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Environmental migration and capital mobility

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ABSTRACT

Based on utility equalization, this paper considers a developing economy with labor migration. Pollution and capital taxes are imposed on producers in the polluted sector. The optimal policy combinations of capital taxes and pollution taxes for the host economy are examined. A zero capital tax is required for increasing mobility of capital to raise real GDP, while a larger than Pigovian pollution tax is needed for enhancing environmental amenities. The impacts on those two optimal tax rates are examined theoretically and numerically if foreign countries adopt higher environmental standards or if foreign countries impose tax credits on foreign investments.

1. Introduction

Over the past three decades, China has experienced explosive economic growth. With an average annual GDP growth rate of 9–10%, China has become the second largest economy in the world (Yueh, 2014). However, such rapid economic ascendance is accompanied by severe environmental degradation in many areas of China. The most critical environmental challenge faced by China recently is severe air pollution. Today, the people of China are exposed to air pollution on a daily basis. According to the annual report on air quality released by the Ministry of Environmental Protection, 71 out of 74 cities monitored by the authority failed to meet air quality standards (Bloomberg News, 2014). The concentration level of the airborne fine particles, measured by PM2.5, in these cities far exceeded the safe level of 25 recommended by World Health Organization (WHO). The daily exposure to the hazardous air pollutants poses health risk, and could lead to premature death. In fact, the WHO report released in March 2014 estimated that there were 7 million premature deaths attributable to air pollution in 2012 with 3.3 million deaths occurring in the Western Pacific region, including China (World Health Organization (WHO), 2014).

Recognizing the importance of protecting environment and natural resources, over the years, the Chinese government has been adopting various policy measures within its comprehensive environmental protection regulatory and policy framework established to protect environment and prevent pollution. Among these policy measures, the pollution levy system, which has been implemented nationwide since 1982, is an integral part of the environmental pollution control regulatory system (Wang, 2002). When the system was initially implemented, it imposes charges on enterprises when the pollutant discharge exceeds the designated standards of pollution discharge (Wang, 2002). After 2003 reform to the levy system, the charges cover all pollution emissions, including the emissions within the standards (Jiang, Lin, & Lin, 2014). Since then, there has been a significant increase in the pollution fees collected each year for air, water, solid waste, and noise pollution. In 2013, total pollution fees collected were US$3.52 billion, representing an increase of 5.2% from 2012, while the number of polluters increased by 22.2%

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to 431,100 polluters (Song, 2014). Despite repeated promises by the Chinese government to address the severe pollution problems, due to ineffective environmental policy implementation and legal enforcement, the environment in China has continued to deteriorate, and this has caused public outrage over the environmental crisis wrought by unchecked economic growth.

Dissatisfaction with the worsening environmental condition in China has prompted many Chinese people, especially the elites and wealthy nationals, to move abroad to find cleaner living environment. Based on the United Nations estimation, in 2013 China ranked the fourth largest migrant-sending country after India, Mexico and Russia (Pew Research Center, 2013). The top two emigration destinations for Chinese people are the US and Canada (see Table 1 below).

Furthermore, surveys of China high net worth individuals conducted by Huren Research Institute (2014) reveal that education concerns (21%), pollution (20%) and food safety (19%) are the top three main factors influencing respondents' emigration decision.

This new wave of migration from China to other countries such as Australia in search of a cleaner living environment has caught the attention of media and academia. This phenomenon has been described in a recent article 'Middle-class flight: Yearning to breathe free' published in The Economist (2014). In addition, a recent study on international migration has incorporated environmental factors into its analysis.[1] Previous studies on international migration have focused on wage differentials between urban and rural regions or between source and host countries (e.g. Harris & Todaro, 1970; Todaro, 1969). This new wave of environmental migration from China provides a vivid example for the incentive of migration that depends not only on wage differentials but also more importantly on environmental amenities. To address the environmental factor, in this paper we consider a migration equilibrium that is based on utility equalization, rather than wage equilibrium. Environmental amenities play a crucial role in determining utility.

We consider a developing economy with two sectors, in which one is a polluted sector that generates pollution emissions as a by-product during the production process. Pollution negatively affects consumers via an eyesore externality. Using the user-pay principle, pollution taxes or fines are imposed on producers in the polluted sector. Consider a developing country which is lack of capital. To attract foreign capital, low capital taxes are introduced. However, inflows of foreign capital create a pollution haven, thereby generating mass pollution emissions. This leads to environmental migration. In addition, following the pollution haven hypothesis, foreign investment takes place in the polluted sector of the host country but subjects to capital taxes under a revenue consideration of the host government.

This paper examines the relationships and interactions between environmental migration and capital mobility, and studies the optimal policy combinations of capital taxes and pollution taxes. We investigate the individually and jointly optimal policy combinations of capital taxes and pollution taxes for the polluted host economy. A zero capital tax is required for increasing mobility of capital to raise real GDP, while a larger than Pigovian pollution tax is needed for enhancing environmental amenities to retain domestic workers or even attract foreign workers. We then examine the impacts on those two optimal tax rates if foreign countries adopt higher environmental standards or if foreign countries impose tax credits on foreign investments. Numerical simulations confirm the results obtained in our theoretical analyses.

2. The model

We consider a developing open economy that consists of two sectors and produces two traded goods, X and Y, by using labor (L_i), land (T_i) and capital (K) as inputs, and the production functions, $X = X(L_X, T_X, K)$ and $Y = Y(L_Y, T_Y)$, are under constant-returns-to-scale technologies. Labor and land are mobile between sectors, but capital is specific to sector X in production. Furthermore, both labor and capital are internationally mobile, while capital is subject to taxation. We assume that pollution Z is generated from the production of good X as a by-product, which harms consumers as an "eyesore" externality. Adopting the user-pay principle, a pollution tax at the rate s is imposed on the producers by the government.

Choosing good Y as the *numeraire*, the production side of the home economy can be summarized by the net revenue function, defined as: $R(p, s, L, K) = \max\{pX + Y - sZ: L_X + L_Y = L\}$, where p is the relative price of good X and L denotes the labor employment in the economy. It is noted that land is fully utilized, $T_X + T_Y = T$, and is suppressed in the net revenue function. By using Shephard's lemma, we have: $R_p = X$ and $R_s = -Z$, as the supply of good X and the (negative) amount of pollution emissions Z. In addition, we have $R_L = w$ being the domestic wage rate and $R_K = r$ for the domestic rate of return on capital.

The demand side of the economy can be represented by the expenditure function. Each worker minimizes expenditure, subject to a budget constraint: $E^L(p, Z, u^L) = \min\{pc_X + c_Y: u(c_X, c_Y, Z) = u^L\}$, where c_i is the demand for good i, u^L expresses the level of individual utility and $u(\cdot)$ is the utility function. By Shephard's lemma, we have $E^L_p = c_X$. Total pollution Z enters into the utility function as a negative eyesore externality by assuming that $\partial u / \partial Z < 0$. To maintain the same level of utility, more goods need to be consumed to offset the loss in utility caused by an extra unit of pollution. We further assume that the expenditure function is separable with respect to the utility level, so that we can write $E^L(p, Z, u^L) = e(p, Z)u^L$, where $e(p, Z)$ is the expenditure function per unit of worker's utility and e_Z ($= \partial e / \partial Z > 0$) is the associated marginal damage of pollution in terms of more expenditure on goods.[2]

[1] For example, see Beine and Parsons (2014).

[2] Consider a Cobb–Douglas utility function: $u^L = (c_X / a)^a [c_Y / (1 - a)]^{1-a} (1 + Z)^{-v}$, where $0 < a < 1$ and $v > 0$. This yields the demand functions: $c_X = aE^L / p$ and $c_Y = (1 - a)E^L$, where E^L stands for individual expenditure, and indirect utility is thus: $u^L = (E^L / p^a)(1 + Z)^{-v}$. The expenditure function can be thus expressed as: $E^L(p, Z, u^L) = e(p, Z)u^L$, where $e(p, Z) = p^a(1 + Z)^{-v}$. Note that $E^L_Z = e_Z u^L = p^a v(1 + Z)^{v-1} u^L > 0$ and $E^L_{ZZ} = e_{ZZ} u^L = p^a v(v - 1)(1 + Z)^{v-2} u^L < 0$ if $v < 1$ and $E^L_{Zu} = e_Z > 0$.

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