Statistical Analysis Syntax and Procedures

Supplementary Material

Manuscript Title: Enhancing Digital Financial Literacy and Digital Trust for Sustainable Online Loan Adoption among Micro-Entrepreneurs in Developing Economies

1. Software Information

Item	Detail
Software	JASP 0.19.6
Developer	JASP Team (University of Amsterdam)
Website	https://jasp-stats.org
SEM Engine	lavaan package (Rosseel, 2012)
Estimator	DWLS (Diagonally Weighted Least Squares)
Standard Errors	Robust
Model Test	Scaled and Shifted
Information Matrix	Expected
License	Open-source (GNU AGPL v3)

2. Justification for Software and Estimator Selection

2.1 Why JASP?

JASP is an open-source statistical software that provides a user-friendly GUI interface while employing well-established R packages (including lavaan) as computational engines. Its use supports:

- Reproducibility (open-source, freely available)
- Transparency (analysis steps can be replicated by reviewers)
- Rigor (lavaan is widely cited in SEM literature)

2.2 Why DWLS Estimator?

The Diagonally Weighted Least Squares (DWLS) estimator was selected because:

- The data consist of ordered categorical (Likert-scale) responses
- DWLS does not assume multivariate normality for ordinal indicators
- DWLS provides more accurate parameter estimates and standard errors compared to Maximum Likelihood for non-continuous data (Li, 2016; Bandalos, 2014)
- Robust standard errors and scaled test statistics address potential model misspecification

3. Complete Model Syntax

The following lavaan syntax was entered in the JASP SEM module:

```
# ============================================================
# MEASUREMENT MODEL (Confirmatory Factor Analysis)
# ============================================================

# Digital Financial Literacy (4 indicators)
DFL =~ DFL1 + DFL2 + DFL3 + DFL4

# Perceived Usefulness (4 indicators)
PU =~ PU1 + PU2 + PU3 + PU4

# Digital Trust (4 indicators)
DT =~ DT1 + DT2 + DT3 + DT4

# Online Loan Adoption Intention (3 indicators)
OLAI =~ OLAI1 + OLAI2 + OLAI3

# Sustainable Online Loan Use (4 indicators)
SOLU =~ SOLU1 + SOLU2 + SOLU3 + SOLU4


# ============================================================
# STRUCTURAL MODEL (Path Analysis — Hypothesized Relationships)
# ============================================================

# H1: Digital Financial Literacy → Perceived Usefulness
PU ~ DFL

# H2: Digital Financial Literacy → Digital Trust
DT ~ DFL

# H3: Digital Trust → Perceived Usefulness
PU ~ DT

# H4: Perceived Usefulness → Online Loan Adoption Intention
OLAI ~ PU

# H5: Digital Trust → Online Loan Adoption Intention
OLAI ~ DT

# H6: Online Loan Adoption Intention → Sustainable Online Loan Use
SOLU ~ OLAI


# ============================================================
# RESIDUAL COVARIANCE SPECIFICATION
# ============================================================

# Correlated residual between DFL3 and DFL4
```

```
# Theoretical justification: Both items measure practical application
# of digital financial security knowledge (risk identification and
# information protection). Empirical support: MI = 47.96.
DFL3 ~~ DFL4
```

4. Syntax Notation Guide (lavaan)

Operator	Meaning	Example
=~	"is measured by" (factor loading)	DFL =~ DFL1 + DFL2
~	"is regressed on" (structural path)	PU ~ DFL
~~	"is correlated with" (covariance/variance)	DFL3 ~~ DFL4
+	separates indicators/predictors	DFL1 + DFL2 + DFL3
#	comment (not executed)	# This is a comment

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5. JASP Analysis Settings

5.1 Data Preparation

Step	Action
1	Open Supplementary_Data.xlsx in JASP
2	Set all 24 variables as **Ordinal** measurement level
3	Verify N = 320 cases loaded correctly
4	Confirm no missing values detected

5.2 SEM Module Configuration

Navigate to: **SEM → Structural Equation Modeling**

Setting	Selection
Model	Enter syntax from Section 3 above

Setting	Selection
Estimator	DWLS
Standard Errors	Robust
Model Test	Scaled and shifted
Information Matrix	Expected
Mimic	lavaan
Missing Data Handling	Listwise (N/A — no missing data)

5.3 Output Options Selected

Category	Options Checked
Estimates	☑ Standardized estimates
	☑ Confidence intervals (95%)
	☑ R-squared
Fit Measures	☑ Additional fit measures
	☑ RMSEA 90% CI
Modification Indices	☑ Show modification indices
	☑ Threshold: 10.0
Advanced	☑ Residual covariances
	☑ AVE (Average Variance Extracted)
	☑ HTMT (Heterotrait-Monotrait Ratio)

Category	Options Checked
	☑ Reliability (Cronbach's α, McDonald's ω)
	☑ Indirect effects
	☑ Total effects
Plot	☑ Path diagram
	☑ Standardized estimates on diagram

6. Model Specification Summary

6.1 Model Components

Component	Count
Latent variables (factors)	5
Observed indicators	19 (DFL: 4, PU: 4, DT: 4, OLAI: 3, SOLU: 4)
Structural paths (regressions)	6
Residual covariances specified	1 (DFL3 ~~ DFL4)
Total free parameters	95
Degrees of freedom	145

6.2 Structural Paths and Hypotheses

Path	Hypothesis	Direction
DFL → PU	H1: DFL positively predicts PU	+
DFL → DT	H2: DFL positively predicts DT	+
DT → PU	H3: DT positively predicts PU	+

Path	Hypothesis	Direction
PU → OLAI	H4: PU positively predicts OLAI	+
DT → OLAI	H5: DT positively predicts OLAI	+
OLAI → SOLU	H6: OLAI positively predicts SOLU	+

6.3 Indirect Effects Tested

Pathway	Mediator(s)
DFL → PU → OLAI	PU mediates DFL–OLAI
DFL → DT → OLAI	DT mediates DFL–OLAI
DFL → DT → PU → OLAI	Serial mediation (DT then PU)
DFL → PU → OLAI → SOLU	Sequential: PU then OLAI
DFL → DT → OLAI → SOLU	Sequential: DT then OLAI
DFL → DT → PU → OLAI → SOLU	Full serial mediation
PU → OLAI → SOLU	OLAI mediates PU–SOLU
DT → OLAI → SOLU	OLAI mediates DT–SOLU
DT → PU → OLAI	PU mediates DT–OLAI
DT → PU → OLAI → SOLU	Sequential: PU then OLAI

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7. Key Results Summary

7.1 Model Fit

Index	Value	Threshold	Interpretation
$\chi^2(145)$	314.7	—	$p < .001$
χ^2/df	2.170	< 3.0	Good
CFI	0.974	> 0.95	Excellent
TLI	0.969	> 0.95	Good
NFI	0.953	> 0.90	Good
RMSEA	0.073	< 0.08	Acceptable
RMSEA 90% CI	[0.062, 0.084]	—	—
SRMR	0.063	< 0.08	Good
GFI	0.991	> 0.90	Excellent

7.2 Direct Effects

Path	β	SE	z	p	Result
DFL → DT	0.834	0.036	23.34	< .001	Supported
DFL → PU	0.510	0.126	4.032	< .001	Supported
DT → PU	0.234	0.122	1.915	.055	Not supported
PU → OLAI	0.442	0.071	6.243	< .001	Supported
DT → OLAI	0.457	0.065	7.005	< .001	Supported
OLAI → SOLU	0.945	0.037	25.39	< .001	Supported

7.3 Variance Explained (R^2)

Endogenous Variable	R^2	Interpretation
DT	0.695	DFL explains 69.5% of DT variance
PU	0.514	DFL + DT explain 51.4% of PU variance
OLAI	0.671	PU + DT explain 67.1% of OLAI variance
SOLU	0.893	OLAI explains 89.3% of SOLU variance

8. Reproducibility Instructions

To replicate this analysis:

1. Download and install JASP 0.19.6 from https://jasp-stats.org
2. Open the supplementary data file (Supplementary_Data.xlsx)
3. Set all variables to **Ordinal** scale
4. Navigate to SEM → Structural Equation Modeling
5. Copy and paste the syntax from Section 3 into the model specification field
6. Configure settings as specified in Section 5
7. Run the analysis

All results reported in the manuscript should be reproduced exactly.

9. References

- Bandalos, D. L. (2014). Relative performance of categorical diagonally weighted least squares and robust maximum likelihood estimation. *Structural Equation Modeling*, 21(1), 102–116.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis* (8th ed.). Cengage.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis. *Structural Equation Modeling*, 6(1), 1–55.
- JASP Team (2024). JASP (Version 0.19.6) [Computer software]. https://jasp-stats.org
- Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, 48(3), 936–949.
- Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48(2), 1–36.