



## Outsourcing and the skilled–unskilled wage gap

Sajid Anwar\*

School of Business, University of the Sunshine Coast, Maroochydore DC, QLD 4558, Australia

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### ABSTRACT

Within the context of a product variety model, this paper examines the impact of outsourcing of skill-intensive tasks on the skilled–unskilled wage gap. Outsourcing affects the wage gap through direct as well as indirect channels. While outsourcing decreases the effective wage of skilled workers in the services sector, owing to inter-sectoral labour mobility, its overall impact on the equilibrium skilled wage is positive. Through an increase in the size of external economies in the industrial sector, outsourcing can reduce the unskilled wage. In overall terms, outsourcing of skill-intensive tasks increases the skilled–unskilled wage gap.

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### 1. Introduction

A number of studies have attempted to identify the determinants of the skilled–unskilled wage gap. However, most existing studies focus on the role of trade liberalisation and skill-biased technological progress.<sup>1</sup> This paper considers the link between international outsourcing and the skilled–unskilled wage gap. Improvements in communications technology and an increase in competitive pressures arising from globalisation have resulted in a greater use of international outsourcing.

Ethier (2005) showed that, in the presence of outsourcing, globalisation can lead to an increase in the skilled–unskilled wage gap. However, Ethier focused on outsourcing of unskilled labour tasks. While comparing foreign direct investment with international outsourcing, Stähler (2007) argues that outsourcing, which is often viewed as a cost-saving strategy, also involves training of workers located in foreign locations. Using manufacturing sector data from the UK over the period 1993–1998, Hijzen (2007) examined the link between international outsourcing and wage inequality. Hijzen's work is based on the assumption that cheaper labour in developing countries encourages outsourcing. While examining the link between international outsourcing and the skilled–unskilled

wage gap, Chakrabarti and Mitra (2010) have highlight the role of asymmetric adjustment costs.

In a recent study, Batra and Beladi (2010) incorporate outsourcing of skill-intensive tasks in the Heckscher–Ohlin model. They argue that outsourcing of skill-intensive tasks to developing countries reduces the demand for skilled labour in developed countries, and hence its effect on domestic wages is negative. Chongvilaivan and Thangavelu (2012) empirically examined the impact of outsourcing provision on wage inequality in Thailand. They suggest that provision of outsourcing increases both the skilled and unskilled wages but its impact on the skilled–unskilled wage gap is positive.<sup>2</sup>

While some studies have empirically examined the link between outsourcing and wage inequality, few studies have attempted to provide a theoretical foundation of the link between outsourcing of skill-intensive tasks and the skilled–unskilled wage gap. This paper attempts to fill this gap in the existing literature. It has been suggested that a significant amount of international outsourcing involves intermediate goods (see Stähler, 2007), and hence this paper considers the impact of skill-intensive outsourcing in the intermediate goods sector on the skilled–unskilled wage

\* Tel.: +61 7 5430 1222; fax: +61 7 5430 1231.

E-mail address: [SANwar@usc.edu.au](mailto:SANwar@usc.edu.au).

<sup>1</sup> For example, see Acemoglu (2002) and Epifani and Gancia (2008).

<sup>2</sup> Other aspects of outsourcing have been considered by, among others, Deardorff (2005), Hijzen et al. (2005), Jones (2005), Kierzkowski (2005), Egger and Egger (2006), Geishecker and Görg (2008), Grossman and Rossi-Hansberg (2008), Munch and Skaksen (2009), Brecher and Chen (2010), Chowdhury (2010) and de Mello-Sampayo et al. (2010).

gap. The model used in this paper combines elements of some existing studies, including [Batra and Beladi \(2010\)](#) and [Zhang \(2012, 2013\)](#).

The rest of this paper is organised as follows. A simple general equilibrium model involving outsourcing in skill-intensive intermediate goods is presented in Section 2. The model is used to consider the link between international outsourcing and the skilled–unskilled wage gap in Section 3. Section 4 offers some concluding remarks.

## 2. Outsourcing in a simple general equilibrium model

Consider a small open economy that produces an exportable industrial good ( $Y$ ) and an importable agricultural good ( $Z$ ). Skilled labour, capital and varieties of producer services ( $x_i$ ) enter into the production of the industrial good, where  $i$  varies from 1, 2, . . . ,  $n$ . Varieties of producer services are produced by means of skilled labour and capital, whereas the importable agricultural good is produced by unskilled labour and capital. This paper focuses on outsourcing of skill-intensive tasks in the intermediate goods sector. In other words, it is assumed that only the producer services sector is involved in outsourcing, which involves subcontracting part of the skilled labour work. [Stähler \(2007\)](#), among others, has highlighted the importance of outsourcing in the intermediate goods and services.<sup>3</sup> Following [Hijzen \(2007\)](#) and [Batra and Beladi \(2010\)](#), outsourcing is assumed to be exogenous.

The cost function for each variety of producer services,  $c^{xi}(\cdot)$ , is as follows:

$$c^{xi}(w_s, r, x_i; \lambda, \mu, \phi) = [\mu + \lambda x_i] \left[ \frac{w_s}{v} \right]^{1-\phi} r^\phi,$$

where  $v$  is an index of outsourcing, which initially equals unity;  $w_s$  and  $r$  respectively are the skilled wage and the reward for capital;  $\lambda$  and  $\mu$  are parameters that are positive, whereas  $\phi$  is positive, but less than 1.

An increase in  $v$  starting from the initial value of 1 amounts to outsourcing, which reduces the cost of production of each variety through a decrease in the cost of skilled labour.<sup>4</sup> As some skilled labour tasks are performed by workers located in a foreign country, outsourcing reduces the effective wage of skilled labour. The above cost function, due to the presence of fixed cost, involves internal economies of scale.<sup>5</sup>

Following the existing literature, this paper focuses on a symmetric equilibrium where all varieties of producer services are equally priced. As the production of each variety is subject to internal economies of scale, the production of the industrial good, where producer services are used as input, is subject to external economies of scale. The zero-profit condition that determines the equilibrium output of the industrial good is as follows.

$$1 = \Psi r^{\beta(1-\alpha)} w_s^{(1-\alpha)(1-\beta)} \left[ \frac{p^\alpha}{n \frac{\alpha(1-\delta)}{\delta}} \right] \quad (1)$$

$$\Psi = (1 - \alpha)^{(1-\alpha)} (1 - \beta)^{(1-\alpha)(1-\beta)} \alpha^\alpha \beta^{\beta(1-\alpha)} > 0,$$

where  $p$  is the price of varieties of producer services;  $n$  is the number of varieties;  $\alpha, \beta, \delta$  are parameters that are positive, but less than unity.

The right-hand side of Eq. (1) is the marginal cost of production, whereas the left-hand side is the unit price, which has been set

equal to unity. As the economy is small and varieties of producer services are traded, the price of all varieties is determined in the international market. Due to the presence of internal economies of scale, varieties of producer services are produced under conditions of monopolistic competition. Eq. (2) determines the equilibrium output of each variety as follows:

$$\delta p = \lambda r^\phi \left[ \frac{w_s}{v} \right]^{1-\phi}. \quad (2)$$

Because of free entry and exit of firms in the long run, each firm in the producer services sector produces a single variety and earns zero economic profit.

Eq. (3) ensures zero economic profit in the producer services sector. This equation determines the optimal number of varieties that are produced by the services sector.

$$px = \left[ \frac{\mu}{1 - \delta} \right] \left[ \frac{w_s}{v} \right]^{1-\phi} r^\phi. \quad (3)$$

The right-hand side of Eq. (3) is the total cost of production, whereas the left-hand side is the total revenue. The profit-maximising output of the agricultural good is determined by Eq. (4) as follows:

$$q = \Omega r^\theta w_u^{1-\theta} \quad (4)$$

$$\Omega = [\theta^\theta + (1 - \theta)^{1-\theta}] > 0$$

where  $w_u$  and  $q$  respectively are the unskilled wage and relative price of the agricultural good (which is exogenous);  $\theta$  is a parameter, which is positive, but less than unity.

The right-hand side of Eq. (4) is the marginal cost of production in the agricultural sector, whereas the left-hand side is the unit price. There is no international factor mobility in the initial equilibrium. The market clearing condition for skilled labour is as follows:

$$\left[ \frac{(1 - \alpha)(1 - \beta)Y}{w_s} \right] + \left[ \frac{\delta(1 - \phi)(\mu + \lambda x)np}{\lambda} \right] \left[ \frac{v}{w_s} \right] = L_s, \quad (5)$$

where  $L_s$  is the supply of skilled labour, which is fixed.

Eq. (5) shows that skilled labour is used in the production of the industrial good and varieties of producer services.<sup>6</sup>

The market clearing condition for unskilled labour is as follows:

$$\left[ \frac{(1 - \theta)qZ}{w_u} \right] = L_u, \quad (6)$$

where  $L_u$  is the supply of unskilled labour, which is fixed.

Eq. (6) shows that unskilled labour is used only in the production of the agricultural good, which rarely reduces the mathematical complexity of comparative static results. Capital is used in all sectors, and the relevant market clearing condition is as follows:

$$\left[ \frac{\beta(1 - \alpha)Y}{r} \right] + \left[ \frac{n(\mu + \lambda x)\phi\delta p}{\lambda r} \right] + \left[ \frac{\theta qZ}{r} \right] = K, \quad (7)$$

where  $K$  is the supply of capital, which is fixed.

The first term on the left-hand side of Eq. (7) is demand for capital in the industrial sector. The second and the third terms, respectively, are demand for labour in the intermediate good and the agricultural good sectors. This completes the description of the model. Eqs. (1)–(7) are seven equations in seven endogenous variables:  $n, x, r, w_s, w_u, Z$  and  $Y$ . The impact of international outsourcing on the skilled–unskilled wage gap is considered in Section 3.

<sup>3</sup> An excellent discussion of trade policy involving services can be found in [Francois and Hoekman \(2010\)](#).

<sup>4</sup> International outsourcing in this paper is modelled along the lines of [Batra and Beladi \(2010\)](#).

<sup>5</sup> If  $\mu$  equals zero, there is no fixed cost, and therefore the production function corresponding to the specified cost function exhibits constant returns to scale.

<sup>6</sup> Properties of cost functions are used in Eqs. (5)–(7).

### 3. Impact of outsourcing on the wage gap

By making use of the model presented in Section 2, the aim of this section is to investigate the impact of international outsourcing of skill-intensive tasks on the skilled–unskilled wage gap. Using Eqs. (2) and (4), the following relationships can be derived.

$$\hat{w}_s = - \left[ \frac{\phi}{1-\phi} \right] \hat{r} + \hat{v} \quad (8)$$

$$\hat{w}_u = - \left[ \frac{\theta}{1-\theta} \right] \hat{r}, \quad (9)$$

where  $\hat{w}_s = \frac{dw_s}{w_s}$ ;  $\hat{r} = \frac{dr}{r}$ ;  $\hat{v} = \frac{dv}{v}$ ; and  $\hat{w}_u = \frac{dw_u}{w_u}$ .

Eqs. (8) and (9) can be combined to derive the link between the skilled–unskilled wage gap and outsourcing as follows:

$$\hat{w}_s - \hat{w}_u = - \left[ \frac{\theta - \phi}{\theta(1-\phi)} \right] \hat{w}_u + \hat{v}. \quad (10)$$

Eq. (10) shows that outsourcing affects the skilled–unskilled wage gap directly as well as indirectly. The direct effect is positive, whereas the indirect effect of outsourcing arises from its impact on the unskilled wage rate and the relative income share of capital in the industrial and agricultural sectors.<sup>7</sup> The overall impact of outsourcing on the skilled–unskilled wage gap is as follows:

$$\begin{aligned} \frac{\hat{w}_s - \hat{w}_u}{\hat{v}} = & \left[ \frac{1}{D} \right] \left[ \left[ \frac{\alpha(1-\delta)}{\delta} \right] [(1-\phi)\{\theta K_z + (1-\theta)K\}L_y \right. \\ & + \{\theta(1-\phi)L_y + \phi(1-\theta)nL_x\}K_y \\ & + (1-\phi)\{\beta(1-\alpha)(1-\theta) - \theta(1-\alpha)(1-\beta)\} \\ & \left. \times \{nL_xK_y - nK_xL_y\} \right] \quad (11) \end{aligned}$$

$$\begin{aligned} D = & \left[ \frac{\alpha(1-\delta)}{\delta} \right] [\phi(1-\theta)K_yL_s + (1-\phi)L_y \\ & \times \{\theta K_z + (1-\theta)K\} + (1-\theta)[\beta(1-\alpha)(1-\phi) \\ & - \phi(1-\alpha)(1-\beta)][nL_xK_y - nK_xL_y]. \end{aligned}$$

The sign of the comparative static result presented in Eq. (11) depends on the sign of  $D$ . The sign of  $D$  depends on relative factor intensities and relative income shares of primary factors of production (i.e., capital and labour).  $D$  is positive because when the industrial good is capital intensive as compared to varieties of producer services (i.e.,  $K_yL_x > K_xL_y$ ), the income share of capital in the industrial sector is greater than the income share of capital in the services sector (i.e.,  $\beta(1-\alpha) > \phi$ ) and vice versa.<sup>8</sup>

Eq. (11) shows that outsourcing of skill-intensive tasks in the services sector leads to an unambiguous increase in the skilled–unskilled wage gap when (i) the industrial sector is capital intensive as compared to the services and (ii) the income share of capital in the industrial sector is greater than the income share of capital in the agricultural sector. While outsourcing of skill-intensive tasks decreases the effective wage in the services sector, the overall impact on the skilled wage rate is positive.<sup>9</sup> This follows

<sup>7</sup> Eq. (9) shows that the unskilled wage rate and the price of capital are inversely related.

<sup>8</sup> By using properties of cost functions, it can be confirmed that  $\beta(1-\alpha)(1-\phi) > (1-\alpha)(1-\beta)\phi \Leftrightarrow K_yL_x > K_xL_y$  and  $\beta(1-\alpha)(1-\phi) < (1-\alpha)(1-\beta)\phi \Leftrightarrow K_yL_x < K_xL_y$ .

<sup>9</sup> This result is also consistent with Görg et al. (2011).

from the fact that, due to the presence of external economies of scale in the industrial sector, outsourcing increases the skilled wage rate even if the income shares of capital were identical.

$$\begin{aligned} \frac{\hat{w}_u}{\hat{v}} = & \theta(1-\alpha)(1-\beta)(1-\phi) \left[ \frac{n(K_yL_x - K_xL_y)}{D} \right] \\ & - \left[ \frac{\alpha(1-\delta)}{\delta} \right] \left[ \frac{\theta K_yL_y}{D} \right]. \quad (12) \end{aligned}$$

However, as shown in Eq. (12), an increase in productivity in the industrial sector contributes to a decrease in the unskilled wage rate. The overall impact of international outsourcing on the unskilled wage can be ambiguous, if the industrial sector is capital intensive as compared to the services sector.

### 4. Conclusion

While examining the determinants of the skilled–unskilled wage gap, a number of studies have highlighted the role of skilled biased technological change and trade liberalisation. This paper focuses on the role of international outsourcing. Based on the work of Batra and Beladi (2010), international outsourcing of skill-intensive tasks is introduced in a Heckscher–Ohlin-type product variety model.

The model is used to investigate the impact of outsourcing on the skilled–unskilled wage gap, when all goods are traded. Outsourcing affects the skilled–unskilled wage gap through a direct as well as an indirect channel. The direct impact of outsourcing on the skilled wage is positive but the indirect impact on the unskilled wage can be ambiguous. The results presented in this paper suggest that, in overall terms, international outsourcing increases the skilled–unskilled wage gap.

This paper focuses only on the long-run equilibrium. It would be interesting to examine the properties of the short-run equilibrium.

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### References

- Acemoglu, D., 2002. Technical change, inequality, and the labor market. *Journal of Economic Literature* 40, 7–72.
- Batra, R., Beladi, H., 2010. Outsourcing and the Heckscher–Ohlin model. *Review of International Economics* 18 (2), 277–288.
- Brecher, R.A., Chen, Z., 2010. Unemployment of skilled and unskilled labor in an open economy: International trade, migration, and outsourcing. *Review of International Economics* 8, 990–1000.
- Chakrabarti, S., Mitra, R., 2010. Skilled–unskilled wage inequality and offshore outsourcing with asymmetric adjustment costs. *International Review of Economics and Finance* 19 (2), 340–345.
- Chongvilaivan, A., Thangavelu, S.M., 2012. Does outsourcing provision lead to wage inequality? new evidence from Thailand's establishment-level data. *Review of International Economics* 20 (2), 364–376.
- Chowdhury, S.R., 2010. Technology and outsourcing: an explanation to the rising wage gap. *Economic Modelling* 27, 380–387.
- Deardorff, A.V., 2005. A trade theorist's take on skilled-labor outsourcing. *International Review of Economics and Finance* 14, 259–271.
- de Mello-Sampayo, F., de Sousa-Vale, S., Camões, F., 2010. Delaying the timing of offshoring low-skilled tasks. *Economic Modelling* 27 (5), 951–958.
- Egger, H., Egger, P., 2006. International outsourcing and the productivity of low-skilled labor in the EU. *Economic Inquiry* 44, 98–108.
- Epifani, P., Gancia, G., 2008. The skill bias of world trade. *The Economic Journal* 118 (530), 927–960.
- Ethier, W., 2005. Globalization, globalization: trade, technology, and wages. *International Review of Economics and Finance* 14 (3), 237–258.
- Francois, J., Hoekman, B., 2010. Services and trade policy. *Journal of Economic Literature* 48 (3), 642–692.

- Geishecker, I., Görg, H., 2008. Winners and losers: A micro-level analysis of international outsourcing and wages. *Canadian Journal of Economics* 41, 243–270.
- Görg, H., Geishecker, I., Krieger-Boden, C., 2011. Services offshoring increases wage inequality. Available at: <http://www.voxeu.org/article/services-offshoring-increases-wage-inequality>.
- Grossman, G., Rossi-Hansberg, E., 2008. Trading tasks: A simple theory of offshoring. *American Economic Review* 98 (5), 1978–1997.
- Hijzen, A., 2007. International outsourcing, technological change, and wage inequality. *Review of International Economics* 15, 188–205.
- Hijzen, A., Görg, H., Hine, R.C., 2005. International outsourcing and the skill structure of labour demand in the United Kingdom. *The Economic Journal* 115, 860–878.
- Jones, R.W., 2005. Immigration vs. outsourcing: effects on labour markets. *International Review of Economics and Finance* 15, 105–114.
- Kierzkowski, H., 2005. Outsourcing and fragmentation: blessing or threat. *North American Journal of Economics and Finance* 14, 233–235.
- Munch, J.R., Skaksen, J.R., 2009. Specilaization, outsourcing and wages. *Review of World Economics* 145, 57–73.
- Stähler, F., 2007. A model of outsourcing and foreign direct investment. *Review of Development Economics* 11 (2), 321–332.
- Zhang, J., 2012. Inflow of labour, producer services and wage inequality. *Economics Letters* 117 (3), 600–603.
- Zhang, J., 2013. Factor mobility and skilled-unskilled wage inequality in the presence of internationally traded product varieties. *Economic Modelling* 30, 579–585.