The pollution haven hypothesis for china economics essay

Economics

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Abstract

This paper under framework of pollution haven hypothesis tests whether there is raising an intra-county pollution haven to foreign investors with a case study of China, using a panel dataset of 30 provinces over the period 1997-2009. This study applies a model advanced in previous theoretical literature to divide the trade effects into scale, technique, and composition effects. Our estimates indicate that the openness generally appears to be good for the environment. The estimation results show that the western region in China potentially develops a " comparative advantage" in pollution-intensive industry from strong incentive in economic expansion. However, our further estimates of the location decision of FDI indicate that FDI still prefers to locate into coastal region intra China, where impose tighter environmental regulation policy. Our findings suggest better infrastructure and technology spillover may be more attractive to FDI than relatively weak environmental stringency.

Keywords: Pollution haven; Environmental stringency; FDI; Intra-country; Openness; ChinaJEL Classification: F18, F21, O13, Q56, R11

1. Introduction

The debate over the role of international trade plays in determining environmental outcomes has at times generated more heat than light. A developing country seeks trade liberalization through deduction of trade barrier and lax environment stringency because this opens its economy to foreign investors and in turn adds more investment in both human and

physical capital and drives the economic growth, which seems to be valuable to the host economy (Busse and Groizard 2008). The increased trade leads these developing countries to more specialize in dirty industries where they can enjoy a comparative advantage to meet increased world demand. In essence, one of the parties might not gain all that much by opening up to trade, and the effect of openness can harm the host country’s environment and exacerbate existing environmental problems. A large literature develops a series of theoretical framework to interpret the linking of openness to trade and environmental quality. Foremost among these is the pollution haven hypothesis that predicts that multinational firms, taking advantage of lax environmental stringency, will locate or relocate the production of their pollution-relative goods to low-income developing countries, where will be made " havens" for world’s pollution industries. Generally, open economies are likely to be so-called pollution haven. The alternative theory, factor endowment hypothesis, asserts that capital abundant country exports the dirty capital-intensive goods, which in turn affect the level of production, thus raising more pollution in the capital abundant country than labor-intensive ones. Early studies develop a general equilibrium model of trade to divide trade’s impact on pollution into composition, scale, technique effects that have been proven useful in other contexts (Grossman and Krueger 1993; Copeland and Taylor 1994; Antweiler et al. 2001; Bao et al. 2011). As a consequence of income-induced demand for environment regulations, foreign firms may bring about greater access to environmentally beneficial production technologies and cleaner reduction methods that will be a positive impact on local environmental quality. If this model holds for the

reality, combining estimates of all three effects would yield a conclusion that trade liberation is good for the environment in developing countries (Antweiler et al. 2001). Another important factor in determining the direction of trade is the endowment of pollution permits, which is larger for developing countries than for developed countries (Birdsall and Wheeler 1993; Dietzenbacher and Mukhopadhyay 2007). There are several reasons to be expected higher pollution intensity in developing countries. First, if environmental amenity is normal good, higher-income developed countries generate a greater demand for clean air and water. Similarly, developing countries with lower levels of income and higher discount rates may appeal to foreign investors and value more to employment and economic growth than health and cost of pollution. Second, relative costs of monitoring and enforcing pollution standards are higher in developing countries, given purchasing green equipment and facility are costly. Third, developing countries seek to improve their international competitiveness by shifting from agriculture to industrializing manufacture with paid urban growth and heavy investment in infrastructure. The industrializing process causes their industrial pollution to be highly concentrated in location and type. However, the developed countries shifted out of polluting industry into services, resulting in a decreasing level of pollution for each unit of output. Under free trade, the structural differences would be reinforced by specializing in a comparative advantage. For the pollution haven hypothesis, when lax environment stringency becomes a source of the comparative advantage, it drives shifts in location decision of FDI and in turn the State intentionally uses lax environmental stringency to sufficiently attract FDI to promote

employment opportunities and hence higher growth rate (List and Co 2000; Keller and Levinson, 2002; Copeland and Taylor 2003; 2004; Javorcik and Wei, 2004; Henderson and Millimet 2007; Cole et al. 2009; Dean et al. 2009; Kellenberg 2009; Bao et al. 2011). Although early studies successful in identifying pollution haven hypothesis linking openness to FDI and environmental quality between host countries, but empirical verification on impacts of trade effects across regions intra-country and the location decision of FDI still seem to be seriously lagged. (Antweiler 2001; Cole 2004; He 2006; Dietzenbacher and Mukhopadhyay 2007). This article aims at contributing to the existing literature by adding another piece of evidence. The inquiry presents trade effects across host regions, where are undertaking a great opportunity for economic expansion, and investigate the location decision of FDI, shifting toward to western region in China when facing its comparative advantage in pollution. China is a developing country seeking inward FDI to finance its domestic growth. Although the total amount of FDI in China is extremely high, the heterogeneous degree of openness to the world economy across regions leads to significant imbalances in FDI stocks between western and coastal regions, which coastal region absorbs a larger amount of FDI. Recently, China has been hosting the world's biggest development program, namely Western China's Development Program (WCDP)[1]to speed up the economy of western region and attempt to correct regional inequality since 2000, though this project might be expected to cause severe environment problems towards western region in China (Lu and William 2004). This argument, as a counterpart, also can be derived that the lax environmental stringency in western region would enhance the inland

forward of FDI. Also note that the second dimension indicates the importance of structural determinants of FDI flows such as infrastructure provision, economic condition and technology spillover, and potential market share to the regional location of FDI inflow (Gong 1995; Head and Ries 1996; Eduardo and Jonathan 1996; Qu and Green 1997; Luo and O'Conoor 1998Zhao and Zhu 2000; Sun et al. 2002; Fung et al. 2002; Lin and Cheung 2004; Crespo and Fontoura 2007; Wei et al. 1999; 2008; Zhang and Fu 2008; Xin and Whalley 2010). In this context, our estimates indicate lagged infrastructure and technology spillover might appear to be correlated with the inequality of FDI distribution between western and coastal regions and might persist for a longer period, even if the attractiveness of participating in the economic program and the lax environmental regulation is a major source of comparative advantages to the western region. The remainder of the paper is organized as follows. Section II describes institutional background in China. Section III describes the data source and modeling framework. Section IV reports our empirical results. Section V concludes. Additionally, appendix 1 provides the data sources for all variables in detail.

2. Institutional Background

China is emerging as a major player on the global stage, as its economy pushes full steam ahead. Globalization through FDI has become significantly more important to since the early 1990s, and various groups of developing countries have participated to a strikingly different degree in the FDI boom (Nunnenkamp 2001). China has taken overtaken the United States to receive the most annual FDI of any country since 2002. Although the total amount of FDI inflow into China is extremely high, of the three regions in

China—coastal, central, and western[2], the Chinese government focused its attention on the coastal region for most of the 1980s and 1990s that gives the coastal region an absolute advantage in the State investment, exposure to the world economy, and thus leads to significant imbalances in FDI stocks between interior and coastal regions. The economic bases in the coastal region in fact enjoyed easy access to external market and investment as early as 1985, but the center created no open area of interior China to foreign business and investment in interior regions until 1992. For this reason, the interior regions have trailed behind the coastal region even before interior regions open their doors to FDI. The central and western regions can attract only 10. 7% and 3. 5% of total FDI in China in 1997, respectively. In short, the remarkable economic growth has been mainly a coastal phenomenon, and has fuelled growing social and income differences between the coastal and interior regions. Till 1999, after two decades of pursuing coastal development, Chinese leaders announced a change in China's regional development strategy and initiated the western drive. Since 2000, China has been hosting one the world’s biggest development program, namely the Western China’s Development Program, which is composed of over half area of the country land and viewed by China’s leaders as the key to national long-term development (Liu and Diamond 2005). Once this incentive program launched, the ongoing development of western China centered by Chongqing have also been proposed to encourage western region to launched massive complementary programs to get more opportunities to use the foreign capital, speed up the its economic development, and, thereby, attempt to correct regional inequality, though

this project is expected to cause severe environment problems towards western region in China (Lu and William 2004). Recently, the western region is under a fast developing and becomes a more important component of China economy. The inflow of FDI, as a result of fiscal stimulus, contributes more to regional GDP of interior regions in China. As markets in the coastal region relatively mature, it is likely that many of comparative advantages will disappear, and these results lead foreign investors widen their decision by looking at interior China, thus fuelling competition for FDI location between the interior and coastal regions (Ljungwall and Linde-Rahr 2005). Therefore, a substantial tension between environmental quality objectives and development goal within Chinese provincial governments will exist in a long period[3](Xu 2000). On the other hand, there is a significant heterogeneity in environmental stringency across regions in China. As a parallel to early studies, this context compares the distribution of investment in industrial pollution treatment[4]and industrial pollution charge[5]for penalty among coastal, western, and central regions over a period 1997 to 2009. Interestingly, previous empirical studies in FDI location decision finds that FDI in China is concentrated in higher income provinces where impose heterogeneous environmental policy (Cheng and Kwan 2000; Dean 2002; Wang and Wheeler 2003; Dean et al. 2009). On the international trade, the pollution haven hypothesis predicts that stringent environment regulation in developed countries lead to the relocation of pollution intensive production away from high income countries toward developing countries, where are relatively weak. However, there is limited literature provide evidence by asking whether FDI in different regions (or provincial) in China has responded

significantly to the regional (or provincial) environmental regulation stringency. If the weak environment policy in interior region can be considered as a source of comparative advantage, it is reasonable to be concerned that governments of interior regions may seek to attract FDI by maintaining the relative weak environmental regulations or even undercutting competitively and thus there will be a significantly increasing in the FDI inflow toward interior region instead of coastal region. Hitherto, it is interesting to address empirical test to question that whether the higher environmental stringency imposed in coastal region would drive the FDI to locate or relocated towards interior regions. Further analysis therefore is required to determine whether any other factors could offset these effects.

3. Methodology and Data

3. 1 Econometric model and Model specifications

This study applies a decomposition of trade effect on China’s overall and regional pollution emissions into composition, scale, technique effects that have been proven useful in other contexts (Grossman and Krueger 1993; Copeland and Taylor 1994; Antweiler et al. 2001; Bao et al. 2011). In this context, we also control the effects of demographic location and WCDP policy to test whether western region is able to raise comparative advantage in pollution through openness. We amend the empirical model and rewrite the model yielding the cross-province equation as Equation (1):(1)Industrial pollutions of air and water are two major pollutants in China. As reported by the Ministry of Environmental Protection of China (MEPC) reported the industrial air pollution accounted for about 53. 1% of national total pollution, while water pollution accounts for about 33. 4% of national total pollution

over the past two decades. Therefore, three measures of the intensity of industrial pollutants (EmInti, t) such as industrial sulfur dioxide (SO2i, t), industrial smoke (SMOKEi, t), and industrial polluted water (PWATERi, t) would be represent the by-product of goods production and be subjective to regulation because of their noxious effect on the local and the population. The industrial polluted water is measured as concentration in tons per km2, and industrial sulfur dioxide and smoke are measured as concentration in kilograms per km2. All independent variables are transformed into natural logarithm form except the international trade intensity (TIi, t) in percent, which represents openness by taking the ratio of total nominal exports and imports over GDP. GDPPCi, t-1 is lagged per capita GDP that measures the income or technique effect of regional production; SCALEi, t measures provincial total industrial GDP divided by the land size that measures the scale effect of regional industrial production; K/Li, t describes the capital abundance that is intended to test whether or not a higher capital-intensive province results in more pollution (Copeland and Taylor 1994); WAGEi, t-1 represents a lagged proxy of annual income for urban workers in the manufacturing sector; WCDPi, t is a dummy variable that is assigned 1 to these twelve provinces joint in the Western China's Development Program, dually proxy for fiscal policy and location control; COASTi, t is the second site-specific dummy that is assigned 1 to the six coastal provinces and three municipalities; εi, t accounts for the effect of unobservable variables given by εi, t= θt+ψi, t+ηi, t, where θt is time-specific effect, ψi, t is a location-specific effect, and ηi, t is an idiosyncratic error term for observation province in year t. Theoretically, the impact of capital accumulation on

pollution depends on the techniques of production in place (Antiweiler et al. 2001), but provinces differ in per capita income may result in the difference in producer prices and hence their technologies of production. Similarly, the impact of per capita income gains on pollution depends on the existing composition of output and hence the existing capital abundance and per capita income. To explain these possibilities, we construct the squares of lagged per capita income (), lagged wage (), scale () and capital abundance (and add them in our models. A nonlinearity in the impact of openness could arise from non-homothetic ties in income and capital abundance. We also refer cross-products such as TIi, t×K/Li, t , TIi, t×WAGEi, t-1×K/Li, t to the model. In general, multinational firms are assumed to have a strong incentive to seek maximum profits by minimizing operation costs. It is expected, then, that FDI is attracted to provinces with weak environmental stringency. The benefit of locating in the " haven" could be generated by carefully assessing local environmental stringencies, production costs, government regulations, infrastructure, agglomeration effects and so forth. While accounting for differ in environmental stringency, we derive the empirical model to capture determinants of FDI location decision in China (Gao 2005; Zhang and Fu 2008; Bao et al. 2011).(2)In our model we employ two variables to proxy for the FDI location preference: one is the FDI divided by regional GDP (FDI/GDPi, t), and the second is FDI divided by regional population(FDI/POPi, t). Two attributes are used to be proxy for the strictness of environmental regulations (ERSi, t). One is the lagged share of investment in industrial pollution investment projects in total innovations (TRMTi, t-1) for province i at year t-1. The second proxy is one-period lagged industrial

pollution charge normalized by the number of organizations that paid this charge (CHRGi, t-1), which is implemented by the local government and reflects the provincial differences in implementation of pollution levy systems. Under assumption, there is no effect of the stringency of environmental regulations on FDI across regions, if the expected value for β1 is equal to zero. If β1 is positive at a significant level we could expect that the region would be preferred by the foreign investor within " green" industries. Otherwise, if β1 is negative and significant increased stringency in environmental regulation is negatively related to FDI inflow. The quality of the labor force in a region is captured by two measures, such as the lagged labor productivity (LPi, t-1) and the lagged illiteracy rate (IRi, t-1). Under the assumption of lower labor mobility among provinces, lagged population density (POPDi, t-1) is employed as a proxy for land prices and potential market size. In addition, both the availability and quality of infrastructure are important in the overall cost of running business and hence is an essential factor to FDI inflow. Transport production facilities are proxied by the lagged railway density (RAILi, t-1) and road density (ROADi, t-1) that respectively denote the length density of railways and highways of provincial land size. The regional gross industrial product value (RIPi, t-1) is included to capture the agglomeration effects of firms locating where hubs of economic activity already exist.

3. 2 Oaxaca Decomposition

Finally, the study continues to examine effects of environmental stringency and WCDP fiscal policy that can respectively influence foreign investors' decision on investing across the regions within China, as implied by pollution

haven hypothesis. We implement the Oaxaca decomposition (Oaxaca 1973) to decompose the effects on FDI location decision into a part that is due to difference with observable characteristics between provinces and another part that is still unexplained characteristics. Here, we focus on effects of WCDP fiscal policy and the two environmental stringencies studied above. This analysis is easily done by running separate regressions by control dummy attribute. Take the dummy variable WCDPi, t as an example. First, define αw and βw (a vector) as coefficient estimates from a regression of FDI preference from the province joining the Western China's Development Program only, and (a vector) as the mean characteristics of western provinces. The variables αnw, βnw, and are similarly defined for the provinces that are in WCDP program. The overall FDI location difference between western region and other non-western region is expressed as Equation (3):(3)There are two popular ways to rewrite this equation. The first Oaxaca decomposition (I) is based on adding and subtracting, to Equation (3), which yields:(4)In this case, we are assuming that the returns to Western region characteristics, βw , are the baseline. The second Oaxaca decomposition (II) is found by adding and subtracting to equation (3), which yields:(5)In this case, we assume that the return to characteristics (βw) of other non-Western region is the baseline. In both equations, the first two terms are the part of the total gap left unexplained and the third term is the part of the difference due to explained characteristics. The empirical regression model for analysis of Oaxaca decomposition is expressed as Equation (6):(6)In this part, three control dummy (CTRL Dummy), including of WCDPi, t, and lagged environmental stringency dummies TRMTDi, t-1 and

CHRGDi, t-1, respectively, are implemented by the Oaxaca decomposition. For the province with industrial pollution treatment (or industrial pollution charge) that is higher than the median value across the provinces in China at year t-1 will be assigned as 1, otherwise is 0. We also use the sample median threshold to construct two addition dummy variables ROADDi, t-1 and LPDi, t-1 that proxy for highway road density and labor productivity to investigate the explanatory power of characteristics of infrastructure and technology spillover.

3. 3 The Data

The annual data is mainly compiled from the China Statistical Yearbook, China Environmental Yearbook, and China Industrial Economy Statistical Yearbook over period 1997-2009. In this paper, all monetary variables are adjusted to Producer Price Index at year 1997 for manufactured products in Chinese currency, and variables are taken in the natural logarithm transform. Appendix 1 shows the descriptions and sources of variables in detail.

4. Empirical Results

4. 1 Descriptive and Analysis

In Table 1, it provides summary statistics on the variables used in the regression analysis. One problem that is still prevalent in panel data approaches is the possible endogeneity of the variable environmental regulation. To detect sources of spurious regression in time-series estimation, it is necessary to test the stationary of variables. Recent economic literature has proposed several methods for testing the existence

of unit roots under panel setting. We choose the IPS W-test (Im et al. 2003) and ADF-Fisher Chi-square test (Maddala and Wu 1999) to perform panel unit root test and compare the outcomes (Christopoulos and Tsionas 2003; Hsiao and Hsiao 2006). The result of both IPS W-test and ADF-Fisher Chi-square test indicate that those variables in Table 1 are stationary series. Therefore, we observe that the null hypothesis of having a unit root rejects for all variables including a trend, and hence conclude that the potential problem of spurious regression is partially eliminated in model estimation.

4. 2 Test of Trade Effects Intra host country

The typical approach for estimating the determinants of pollution intensity is to run the regression of those chosen variables, e. g. the intensity of industrial sulfur dioxide (SO2t), industrial smoke (SMOKEt), and industrial polluted water (PWATERt). Given stationary variables, we initially run both fixed effect and random effect regressions, whereas fixed effect estimation is in statistically more efficiency in our estimations, because Hausman test reject the random effect model. Therefore, Table 2 presents the main results from estimation dependable in three measures of pollution intensity by concentrating our effort on the fixed effect estimation. In all column of Table 2 we find a positive and significant relationship with pollution intensities and the scale of city economic intensity (SCALEt) as measured by GDP per km2. We also observe that the coefficient estimates imply the highest scale elasticity of concentration in sulfur dioxide between 1. 4 and 1. 5. Holding other constant, we find ten percent in city economic intensity will result in perhaps 14% increase in pollution emission. Additionally, the negative estimates in SCALEt with a positive coefficient of reveal an inverse U-shape

relationship between pollution concentration and the scale of economic activity. Next consider the impact of regional capital abundance (K/Lt). In all columns of Table 2, we find a positive composition effect arising from an increase in the ratio of capital-to-labor. Our result in finding a positive relationship between factor endowments and regional pollution within a country might complement to Heckscher–Ohlin–Samuelson model on the link between factor endowments and international trade. We then investigate income effect because it determines the strength of the technique effect mentioned above, which is tied to the scale of economic activity and can determine how free trade affects the composition of national outputs and overall pollution levels (Taylor and Copeland 1994). The estimates in Table 2 find a negative relationship between per capita income levels and pollutant concentrations. However the elasticity of concentrations to an increase in income is not significant. This is because, under pollution haven hypothesis, a low income economy should be made dirtier by free trade, but if a pollution-intensive industry is also capital-intensive, then whatever benefits accrue from lax pollution regulations could be forgone by the relatively higher price of capital in this capital scare province. On the other hand, the estimates in Table 2 predict a strong and negative relationship between GDP per capita level (GDPPCt) and air pollution intensity. The elasticity of concentrations to an increase in GDP per capita is typically large and is always significant. We calculate the trade intensity (TIt) as a ratio of the sum of import and export to the regional GDP to proxy for the regional exposure to the foreign trade, which is assumed to be positive and large for a pollution haven. Our results show that the estimates of TIt are

negative and highly significant for sulfur dioxide and polluted water, while moderately significant for smoke. This result predicts a negative link between trade liberalization and overall pollution intensive output. The trade intensity interactions with income (TIt×WAGEt-1) and income squared in the Table 2 suggest that technique effect is very big, and the result reject the hypothesis of a zero technique effect in highly opened region. Therefore, for an average province in our sample the trade-induced composition effect is negative. However, we also note that the results above might predict a very small effect of further openness on pollution intensity of output for low income provinces, like provinces in western region. Because the trade gain may not only be ascribed to the openness we note that it is important to distinguish endogenous policy responses by controlling coastal region and western region (where initiate the world’s biggest economic developing program). The site-specific dummy WCDPt embedded with endogenous policy is positively associated with the pollution intensity in two measures of pollutants such as industrial sulfur dioxide and industrial polluted water. In conformity with pollution haven hypothesis, the western region as compared to coastal region is more interested in economic expansion in prior rather than environment. However, the western region interactions of with income and income square are negatively associated with pollution intensity and only reject the hypothesis of zero technique effect at the 10% significance level. The result in manner of significant magnitude for WCDPt×WAGEt-1 suggests that technique effect may be small or nonexistent in western region as transient as low-wage haven. We note that western region has higher autonomous level of air pollution. Interestingly, we observe that the

coastal region, rather than poor western region, is positively associated with the higher level of industrial water pollution. This is because the western region, which covers more than 50% of China’s land, is burdened with a limited water supply (Fung et al. 2005). Overall, the likelihood on the basis of site-specific effect embedded with endogenous policy effect that the major impacts of development would occur in less developed region would provide the western region with incentive to participate in an internationally agreed scheme, and generate tendencies toward formation of western region’s comparative advantages and motivation in pollution-intensive industries.

4. 3 Environmental Stringency and Location Decision of FDI Intra-country

Relevant to pollution haven hypothesis, we expect that relative tight environmental stringency might account for the smaller FDI inflow, ceteris paribus. Tables 3 and Table 4 present results for environmental stringencies proxy by industrial pollution investment and industrial pollution charge, respectively. Each table includes two parts, depending on the two measures of FDI location preference, as columns (1)~(4) accounting for FDI/GDPt and columns (5)~(8) accounting for FDI/POPt. As Table 3 shows, the share of industrial pollution investment (TRMTt-1) has a negative and significant effect on FDI inflow into a province, and estimates are relatively stable across regressions. The results indicate that FDI inflow shows an inverse association with environmental stringency in the measure of the share of industrial pollution investment, indicating that a 10% increase in the share of industrial pollution investment would lead to a 2. 16%~3. 62% decreases in the amount of FDI inflow. In addition, Table 4 gives the similar results when

environmental stringency is proxy by industrial pollution charge (CHRGt-1). The results reveal that a 10% increase in the share of industrial pollution charge would result in a 2. 09%~3. 38% decreases in in the amount of FDI inflow. Taken together, the statistical results show that the environmental regulation is a significant determinant of FDI location. Caeteris paribus, the FDI should prefer to invest in the interior regions in such as western China. However, the estimates of dummy WCDPt show a negative association with the FDI location preference, while the COASTt is positively related to the FDI inflow in control of environmental stringency. The results are consistent with the fact that approximates 80% annual inward FDI flows into the coastal region instead of interior regions, which the amount of FDI keeps increasing. We therefore argue whether other factors might act in a strong negative effect as barriers to deter the westward of foreign investments and also account for the inequality distribution of FDI, even though both WCDP fiscal policy might have improved condition of openness in western region and enhanced its motivation to trade the environment for economic growth. Agglomeration economies, labor market conditions, and other usually identified as relevant for location decisions apply at a local level. The average wage cost, living expense, and cost of operation in coastal provinces are much higher than central and western regions (Firth et al. 2006). In particular, costs and wages are very high in first-tier cities such as Shanghai and Beijing. We observe that those provinces in coastal region with higher share of inward FDI achieve higher per capita GDP (GDPPCt-1) and income (WAGEt-1). Therefore, contrary to PHH, FDI has done more than simply create low-wage employment in China. The industrial productivity (LRt-1)

and population density (POPt-1) can be viewed as an approximation of labor skill level and labor pool, which represent the attractiveness to FDI. In support of this, our findings reveal that LRt-1 and POPt-1 are positively correlated with the amount of inward FDI, suggesting that foreign firms tend to invest more in the coastal region, where has absolute advantage in amount of skilled labor as well as skill level. These results are in consistent with the predication that FDI would tend to invest in labor-intensive sectors and seek export-oriented (Lin and Kwan 2011). Our finding also indicates that the illiteracy rate (IRt-1) may not server as a crucial determinant that impacts on the decision of FDI inflows. Because the educational background of worker in the host country is not as great as working experience that influences the location decision for foreign firms to produce across countries (Zhang 2001). Meanwhile, an important factor affecting the location decision, and the point of this research, is the existence of agglomeration externality. In general, agglomeration economies consist simply of those positive externalities resulting from the spatial concentration of existing economic activity. In Table 3 and Table 4, we include the lagged regional industrial production (RIPt-1) to account for the degree of agglomeration. The estimate of RIPt-1 indicates an inverse relation to inward FDI, which might be explained in part by the fact that the negative externality across provinces arise as a firm bid up price in local input markets and compete with one another downstream producer in that region (Wagner and Timmins 2009). We finally turn to a discussion whether the regional physical infrastructure, such as superior transportation facilities, can influence the location decision of FDI. The logistics capability and freight cost are key factors that will most

likely influence the FDI location decision within the country. Transportation infrastructure that is more highly developed should enhance the competition of a developed logistics system and possibly lower costs for firms. The hypothesis is that the coastal region with better infrastructure condition, in the form of more highways and railroads, is more attractive to foreign firms. The coefficient on the density of urban highways (ROADt-1) shows that FDI prefers to locate in the regions with good road transportation network. These results advocate the importance of urban transportation network in attracting FDI. However, the location determinants differ in effect of railway density (RAILt-1). The estimation finds that the density of the railway shows a negative consideration when foreign investors make their location choice. As compared to urban highway, the railway plays a significant role in supporting inter-city or inter-province transport which is in a long distance. The trade cost would be too higher for foreign investors to produce in the inland country, transport to the coastal harbor, and ship back to the parent country or oversea markets from foreign affiliates, which make inland investment a less attractive option to FDI. On optimistic measure, the continuing China’s Railway Investment Program[6]in China might help the western region to increase the freight mobility and intermodal connectivity with coastal region and lower the freight rate sufficiently. If this goal can be achieved as quickly as possible, it might enhance the exposure of western region to the international trade in the future. The findings above collectively suggest that the attraction to FDI is likely to depend on the infrastructure, technological spillover, and environmental stringency in a host region, of which is not easily altered by the economic policy. The evidence points to an

increasing concern between the level of development in a recipient economy and the environment benefit associated with the competition for more FDI inward.

4. 4 Robustness Checks

To address the concerns on the robustness of our estimates, we conduct multiple specification tests. First, the panel dataset is amended to exclude municipalities (Beijing, Shanghai, Tianjin, and Chongqing), and the regression results are qualitatively similar to the full sample, and reach the similar conclusions for all models. Alternatively, we implement another robust estimation to exam the effect of environment stringency on FDI location preference by transforming the lagged environmental stringency variable (TRMTt-1 and CHRGt-1) into dummy variable. The value of annual provincial investment in industrial pollution treatment (or Charge) is higher than its median value across the country is assigned to be one, the other province lower than the median is assigned to be zero. Holding attributes as regression model (IV) in Table 3 and Table 4, we then apply the dummy environmental stringency TRMTDt-1 and CHRGDt-1 respectively represent the dummy for TRMTt-1, and CHRGt-1. As before, inclusion of dummy controls for the environmental stringency provides the significant negative sign of industrial pollution treatment (industrial pollution charge), which is consistent with our previous results. In doing so, our conclusion appear quite robust and demonstrate that such a negative effect of the environment stringency can be largely to associated with the decision of FDI inflow location, and thereby a relative strict environment stringency is effective to discourage the pollution-incentive FDI investment.

4. 5 Oaxaca Decomposition

The novelty of our study is also that we use Oaxaca decomposition methodology to examine to which extent the inequality distribution of FDI inflow can be explained by the difference in specific factors of host regions. The target factors are transformed into dummy variable by median value. As it shown in Table 5, the decision of FDI location is attributed to environmental stringency. When FDI/POPi, t is proxy for FDI location preference, the investment in industrial pollution treatment (TRMTDi, t-1) explains 63. 0%~80. 8% of FDI location preference, while Charge in industrial pollution (CHRGDi, t-1) explains 59. 9%~74. 8% at all, of which confirm our previous conclusion and evidence environmental stringency policy could explain the FDI location preference. In addition, the findings also reveal that the advantage in both infrastructure and technology spillover in coastal region, such as highway road density (ROADDt-1) and labor productivity(LPDt), show a great explanatory power and have substantial impact on attracting and keeping FDI. Moreover, the unexplained gap for site-specific dummy WCDPt is greater than the explained gap, suggesting that location effect has been an negative factor that accounts for the inequality distribution of FDI intra host country. In somewhat finding, foreign investors still view coastal provinces favorably.

5. Conclusions

This paper investigates the effects of openness on pollution intensity by examine the scale, technique, and composition effects of empirical model via 13-year-panel dataset. Our estimates indicate that the increased exposure to international trade in China increases pollution intensity in air and water

pollutants due to the scale effect. This increase in output raises the incomes of workers and staff in the industrial sections of provinces that are more open to trade. There is, however, a negative effect for the techniques in our model, which implies that as incomes increase, pollution decreases. The associated increase in openness and capital abundances will then exert an additional impact on the pollution concentration via our estimated composition effect. Undergoing the Western China’s Development Plan, the more opened western region is potentially raising a comparative advantage in specializing in pollution–intensive to trade the environment and achieve the economic expansion. In this context, the negative effect of environmental stringency on the location of FDI intra-country is consistent with previous literature that studies on FDI location choice between countries. Evidence from this study indicate that the tighter environment regulation policy show a significant effect in deterring the FDI, but coastal region is still attracting and keeping more FDI than other regions in China. In deed there is some evidence supporting the pollution haven hypothesis, but it does not seem an overwhelming phenomenon. Instead, the analyses in the current study suggest that better infrastructure and technology spillover are the major determinants of the influx and persistence of FDI in coastal region. To maintain a fast, durable, and sustainable development in China, further study is required to rethink the tradeoff between environmental impact and economic growth.