Resource and Energy Economics 32 (2010) 456–475

Contents lists available at ScienceDirect

Resource and Energy Economics

journal homepage: www.elsevier.com/locate/ree

Financing investment in environmentally sound technologies: Foreign direct investment versus foreign debt finance

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ARTICLE INFO

Article history:
Received 6 August 2008
Received in revised form 18 November 2009
Accepted 19 November 2009
Available online 6 January 2010

JEL classification:
F21
F34
Q58
Q59

Keywords:
International capital flows
Environment
Asymmetric information
Foreign direct investment
Debt finance

ABSTRACT

This paper develops a screening model to examine the relationship between alternative sources of private capital and investment in environmentally sound technologies (ESTs). In the model, a polluter (agent) must secure investment funds from the international financial markets in order to upgrade its production and abatement technology. The requisite capital can be obtained via either market loans (debt finance) or foreign direct investment (FDI). Under debt finance, the foreign financier supplies only capital and the relationship between the two parties is more 'arms-length'. By contrast, under FDI, the investor delivers both capital and managerial skills. We use the model to derive the implications of debt finance for optimal investment decisions and compare them to those obtained under FDI. Investment incentives are more pronounced under debt finance.

1. Introduction

The explosive growth in the flow of private capital from rich to developing countries over the last few decades has reignited intense research on the determinants and the potential impact of these flows. The preponderance of this inquiry has, however, tended to focus on the macroeconomic aspects of this phenomenon.[1] Less well investigated has been the role that these flows play in determining

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[1] See, for example, Razin et al. (1998), Albuquerque (2003); Neumann (2003).

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doi:10.1016/j.reseneeco.2009.11.005

environmental quality. This omission is not trivial. It is widely recognized that private foreign investment can provide the resources and capacity to address environmental challenges that confront financially constrained economies (Gentry, 1998; OECD, 1997). Understanding the interaction between these flows and environmental protection is therefore important from both a practical and a policy perspective. This paper explores the relative importance of foreign direct investment (FDI) and foreign debt for environmental quality.

The environmental impact of foreign private capital is still not well understood: there is inadequate data and only a limited understanding of the basic science involved. Gentry (1998) perhaps represents the earliest attempt to investigate this question. Using the experience of Latin America, the author uncovers a number of cases that appear to lend support to the presumption of a positive relationship between capital flows and the environment: in Brazil, Aracruz Celulose, the world's largest producer of hardwood short-fiber cellulose and a joint venture between Norwegian and Brazilian investors, upgraded its production process, nearly completely eliminating chlorine emissions load while enhancing productivity; in Mexico and Argentina, privatization of government operations led to reduced pollutant loads; in Costa Rica, more effective protection of some sensitive sites was accomplished by applying the proceeds of private investment.[2]

Strictly speaking, the foregoing examples are testament to a positive environmental impact of only one form of international capital, namely FDI. Nevertheless, there are a number of plausible reasons to expect this optimistic relationship to prevail between private capital flows in general and environmental performance: First, improved technologies that waste fewer raw materials and energy have an environmental advantage that complements a firm's cost advantage (see the example of Aracruz Celulose). Capital flows simply provide the means by which resource-constrained firms can adopt such technologies more quickly (Gentry, 1998; OECD, 1997). Second, because they are less powerful politically or on account of their 'deep pockets,' multinational investors may face heightened regulatory scrutiny or pressure from domestic environmental groups—a risk that can best be mitigated by reducing emissions or damages (Wheeler, 2001; Gray and Deily, 1996). Third, international commercial lenders, fearful of being seen as profiting from pollution, may require their borrowers to comply with the environmental laws of their countries, and in this way supplant the relative absence of enforcement in many of these economies.

The idea that capital flows can have a positive environmental influence as posited above is fascinating. These flows, however, are not monolithic; they represent distinct financial instruments. There is thus a need to develop a simple framework that can generate predictions about the relative importance, for environmental decision-making, of each type of capital flow. To the best of our knowledge, there are no adequate models that accomplish this task. Herein lies the main contribution of this paper. We build a screening model to investigate how using debt versus Foreign Direct Investment (FDI) as alternative sources of foreign capital can affect the incentive for a wealth-constrained polluter in a developing country to invest in environmentally sound technologies (ESTs). In so doing, we incorporate foreign capital into the standard theory of pollution control.

In the model, an operator (agent) of a polluting firm must secure financial resources from a risk neutral foreign investor in order to undertake a project. The project involves large-scale modernization (''greening'') of the production process through the acquisition and installation of a cleaner technology. Its expected cash flows depend upon the amount of investment in the clean technology, the productivity of the firm and the foreign investor's direct input (or effort). The model allows for both adverse selection and moral hazard problems. There is adverse selection in that the agent has private information regarding the productivity of the firm. There is a moral hazard problem because the agent's investment decision is unobservable and cannot therefore be contracted upon. Given this information structure, a financial contract need not only motivate the agent, but more importantly, facilitate the transmission of information from the agent to the investor.

We distinguish between FDI and debt on the simple, and we believe very plausible, premise that the mode of finance critically affects the interaction between the private information possessed by the agent and the project's financial outcome. More precisely, we assume that when debt is the financing vehicle, the agent's private information contributes to the project's financial outcome by

[2] On the flip side, private capital flows can increase environmental damage through increased resource use.