Wage premiums in the digital economy: Evidence from Malaysia

(Preliminary; do not cite or circulate)

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Background

Views on the benefits of technologies on workers are less sanguine

"26% of American workers think that their jobs will disappear in the next 20 years"

- Christine Lagarde, 2017 IMF-WB Annual Meeting, Future of Work Forum

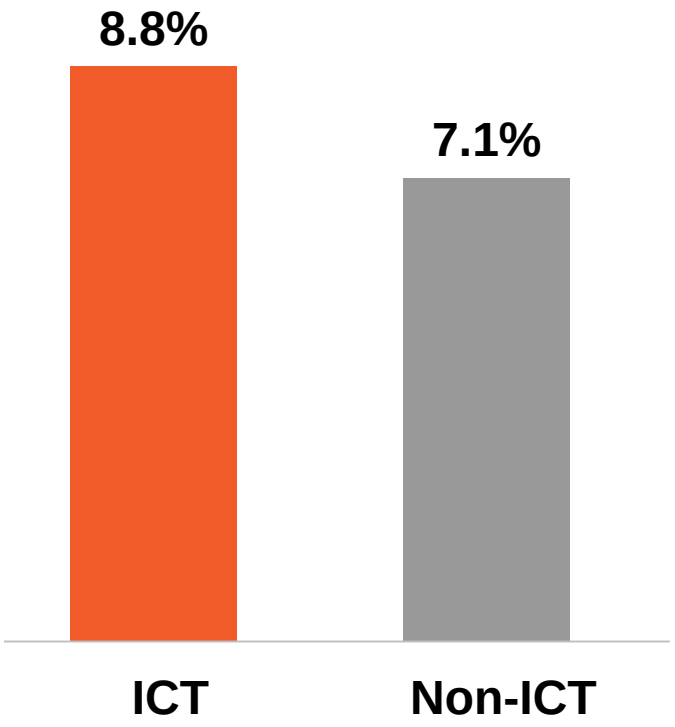
"There's never been a better time to be a worker with special skills or the right education… However, there's never been a worst time to be a worker with only ordinary skills and abilities to offer because computers, robot, and other digital technologies are acquiring these skills and abilities at an extraordinary rate"

- Brynjolfsson and McAfee (2014)

Motivation: Stronger contribution to GDP growth amid slower employment gains in ICT sectors

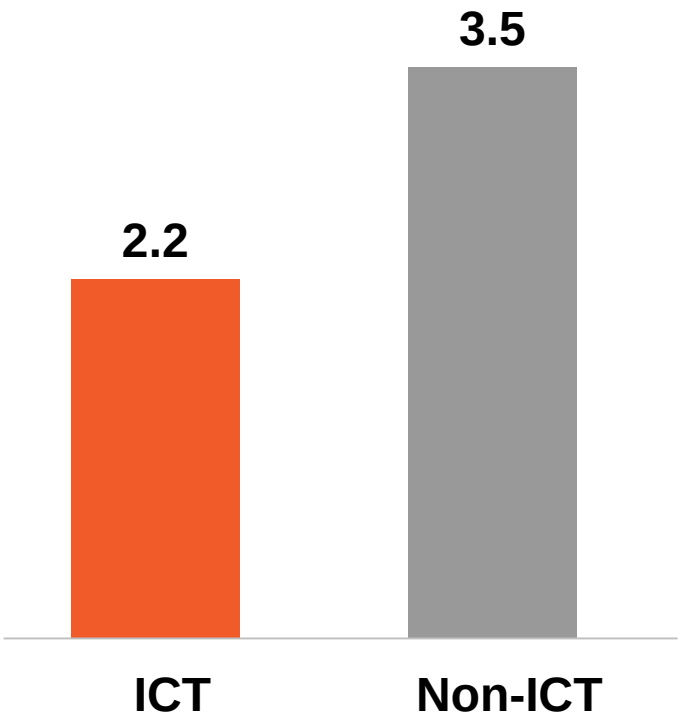
Stronger value added growth in ICT sector in recent years...

Value added growth (%), 2010-2015



… but employment gains were slower than other sectors

Employment growth (%), 2010-2015



Source: DOSM ICT Satellite Account, GDP by Income Approach, authors' estimations

Broad question: Is there evidence of wage disparity due to technological change?

Key question: Do ICT workers earn higher wages?

- More broadly, to what extent wages vary between ICT and non-ICT workers

Methodology and data: Human capital model (Mincer) and HIES 2014

Literature: Link between technological progress and wage differentials

- Part of a broader literature that analyse sources of wage differentials, including technological progress:

  ✓ **Education, and age (work experience)**

  – Wage differentials attributed to different levels of education and age

  – *E.g. Mincer (1973), Anand and Kanbur (1993), Feenberg and Poterba (2000), McCall (2000), Card and DiNardo (2002) and Moretti (2013)*

  ✓ **Skill-biased technological change (SBTC) and skill premiums**

  – Technological innovation mainly benefitting high-skilled workers, leading to wider wage dispersion

  – *E.g. DiMaggio et al (2004), Goos, Manning and Salomons (2009), Mishel et al (2013), Dabla-Norris et al (2015), Autor (2015), Frey and Osborne (2017)*

Data: 2014 Household Income and Expenditure Survey (HIES)

Raw data

- 46,000 households;
  215,000 individuals
- Age, educational attainment
- Employment status
- Occupation and industry types
- Total annual household wages

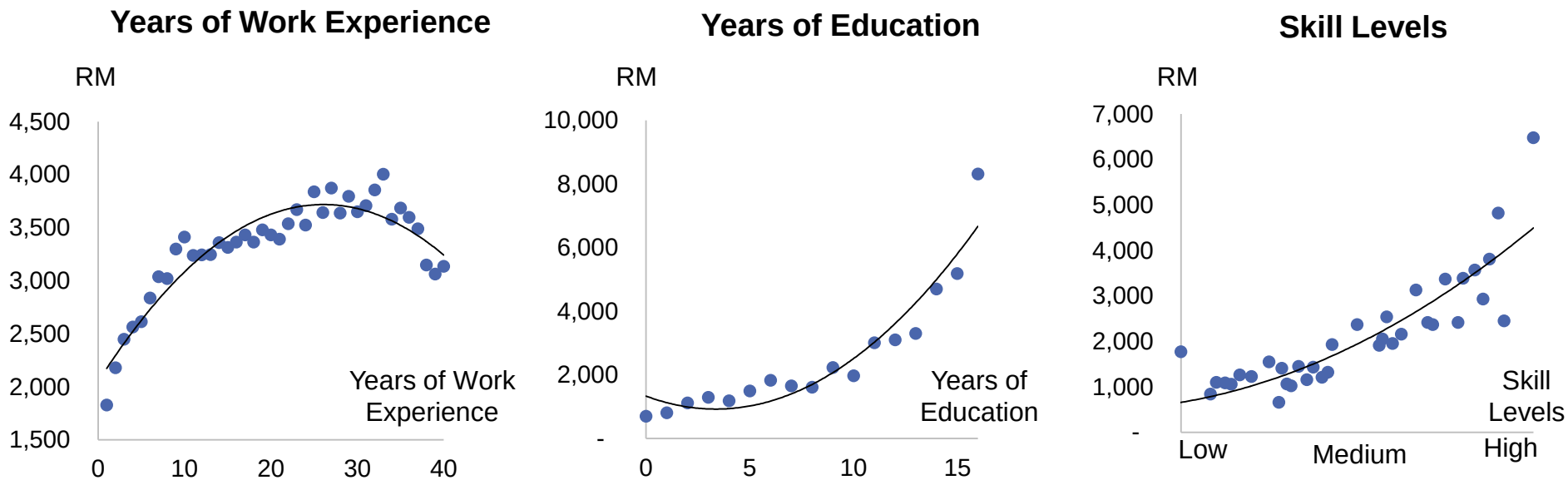
Constructed variables

- Years of education
- Years of work experience
- Sector dummies
- Skill dummies
- Monthly wages per worker

Stylised findings (1)

- **Sharp acceleration in wages during early years of employment, peaking after 25-30 years, declines thereafter (retirement)**
- **Wages increase exponentially with higher educational attainment and skill levels**

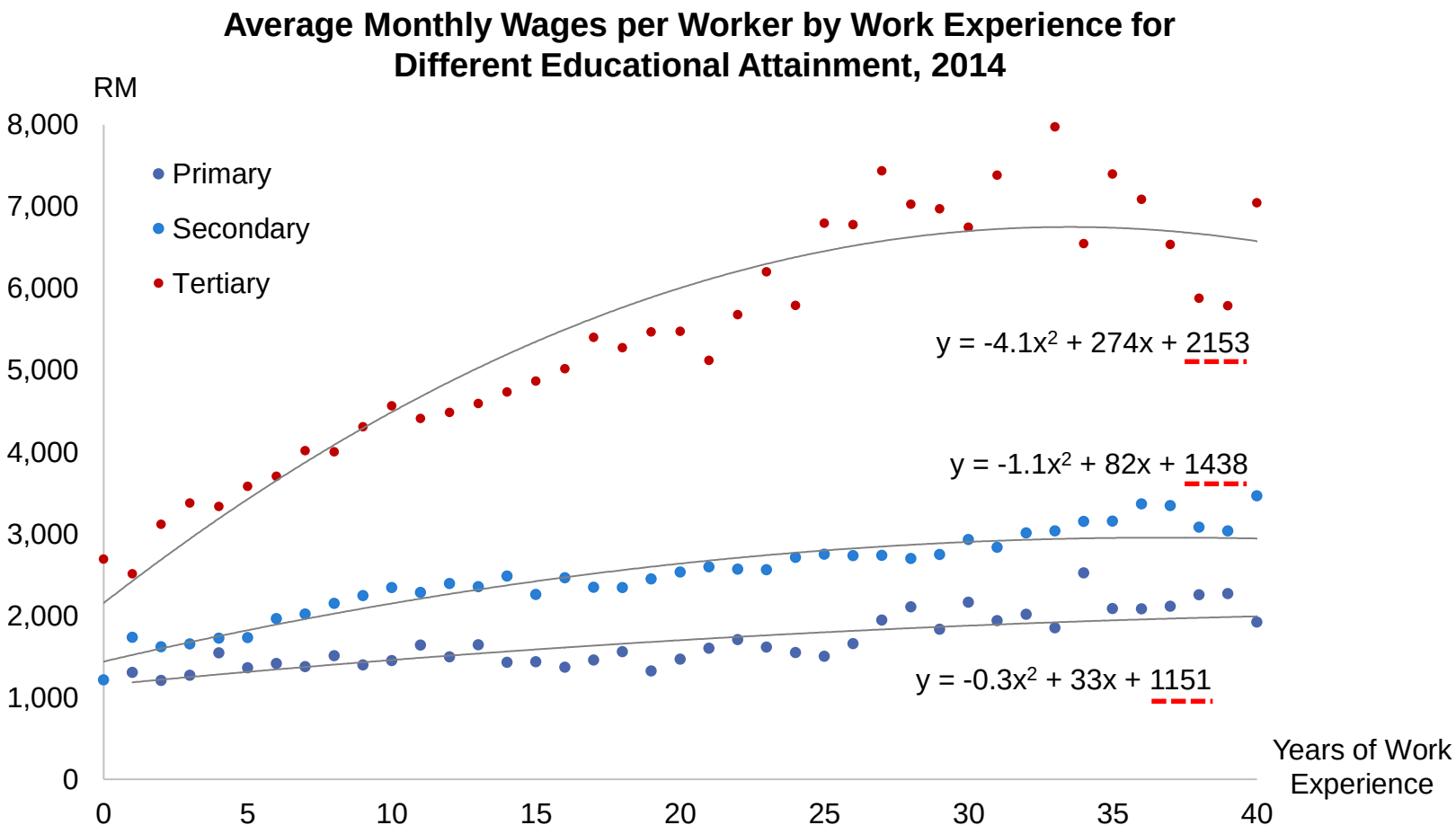
Scatterplot of Average Monthly Wages per Worker (RM) and Key Determinants, 2014



Source: DOSM HIES (2014)

Stylised findings (2)

- **Wages for workers with tertiary education are higher and increase at a faster pace with years of work experience than lower levels of educational attainment**

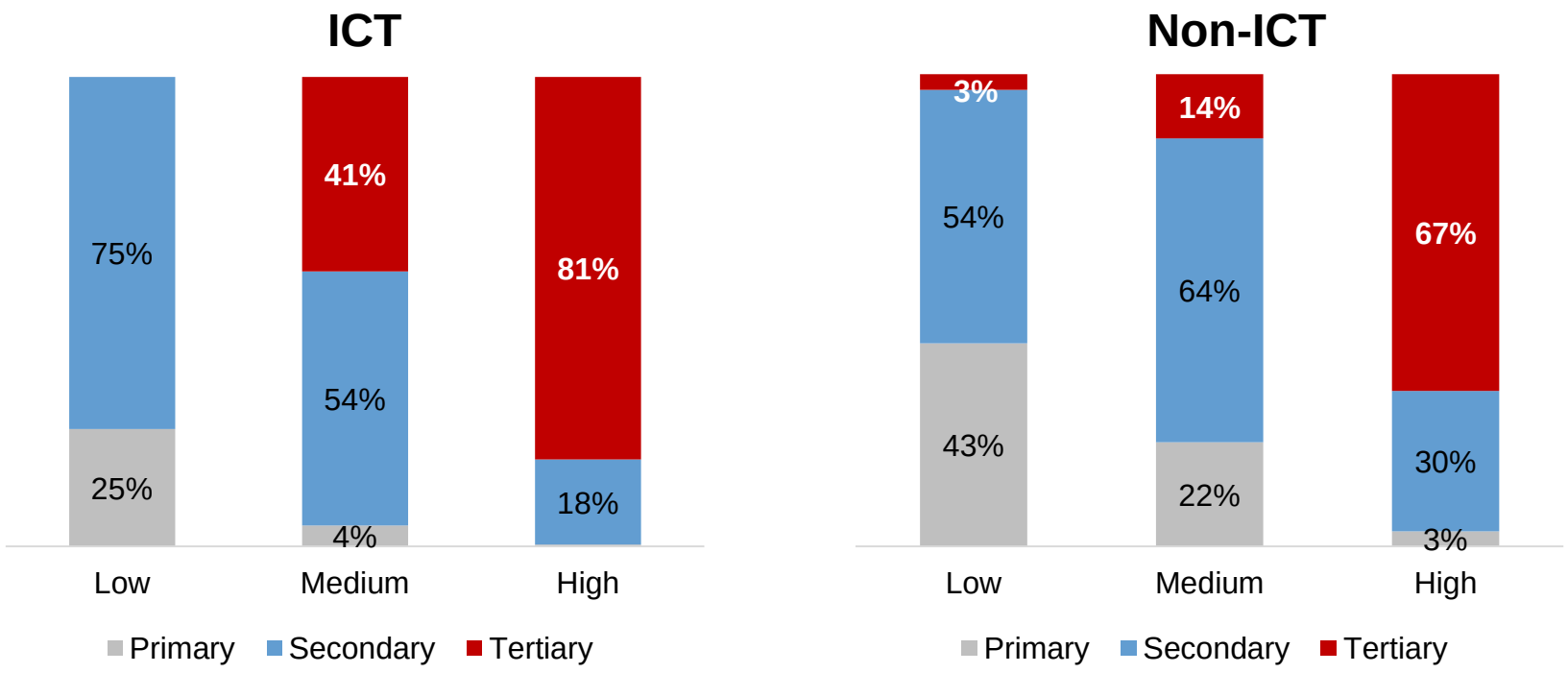


Source: DOSM HIES (2014)

Stylised findings (3)

- **More educated medium- and high-skilled workers in ICT sectors**

Distribution of ICT and non-ICT Workers by Educational Attainment and Skill Levels (%), 2014



Source: DOSM HIES (2014)

Methodology: Estimating the technology wage premium

Human Capital Earnings Model à la Mincer

- A model of wages as a function of education, working experience, skill levels and ICT employment

$$Log\ Y_i = c + \alpha S_i + \beta X_i + \delta {X_i}^2 + ICT_i\ .Z_i + \varepsilon_i$$

where,

$Log\ Y_i$	= logged monthly wages (RM) of worker *i*
S_i	= years of education
X_i, ${X_i}^2$	= years of work experience and its squared term
Z_i	= vector of skill dummies (low, medium and high)
ICT_i	= ICT dummy with value 1 if worker *i* is in ICT sector and 0 otherwise

Results (1): Average 13% wage premium for ICT workers

	Base 1	Base 2
Education	0.0686***	0.0686***
	(0.0011)	(0.0011)
Work	0.0072***	0.0072***
	(0.0008)	(0.0008)
$Work^2$	-0.0001***	-0.0001***
	(0.0000)	(0.0000)
Medium skill	0.1504***	0.1497***
	(0.0105)	(0.0105)
High skill	0.7245***	0.7249***
	(0.0122)	(0.0122)
ICT	**0.1275*** **	-0.1507
	(0.0166)	(0.1362)
ICT*Medium skill		**0.3090** **
		(0.1394)
ICT*High skill		**0.2660***
		(0.1377)
Observations	46,741	46,741
Adj R^2	0.4007	0.4007

Robust standard errors in parentheses

****, ** and * indicate significance at 1%, 5% and 10% levels respectively*

- **ICT workers earn 13% more than others**
- **Medium- skilled ICT workers earn 31% more than other medium-skilled workers**
- **High- skilled ICT workers earn 26% more than other high-skilled workers**

Results (2): Wage premiums for medium- and high-skilled ICT workers

- **Accounts for different returns to education and work experience for each skill level**
- **In line with wage premiums for medium- and high-skilled ICT workers in Results (1)**

	(3)	(4)	(5)
	Low skill	**Medium skill**	**High skill**
Education	0.0410***	0.0616***	0.1091***
	(0.0035)	(0.0013)	(0.0028)
Work	0.0057**	0.0027***	0.0260***
	(0.0025)	(0.0009)	(0.0020)
$Work^2$	-0.0001**	-0.0000**	-0.0003***
	(0.0000)	(0.0000)	(0.0000)
ICT	-0.1628	**0.1614*** **	**0.1039*** **
	(0.1516)	(0.0299)	(0.0188)
Observations	3,017	28,498	15,226
Adj R^2	0.0851	0.1138	0.2374

Robust standard errors in parentheses

****, ** and * indicate significance at 1%, 5% and 10% levels respectively*

Results (3): 32% wage premium for high-skilled workers in ICT

- **Lower wage premium for high-skilled ICT workers (32%) due to:**
  - ✓ **Higher returns to education (2 times)**
  - ✓ **Better work experiences (3 times)**

	(6)	(7)	(8)	(9)
	ICT	**Non-ICT services**	**Manufacturing**	**Construction**
Education	**0.1415*** **	0.0779***	0.0714***	0.0626***
	(0.0117)	(0.0014)	(0.0024)	(0.0027)
Work	**0.0277*** **	0.0092***	0.0031	-0.0105***
	(0.0069)	(0.0011)	(0.0019)	(0.0025)
Work^2	-0.0002	-0.0001***	0.0000	0.0003***
	(0.0002)	(0.0000)	(0.0000)	(0.0001)
High skill^	**0.3188*** **	0.5014***	0.5709***	0.7870***
	(0.0477)	(0.0079)	(0.0125)	(0.0184)
Observations	1,040	33,050	9,877	6,398
Adj R^2	0.4626	0.3758	0.4030	0.4442

Robust standard errors in parentheses

****, ** and * indicate significance at 1%, 5% and 10% levels respectively*

^ Reference group: medium-and low-skilled workers combined

Summary of key findings:
Do ICT workers enjoy a wage premium? Why? How?

1) **An average 13% wage premium for ICT workers**
   - ✓ Higher returns to education (that meets the skill demand of the industry) and on-the-job training (work experience)

2) **Wage premium for both medium- (16%) and high-skilled ICT workers (10%)**
   - ✓ Indicative of higher productivity in ICT sector
   - ✓ More educated medium-skilled ICT segment

3) **32% wage premium for high-skilled workers in ICT, driven by:**
   - ✓ Higher returns to education and on-the-job training reduced high-skilled ICT premium

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