Introduction to the Theory of Skill Premia – Acemoglu (2002)

Yanna Brede (i6141313)

Acemoglu's framework of a competitive labour market, links wages to skill supply and demand created through the "technology possibility frontier", in which skilled (H) and unskilled workers (L) are risk neutral and maximise their labour income[1].

Furthermore, the production function, which takes on the CES form,

$$Y(t) = [(A_l(t)L(t))^{\rho} + (A_h(t)H(t))^{\rho}]^{\frac{1}{\rho}}$$

has three different interpretations. It is essential to analyse the different elasticities of substitution, which determine whether the demand for labour works complementary or substitutive depending on the change in the workers' productivity through technology improvements.

Elasticity of Substitution[2]	
$\sigma = 0$	Perfect Complements
$0 < \sigma < 1$	Imperfect Complements
$\sigma = 1$	Unrelated (Cobb-Douglas)
$1 < \sigma < \infty$	Imperfect Substitutes
$\sigma = \infty$	Perfect Substitutes

[1] Acemoglu uses the terms education & skill interchangeably, however, they are imperfectly correlated (use of education because it can be better quantified).

Firstly, in an economy with only one good, unskilled and skilled workers are imperfect substitutes. Secondly, a closed economy with two goods that defines the customers' utility with $[Y_l^{\rho} + Y_h^{\rho}]^{\frac{1}{\rho}}$, where good Y_h is produced by skilled workers and Y_l by unskilled, the production function is $Y_h = A_h H$ and $Y_l = A_l L$, respectively. The third interpretation is a mixture, where different sectors produce goods that are imperfect substitutes and both types of workers are employed. This interpretation is the closest to reality, but too complex in theory.

Moreover, the wage equations of skilled[2] and unskilled[3] workers are discussed, which combined give the skill premium:

$$w = \frac{w_h}{w_l} = (\frac{A_h}{A_l})^{\rho}(\frac{H}{L})^{-(1-\rho)}$$

With a decrease in the supply of skilled workers, the skill premium increases, which demonstrates the substitution effect. An increase in H/L leads to two types of substitutions depending on the type of good produced. Nevertheless, the substitution always negatively affects the *relative* earnings of skilled workers.

[2] $\frac{\frac{\delta w_H}{\delta H}}{L} < 0$ as the fraction of H increases, their wages should decrease.

[3] $\frac{\frac{\delta w_L}{\delta H}}{L} > 0$ as the fraction of H increases, the unskilled wage should increase.

To further understand the effects of a change in H/L, one should take a look at the relative demand for skills.

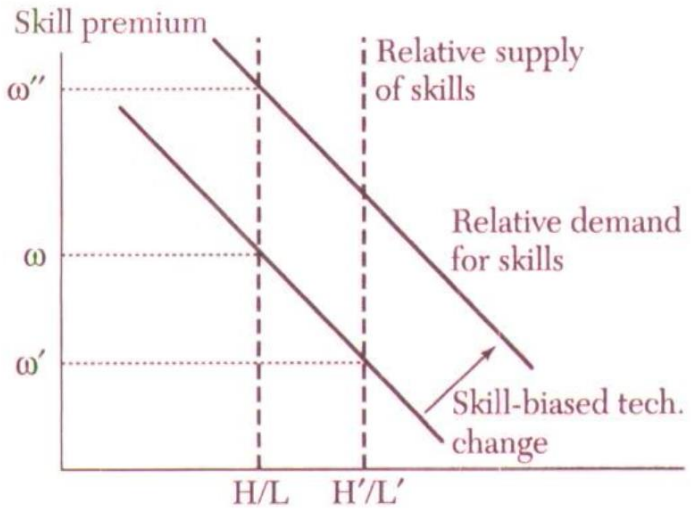

Figure 4. The Relative Demand for Skills

An increase in the relative supply to H'/L' leads to a movement along the relative demand (RD)[4] curve and decreases the skill premium to w'[5]. Furthermore, if $\sigma > 1$, then an improvement in skill-complementary technology increase the skill premium to w'' and the RD curve shifts upwards.[6]

The effects of an increase in H/L is a rise in unskilled labour wages and a decrease in (relative) wages of skilled workers. The average wage increases, as H generally have higher wages and productivity than L, even if w_h[7] decreases. Additionally, the demand for H increases as H becomes less expensive, if $1 < \sigma < \infty$[8]. To conclude, when H/L increases, the skill premium should decrease, either through a decrease in demand or increase in supply[9].

[4] Refer to RD as *relative demand*.
[5] Substitution of low skilled workers as preference for high skilled increases when $1 < \sigma < \infty$, thus RD shifts right.
[6] See Appendix A for further explanation.
[7] w_h = Wages of skilled workers.
[8] Decrease in skilled workers and increase in unskilled workers result in higher substitution.
[9] There are two "preponderant forces": technological development & increased education (Tinbergen, 1975).

Table 1 demonstrates the hypothesis that the past 60 years have been influenced by skill-biased technological change due to following observations: the higher the demand for H, the higher sigma, therefore the higher the substitution[10] leading to higher employment, wage and demand for productivity.

TABLE 1
EMPLOYMENT SHARES AND SKILL-BIASED TECHNICAL CHANGE, 1940–1990

	Employment Share			Wage Bill Share		
	Some college	College graduate	College equivalent	Some college	College graduate	College equivalent
1940	6.4	6.1	9.3	8.9	12.3	16.7
1950	9.5	7.7	12.4	11.0	11.9	17.4
1960	12.5	10.1	16.4	14.1	16.4	23.4
1970	16.4	13.4	21.5	16.5	21.5	29.7
1980	23.6	19.2	31.0	22.4	28.1	39.3
1990	30.8	24.0	39.3	28.5	36.7	51.0

	$\sigma = 1.4$						$\sigma = 2$					
	Some college		College graduate		College equivalent		Some college		College graduate		College equivalent	
	$\frac{A_h}{A_l}$	D	$\frac{A_h}{A_l}$	D	$\frac{A_h}{A_l}$	D	$\frac{A_h}{A_l}$	D	$\frac{A_h}{A_l}$	D	$\frac{A_h}{A_l}$	D
1940	0.004	0.21	0.016	0.31	0.035	0.38	0.140	0.37	0.303	.055	0.392	0.63
1950	0.006	0.24	0.011	0.28	0.030	0.37	0.146	0.38	0.219	0.47	0.313	0.56
1960	0.013	0.29	0.030	0.37	0.080	0.48	0.189	0.43	0.343	0.59	0.476	0.69
1970	0.017	0.32	0.069	0.47	0.179	0.61	0.199	0.45	0.485	0.70	0.652	0.81
1980	0.042	0.40	0.157	0.59	0.486	0.81	0.270	0.52	0.643	0.80	0.933	0.97
1990	0.090	0.50	0.470	0.81	1.777	1.18	0.357	0.60	1.064	1.03	1.673	1.29

[10] Imperfect substitutes: $1 < \sigma < \infty$

Appendix

Appendix A – The Relative Demand for Skills

$1 < \sigma < \infty$	$0 < \sigma < 1$
Imperfect Substitutes	*Imperfect Complements*
Improvement in skill-complementary technology increases skill premium	Improvement in productivity of skilled workers
Relative demand curve shifts *upwards*	Relative demand curve shifts *downwards*
Example: Leontief (fixed proportions) production function: When A_h increases & skilled workers are more productive, then the demand for unskilled labour increases relatively by more than the demand for skilled labour. Therefore, the increase in A_h creates "excess supply" of skilled labour, thus, unskilled workers' wages increases relatively to skilled worker's wages.	
Skill premium increases when skilled workers are more productive	Improvements of technology used with unskilled labour that increases relative productivity and skilled worker's wages. Thus, an increase in A_h relative to A_l leads to "skill-replacement"

Appendix B - Chapter 4: Steady-Demand & Acceleration Hypothesis

Steady-Demand Hypothesis	Acceleration Hypothesis
Role of Computers: computer wage premium for unobserved skills (supply-side factor) [weak evidence]	If demand for skills increased at steady rate, college premium should have decreased, however, not the case Computerised industries had a more rapid skill upgrade
Cross-Industry Studies: most industries employed more educated workers [weak evidence]	Computerised industries had a more rapid skill upgrade
In 1970ies supply of skilled workers increased steadily	Equipment capital is more complimentary to skilled workers, therefore, if capital increases, prices decrease, thus, rental rate decreases and demand for skilled labour increases
	Sharp increase in overall & residual wage inequality

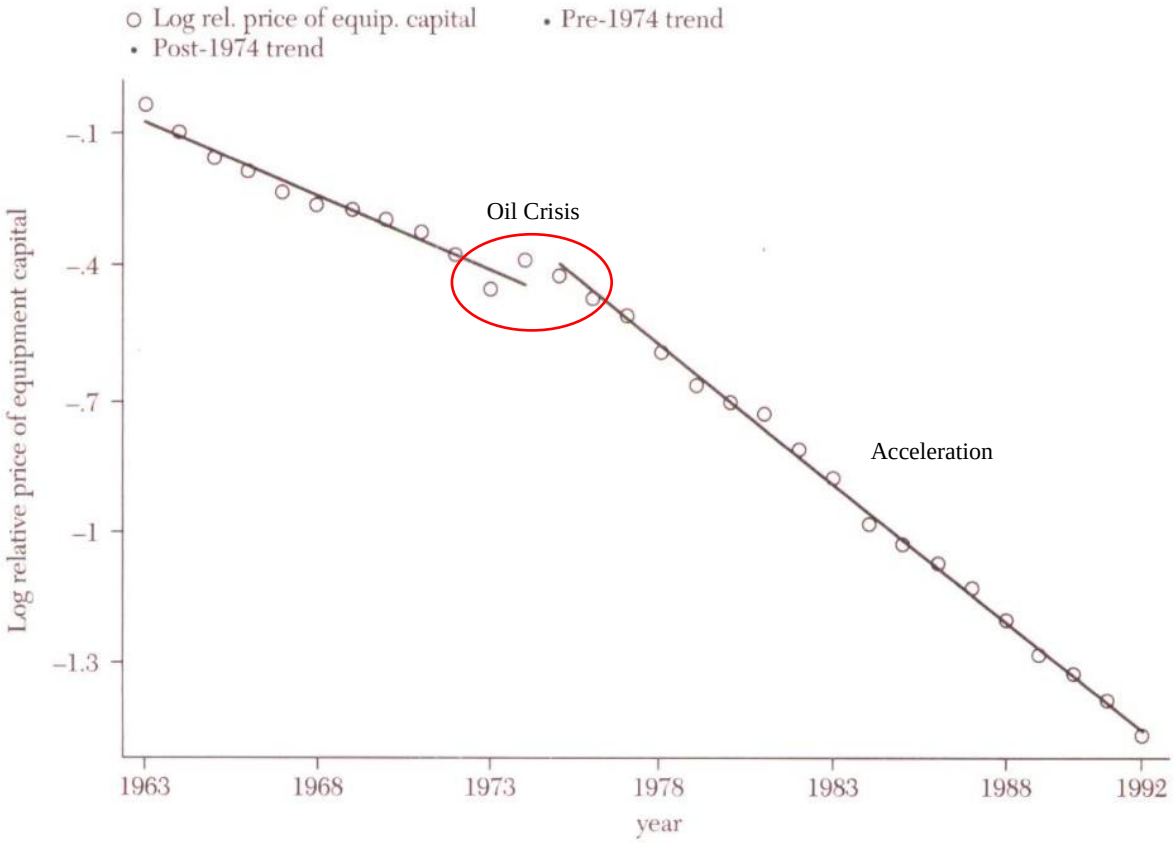

Figure 6. Behavior of the Log Relative Price of Equipment Capital, 1963–92

Appendix C – Additional Course Manual Questions

Q3: Imperfectly inelastic, thus perfect substitutes (If demand curve is horizontal, the slope = 0; if the demand curve is vertical, the slope = ∞). Reasonable in the short run, since it takes time until workers are educated, thus the supply is *inelastic*.

Q4: refer to session 3 (derivate)

Q5: Relationship between substitution effect, skill-biased technology change & shift in demand -> Wage Premium: $\frac{w_h}{w_l} = \frac{MPL_h}{MPL_l}$