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Incidence of an Outsourcing Tax on Intermediate Inputs*

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Abstract

The paper uses a Heckscher-Ohlin-Samuelson type general equilibrium framework to consider the incidence of an outsourcing tax on an economy in which the production of a specific intermediate input has been fragmented and outsourced. When the input is “non-traded”, the outsourcing tax can reduce domestic wages even if the intermediate input producing sector is the *most capital-intensive* sector of the economy. This implies that contrary to received wisdom, a tax on a capital-intensive sector may actually hurt labor. On the other hand, if the intermediate input is traded, the outsourcing tax must close down the final good producing sector that uses it specifically in its production. In turn, this may force the government to look for additional policy instruments to help sustain this domestic industry.

Keywords: Fragmentation, Outsourcing, Factor intensity, Tax incidence.

JEL Classification: F1, D3

1. Introduction

Economic recession in the U.S. and continuing job losses prompted the new president to suggest policies that would make outsourcing a relatively expensive activity. Firms, which will rely on outsourced activities, will find it harder to get “tax-breaks”. Similarly, procedure or formalities for H-1B visa (a type of visa required by foreign nationals to work temporarily in USA) are also being made stringent. The “tax” on outsourcing activities is expected to reverse the trend in fragmentation of production and to provide a boost to the demand for local labor.

Some papers have attempted to analyze the general equilibrium incidence of an outsourcing tax in a relatively capital abundant country like the U.S., where firms outsource their relatively labor intensive production fragments. Arndt (1997), Markusen and Venables (2005), among others, assume full employment of factors and a small open economy, to show that if the outsourcing sector is labor (capital) intensive, the “tax” hurts (benefits) labor. A limitation of these papers is that they consider only the final good sectors. Outsourcing, however, is a reality even in sectors, which produce intermediate inputs¹. For example, if airline services are conceived as inputs to business activities; then call centers outside the U.S. serving the airlines are contributing towards the provision of an intermediate input. Although in the example above the input is non-traded, outsourcing can also take place in a traded input (as it lowers the cost of production in the outsourced fragment). This paper stands out from its predecessors as it considers the implications of an outsourcing tax on the intermediate input-producing sector. It uses a variant of the standard two final goods, two primary inputs, Heckscher-Ohlin-Samuelson framework, where an intermediate input is also used. We find that if the outsourced sector provides a non-traded input, an outsourcing tax can have adverse impact on labor even if it is the *most capital-intensive* sector of the economy. This is interesting, because it is apparently counterintuitive that a tax on a capital-intensive sector hurts labor². In addition, we find that when the intermediate input is traded, the outsourcing tax closes down the final good producing sector which uses it specifically in its production.

The next section presents the model. In the subsections we discuss the results for the cases where the intermediate input is non-traded and traded, respectively. The last section concludes.

¹ See Head, Mayer and Ries (2009) for an overview of the data on recent growth in service and manufacturing sector outsourcing, the composition of different services in the service sector outsourcing and country specific flows. It shows that the cost of outsourcing of services is falling over time.

² The result assumes no reversal of factor intensity rankings of the commodities consequent on outsourcing of the labor intensive fragmented part of the production.

2. The Model and Results

The economy has three sectors X, M and Y. X is a final good, which is produced using local labor and capital. M is the sector, which produces the intermediate input, using local labor, capital and an outsourced input produced by foreign labor. The rate of return of foreign labor (foreign wage) cannot be affected by local policies. Y is produced with local labor and the intermediate input M. Production functions are standard, exhibiting CRS and diminishing marginal productivities. Resources are fully employed and markets are competitive. X and Y are traded. The traded good prices are frozen by the “small” economy assumption. Notice that X represents an activity, which does not depend on the outsourced input (via the intermediate input).

2.1 M is non-traded

Following equations provide a formal description of the model. Symbols have usual natural interpretations. Competitive price conditions imply:

$$wa_{LX} + ra_{KX} = p_X \quad (1)$$

$$wa_{LM} + w^*(1 + t)a_{LM}^* + ra_{KM} = p_M \quad (2)$$

$$wa_{LY} + p_M a_{MY} = p_Y \quad (3)$$

where t is the tax on outsourced input. Full employment conditions give us:

$$a_{LX}X + a_{LM}M + a_{LY}Y = L \quad (4)$$

$$a_{KX}X + a_{KM}M = K \quad (5)$$

For market clearance the demand for M must match its supply:

$$a_{MY}Y = M. \quad (6)$$

Given (p_X, p_Y, w^*, t, K, L) we can determine (w, r, p_M, X, Y, M) from equations (1) to (6). Also note that by CRS when factor prices are determined the factor intensities are also determined.

Simple manipulation of the equations (2) and (3) yield:

$$w(a_{LY} + a_{LM}a_{MY}) + ra_{KM}a_{MY} = p_Y - w^*(1 + t)a_{LM}^*a_{MY}. \quad (7)$$

Consider equations (1) and (7) and work out the effect of change in t on w . Using standard algebra and using $\hat{\cdot}$ over a variable to denote proportional change one can get:

$$\theta_{LX} \hat{w} + \theta_{KX} \hat{r} = 0 \quad (8)$$

$$\theta_{LY} \hat{w} + \theta_{KX} \hat{r} = -\theta_{LY}^* \hat{t}. \quad (9)$$

Note θ_{ij} s are factor income share in unit cost. From equation (8) and (9) one can calculate:

$$\hat{w} = \frac{\hat{t} \theta_{KX} \theta_{LY}^*}{\theta_{LX} \theta_{KY} - \theta_{KX} \theta_{LY}}. \quad (10)$$

Equation (10) yields the following proposition:

Proposition 1: *The necessary and sufficient conditions for a fall in w following a rise in t are*

given by $\frac{\tilde{\theta}_{LY}}{\theta_{KM} \theta_{MY}} > \frac{\theta_{LX}}{\theta_{KX}} - \frac{\theta_{LM}}{\theta_{KM}}$ and $\frac{\theta_{LM}}{\theta_{KM}} > \frac{\theta_{LX}}{\theta_{KX}}$ respectively where $\tilde{\theta}_{LY} = \frac{wa_{LY}}{p_Y}$.

Proof: As $\hat{t} > 0$ equation (10) implies $\hat{w} < 0$ iff $\theta_{LX} \theta_{KY} - \theta_{KX} \theta_{LY} < 0$.

$$\text{Now } \theta_{KY} = \frac{ra_{KM} a_{MY}}{p_Y} = \frac{ra_{KM}}{p_M} \frac{p_M a_{MY}}{p_Y} = \theta_{KM} \theta_{MY}.$$

$$\text{Similarly } \theta_{LY} = \frac{wa_{LY} + a_{LM} a_{MY}}{p_Y} = \tilde{\theta}_{LY} + \theta_{LM} \theta_{MY}.$$

Suppose we violate the necessary condition such that

$$\frac{\tilde{\theta}_{LY}}{\theta_{KM} \theta_{MY}} < \frac{\theta_{LX}}{\theta_{KX}} - \frac{\theta_{LM}}{\theta_{KM}}$$

which in turn implies:

$$\frac{\tilde{\theta}_{LY} + \theta_{LM} \theta_{MY}}{\theta_{KM} \theta_{MY}} < \frac{\theta_{LX}}{\theta_{KX}}. \quad (11)$$

Now using the definitions of θ_{KY} and θ_{LY} from inequality (11) we obtain:

$$\frac{\theta_{LY}}{\theta_{KY}} < \frac{\theta_{LX}}{\theta_{KX}}$$

such that $\theta_{LX} \theta_{KY} - \theta_{KX} \theta_{LY} > 0$. So, w cannot fall following a rise in t .

On the other hand, suppose we satisfy the sufficient condition $\frac{\theta_{LM}}{\theta_{KM}} > \frac{\theta_{LX}}{\theta_{KX}}$. If the sufficient

condition holds it must be true that:

$$\frac{\tilde{\theta}_{LY} + \theta_{LM} \theta_{MY}}{\theta_{KM} \theta_{MY}} > \frac{\theta_{LX}}{\theta_{KX}}.$$

So, using the definitions of θ_{KY} and θ_{LY} we obtain:

$$\frac{\theta_{LY}}{\theta_{KY}} > \frac{\theta_{LX}}{\theta_{KX}}$$

which in turn implies $\theta_{LX} \theta_{KY} - \theta_{KX} \theta_{LY} < 0$. Hence from equation (10) it follows that $\hat{w} < 0$. \square

Proposition 1 implies that if M is labor intensive relative to X, a tax on outsourcing must lower w . However, following a tax on outsourcing, w may fall even if M is capital intensive, provided it is not too capital intensive relative to X. Let us explain why these results are important.

If M is labor intensive, taxing it will raise r and reduce w by the Stolper-Samuelson result. Note that this has to happen notwithstanding the substitution effects, even if M uses more local labor and capital relative to foreign labor. From (3), as w goes down, p_M must rise in equilibrium. Therefore, this is a clear case where M becomes more costly. In this case, effectively Y is labor intensive relative to X, once we take the indirect requirement of capital and labor in this sector through the use of M.

When M is capital intensive, Y can still be labor intensive. The necessary condition derived in proposition 1 tells us that as long as $\tilde{\theta}_{LY} (\theta_{MY})$ is very high (low), w will still go down. Even if θ_{KM} is high, a low θ_{MY} can induce a fall in w because the effective capital intensity of Y can be pretty low.

By the same logic as above, the conditions under the outsourcing tax can raise w are also clear. For this to happen, such a tax must adversely affect the cost of production of the capital-intensive final good. Thus, if M is labor intensive, but it helps the capital-intensive segment, an outsourcing tax may raise the local wage. On the other hand, if the outsourcing helps a capital-intensive intermediate good or service but the users of such facilities are labor intensive, then an outsourcing tax will ultimately hurt the typical worker.

Finally, note that in our model if the outsourcing tax increases the wage rate, it must reduce p_M . This is a peculiar but very interesting outcome. In this case, as Y decreases, demand for M drops considerably leading to a decline in p_M . This is apparently paradoxical, because the tax makes foreign labor more costly for M, but that cannot (in equilibrium) translate to a rise in its price.

2.2 M is traded

Since M is a traded good, we freeze its price by the “small” economy assumption. Therefore, the market clearing equation for M (equation-6) no longer applies here. X, Y and M are produced using the same production technology as above. The full employment conditions of the primary factors of production also remain unchanged. We are left with equations (1) through (5) to determine the equilibrium of this economy.

Equation (2) can be rewritten as:

$$wa_{LM} + ra_{KM} = p_M - w^*(1 + t)a_{LM}^*. \quad (12)$$

Since M is traded, we work out the effect of a change in t on w by using equations (1) and (12):

$$\theta_{LX} \hat{w} + \theta_{KX} \hat{r} = 0 \quad (13)$$

$$\theta_{LY} \hat{w} + \theta_{KY} \hat{r} = -\theta_{LM}^* \hat{t} \quad (14)$$

where θ_{ij} s are factor income share in unit cost. From equation (13) and (14):

$$\hat{w} = \frac{\hat{t} \theta_{KX} \theta_{LM}^*}{\theta_{LX} \theta_{KM} - \theta_{KX} \theta_{LM}}. \quad (15)$$

Using equation (15) we state the second proposition of the model.

Proposition 2: *If M is capital (labor) intensive compared to X, a rise in t leads to closure (expansion) of Y.*

Proof: If M is capital intensive relative to X, it must be $\theta_{LX} \theta_{KM} - \theta_{KX} \theta_{LM} > 0$. Therefore, from equation (15) it follows that as t rises, w rises. Since p_M and p_Y are fixed internationally, the rise in w turns equation (3) into:

$$wa_{LY} + p_M a_{MY} > p_Y \quad (16)$$

i.e. the unit cost of production exceeds the price of the commodity. So, the production of Y stops.

If M is labor intensive relative to X, it must be $\theta_{LX} \theta_{KM} - \theta_{KX} \theta_{LM} < 0$. Therefore, from equation (15) it follows that as t rises, w falls. So, the opposite happens. This proves the statement of the proposition. \square

Proposition 2 starkly exhibits how the differential impact of an outsourcing tax (affecting the traded intermediate input) on the final good producing sector (using the intermediate input) depends critically on factor intensities. If the intermediate input is relatively capital intensive

compared to X, the tax makes the Y sector stop production. If it is relatively labor intensive, sector Y expands. The difference in the outcomes may be reconciled as follows. The Stolper-Samuelson effect works differently in the two situations. To understand this, observe that X and M are the only sectors in the economy that use both capital and labor in their production. Therefore, the relative factor intensities of these two sectors determine the economy-wide factor returns. In the case where the intermediate input producing sector is more capital-intensive than X, the tax raises the wage rate compared to the initial equilibrium. Given that the product prices are internationally fixed, production in the Y sector turns non-viable. In the other case where the intermediate input producing sector is relatively more labor-intensive, the tax lowers the wage rate. In turn, this reduces the unit cost of production of Y relative to its price, and in equilibrium leads to a higher output in the sector.

Proposition 2 has interesting policy implications. A government that is committed to keeping the Y sector in operation while it imposes an outsourcing tax, may have to support it through additional policy instruments like a protective tariff. Effectively, to balance conflicting policy objectives, more distortions may need to be introduced. While we do not model this issue here, in reality the government's preference for survival of Y may stem from lobbying done by some factor specific to Y, whose welfare is inextricably linked with production in the sector.

3. Conclusions

The paper shows that there are critically important differences between the effects of outsourcing that is related to the intermediate input sector, compared to outsourcing that caters to final good production. Also, it is important to identify whether the intermediate input is traded or non-traded. If it is non-traded, labor is hurt even if the intermediate input producing sector (suffering from the outsourcing tax) is the most capital-intensive in the economy. This finding is apparently paradoxical. On the other hand, if the input is traded, the production of the final good using the input becomes non-viable. Therefore, if the government wants to sustain this sector when it imposes an outsourcing tax, it has to consider further policy intervention (for example, a protective tariff), which may further distort the economy.

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