Trade Liberalisation, Health Care and International Fragmentation: The Role of Health Capital Mobility

TONMOY CHATTERJEE and KAUSIK GUPTA

This paper delves into the complex relationship between health trade through international fragmentation and health trade through commercial presence. A neo-classical full employment four sector static general equilibrium model has been developed, where the three sectors produce final products except the health intermediate goods producing sector. The paper shows that expansion of health trade through commercial presence implies, under some reasonable conditions, enhancement of the volume of health trade through international fragmentation. It also shows that the composite volume of trade in health services through international fragmentation and commercial presence increases the size of the health care in our stylised small open economy.

JEL Classification: I10, F11, F21, D58

Keywords: Health Sector, Health Intermediate Sector, International Fragmentation and International Health Capital Mobility

1. INTRODUCTION

It has been specifically pointed out in General Agreement on Trade in Services (GATS) that trade in health services occur through four modes. These are namely, (1) *cross-border supply:* where the service is provided remotely from one country to another, such as telemedicine via Internet or satellite, or international health insurance policies; (2) *consumption abroad:* where individuals use a service in another country, such as patients travelling to take advantage of foreign health care facilities; (3) *commercial presence:* where a foreign company sets up operations within another country in order to deliver the service, such as hospitals, health clinics or insurance offices, and (4) *presence of natural persons:* where individuals such as doctors, nurses or midwives travel to another country to supply a service there on a temporary basis. In this paper we have considered only trade in health

services via the mode of commercial presence. The consideration of this mode of health trade becomes important mainly due to the massive presence of foreign direct investment (FDI) in health care in the post globalisation era of any developing economy.[1] However, there is dearth of theoretical works which have considered health trade in the context of international trade. In particular, there is almost no study (empirical as well as theoretical) that has considered health trade through international fragmentation. This issue has also not been considered in any one of the four modes of GATS.

It is to be mentioned in this context that the term international fragmentation is widely used in the literature on international trade. For instance, Jones and Kierzkowski (2005), Deardoff (2001), Jones and Marjit (2001), Marjit (2008), Marjit (2009) and Marjit, Beladi, and Chakraborty (2004) etc.[2] have nicely defined international fragmentation and have discussed its various implications. The term international fragmentation implies that the production process is dependent on intermediate inputs from abroad. In India, over 65 percent of the medical equipments are still being imported from abroad in a very fast growing domestic market, which was 80 percent—90 percent in the pre liberalisation period. This implies health service sector is internationally fragmented. Not only for India this is also relevant for many other developing economies. However, neither of the modes of GATS has captured this issue in spite of its relevance in a globalised world. The present paper is an attempt to analyse theoretically the consequences of incorporating the issue of international fragmentation in the context of the health sector. In fact this paper is probably the first attempt to examine theoretically the interrelation between different patterns of health trade like commercial presence and international fragmentation. The present study thus not only focuses on an aspect that is not mentioned in any one of the modes of GATS but also tries to link mode 3 of GATS with international fragmentation. In other words the paper shows how mode 3 of GATS can be broadly interpreted to incorporate international fragmentation.

In the literature all the authors, as mentioned earlier, have discussed either the causes behind the term international fragmentation or have related fragmentation with the pattern of trade. Unlike others, in this paper we are interested to identify FDI as a source of international fragmentation. This is something new in the context of the literature on international fragmentation. Given the fact that trade through international fragmentation is possible due to inflow of FDI, there is enough scope to analyse the impact of trade through international fragmentation, in the presence of health capital mobility, on the size of the

[1]Feedback ventures expect private equity funds to invest at least US$ 1 billion during 2009-2013. 12 percent of the US$ 77 million venture capital investments in July-September 2009 were in the healthcare sector. GE plans to invest over US$ 3 billion on R&D, US$ 2 billion to drive healthcare information technology and health in rural and underserved areas, US$ 1 billion in partnerships, content and services, over the next six years. International clinic chain Asklepios International plans to invest US$ 100-200 million in the Indian healthcare market. Gulf-based group Dr Moopen is planning to invest US$ 200 million for setting up hospitals and eye-care centres across India. Fortis is planning to invest US$ 55 million to expand its pan-India operations. In the recent decade the medical devices and equipments industry has been successful in attracting foreign direct investment too though this sector is importing 50 percent–60 percent till now. From merely US$2.3 million in 2000 it reached US$ 147.69 million in 2009. Some of big foreign firms in the sector invested in India either directly or through collaborations and joint ventures. Some to mention are GE (USA), Isoft (Australia), Proton Healthcare (USA) and Seimens (Germany) etc.

[2]Jones and Marjit (2008) have considered a general equilibrium framework and from which they have argued that trade may lead to more fragmented activities relative to autarky even if one observes specialisation. Again Marjit, Beladi, and Chakraborty (2004) have shown that reduction in the price of intermediate product may lead to a zone which is more fragmented. They have also examined the impact of fragmentation on skilled-unskilled wage gap.

health care. This is consistent with GATS view that commercial presence (inflow of FDI) is a major source of health trade for any developing economy. Moreover, this issue becomes more relevant for the policy-makers in the context of mobile health capital regime.

In this paper we have tried to examine the impact of trade in health services via commercial presence and international fragmentation on the output levels of a health care of a small open developing economy. Moreover, we have found in our study that finite changes in trade policy through commercial presence in a health care may enhance the volume of health trade due to international fragmentation. It also shows that the composite volume of trade in health services through international fragmentation and commercial presence increases the size of the health care in our small open economy.

The paper is organised in the following manner. Section 2 considers the model. It has one subsection. Subsection 2.1 considers the drive towards fragmentation and health sector. Finally, the concluding remarks are made in Section 3.

2. MODEL

We consider a small open economy consisting of four sectors in a Heckscher-Ohlin-Samuelson framework. Out of the four sectors, one is an export sector (A), which produces an exportable composite good (X_A) (other than health) using unskilled labour (L) and capital (K). The second sector is an import competing sector (M), which produces importable good (X_M) using skilled labour (S) and capital. The third and fourth sectors of our economy are the domestic intermediate health good producing sector (I) and the health sector (H) respectively. Sector I uses skilled labour along with health capital (N) for production of the intermediate health product (X_I) of our economy and the health sector uses health capital,[3] skilled labour and intermediate health input (X_I) to produce another exportable product (X_H). Here we assume that the requirement of intermediate goods for the production of one unit of output of the health sector is fixed. Competitive markets, CRS technology, diminishing marginal productivity and full employment of factors of production are also assumed.

The notations used in the model are stated as follows:

X_i = product produced by the ith sector,
$\quad i$ = A, M, I, H;
P^f_A = world price of commodity A;
P_A = domestic price of commodity X_A, we assume
$P_A = P^f_A = 1$;
P_M = world price of good X_M;
P_I = domestically determined price of X_I;
P^f_I = price of the foreign intermediate commodity;
P_H = world price of X_H;
a_{ji} = quantity of the jth factor for producing one unit of output in the ith sector,
$\quad$ j=L,K,S,N and i=A,M,I,H;
W = competitive unskilled wage rate;
W_S = skilled wage rate;

[3]By the term health intermediate goods we actually mean those commodities which are exhausted in the course of production in the health service sector (H), e.g. injectable goods and its associated products, several chemicals, equipments used in pathology and different forms of medicines. Again by health capital we mean those equipments and products which are not exhausted in the production process, e.g. ECG machine, X-ray machine etc.

r = rate of return to capital;

R = rate of return to health capital;

ζ = nutritional efficiency of unskilled labour and $\zeta' > 0$;

γ = nutritional efficiency of skilled labour and $\gamma' > 0$;

$\wedge$ = proportional change, d = domestic and f = foreign.

The structure of equations of the model is as follows.

The competitive equilibrium conditions in the product market for the four sectors give us the following equations.

$$a_{LA}W + a_{KA}r = 1 \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (1)$$

$$a_{SM}W_S + a_{KM}r = P_M \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (2)$$

$$a_{SI}W_S + a_{NI}R = P_I \quad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (3)$$

$$a_{SH}\ W_S^f + a_{NH}R + a_{IH}\,P_I = P_H \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (4)$$

For simplicity we assume that a_{SH} and a_{IH} are given to us and we have also assumed that $W_S^f > W_S$.

Equilibrium condition for the health intermediate sector is given by

$$a_{IH}\,X_H = X_I = X_I^d + X_I^f \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (5)$$

Sector specificity of unskilled labour is given by the following equation

$$a_{LA}X_A = L\,\zeta(X_H) \quad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (6)$$

Perfect mobility of capital between sectors A and M can be expressed as

$$a_{KA}X_A + a_{KM}X_M = K^d + K^f = K \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (7)$$

Full employment of skilled labour implies the following equation

$$a_{SM}X_M + a_{SI}X_I + a_{SH}X_H = S\,\gamma(X_H) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (8)$$

Perfect mobility of health capital between sectors H and I can be expressed as

$$a_{NH}X_H + a_{NI}X_I\ = N^d + N^f = N \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (9)$$

This completes the specification of our model. We have nine unknown variables— W, W_S, r, R, P_I, X_A, X_M, X_I, and X_H —that are solved by nine Equations, (1)–(9), for the given parameters, P_A, P_M, P_H, L, K, S and N.

Here we are eager to find out the cause and implications of international fragmentation (IF) in the presence of a health care. In this model sector I has been considered as a domestic intermediate health good producing sector. This intermediate good can be imported by the health sector from foreign but in this case it has to incur an intermediate cost (Φ) mainly due to transaction or communication factors.[4] Thus whether the health service sector is going with IF or no IF, that depends upon the following conditions,

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[4]Interested readers may look at Marjit, Beladi, and Chakraborty (2004) for the definition of international fragmentation that we have used in this paper. The RHS of both (10.1) and (10.2) are implying the gap between cost of domestic intermediate health service provider at W_S^f, R^f and cost of domestic intermediate health service provider at W_S, R. Now IF is preferable if this gap is greater than the fixed cost associated with import of intermediate health services and IF is not preferable if this gap is less than the fixed cost associated with import of intermediate health services. For details one can go through the above mentioned paper.

(i) IF is preferable if $(W_S^f - W_S)a_{SI} + (R^f - R)\, a_{NI} > \Phi(N)$, ... (10.1)

(ii) IF is not preferable if $(W_S^f - W_S)a_{SI} + (R^f - R)\, a_{NI} < \Phi(N)$ ... ... (10.2)

So far we have considered that internationally health capital is immobile and hence N has been treated as exogenous. Now we want to take into account the case of international health capital mobility, implying N is to be treated as an endogenous variable. This is very crucial in the context of the present paper. In most of the studies related to fragmentation the authors have considered the change in the gap between price of domestic intermediate and price of foreign intermediate as main cause of trade through IF, whereas in this paper we want to show that mobility of health capital causes trade through IF. In the regime of international health capital mobility the equation structure remains similar to that of earlier. The only change that we have to note is that N becomes endogenous and R is fixed at R^f. Thus the number of unknowns and number of independent equations remain same and hence the system can be solved.

Let us start with a movement from regime of international health capital immobility to regime of international health capital mobility and hence R will go down. From Equation (4) we can say that a fall in R leads to an increase in P_I, since P_H and W_S^f are exogenously given. By using similar type of arguments from Equations (1), (2) and (3) we can infer that finite increase of N causes rise in W, W_S and fall in r.[5] Thus above mentioned inequalities can be rewritten as

(i) $\Psi(N) > \Phi(N)$, ... (10.1)

(ii) $\Psi(N) < \Phi(N)$ ... ... (10.1)

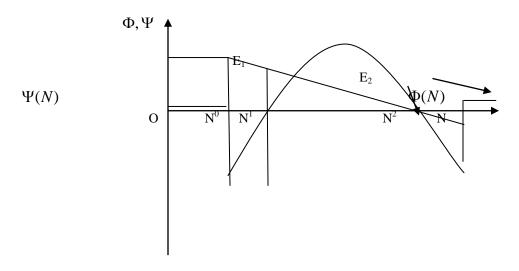The above analysis can be explained with the help of Figure 1.[6]

Fig. 1.

[5]See Appendix 2 for details.
[6]Shapes of Φ and Ψ schedule have been explained in Appendix 1.

In this paper we find that there exist two critical values of N such that for all $N \in [N^1, N^2]$ there will be IF. Here N^2 is the international health capital market clearing level of health capital. It is to be noted for $N \in [0, N^1]$ there will be no fragmentation. Actually by using this interval we want to explain the initial stage of economic growth of any developing economy, since here we assume N^f is zero up to N^0. As we move towards N^1 it implies the economy needs more of N, it also implies the need for foreign intermediate health product. At N^1 (point E_1) we can arrive at a situation, where health service sector will be indifferent between *IF* and no *IF*. Hence to fill up the demand for health care, sector H has to import more foreign health intermediate products. Thus it is clear from the above figure that movement from lower level of N (say N^1) to a higher level of it (say towards N^2) causes further increase in *IF* in health care. Here point N^2 (point E_2) implies a threshold level of health capital where we will reach again to a situation where sector H will be indifferent between *IF* and no *IF*. The only difference between E_1 and E_2 is that, at E_1 the economy has low level of health capital resulting in *IF*, whereas at E_2 the economy has very high level of health capital implying that sector H has made its own infrastructure for intermediate health product. It implies after E_2 the economy will be indifferent between *IF* and no *IF*.

We state the results in the form of following proposition.

Proposition 1: *If* $[\Psi(N) - \Phi(N)] > 0$ *for* $N \in [N^1, N^2]$, *trade due to international fragmentation in health service sector will rise through trade liberalisation and foreign health capital mobility.*

2.1. The Drive towards Fragmentation and the Health Sector

An increase in N implies a fall in R. To examine the impact of an increase in N on X_H, we are modifying the Equation (9) as follows. Using Equation (5) in Equation (9) we get

$$(a_{NH} + a_{NI}\, a_{IH})\, X_H = N \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \quad (9.1)$$

From Equation (9.1) we can argue that a reduction in R implies an increase in unit health capital demand of sectors H and I. Again a rise in N causes a rise in supply of health capital. Thus X_H will go up if change in supply of health capital dominates the change in demand for health capital. This is usual in case of a small open developing economy, because purchasing power of consumers of health capital in these economies is very low. From Equation (5) we can infer that an expansion of health care leads to an increase in X_I^f. From Equation (6) we can say that a rise in X_H causes an increase in X_A due to both—*Nutritional Efficiency Effect* (NEE) and *Factor Price Effect* (FPE). A fall in R will lead to a reduction in per unit labour demand in sector A. Thus from Equation (6) we can infer that, given nutritional efficiency factor, a movement towards health capital mobility will enhance the output level of sector A. We call it FPE. Again a rise in X_H implies a rise in nutritional efficiency of labour and hence it will cause an expansion of sector A. We call it NEE. Using these arguments from Equation (8) one can observe that there is another rise in X_H. The first rise in X_H as already mentioned, is mainly due to infrastructure developmental aspect of health capital mobility. However, the second rise

in X_H is due to two different aspects, first, because of nutritional efficiency aspect of health capital mobility on both types of labour and second because of the impact of international fragmentation. Regarding the first effect it is to be noted that an increase in X_H due to a rise in N leads to an increase in $\zeta(X_H)$ and $\gamma(X_H)$. From Equations (6) and (7) we can argue that a rise in $L\zeta(X_H)$ leads to an expansion of sector A and a contraction of sector M. A fall in X_M implies sector M releases some amount of skilled labour on one hand and on the other hand a rise in $S\gamma(X_H)$, due to rise in X_H, implies productivity of skilled labour will go up. Thus combining these nutritional efficiency effects one can say that sector H will definitely improve. Regarding the second effect we find that an increase in X_H due to rise in N leads to fall in X_I^d and rise in X_I^f. This is mainly due to the presence of international fragmentation. Thus contraction of domestic health intermediate goods producing sector implies availability of S and N to sector H will increase and hence output levels of health care will go up.

Proposition 2: *A movement from a regime of no fragmentation towards a regime of fragmentation (or towards a regime of international health capital mobility) leads to an increase in the levels of output of health care and a reduction in the level of output of the domestic intermediate health goods producing sector.*

3. CONCLUDING REMARKS

The present paper considers a four sector general equilibrium structure where the third and fourth sectors are intermediate health goods producing sector and health service sector respectively. In this model we have captured the positive production externality of health service sector for both types of labour through nutritional efficiency factors. In such a setup we have shown that a movement towards health capital mobility may increase the possibilities of health trade through international fragmentation. Thus policy makers can use the mobility of health capital as an instrument for controlling the volume of health trade through international fragmentation. Apart from this here we have examined the impact of trade liberalisation in the form of regime change on the output levels of different sectors, in the presence of a private health care. In this part we have shown that a change in regime from international health capital immobility to international health capital mobility, leads to an expansion of health service sector and hence it increases the demand of imported health intermediate product. Thus an improvement of health trade through commercial presence may uplift trade of health services due to international fragmentation.

Appendices

APPENDIX 1

1. Shape of $\Phi(N)$ Schedule

Initially we have assumed a very high and fixed intermediate cost for $N \in [0, N^0]$, it implies $\Phi(N)$ schedule is horizontal up to foreign health capital immobility. As we

have entered into the region of health capital mobility it implies the cost related to transaction and communication factors will decline because technology will be transferred from north to south and medium of communications and transactions will become more cheap compared to the situation of no health capital mobility. Thus it will be downward sloping for $N \in [N^0, N^2]$. Cost related to communication and transaction factors are declining is a fact but it will decline up to N^2 and after that $\Phi(N)$ schedule will become horizontal, as Φ will be fixed at its minimum value.

2. Shape of $\Psi(N)$ Schedule

Since R is fixed in the region of health capital immobility, it implies the left hand side of inequality (10.1) will also remain fixed and hence $\Psi(N)$ becomes horizontal for $N \in [0, N^0]$. As we move towards health capital mobility, we may have different situations and that will affect the shape of $\Psi(N)$ schedule. If initially we assume that fall in R dominates the increase in W_S and $\Psi(N)$ becomes upward rising and after a large amount of inflow of foreign health capital, the $\Psi(N)$ becomes downward sloping due to the assumption that an increase in W_S dominates the decline in R. Thus $\Psi(N)$ schedule will be of inverted U shape for $N \in [N^0, N^2]$. After N^2 it will be horizontal as R is fixed at R^f.

APPENDIX 2

Here we consider the following,

θ_{ji} = distributive share of the jth input in the ith sector and
σ_i = elasticity of factor substitution in sector i, i = A, M, I, H.

Differentiation of equation (4) gives us

$$\theta_{NH} \hat{R} + \theta_{NH} \hat{a}_{NH} + \theta_{IH} \hat{P}_I = 0$$

Now $\sigma_H = (\hat{a}_{NH} - \hat{a}_{IH} / \hat{P}_I - \hat{R})$

$$\hat{a}_{NH} = (\hat{P}_I - \hat{R})\sigma_H$$

Using it we get

$$\theta_{NH} (1- \sigma_H) \hat{R} + (\theta_{NH} \sigma_H + \theta_{IH}) \hat{P}_I = 0$$

$$\hat{R} = - (A_2/A_1) \hat{P}_I \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \text{ (A.1)}$$

Where, $A_1, A_2 > 0$.

Differentiation of Equation (3) gives us,

$$a_{SI} dW_S + W_S da_{SI} + a_{NI} dR + R da_{NI} = dP_I$$

From the envelop condition we get

$$W_S da_{SI} + R da_{NI} = 0$$

Using envelop condition we get

$$\theta_{SI} \hat{W}_S + \theta_{NI} \hat{R} = \hat{P}_I$$

Using (A.1) we get

$$\hat{W}_S = \{(1/\theta_{SI}) + (\theta_{NI}/\theta_{SI})(A_2/A_1)\} \, \hat{P}_I$$

$$\hat{W}_S = A_3 \, \hat{P}_I \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (A.2)$$

Where, $A_3 > 0$.

Differentiating Equation (2) we get

$$\hat{r} = - (\theta_{SM}/\theta_{KM})\hat{W}_S \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (A.3)$$

Similarly from Equation (1) one obtains

$$\hat{W} = - (\theta_{KA}/\theta_{LA})\hat{r} \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (A.4)$$

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