

Pay it Forward (Digitally): Sizing up the Global Impact of Electronic Wages on Digital Payment Usage

Statistical Appendix

This statistical appendix presents modeling results referenced in the main analysis. The tables and figures contained in the appendix are described below:

- **Table A.1. Probit Selection (Adoption) Models:** Presents the results of the adoption models at the global and regional levels. The coefficients in A.1 do not represent marginal effects and should not be interpreted as magnitudes.
- **Table A.2: Usage Models:** These are the main models in the report and correspond to Figures 3 and 4. The coefficients in A.2 represent marginal effects. Table A.2 also contains the IMR coefficients. The Global model includes regional fixed effects. As discussed in the main analysis, the standard errors underlying these models are clustered by country. Additionally, note that the Heckman procedure calls for modeling cases in the second stage that had positive outcome variables in the first stage. Therefore, the sample sizes are lower than in the adoption models.
- **Table A.3: Interaction Effects between Electronic Wages and Employment:** Global usage model with interaction effects for electronic wages and employment. The coefficients in A.3 do not represent marginal effects and should not be interpreted as magnitudes. The coefficient on the interaction term between electronic wages and employment is positive and strongly statistically significant, indicating reinforcing effects between electronic wages and employment status. The constituent coefficient of interest, electronic wages, remains positive and statistically significant in the interaction model.
- **Table A.4: Alternative Versions of Dependent Variable:** Models 1 and 2 in Table A.3 replace the “Made Digital Merchant Payment” dependent variable from the main analysis with, respectively, “Used Debit Card In-Store” and “Used Mobile Phone to Pay for a Purchase In-Store.” In these models, individuals who receive electronic wage payments are about 11 percent more

likely to make payments using these specific forms of digital payments than those who do not receive wages electronically. The electronic wages variable is highly statistically significant.

- **Table A.5: Electronic Payment Acceptance Controls:** Models 1 and 2 in Table A.4 control for electronic payment acceptance (EPA) in individual economies. The electronic payments market is two-sided. Merchants' willingness to accept electronic payments affects consumers' usage of electronic payments, and vice versa. Measures of EPA are difficult to obtain. Model 1 proxies EPA by controlling for POS terminals per 100,000 adults from World Bank (2015). Model 2 uses an alternative measure, noncash payment transactions per 1,000 adults from World Bank (2015), as another proxy. Clearly these metrics are dated, but they are, to my knowledge, the best available EPA proxies at the country level. After 2015, the World Bank stopped publishing country-level results for these indicators. It now only publishes regional aggregates. The effects of electronic wages remain elevated in these models at around 13-15 percent. The effects are highly statistically significant. The EPA effects are very low and statistically insignificant. This could be due, in part, to the unit of analysis mismatch. The EPA variables are country-level, while the bulk of the analysis is individual-level.
- **Figure A.1: Distribution of digital payment usage by region:** Replicates Figure 1 in the main paper broken out by region.
- **Figure A.2: Digital merchant payment penetration as a function of electronic wages (by region):** Replicates Figure 2 in the main paper broken out by region.

Table A.1. Probit Selection Equations

	Dependent Variable: Electronic Payment Instrument								
	Global*	EAP	ECA	HI-OECD	HI-Other	LAC	MENA	SAS	SSA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age: 30-44	0.292*** (0.011)	0.431*** (0.035)	0.231*** (0.030)	0.254*** (0.051)	0.188*** (0.053)	0.275*** (0.029)	0.473*** (0.036)	0.388*** (0.038)	0.191*** (0.022)
Age: 45-59	0.326*** (0.013)	0.479*** (0.040)	0.239*** (0.031)	0.268*** (0.053)	0.169*** (0.051)	0.234*** (0.034)	0.536*** (0.042)	0.438*** (0.044)	0.268*** (0.028)
Age: 60 and Up	0.618*** (0.015)	0.561*** (0.051)	0.576*** (0.034)	0.901*** (0.066)	0.456*** (0.051)	0.556*** (0.040)	0.956*** (0.056)	0.707*** (0.055)	0.422*** (0.034)
Education: Secondary	0.390*** (0.010)	0.468*** (0.031)	0.387*** (0.025)	0.425*** (0.050)	0.338*** (0.039)	0.324*** (0.027)	0.256*** (0.034)	0.359*** (0.036)	0.484*** (0.021)
Education: Tertiary	0.832*** (0.019)	1.176*** (0.061)	0.808*** (0.039)	0.494*** (0.063)	0.803*** (0.074)	0.825*** (0.044)	0.878*** (0.053)	0.729*** (0.096)	1.007*** (0.080)
Sex: Female	-0.062*** (0.009)	-0.087*** (0.028)	-0.012 (0.023)	-0.002 (0.040)	-0.001 (0.035)	-0.130*** (0.024)	-0.277*** (0.033)	0.088*** (0.034)	-0.063*** (0.019)
Employed	0.290*** (0.010)	-0.067** (0.030)	0.438*** (0.024)	0.430*** (0.045)	0.403*** (0.039)	0.279*** (0.027)	0.327*** (0.034)	0.228*** (0.033)	0.375*** (0.021)
Income: Second 20%	0.090*** (0.014)	0.051 (0.041)	0.091*** (0.033)	0.026 (0.055)	0.183*** (0.046)	0.064* (0.036)	0.062 (0.047)	0.070 (0.048)	0.143*** (0.029)
Income: Middle 20%	0.124*** (0.014)	-0.022 (0.042)	0.158*** (0.034)	0.173*** (0.058)	0.254*** (0.051)	0.076** (0.036)	0.133*** (0.048)	-0.023 (0.048)	0.211*** (0.029)
Income: Fourth 20%	0.168*** (0.014)	0.043 (0.044)	0.247*** (0.035)	0.258*** (0.061)	0.280*** (0.054)	0.129*** (0.037)	0.145*** (0.048)	0.048 (0.049)	0.212*** (0.029)
Income: Richest 20%	0.280*** (0.015)	0.133*** (0.047)	0.322*** (0.037)	0.420*** (0.067)	0.313*** (0.060)	0.317*** (0.039)	0.342*** (0.050)	-0.056 (0.052)	0.351*** (0.030)
Internet Access	0.528*** (0.012)	0.644*** (0.036)	0.506*** (0.031)	0.200*** (0.061)	0.756*** (0.047)	0.610*** (0.029)	0.017 (0.038)	0.487*** (0.041)	0.644*** (0.022)
Mobile Owner	0.538*** (0.014)	0.606*** (0.054)	0.422*** (0.046)	0.332*** (0.098)	0.432*** (0.059)	0.332*** (0.039)	0.293*** (0.059)	0.282*** (0.037)	0.754*** (0.023)
Worried Age: Somewhat	0.104*** (0.014)	-0.086* (0.046)	0.240*** (0.032)	0.190*** (0.055)	0.269*** (0.046)	0.107*** (0.038)	0.105** (0.043)	-0.112** (0.054)	0.037 (0.032)
Worried Age: Very	0.104*** (0.015)	-0.322*** (0.052)	0.231*** (0.038)	0.127* (0.070)	0.294*** (0.059)	0.197*** (0.042)	0.153*** (0.047)	0.190*** (0.055)	0.010 (0.030)
Worried Medical: Somewhat	-0.049*** (0.016)	0.053 (0.049)	0.057 (0.036)	0.082 (0.057)	-0.096** (0.048)	-0.044 (0.043)	-0.099** (0.049)	-0.102 (0.064)	-0.158*** (0.037)
Worried Medical: Very	-0.112*** (0.017)	0.014 (0.054)	0.016 (0.040)	-0.055 (0.068)	-0.359*** (0.057)	-0.042 (0.046)	-0.230*** (0.052)	-0.149** (0.066)	-0.160*** (0.035)
Worried Bills: Somewhat	0.004 (0.014)	-0.114*** (0.042)	-0.072** (0.031)	-0.085 (0.055)	-0.207*** (0.046)	0.063* (0.038)	0.032 (0.043)	0.098* (0.054)	0.141*** (0.029)
Worried Bills: Very	-0.080*** (0.015)	-0.200*** (0.048)	-0.135*** (0.037)	-0.028 (0.070)	-0.282*** (0.057)	-0.059 (0.042)	-0.186*** (0.048)	-0.013 (0.055)	0.061** (0.028)
Constant	-1.041*** (0.025)	-0.742*** (0.075)	-1.346*** (0.058)	-0.350*** (0.114)	0.076 (0.080)	-1.268*** (0.059)	-1.172*** (0.078)	-0.715*** (0.074)	-1.363*** (0.043)
Observations	120,914	11,221	16,924	8,812	30,711	13,875	8,573	7,490	23,308
Log Likelihood	-50,981.750	-5,434.937	-8,772.115	-2,589.436	-3,039.492	-8,099.634	-5,009.253	-4,545.987	-12,339.410
Akaike Inf. Crit.	102,017.500	10,909.880	17,584.230	5,218.872	6,118.984	16,239.270	10,058.510	9,131.974	24,718.810

Note:

*p<0.1; **p<0.05; ***p<0.01

* Global model includes regional fixed effects

Table A.2. Usage Models

	Dependent Variable: Made Digital Merchant Payment								
	Global*	EAP	ECA	HI-OECD	HI-Other	LAC	MENA	SAS	SSA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Electronic Wages	0.151*** (0.014)	0.253*** (0.037)	0.145*** (0.020)	0.210*** (0.067)	0.082*** (0.026)	0.187*** (0.018)	0.004 (0.015)	0.085*** (0.024)	0.194*** (0.020)
Age: 30-44	-0.032*** (0.012)	-0.043 (0.045)	-0.059** (0.029)	-0.055 (0.036)	-0.035** (0.016)	-0.030 (0.028)	-0.101** (0.044)	-0.014 (0.019)	0.014 (0.026)
Age: 45-59	-0.074*** (0.016)	-0.043 (0.050)	-0.155*** (0.025)	-0.129*** (0.036)	-0.101*** (0.020)	-0.014 (0.038)	-0.123** (0.053)	-0.010 (0.011)	0.015 (0.028)
Age: 60 and Up	-0.135*** (0.022)	-0.246*** (0.080)	-0.237*** (0.052)	-0.173** (0.080)	-0.142*** (0.036)	-0.023 (0.063)	-0.163** (0.073)	-0.043 (0.049)	-0.006 (0.059)
Education: Secondary	0.065*** (0.023)	-0.123* (0.069)	0.167*** (0.048)	0.041 (0.065)	0.095** (0.046)	0.161*** (0.046)	0.035 (0.023)	0.066** (0.028)	0.104* (0.054)
Education: Tertiary	0.125*** (0.029)	-0.101 (0.084)	0.242*** (0.077)	0.031 (0.097)	0.157*** (0.050)	0.279*** (0.104)	0.096* (0.056)	0.138* (0.074)	0.242*** (0.093)
Sex: Female	0.006 (0.007)	0.037*** (0.014)	0.017 (0.013)	0.070*** (0.024)	0.004 (0.008)	-0.050*** (0.018)	-0.026 (0.025)	-0.047** (0.019)	0.004 (0.012)
Employed	-0.021 (0.013)	-0.126*** (0.037)	-0.017 (0.039)	-0.031 (0.048)	0.043*** (0.016)	0.022 (0.038)	-0.029 (0.037)	0.002 (0.027)	0.021 (0.029)
Income: Second 20%	0.021*** (0.007)	-0.025 (0.029)	0.033 (0.024)	0.038 (0.026)	0.039*** (0.014)	0.004 (0.031)	-0.061* (0.035)	0.040 (0.029)	0.024 (0.019)
Income: Middle 20%	0.040*** (0.008)	-0.009 (0.026)	0.055* (0.028)	0.085** (0.042)	0.066*** (0.017)	0.043** (0.017)	-0.047 (0.034)	0.036** (0.018)	0.026 (0.031)
Income: Fourth 20%	0.050*** (0.010)	-0.008 (0.055)	0.078** (0.030)	0.099** (0.046)	0.063*** (0.018)	0.089** (0.038)	-0.033 (0.035)	0.088*** (0.027)	0.015 (0.028)
Income: Richest 20%	0.076*** (0.011)	-0.036 (0.061)	0.111*** (0.031)	0.106* (0.061)	0.090*** (0.020)	0.175*** (0.060)	0.025 (0.035)	0.132*** (0.021)	0.020 (0.034)
Internet Access	0.132*** (0.023)	0.031 (0.067)	0.159*** (0.041)	0.292*** (0.046)	0.180*** (0.053)	0.199 (0.121)	0.136*** (0.038)	0.101*** (0.039)	0.114** (0.054)
Mobile Owner	0.100*** (0.026)	0.067 (0.056)	-0.003 (0.057)	-0.053 (0.058)	0.397*** (0.046)	0.066 (0.056)	-0.012 (0.042)	0.030 (0.025)	0.041 (0.076)
IMR	-0.126** (0.056)	-0.533*** (0.200)	-0.146 (0.154)	-0.227 (0.290)	0.364 (0.228)	0.106 (0.231)	-0.123 (0.103)	-0.073 (0.081)	0.017 (0.131)
Constant	-0.258 (0.355)	1.335* (0.741)	-0.544 (0.530)	-0.790 (0.710)	-1.922*** (0.294)	-1.716 (1.217)	-0.618 (0.705)	-1.848*** (0.447)	-1.421** (0.664)
Observations	90,772	8,502	12,544	8,083	30,158	8,816	4,054	4,510	14,105
Log Likelihood	-49,154.720	-3,840.822	-6,797.596	-4,630.497	-18,803.130	-4,810.312	-1,463.966	-1,293.811	-6,510.494
Akaike Inf. Crit.	98,355.440	7,713.643	13,627.190	9,292.994	37,638.260	9,652.624	2,959.932	2,619.623	13,052.990

Note:

*p<0.1; **p<0.05; ***p<0.01

* Global model includes regional fixed effects

EAP (East Asia & Pacific); ECA (Europe & Central Asia); HI-OECD (High Income OECD); HI-Other (High Income Non-OECD); LAC (Latin America & Caribbean); MENA (Middle East & North Africa); SAS (South Asia); SSA (Sub-Saharan Africa)

Categorical variable baselines: Age (15-29); Education (Primary or less); Income (Poorest 20%)

Table A.3. Electronic Wages and Employment Interaction Effects

	Dependent Variable: Made Digital Merchant Payment
Electronic Wages	0.209*** (0.060)
Employed	-0.137*** (0.050)
Age: 30-44	-0.101*** (0.033)
Age: 45-59	-0.226*** (0.044)
Age: 60 and Up	-0.423*** (0.063)
Education: Secondary	0.181*** (0.066)
Education: Tertiary	0.347*** (0.083)
Sex: Female	0.015 (0.020)
Income: Second 20%	0.057*** (0.022)
Income: Middle 20%	0.111*** (0.024)
Income: Fourth 20%	0.141*** (0.029)
Income: Richest 20%	0.216*** (0.033)
Internet Access	0.375*** (0.070)
Mobile Owner	0.284*** (0.078)
IMR	-0.423** (0.165)
Electronic Wages:Employed	0.293*** (0.077)
Constant	-0.156 (0.359)
Observations	90,772
Log Likelihood	-49,092.420
Akaike Inf. Crit.	98,232.830

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Model includes regional fixed effects

Table A.4. Alternative Versions of Dependent Variable

	Made In-Store Purchase Using:	
	Debit Card (1)	Mobile Phone (2)
Electronic Wages	0.111*** (0.017)	0.110*** (0.011)
Age: 30-44	0.006 (0.012)	-0.055*** (0.011)
Age: 45-59	-0.009 (0.014)	-0.118*** (0.016)
Age: 60 and Up	-0.037* (0.020)	-0.196*** (0.019)
Education: Secondary	0.041* (0.023)	0.028 (0.022)
Education: Tertiary	0.039 (0.030)	0.094*** (0.027)
Sex: Female	0.013** (0.006)	-0.005 (0.006)
Employed	-0.050*** (0.012)	-0.003 (0.012)
Income: Second 20%	0.001 (0.007)	0.016** (0.007)
Income: Middle 20%	0.010 (0.008)	0.036*** (0.007)
Income: Fourth 20%	0.020** (0.009)	0.041*** (0.008)
Income: Richest 20%	0.037*** (0.013)	0.072*** (0.008)
Internet Access	0.071*** (0.023)	0.112*** (0.023)
Mobile Owner	0.008 (0.031)	0.112*** (0.023)
IMR	-0.283*** (0.065)	-0.051 (0.046)
Constant	-0.471 (0.329)	-0.609 (0.383)
Observations	90,751	90,709
Log Likelihood	-40,563.790	-44,106.640
Akaike Inf. Crit.	81,173.580	88,259.270

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Models include regional fixed effects

Table A.5. Electronic Payment Acceptance (EPA) Controls

EPA Control:	Dependent Variable: Made Digital Merchant Payment	
	POS Terminals	Noncash Transactions
	Per 100K Adults	Per 1K Adults
	(1)	(2)
Electronic Wages	0.148*** (0.018)	0.132*** (0.017)
Age: 30-44	-0.066*** (0.011)	-0.057*** (0.015)
Age: 45-59	-0.103*** (0.016)	-0.099*** (0.019)
Age: 60 and Up	-0.177*** (0.027)	-0.186*** (0.026)
Education: Secondary	-0.001 (0.032)	0.024 (0.023)
Education: Tertiary	0.014 (0.043)	0.068** (0.035)
Sex: Female	0.019** (0.008)	0.009 (0.008)
Employed	-0.061*** (0.018)	-0.037** (0.016)
Income: Second 20%	0.011 (0.008)	0.031*** (0.008)
Income: Middle 20%	0.017* (0.010)	0.045*** (0.010)
Income: Fourth 20%	0.028** (0.013)	0.059*** (0.013)
Income: Richest 20%	0.041** (0.016)	0.084*** (0.015)
Internet Access	0.060** (0.026)	0.110*** (0.031)
Mobile Owner	0.072** (0.037)	0.093** (0.039)
IMR	-0.600*** (0.105)	-0.376*** (0.109)
EPA Control	0.000	-0.000
Constant	0.970** (0.493)	0.396 (0.445)
Observations	62,487	62,615
Log Likelihood	-34,045.960	-34,342.430
Akaike Inf. Crit.	68,139.910	68,732.860

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: Models include regional fixed effects

Figure A.1: Distribution of Digital Payment Usage by Region

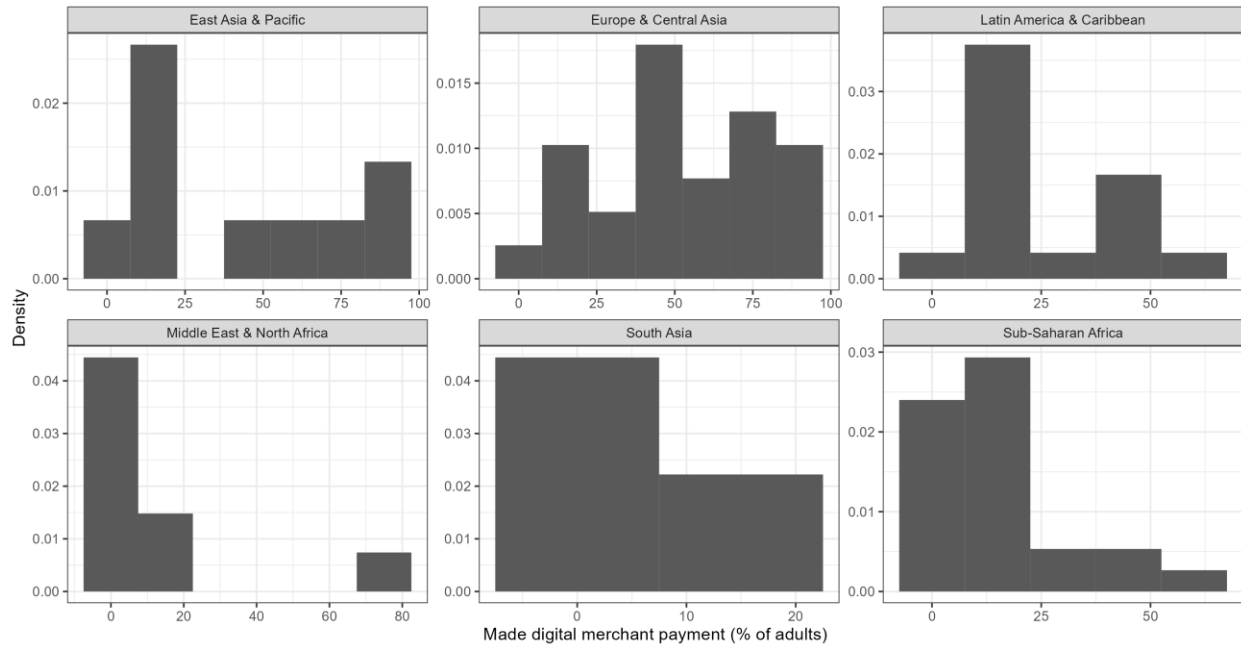
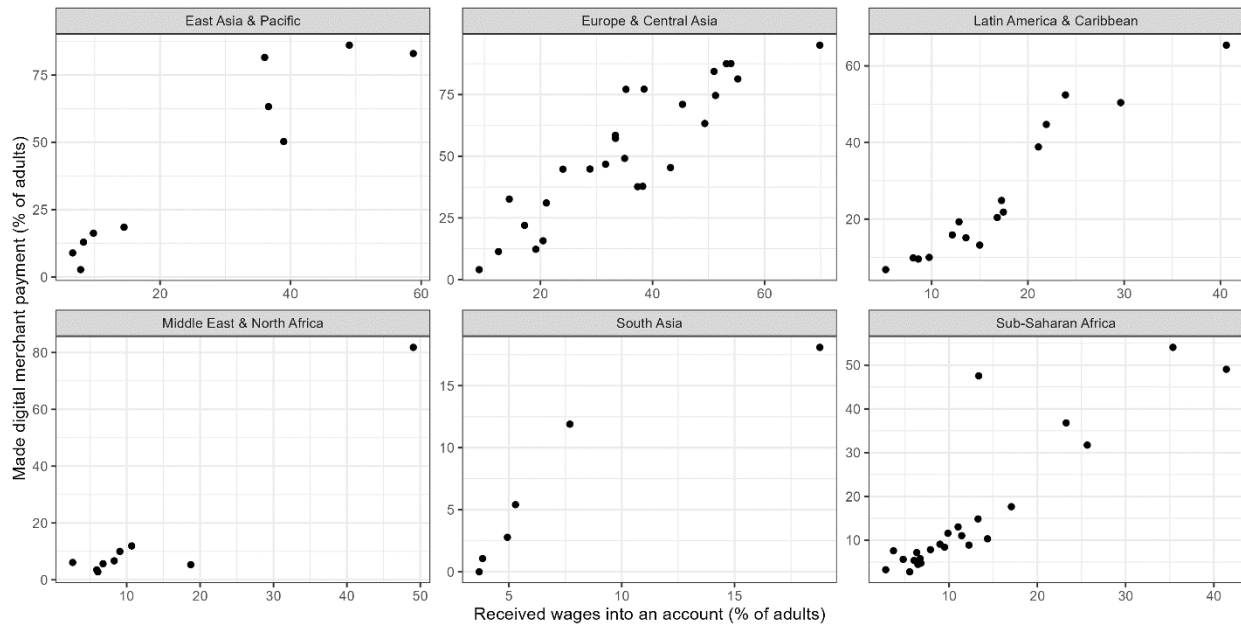


Figure A.2: Digital merchant payment penetration as a function of electronic wages (by Region)



Source: World Bank Global Findex Database (2021)

References

World Bank. 2015. Global Payments Systems Survey. Retrieved from World Bank DataBank, G20 Financial Inclusion Indicators. <https://datatopics.worldbank.org/g20fidata/>.