



Foreign direct investment, environmentally sound technology and informal sector[☆]

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ABSTRACT

The paper examines the linkages between foreign direct investment, informal sector and transfer of environmentally sound technology (EST) in a developing economy in terms of a three-sector, full-employment general equilibrium model with an informal sector that produces a non-traded input for the formal final good producing sector. The same input is produced by another division of the formal sector, which generates less pollution than the informal sector since the former uses a different type of capital that embodies EST. The formal sector has to pay a penalty for using the output of the excessively polluting informal sector. In this scenario, the analysis finds that foreign capital inflow in the formal sector may accentuate pollution, even if it involves transfer of EST. This result can at least question the favorable environmental impact of FDI in a developing economy even if it involves transfer of EST.

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1. Introduction

The most exigent task ahead of all the economies perhaps is to strive for environmentally sustainable economic growth. The desperate pursuit for economic well-being, particularly in the last few decades after liberalization, has triggered colossal environmental deterioration. The trade and environment economists consider liberalization as a vector for perpetuating environmental damage. Their disapproval stems from the apprehensions that any gains from trade liberalization may be substantially outweighed by the damage it tends to inflict on the environment through pollution and loss of natural resources.

The role of foreign direct investment (FDI) in environmentally sustainable growth in the developing countries has drawn serious cognizance. It is asserted by the pessimists that the environmental quality of the developing countries is jeopardized due to their low environmental standards, fostering migration of 'dirty' industries to these countries (the industrial flight hypothesis). In addition, the developing countries may deliberately undervalue the environment in order to attract the multinational firms (the 'pollution haven' hypothesis) ending up in

unwarranted environmental pollution in these countries. While there exist some empirical evidences that support the pollution haven hypothesis (Cagatay and Mihci, 2006; He, 2006; Merican et al., 2007), several studies have rejected the phenomenon (Dietzenbacher and Mukhopadhyay, 2007; Eskeland and Harrison, 2003; Rock, 2002). It is argued that factors like capital abundance, technology differences, and infrastructure are more important than environmental policy in determining trade and FDI patterns.¹

The optimists, on the other hand, highlight the environmental benefits that FDI tends to generate. Apart from promoting higher incomes, possibly leading to higher levels of investment in pollution prevention and control facilities, it constitutes an important catalyst for the transfer of environmentally sound technologies (EST) to those countries. Environmentally sound technologies are those that "protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes" (Agenda 21 of the Rio Declaration).

The possibilities of EST transfer associated with FDI have important role in stimulating the developing countries to attract FDI. However, successful transfer of EST depends on both regulatory instruments and market-based mechanisms. Strong environmental regulation and enforcement are the main incentives for firms to acquire and transfer

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¹ For detailed discussion, see de Almeida de and Rocha (2008).

new technologies, so that to make foreign investment conducive to the influx of EST, it is imperative to progressively develop and implement strong environmental regulation, nonetheless, allowing for flexibility in the enforcement of environmental standards and having positive disposition towards a plant's experimentation with alternative cost-effective solutions (Luken et al., 2008).

Moreover, various direct incentives such as the elimination or reduction of taxes on income or sales from investment, the deferment of taxes, tax holidays, and taxation graded according to the level of environmental improvement achieved, may be instrumental (Juma, 1994; Less and McMillan, 2005) in creating a favorable investment environment for EST transfer. Therefore, it is environmentally viable for countries to pull FDI only if the costs that they have to bear in the form of incentives are outweighed by the environmental benefits from transfer of EST. However, empirical evidence on the role of FDI in transfer of cleaner technology is rather inadequate and inconclusive. Even if the MNCs from developed countries have important roles in terms of cleaner technologies, this does not hold for MNCs from developing countries (Zarsky, 1999).²

The environmental impact of FDI on host countries appears even more debatable in the developing countries due to the persistence of urban informal sector.³ The presence of a large number of pollution sources in the form of informal sector units that lack knowledge, funds, technology and skills to treat their effluent, is likely to frustrate environmental instruments and policies.

Empirical evidences indicate that the urban informal sector units mostly produce intermediate inputs for the formal manufacturing sector on a subcontracting basis.⁴ In a number of cases, the large industries give subcontract to production units that produce a component of the formal sector output, mostly involving environmentally "dirty" tasks and processes, on an informal basis.⁵ Perrings et al. (1995) argue that such subcontracting is an economical way for formal sector firms to avoid investment in ESTs made obligatory by the regulatory authority. This is due to the fact that since the informal sector firms are difficult to identify and monitor, they remain outside the purview of environmental regulations and face fewer incentives to prevent pollution.⁶ The interlinkage between FDI and pollution of developing countries may occur in two different ways: first, pollution increases due to subcontracting between the formal firms (including the foreign owned ones), and the polluting informal units; secondly, transfer of EST in firms where there is no such subcontracting has favorable effect on pollution.

However, there hardly exist any work that focus on the nexus between, FDI, informal sector and EST.⁷ The main objective of the present paper is to examine the effects of an inflow of foreign capital on the level of domestic pollution in a developing economy in the presence and absence of transfer of EST. A three sector full-employment general equilibrium model consisting of three sectors, a rural sector,

an informal and a formal sector has been considered. The formal sector has two divisions, one producing a final manufacturing good and another producing a non-traded intermediate input for production in the final good sector. The intermediate input is also produced in the informal sector. Both the formal and informal intermediate input producing sectors pollute the environment. But while the formal sector has access to EST, the informal sector uses backward technology, so that the latter generates more pollution. The paper shows that under some reasonable conditions, an inflow of foreign capital in the formal sector involving adoption may actually aggravate domestic pollution while foreign capital inflow in the informal sector without transfer of EST may reduce pollution. These interesting results despite simplicity and abstraction of the analytical framework can at least question the favorable environmental impact of FDI even if it involves transfer of EST.

2. The Model

A small, open economy is considered to consist of two informal sectors and a formal sector, the latter comprising of two divisions. Thus, there are four sectors in total in the economy. Sector 1 is an informal sector that produces an agricultural commodity, X_1 by means of labor (L) and capital of type K . The informal sector 2 uses the same inputs to produce a non-traded intermediate input, X_2 for sector 3. Sector 3 is the formal sector division producing a final manufacturing commodity, X_3 using labor, capital of type N and the intermediate input, X_2 . The other division of the formal sector (sector m) also produces the intermediate commodity, X_m with the help of labor and both types of capital. Thus the intermediate good is produced in both sectors 2 and m , and is entirely used up in sector 3. Labor is perfectly mobile between all the sectors. Capital of type 1 is mobile between the two informal sectors and the intermediate good producing formal sector division, while capital of type 2 is mobile between the two formal sector divisions. Sector 1 is assumed to be non-polluting,⁸ but the production of the intermediate input generates pollution; this implies that the two sectors (2 and m) producing it and sector 3 using it pollute the society. However, the production technology in sector m is less polluting than in sector 2.

The formal sector divisions face an imperfect, unionized labor market where workers receive a contractual wage, W^* while the wage rate in the informal sectors, W , is market determined and $W^* > W$. The aggregate stock of capital of type K consists of both domestic and foreign capital, which are perfect substitutes, while capital of type N is completely owned by foreign capitalists. It is assumed that the agricultural sector is more labor-intensive than both the intermediate good producing sectors. The price of the non-traded intermediate good, P_2 is endogenously determined,^{9 10} while the prices of the products of the other sectors, P_i ,

² See also Dominguez (1998), Jenkins (1999), Jha and Teixeira (1994), López and Chidiak (1996) and Levy (1995) in this context.

³ The informal sector implies that segment of the labour market where free entry exists (due to high labor turnover) and wages are significantly lower than in the formal sector. It consists of small scale unregistered units, engaged in the production and distribution of goods and services, with the primary objective of generating employment and income to their participants despite capital constraints. See Sethuraman (1981) in this context.

⁴ See for example Joshi and Joshi (1976), Bose (1978), Papola (1981) and Romatet (1983). In India the trend of increasing ancillarisation and subcontracting has increased with the introduction of globalization package in recent years. For example, many of the large industries like the carpet weaving industries, the glass manufacturing industries, the bangles industries, leather bag and shoe manufacturing industries, garments industries etc. have been split up into very small units and been subcontracted to the informal sector.

⁵ For example, in the city of Kolkata, leather-tanning process is handled by the informal sector. Similarly, for the garment industry the dyeing of garments are done by the informal sector participants on a subcontracting basis. Both tanning and dyeing pollute the environment.

⁶ For examples of ESTs in individual firms in Brazil, India, China and Zambia, see Perrings et al. (1995).

⁷ Chaudhuri and Mukhopadhyay (2006, 2009) deal with the theoretical aspect of informal sector pollution and FDI, but the aspect of EST has not been considered in it.

⁸ This is a simplifying assumption. A typical agricultural goods producing sector also vitiates the environment through use of chemical fertilizers and pesticides. However, the amount of pollution generated by the rural sector is insignificant relative to that produced by the manufacturing sectors.

⁹ A pertinent question is why the formal sector (division m) produces at least a part of the total requirement for the non-traded input especially when the informal sector (sector 2) has a cost advantage over the formal sector in production of the input. There could be two reasons. First, sector m produces the input in order to avoid complete dependence on the informal sector. Second, the production of the intermediate input generates environmental pollution. However, due to possession of an improved technology of production, the formal sector is able to produce the input in a less polluting manner vis-à-vis the informal sector. In order to put a brake on the practice on the part of the formal sector to arrange the production of the input done in the informal sector through subcontracting, the pollution regulatory authority imposes a penalty on the formal sector for using the output of the informal sector. The higher the use of the output of the informal sector the greater the environmental pollution and the higher would be the rate of penalty imposed on the formal sector. Therefore, in order to reduce the burden of penalty, the formal sector (division m) might be producing some amount of the non-traded input.

¹⁰ The price of the non-traded input must be the same across sectors. Even if the prices of the input produced in sector 2 and m differ initially, competitive forces would ultimately lead to the uniform price, P_2 .

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