI	R^2	Adj. R^2	Max VIF
1. CP + PF + DPP + CI	−0.166 (.022)	0.774 (<.001)	−0.042 (.058)	−0.130 (.088)	.9969	.9964	20.85
2. CP + PF + DPP	−0.268 (<.001)	0.771 (<.001)	−0.035 (.108)	—	.9965	.9961	6.09
3. CP + PF	−0.242 (<.001)	0.754 (<.001)	—	—	.9961	.9958	5.07
4. PF only	—	0.899 (<.001)	—	—	.9898	.9895	1.00
5. PF + DPP	—	0.876 (<.001)	0.025 (.444)	—	.9900	.9893	3.87
6. CP + DPP	−0.960 (<.001)	—	0.212 (.075)	—	.8747	.8654	3.94
7. CP + DPP + CI	−0.988 (.019)	—	0.213 (.083)	0.036 (.937)	.8747	.8603	17.85

Note. n = 30 throughout. Coefficients are unstandardised. Entries are B with p in parentheses; a dash indicates the predictor was not included in that specification.

not present it as one. It requires explanation, and four explanations were considered. They are not mutually exclusive and the data cannot separate them.

The first, and most likely, is construct overlap between predictors and outcome. The sustainability index asks whether the stall is financially viable, whether current earnings justify continuing in the trade, and whether the business can withstand moderate cost increases. The price-flexibility index asks whether the operator can raise prices without losing customers and change portions or ingredients when costs rise. An operator who believes the stall can absorb a cost increase is close to answering the same question in both sections. Cost pressure likewise asks about profitability, which sustainability also asks about, and daily performance asks whether the stall earns an acceptable return, which is close to asking whether earnings justify staying in the trade. Where predictor and outcome items sample overlapping content, the correlation between them is partly mechanical, and R^2 measures overlap between instruments rather than an economic relationship between constructs. The two most extreme correlations — PF with HES at r = .9949 and CP with CI at r = .9697 — fit that reading.

The second is common-method variance. All five indices came from the same respondent, at one sitting, in one format, on a single response scale: the conditions under which method effects are strongest[28]. A respondent who forms one overall impression of how the business is doing and answers all five sections consistently with it will produce high inter-scale correlations regardless of the underlying economics. Two features of this study make that worse rather than better. The instrument was completed at the respondent's place of work with the researcher present, a setting that invites internal consistency; and because every item was required, respondents could not leave uncertain items blank, so any tendency to settle on a consistent response level applied across all five sections.

The third and fourth explanations are structural. With five items per index, a five-point scale and 30 respondents, a modest number of repeated response patterns is enough to produce near-collinear index totals, which the near-singularity of the correlation matrix is consistent with; and at n = 30 sampling variation alone can generate high correlations. Purposive selection does not correct for either, and may concentrate the sample on operators willing to discuss their business, who may answer more consistently than the population would.

The same conclusion follows from all four: the R^2 reported here is evidence about the measurement instrument, not about the Singapore hawker economy, and nothing in this paper should be read as claiming that 99.69% of real variation in hawker sustainability has been explained. The single most useful change to this design would be to replace the self-reported sustainability index with an outcome not assembled from the same self-reports — an audited or bounded net margin, a revenue-to-cost ratio built from records, or continuation status observed at follow-up. That change, with item-level reliability and discriminant-validity evidence, would determine whether the associations reported here reflect anything about hawker economics at all. It is the first recommendation made below.

Consumer Value Perception: A Separate Descriptive Account

The consumer data are reported separately and are deliberately not integrated into the framework above, because they cannot be: the 30 consumers were sampled independently of the 30 operators, and no consumer observation can be matched to any stall or, in the recorded data, to any venue. The CVP index had a mean of 19.63 (SD = 3.17, range 14–25) on a 5–25 scale, sitting 4.76 points above the hawker sustainability mean of 14.87, with a floor just below the scale midpoint, so no consumer returned a broadly negative valuation. Its distribution is also tighter than the hawker one (SD 3.17 against 3.92), consistent with consumers agreeing about the value of hawker food more than operators agree about the state of their businesses.

The CVP index is a single summed measure covering price, quality, convenience, experience and cultural value, and the components are not reported separately. An aggregate of 19.63 is compatible with very different underlying patterns, including one in which consumers rate cultural value highly

while rating willingness to pay a higher price low — precisely the distinction any policy inference would turn on, and one the aggregate cannot make. The item-level responses were collected and are available on request; reporting them as component means is the first change the consumer section needs.

No relationship between consumer value and seller sustainability is estimated, and none can be, so this study offers no evidence on whether delivery generates more consumer net value or affects seller sustainability. Establishing that requires matched seller and consumer observations at stall level, or aggregation of both sides to venue level across enough venues to support estimation; both are set out under Recommendations.

Discussion

Restatement of Key Findings

The findings are indicative of an associative pattern, that is, the higher the reported sustainability the higher also the reported price flexibility, and vice versa, the higher the reported cost pressure the lower the reported sustainability. The correlation between daily performance and sustainability is positive and strong at bivariate level; however, this relationship is slightly negative when both highly correlated predictors are given. This flip in the sign is not a result of daily performance lowering sustainability, but is merely due to the multicollinearity among DPP, PF and CP. Similarly, the negative CI coefficient should not be read as evidence that cultural integration lowers sustainability; it may reflect conceptual overlap with cost pressure and suppression effects, and it is not statistically significant in any specification tested.

One of the most consistent and robust relationships in these data is the relationship between price flexibility and sustainability. It is also the finding most likely to be subject to the measurement problem described above due to the overlap in content of these two scales. So the finding should be interpreted as a hypothesis which needs to be confirmed by independent measurement, rather than a result.

Implications and Significance

The pattern that is most meaningful from these data is that of pricing capacity. Low prices are a key expectation for the hawkers, but there may be an increase in costs of inputs compared to the price of a menu. Those operators who say they can control their prices, portions, menus/channels also say they can control margins. If it's a genuine connection, it argues for a difference between maintaining the affordability of food and maintaining administrative restraint on prices, which could work against the former over time. To achieve a focus on affordability without price freezing, cost relief, productivity support, shared services and targeted subsidies and/or reduced platform charges may be pursued. None of those interventions are measured, and no evidence of the effectiveness of any is provided; the argument for them is theoretical, and is based on the literature as well as the contribution-margin logic, not on these data.

The decision rule that follows from that scheme for delivery platforms is net incremental contribution: an order should be accepted if the revenue generated by the order is greater than the cost of the food, the commission, the cost of packaging, the expected value of refunds, and additional labour and congestion costs. Platform pilots which reduce or eliminate the hawker commission directly tackle this issue, and a platform-based system has been tested in Singapore[29]. The two-sided-market literature provides explanations for the constraint because the platform uses an asymmetric pricing scheme, where the less elastic side of the market pays more of the charge[12–14], and because commission regulation changes the outcomes in modelled ways[18]. The results from restaurants suggest that participation on the platform can lead to a higher sales volume; the type of contract determines whether or not the seller keeps the profit[9–11]. No delivery-specific variables are included here, so none of this is tested; it is presented as a hypothesis for a future study to test.

Finally, a successful delivery will not produce the externalities of eating at a hawker centre – social mixing, tourism, and the eating culture and community identity[1,4,22]. These build up outside the transaction and are not captured by the margin on either channel, the analytical reason why cultural value is kept separate from financial sustainability and not made a second proxy for profitability.

Connection to Objectives

The first four research questions are answered by estimating and diagnosing the relationship between the four hawker-level predictors and the HES, but importantly, because these predictors overlap in their measures, what the estimates can show is limited. The first question has a direction and is consistent for all specifications: the association with cost pressure is negative. The second, with price flexibility, is answered with the highest association in the data subject to the overlap issue. The third (daily performance) is answered at the bivariate level as a positive association, and the negative multivariate coefficient is attributed to a suppression artefact. The fourth, cultural integration, is left unanswered: The coefficient is unstable, never significant, and is taken from a composite whose dimensionality has not been determined.

The fifth question, regarding the creation of greater net value due to delivery, cannot, and is not, answered by the data. The regression includes no delivery participation or delivery share variable, the dataset contains no commission rate or channel-specific margin, and there is no matched observa-

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tion of seller and consumer at any centre. Instead, what this paper offers on that question is a framework and a set of measurement requirements rather than a result.

Recommendations

The recommendations below are separated according to what supports them, because the two categories carry very different weight.

Recommendations Supported by the Present Data

The findings of this study support recommendations about how the study itself should be redone, and little else. The first and most important is to replace the self-reported sustainability index with an outcome measured independently of the predictor items, such as an audited or bounded net margin, a revenue-to-cost ratio built from records, or continuation status observed at a later date; the measurement overlap documented above makes this the precondition for any further work with this design. The second is to test reliability and factor structure before constructing any index total, reporting Cronbach's alpha, item-total correlations and discriminant-validity evidence for each scale, and to separate cultural integration from financial pressure during scale construction so that the two are not measuring the same thing. The third is to collect a larger stratified sample across substantially more than the three venues sampled here, drawn from several planning areas rather than two and stratified by institutional type so that public food centres and privately operated food courts can be compared rather than pooled, with quotas by stall type, location, operator age, gender, ethnicity and platform participation, so that inference is not attempted at n = 30 with four predictors. The fourth is to estimate alternative models with fewer correlated predictors, to report robust standard errors and influence diagnostics alongside the main model, and to avoid causal wording throughout.

Recommendations Drawn from Theory and the Wider Literature

The remaining recommendations do not follow from these data and are presented as design proposals and as propositions for future testing. Channel-specific variables should be recorded directly: percentage of orders arriving through delivery, commission rate, packaging cost, average order value, delivery menu markup, preparation time, cancellation rate and net margin per order, which together populate the contribution-margin scheme set out earlier. Consumer data should be collected at a matched centre level or stall level so that customer value can be linked meaningfully to seller outcomes, which is the only way the fifth research question becomes answerable. Semi-structured interviews should be used to explain why some hawkers adopt, reject or discontinue delivery platforms and how digitalisation affects workload and identity. As for policy, the case for cost relief, productivity support, shared services, targeted subsidies or reduced platform charges rests on the platform-economics literature and on existing policy work [12,18–21,29] rather than on any estimate produced here, and should be evaluated by studies designed to measure the interventions themselves.

Limitations

The very high model fit is unlikely to represent the complexity of the Singapore hawker economy; the four candidate explanations are set out under Explaining the Model Fit and none can be ruled out without item-level analysis, which was not performed. No reliability or dimensionality evidence exists for any of the five indices, so they must be treated as provisional summative scores. The high VIFs mean the model cannot reliably separate the contributions of CP and CI, and Table 7 shows the CP, DPP and CI coefficients are all specification-dependent. The sample was not random and comprised only 30 operators, so the diagnostic tests have low power and the inferential statistics are fragile. Financial measures are perception-based and unaudited, and self-reports of this kind are exposed to social-desirability bias. The design is cross-sectional, so nothing reported here speaks to change over time and causal interpretation is ruled out altogether. The model contains no delivery-platform variable, so the discussion of delivery is conceptual throughout, and the consumer sample is unmatched and reported separately. The findings are offered not as a representative estimate for Singapore but as an illustration of an economic framework, an analytical process, and the measurement problems a composite-index design must solve before it can support conclusions.

Closing Thought

Singapore's hawker culture is a traditional food system that has been formalised, culturally protected and exposed to platform-driven market change. In this sample the ability to respond to prices and costs is most strongly associated with reported sustainability, though the strength of that association is inseparable from the overlap between the scales measuring it. Delivery applications can extend reach and convenience but are not inherently better for sellers: whether they help depends on commissions, packaging, labour, price markups, genuine market growth rather than channel substitution, and the social benefits displaced when a meal is no longer eaten at a hawker centre. Net seller margin, consumer surplus and cultural externalities should be compared across channels in a fuller model built on independent measurement. These results are preliminary, exploratory and hypothesis-generating, and must be treated cautiously given the small non-random sample, unmatched consumer data, absent reliability evidence

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and severe multicollinearity. What the study contributes with most confidence is a framework, a set of measurement requirements, and a clear account of what a future design must do differently.

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Appendix

Appendix A. Hawker Stall Operator Questionnaire

Response scale for Sections B–F: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral/uncertain, 4 = Agree, 5 = Strongly agree. Each section contains five items. The index for a section is the unweighted sum of its five item scores and therefore ranges from 5 to 25. One item in the whole instrument, CI5 in Section E, was reverse coded as 6 minus the raw score before its index total was calculated; every other item was summed as written. Because all questions were required, all five items in every section were answered by every respondent. This is the version of the instrument that was administered.

Section A: Background

Centre/location; cuisine category; years operating; operator age band; number of workers; typical opening days and hours; average meal-price band; use of GrabFood, Foodpanda, Deliveroo or other platform; approximate delivery share of orders.

Section B: Cost Pressure (CP)

Ingredient costs have increased substantially; rent and service charges place pressure on the stall; utilities and labour costs reduce margins; delivery commissions and packaging reduce the profitability of online orders; it is difficult to absorb cost increases without changing prices or portions. Agreement indicates greater cost pressure; a high CP score therefore denotes an unfavourable condition.

Section C: Price Flexibility (PF)

I can raise prices without losing too many customers; I can change portion size or ingredients when costs rise; I can introduce higher-margin items; I can charge different prices across physical and delivery channels; customers accept price changes when they are explained or justified. Agreement indicates greater price flexibility.

Section D: Daily Profit/Production Performance (DPP)

Daily customer demand is sufficiently predictable; the stall produces enough output to cover operating costs; wastage is kept at a manageable level; peak-period capacity is used efficiently; the stall earns an acceptable return for the time and effort required. Agreement indicates stronger daily performance.

Section E: Cultural Integration (CI)

Items CI1 to CI4: the stall preserves recipes or culinary practices important to Singapore; customers value the stall's cultural identity; the hawker centre encourages interaction across different groups; cultural reputation supports repeat demand. Agreement on these four indicates greater cultural integration and each was summed as written. Item CI5: delivery orders provide less cultural or community interaction than in-person dining. CI5 is worded in the opposite direction to CI1–CI4 and is the one item in the entire instrument that was reverse coded, as $(6 - \text{CI5})$, before the CI total was calculated. As noted under Index construction and scoring, CI5 concerns the delivery channel rather than the stall's own cultural embeddedness, and the recoding fixes its polarity without establishing that it belongs to the same underlying dimension as the other four.

Section F: Hawker Economic Sustainability (HES)

The stall is financially viable at present; I expect the stall to remain viable over the next three years; current earnings justify continuing in the trade; the business can withstand moderate cost increases; I would recommend hawking as a realistic livelihood to a younger person. Agreement indicates greater perceived sustainability. The overlap between the third and fourth items here and the items in Sections B, C and D is discussed in the Results.

Section G: Delivery Comparison

What percentage commission or total platform cost would be acceptable? Do delivery orders increase net profit after all costs? Which channel produces greater profit per order? Which channel produces more predictable demand? What is the main benefit and the main disadvantage of delivery? These items were administered but are not scored as an index and do not enter the regression.

Section H: Open-Ended Prompts

Describe the greatest threat to the future of your stall. Explain one way delivery platforms have helped or harmed your business. What policy or business change would most improve hawker sustainability? What would be lost if customers shifted mainly to delivery? These responses were collected and anonymised but have not been coded or analysed for this paper.

Appendix B. Consumer Questionnaire

The consumer instrument recorded frequency of hawker-centre dining and of delivery use; typical spend; travel and waiting time; delivery fees; price sensitivity; food quality; variety; convenience; social experience; cultural importance; willingness to pay for delivery; and willingness to support policies preserving hawker centres. The CVP index is the summed five-item measure of consumer value perception covering price, quality, convenience, experience and cultural value. It must be analysed within the consumer sample, or aggregated to a matched centre level, rather than merged row by row with unrelated hawker records.

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