

**IMPACT OF IMMIGRATION AND OUTSOURCING
ON THE LABOUR MARKET**
A Partial Equilibrium Analysis

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➤ **Primary Characteristic of a developing country like India: *surplus labour at lower wage***

➤ **The developed countries often utilise the low cost labour supply of the developing countries through *immigration* and *outsourcing* – two manifestations of trade in factor inputs**

Immigration: there are two types of immigration; permanent and temporary

- ***Permanent immigration*: people become the citizen of the foreign country.**
- ***Temporary immigration*: people come back to home country after some years**

Outsourcing: two types - service outsourcing and product outsourcing.

- ***Service outsourcing*: it involves only the exportation of the labour service.**
- ***Product outsourcing*: it involves the exportation of many factor services, along with labour service.**

Burda and Dluhosch (2002) view that rise in outsourcing is on account of cost-efficiency and flexibility of the production process

In this paper we are interested to find the relationship between *temporary immigration and product outsourcing*, and their impact on the developing country

Literature Review

Jones (2004):

- **Analysis of the effects of immigration and outsourcing on the labour market of developed countries**
- **Absence of negative impact of these two process**
- **Positive impact of these two on the domestic wage level of the developed country**

Bandyopadhyay and Wall (2005):

- **Inverse relationship between temporary immigration and outsourcing**
- **Positive impact of temporary immigration quota on the national income level of the developed country**

Concern of this paper:

India, like many other industrialising countries, is an important player in the global outsourcing market. For instance, it is estimated that outsourcing order in India's manufacturing sector will increase to \$ 50 to \$ 60 billions in 2015 . USA is an important outsourcing partner.

H1-B visa issued by US Government is a measure of temporary immigrants. According US Census 2000, India is one of the important source of temporary migrants (124, 647 migrants). Other developing countries include China and Pakistan.

Which one --- temporary immigration or product outsourcing --- is the better option for a developing country, like India?

Objective of the Paper:

- **The relationship between the temporary immigration and the product outsourcing.**
- **The impact of an increase in temporary immigration quota by the developed country on the labour market of developed and developing countries.**

Both theoretical as well as empirical analyses will be done.

Model: Two Countries: Developing Country (as *Domestic Country*)
Developed Country (as *Foreign Country*)

Assumptions of the Model:

- i. Foreign firm produces a final good (Q) with the help of two inputs --- intermediate input (I) and foreign labour (N).
- ii. Intermediate input can be produced in two ways--- foreign firm can produce whole or part of its intermediate input requirement (I_F) with the help of foreign capital (K_F) and immigrant workers (n) or intermediate input can be outsourced to domestic firm (I_D).
- iii. Domestic firm produces outsourced product (I_D) by using her domestic labour (L_D) and domestic capital (K_D)
- iv. The productivity of immigrants is higher than the productivity of domestic workers due to the presence of high quality infrastructure of foreign country. Therefore under the competitive environment wage of the immigrants (W_F) is higher than the wages of the domestic workers (w) employed in the domestic outsourcing sector.

Assumptions of the Model:

- v. Immigrant workers and workers involved in outsourced sector are of same quality.
- vi. This is a short-run analysis, so capital available to both firms – foreign firm and domestic firm – is fixed. Foreign capital is fixed at K_I^* level and domestic capital is fixed at K_O^* level
- vii. Intermediate good is produced by using same technology in the foreign as well as in the domestic country.
- viii. Final good as well as all the factor input markets of the foreign and the domestic country are perfectly competitive in nature. The price of the final consumption good is given at P_Q^* for a particular foreign firm.
- ix. There is full employment in all factor markets, including foreign labour market, intermediate input market, immigration market and domestic labour market.
- x. All the production functions are of the neoclassical type.

Foreign Firm:-

Objective of the foreign firm is to maximise joint profit.

The optimisation problem of the foreign firm can be written as,

$$\text{Maximise } \Pi_F = P_Q^* Q(I_D + F(K_I^*, n), N) - P_I I_D - W_N N - W_i n - c$$
$$I_D, N, n > 0$$

Where c = fixed cost of producing I_F

First Order Conditions for Profit Maximisation:

- $\frac{\partial \Pi_F}{\partial I_D} = P_Q^* Q_I - P_I = 0 \Rightarrow P_Q^* Q_I = P_I$ (1)
- $\frac{\partial \Pi_F}{\partial n} = P_Q^* Q_I F_n - W_i = 0 \Rightarrow P_Q^* Q_I F_n = W_i$ (2)
- $\frac{\partial \Pi_F}{\partial N} = P_Q^* Q_N - W_N = 0 \Rightarrow P_Q^* Q_N = W_N$ (3)

Factor Markets Equilibrium:

Immigration market:

There are many social and political factors related with the temporary immigration policy. Therefore, the number of immigrants is often restricted within a limit by the foreign government. This restricted number is often referred as immigration quota. Let us assume that immigration quota n be fixed at n^* level. This immigration quota is an exogenous variable in this model.

• Immigration Market Equilibrium:

$$n^* = n \quad (4)$$

Foreign labour market:

We are assuming a standard positively sloped foreign labour supply function, given as,

$$N^s = N^s (W_N)$$

• Foreign Labour Market Equilibrium:

$$N^s = N^d \quad (5)$$

Domestic Firm: -

Objective of the domestic firm is to maximise profit

- **The optimisation problem of the domestic firm can be written as,**

$$\text{Maximise } \Pi_D = P_I F(K_O^*, L_O) - w \cdot L_O - c_d$$
$$L_O > 0$$

Where c_d = fixed cost of producing I_D

First Order Conditions for Profit Maximisation:

- $\partial \Pi_D / \partial L_O = P_I F_{L_O} - w = 0 \Rightarrow P_I F_{K_O} = w$ (6)

Factor Markets Equilibrium:

- **Domestic Labour market:**

We are assuming a standard positively sloped labour supply function, given as,

$$L^s = L^s(w)$$

Domestic Labour Market Equilibrium:

$$L^s(w) = n^* + L_O^d$$
 (7)

Factor Markets Equilibrium:

- **Intermediate input market:**

The demand for the intermediate input is derived from the profit maximizing conditions of the foreign firm as,

$$I^d = I^d(P_Q^*, P_I, W_N)$$

The supply part of the intermediate input comprises of two components: supply of the intermediate input by the foreign firm (I_F^S) and the supply of the outsourced intermediate input by the domestic firm (I_D^S).

Intermediate Input Market Equilibrium:

$$I^S = I_F^S + I_D^S \tag{8}$$

Solution Set of the Model:

- $Q^* = Q^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $I^* = I^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $I_D^* = I_D^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $I_F^* = I_F^*(P_Q^*, n^*)$
- $P_I^* = P_I^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $N^* = N^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $W_N^* = W_N^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $W_I^* = W_I^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $L_O^* = L_O^*(P_Q^*, K_I^*, K_O^*, n^*)$
- $w^* = w^*(P_Q^*, K_I^*, K_O^*, n^*)$

Proposition 1: *An increase in the temporary immigration quota reduces the equilibrium price of the intermediate input (P_I^*), but increases the equilibrium usage of the intermediate input (I^*).*

The demand curve for the intermediate input does not change due to an increase in the immigration quota, since $I^d = I^d(P_Q^*, P_I, W_N)$

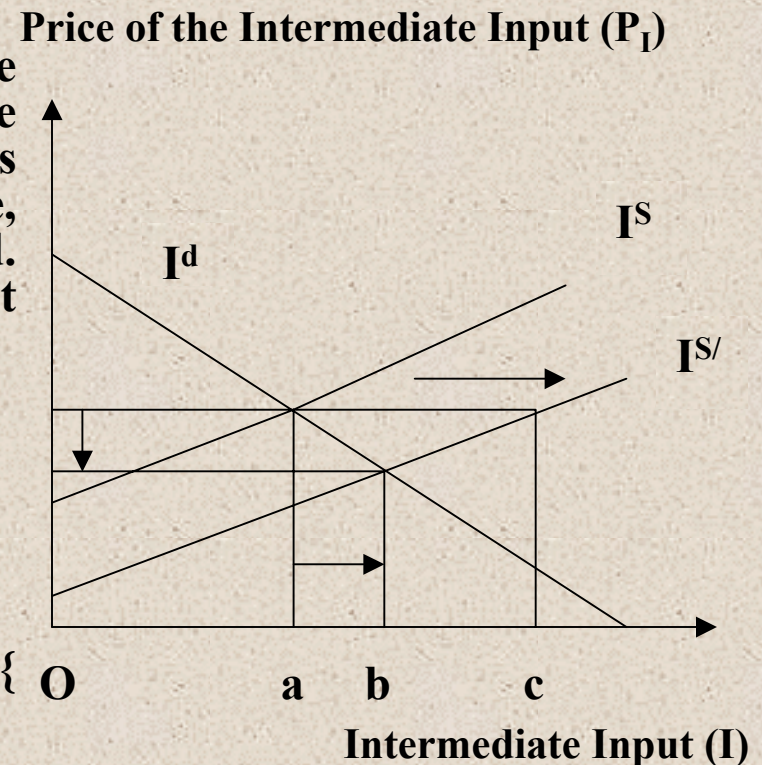
An increase in the immigration quota induces more people migrate from the domestic country to the foreign country. Productivity of the immigrant is higher than that of the domestic workers. Therefore, the supply of the intermediate input is increased. This shifts the supply curve of the intermediate input towards right.

The shift in supply curve = $dI^S = (F_n - F_{LO}) \cdot dn^* = ac$

From figure we have $dP_I^*/dn^* < 0$, and $dI^*/dn^* > 0$.

But, $dI^* = \{1/P_Q^* Q_{II}\} \{dP_I^*/dn^*\} dn^* - \{Q_{IN}/Q_{II}\} \{dN^*/dn^*\} dn^* = ab$

Since, I^S is positively sloped, so $ab < ac$.



Proposition 2: An increase in the temporary immigration quota reduces the outsourced demand for the intermediate input from the domestic country.

Demand for the outsourced intermediate input (I_D^d) = optimum usage of the total intermediate input (I^*) – the intermediate input produced by the foreign firm (I_F^S).

Therefore, $I_D^d = I^* - I_F^S$

Differentiating both sides of the above expression with respect to n^* we obtain,

$$d I_D^d / dn^* = d I^* / dn^* - d I_F^S / dn^*$$

Using proposition (1)

$$d I_D^d / dn^* = \{1/ P_Q^* Q_{II}\} \{dP_I^* / dn^*\} - \{Q_{IN} / Q_{II}\} \{dN^* / dn^*\} - F_n$$

From proposition (1), we have $ab < ac$.

Therefore, $\{1/ P_Q^* Q_{II}\} \{dP_I^* / dn^*\} dn^* - \{Q_{IN} / Q_{II}\} \{dN^* / dn^*\} dn^* < (F_n - F_{LO}).dn^*$.

$$\Rightarrow \{1/ P_Q^* Q_{II}\} \{dP_I^* / dn^*\} - \{Q_{IN} / Q_{II}\} \{dN^* / dn^*\} - F_n < 0.$$

Therefore, $d I_D^d / dn^* < 0$.

Proposition 3: An increase in the temporary immigration quota reduces the real value of product outsourcing from the domestic country.

Monetary value of product outsourcing = $P_I^*(n^*) \cdot I_D^*(n^*)$

Real value of the product outsourcing (RPO) = $\{P_I^*(n^*) \cdot I_D^*(n^*)\} / P_Q^*$

Therefore, RPO = $\{P_I^*(n^*) \cdot I_D^d(n^*)\} / P_Q^*$

\Rightarrow RPO = $p_I^*(n^*) \cdot I_D^d(n^*)$

Where, $p_I^* = P_I^*(n^*) / P_Q^* =$ relative price of outsourced intermediate input

Differentiating both sides of the equation with respect to n^* , we obtain,

$d(\text{RPO}) / dn^* = [I_D^d(n^*) \{d P_I^*(n^*) / dn^*\} + P_I^*(n^*) \{d I_D^d(n^*) / dn^*\}] / P_Q^*$

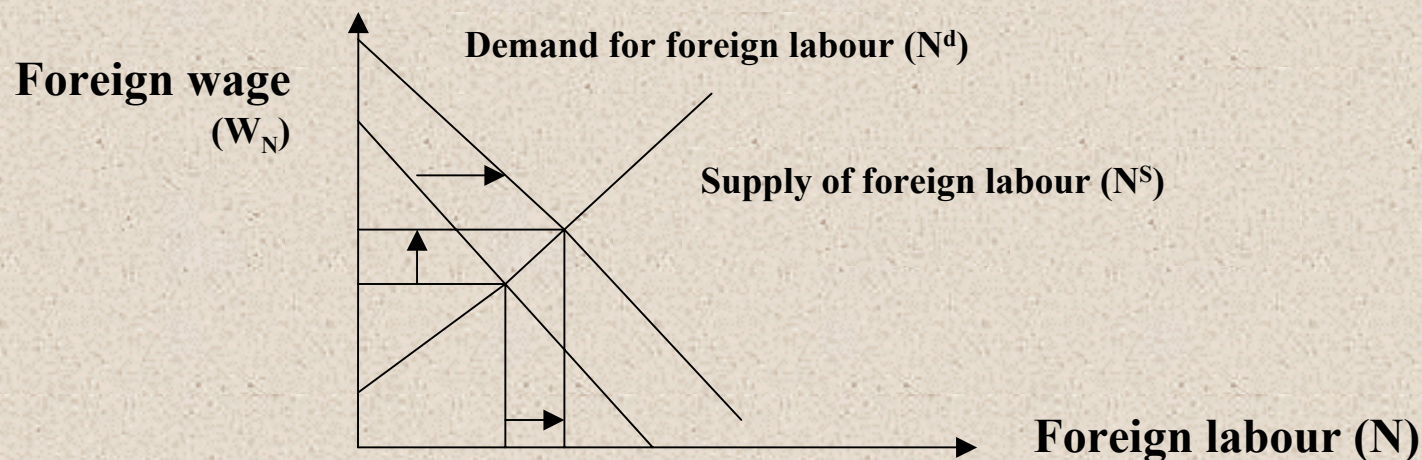
P_Q^* is a parameter. Now $dP_I^*/dn^* < 0$ and $d I_D^d / dn^* < 0$. Therefore, $d(\text{RPO}) / dn^* < 0$.

Proposition 4: An increase in the temporary immigration quota increases the equilibrium wage of the foreign labour (W_N^*).

An increase in the immigration quota increases the equilibrium usage of the intermediate input (I^*). This increases the productivity of the foreign labour, since foreign labour and intermediate input are complement to each other in the production system. Therefore, the demand for the foreign labour increases and the demand curve of foreign labour shifts rightward.

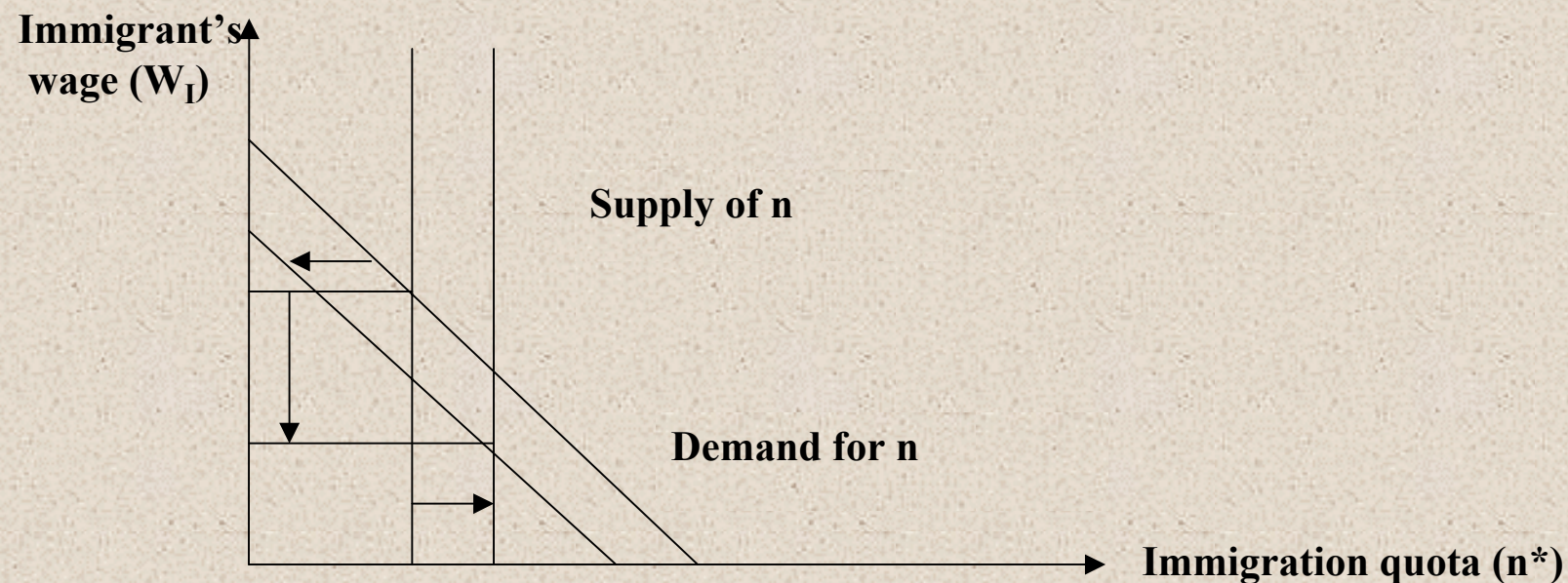
But the supply curve of the foreign labour, given by $N^s = N^s(W_N)$, remains unaffected by the change in the immigration quota.

Therefore, the equilibrium wage of the foreign labour (W_N^*) and the equilibrium usage of the foreign labour (N^*) increase ultimately.



Proposition 5: An increase in the temporary immigration quota reduces the wage of the immigrants (W_I^*).

An increase in the temporary immigration quota induces a reduction in the price of the intermediate input. So the value of the marginal product of the immigrants (VMP) falls. Therefore value of the marginal product (VMP) curve of the immigrants (which can be interpreted as the demand curve of the immigrants) shifts leftward. On the other hand, increase in the immigration quota directly increases the supply of the immigrants. Supply curve of the immigrants shifts rightward. As a result equilibrium wage rate (W_I^*) falls.



Proposition 6: An increase in the temporary immigration quota reduces the total labour demand (L^d) of the domestic country.

An increase in the immigration quota directly increases the demand for domestic labour by the foreign country. On the other hand, the outsourcing demand for the intermediate input from the domestic country falls due to an increase in the immigration quota. Therefore, the derived labour demand by the domestic outsourcing firm is reduced. These two effects have opposite impacts on the total labour demand of the domestic country. But the second effect dominates over first effect. Therefore the total labour demand of the domestic country is reduced.

We have, $L^d = n^* + L_O^d$

Differentiating both sides with respect to n^* we obtain,

$$d L^d / d n^* = 1 + (d L_O^d / d I_D^d) (d I_D^d / d n^*)$$

From proposition (2) we obtain,

$$d L^d / d n^* = 1 + (1 / F_{LO}) [\{ 1 / P_Q^* Q_{II} \} \{ d P_I^* / d n^* \} - \{ Q_{IN} / Q_{II} \} \{ d N^* / d n^* \} - F_n]$$

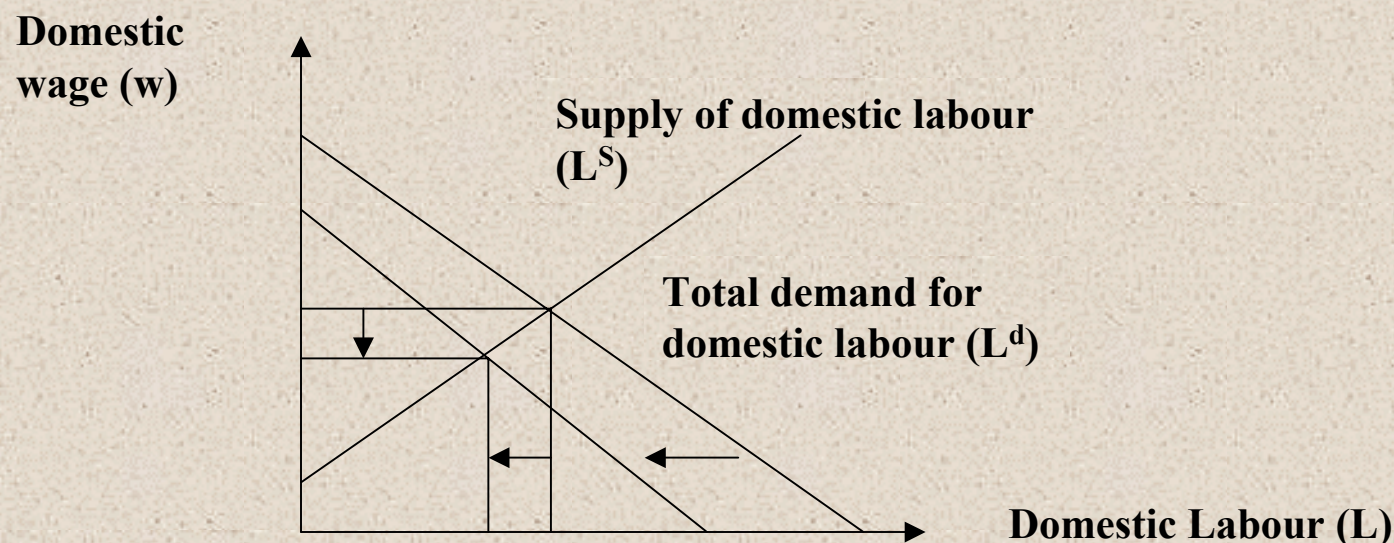
From proposition (1), $ab < ac$,

$$\Rightarrow \{ 1 / F_{LO} P_Q^* Q_{II} \} \{ d P_I^* / d n^* \} - \{ Q_{IN} / Q_{II} F_{LO} \} \{ d N^* / d n^* \} - (F_n / F_{LO}) + 1 < 0$$

Therefore, $d L^d / d n^* < 0$.

Proposition 7: *An increase in the temporary immigration quota reduces the equilibrium domestic wage (w^*) and the equilibrium usage of the domestic labour (L^*).*

An increase in the temporary immigration quota reduces the total domestic labour demand (L^d). Therefore the domestic labour demand curve shifts leftward. But the supply curve of the domestic labour, given as $L^s = L^s(w)$, remains unaffected by the change in the immigration quota. Therefore, the equilibrium domestic wage (w^*) and the equilibrium usage of the domestic labour (L^*) will fall.



The theoretical model has established an inverse relationship between temporary immigration quota and product outsourcing, in a partial equilibrium framework. In the next section, we investigate whether the relationship between temporary immigration quota and the real value of product outsourcing is empirically valid or not. For this purpose, one reduced form equation, derived in the theoretical model, will be estimated.

Empirical Analysis:

Developed country: U.S.A

Developing Countries: 11 countries (Afghanistan, Bangladesh, Ghana, Haiti, India, Kenya, Myanmar, Nepal, Pakistan, Senegal, and Vietnam)

The functional form, showing the relationship between the real value of product outsourcing (RPO) and temporary immigration, at an aggregate level, is given by,
 $RPO = p_I(n)I_D(n) = RPO(n)$

Methodology:

A simple pooled regression is run. Ordinary least square (OLS) method is here applied for estimating the relationship. During OLS, the sum of square of estimated errors is minimised to find the best, linear, unbiased estimator (BLUE) of the parameters.

Data Description:

- ***Current value of product outsourcing:*** United States International Trade Commission (USITC) reports the time series data on 9802 imports under the Harmonized system for the years. This is referred as the offshore assembly program (OAP). Under OAP programme, exporters of the foreign country enjoy the tariff benefits, if their exported products contain U.S.A made parts, components or materials. There is no tariff on the part of the value added produced in U.S.A. So the dutiable OAP import is the value added produced in abroad. This data is considered as the value of product outsourcing of the importing country (Swenson, 2005). The unit of measurement is in current U.S \$. This is referred as the offshore assembly programme (OAP).
- ***Temporary immigration quota (n_{it}):*** H-1B issued by U.S.A Government in a year, categorised by country of birth, is considered as measure of temporary immigration quota. The time period for the analysis is selected from 1997 to 2005.

Empirical Results:

Table 1: Relationship between real value of product outsourcing and temporary immigration policy for 11 low-income countries

Dependent variable= **RPO**; Independent Variable = **n**

Functional Form	R ²	d.f.	F	Significance Level	B ₀	B ₁	B ₂	B ₃
Linear	0.441	86	67.80	0.000	25146.0 (0.605)	26.4159 (0.000)		
Quadratic	0.521	85	46.32	0.000	-724.66 (0.987)	86.5046 (0.000)	-0.0011 (0.000)	
Cubic	0.547	84	33.85	0.000	33808.4 (0.477)	-53.823 (0.418)	0.0047 (0.083)	-6.E-08 (0.032)

Figures in bracket indicate the significance level

Selection of the appropriate functional form:

When the number of the regressor increases, then the justification of introduction of the new variables can be checked through F test.

Null Hypothesis H_0 : Coefficients of new regressors = 0

Alternative Hypothesis H_A : Coefficients of new regressors $\neq 0$

$$\text{Test statistic is, } F(q, n - k) = \frac{(R_{NEW}^2 - R_{OLD}^2) / (q)}{(1 - R_{OLD}^2) / (n - k)}$$

Where, q = number of new regressors

n = number of observations

k = number of parameter in the new model

Under null hypothesis, the test statistic follows F distribution with degrees of freedom ($q, n - k$).

Table 2: Appropriate Model Selection

Test	Hypothesis	Test Statistics	Value	Comment
Linear versus Cubic	$H_0: \beta_2 = \beta_3 = 0$	F (2, 84)	9.83*	H_0 is rejected. So cubic functional form is better than linear functional form
Quadratic versus Cubic	$H_0: \beta_3 = 0$	F (1, 84)	4.82 **	H_0 is rejected. So cubic functional form is better than quadratic functional form.
Linear versus Quadratic	$H_0: \beta_2 = 0$	F (1, 85)	4.19*	H_0 is rejected. So quadratic functional form is better than linear functional form.

Note: * H_0 is rejected at 1% significance level

** H_0 is rejected at 5% significance level

The estimated cubic functional form can be written as

$$\text{RPO} = \beta_0 + \beta_1 n + \beta_2 n^2 + \beta_3 n^3 + E$$

Where E = random error term

$$d(\text{RPO})/dn \text{ at } n = \text{mean } n = \beta_1 + 2\beta_2(\text{mean } n) + 3\beta_3(\text{mean } n)^2$$

Now, mean $n = 4689.341$ and $\beta_1 = -53.823$, $\beta_2 = 0.0047$, $\beta_3 = -0.00000006$

Therefore, $d(\text{RPO})/dn \text{ at } n = 4689.341 = \beta_1 + 2\beta_2(4689.341) + 3\beta_3(4689.341)^2$

$$d(\text{RPO})/dn \text{ at } n = 4689.341 = -13.7012$$

Therefore, there is an inverse relationship between the real value of product outsourcing of the eleven low-income countries and the number of temporary migrants from those low-income countries to U.S.A. at the mean value of regressor (n).

Table 3: Relationship between real value of product outsourcing and temporary immigration policy for all low-income countries

Dependent variable= **RPO**; Independent Variable = **n**

Functional Form	R²	d.f	F	Significance Level	B₀	B₁	B₂	B₃
Linear	0.426	71	52.7	0.000	47539 <i>(0.426)</i>	25.971 <i>(0.000)</i>		
Quadratic	0.506	70	35.91	0.000	20049.7 <i>(0.722)</i>	85.488 <i>(0.000)</i>	-0.0011 <i>(0.001)</i>	
Cubic	0.534	69	26.40	0.000	54766.2 <i>(0.344)</i>	- 61.38 <i>(0.411)</i>	0.005 <i>(0.102)</i>	-6.E-08 <i>(0.046)</i>

Figures in bracket indicate the significance level

Table 4: Appropriate Model Selection

Test	Hypothesis	Test Statistics	Value	Comment
Linear versus Cubic	$H_0: \beta_2 = \beta_3 = 0$	F (2, 69)	8*	H_0 is rejected. So cubic functional form is better than linear functional form
Quadratic versus Cubic	$H_0: \beta_3 = 0$	F (1, 69)	4.15 **	H_0 is rejected. So cubic functional form is better than quadratic functional form.
Linear versus Quadratic	$H_0: \beta_2 = 0$	F (1, 70)	11.34*	H_0 is rejected. So quadratic functional form is better than linear functional form.

Note: * H_0 is rejected at 1% significance level
 ** H_0 is rejected at 5% significance level

The estimated cubic functional form can be written as,

$$\text{RPO} = \beta_0 + \beta_1 n + \beta_2 n^2 + \beta_3 n^3 + E$$

where E = random error term

$$d(\text{RPO})/dn_{\text{at } n = \text{mean } n} = \beta_1 + 2\beta_2(\text{mean } n) + 3\beta_3(\text{mean } n)^2$$

Now, mean n = 5591.767 and $\beta_1 = -61.376$, $\beta_2 = 0.0050$, $\beta_3 = -0.00000006$

Therefore, $d(\text{RPO})/dn_{\text{at } n = 5591.767} = \beta_1 + 2\beta_2(5591.767) + 3\beta_3(5591.767)^2$

$$d(\text{RPO})/dn_{\text{at } n = 5591.767} = -11.086$$

Therefore, there is an inverse relationship between the real value of product outsourcing of the all low-income countries and the number of temporary migrants from those low-income countries to U.S.A. at the mean value of regressor (n).

Problems faced during empirical analysis:

- **Unavailability of data on product outsourcing and on the temporary immigration quota**
- **Unavailability of the sector wise classification of H-1B visa for all years (it is not possible to measure how many H-1B visa holders are employed in which sector.)**
- **Non-linear relationship between the temporary immigration policy and the real value of product outsourcing**

Conclusion:

Theoretical result shows that an increase in the temporary immigration quota reduces the product outsourcing demand of the developed country from the developing country, provided that the temporary immigrants are producing the substitute product of the outsourced product. Temporary immigrants are the complement of the developed country's labour in the production process, so the relaxation of temporary immigration policy has a positive impact on the employment level and domestic wage level of the developed country. On the other hand, this policy adversely affects the labour market of the developing country.

Empirical result has established a non-linear relationship (depicted by the cubic functional form) between the real value of product outsourcing demand and the number of the temporary immigrants. At the mean value of the regressor (temporary immigrants), the slope of the cubic function is negative. An inverse relationship is thus observed between the real value of product outsourcing demand and the number of the temporary immigration quota for a cross-section of developing countries.

Thank You.....

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