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Tax Havens and FDI Spillovers: Implications for LDCs

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Abstract

Tax competition and spillover models offer ambiguous predictions concerning the economic impact of tax havens on non-tax havens. The implications of tax havens for less developed countries (LDCs), in particular, are not well understood and are little studied. This paper investigates the impact of tax havens on non-tax haven countries in terms of foreign direct investment (FDI). We investigate the importance of agglomeration effects by accounting for the level of FDI inflows as well as the role of geography by measuring proximity to the nearest tax haven. Our analysis yields several interesting findings. First, using panel data for 142 countries, we find evidence of positive spillovers from tax havens to nearby LDCs, but not to nearby developed countries. Second, restricting our panel to LDCs, we find the positive effect of tax haven FDI on LDCs to be robust. Third, we find that geographic distance matters for financial flows: LDCs which are the closest to a nearby tax haven benefit the most in terms of FDI inflows. This result is robust to including a lag of the dependent variable and accounting for spatial interdependence of FDI. We conclude that tax haven activity has beneficial implications for FDI inflows of nearby LDCs.

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Ever-increasing levels of foreign direct investment, the rising R&D intensity of multinational firms, and the growing volume of world trade between related parties together imply that the demand for tax haven operations is likely to increase over time, as are the concerns of non-haven policymakers. (Desai, Foley and Hines, 2006b, p. 530)

I. Introduction

Tax havens are often touted as "parasitic" (Slemrod and Wilson, 2009), "offshore pariahs" (Hampton and Christensen, 2002) that flourish at the expense of non-tax haven competitors. Potential negative impacts are argued to be particularly harmful for Less Developed Countries (LDCs).[1] Estimates of LDC annual revenue losses due to tax havens range from $15 billion (Gurtner, 2004) to $50 billion (Oxfam, 2000). Such concerns, fueled by the expansion of tax haven activities throughout the world, have spurred numerous anti-tax haven initiatives at the international and national levels. These include the Organization for Economic Cooperation and Development, European Union's Harmful Tax Competition Initiative (OECD, 1998), the United Nations proposed International Tax Organization (Horner, 2001), the G20 Declaration on Strengthening the Financial System (G20, 2009), the proposed US Stop Tax Haven Abuse Act (Tanenbaum, 2009), and the Foreign Affiliates Rules in Canada (Huynh, Lockwood and Maikawa, 2007).

Several scholars predict that anti-tax haven initiatives are unlikely to protect LDCs from the harmful impacts of tax haven activities (McLure, 2006; Altshuler, 2006; and Kudrle and Eden, 2003). This gloomy outlook for LDCs, however, overlooks the possibility that tax haven activities may create positive spillovers (Altshuler, 2006). For example, Desai, Foley and Hines (hereafter DFH, 2006a) argue that multinational firms translate lower capital costs associated with tax haven activities into increased foreign investment in tax havens and non-tax havens.

[1] See Kudrle and Eden (2003), McLure (2006), Oxfam (2000) and Gurria (2009) for further discussion.

Further, the spillovers are likely to be geographic in nature with positive benefits accruing to countries in closer proximity to tax havens (Rose and Speigel, 2007). Notably, the mechanisms by which tax havens influence economic activity in LDCs have been largely ignored in the literature. In a recent review of previous work on tax havens, Hines (2010) concludes that tax havens encourage investment in high-tax countries and are likely to promote growth in other countries.

We address this gap by analyzing the effect of tax havens in relation to foreign direct investment (FDI) inflows using a panel data framework for a large sample of LDCs and Developed countries (DCs) from 1990 to 2008. Following DFH (2006b) we account for regional agglomeration by including FDI levels in tax havens and following Rose and Spiegel (2007) we capture geographic spillovers by considering FDI in the nearest tax haven as well as proximity to the nearest tax haven.[2]

Our analysis suggests that FDI inflows to tax havens are beneficial in terms of FDI for LDCs but not for DCs. We find a significant regional agglomeration effect: FDI inflows in LDCs are positively associated with FDI inflows in the nearest tax haven. In terms of spillover effects: LDCs that are at a close distance to a tax haven exhibit higher levels of FDI than those LDCs that are more distant. These findings are robust to several model specifications, such as the inclusion of a lag of the dependent variable and consideration of spatial interdependence of FDI. Our findings lend support to claims that positive spillovers may accrue to regional neighbors and are influenced by the level of regional agglomeration of FDI. Accordingly, our results are important for informing international tax policy discussions, particularly those focused on the negative effects attributed to tax haven activities.

[2] DFH (2006b) analyze firm level demand for tax haven operations and Rose and Spiegel (2007) investigate capital market features.

The next section summarizes the literature on tax haven impacts on non-tax havens. Sections III and IV describe the general empirical specification and discuss the results obtained for the full sample (DCs and LDCs) and the sub-sample of LDCs, respectively. Sections V and VI discuss the results obtained for the estimations for the balanced panel of LDCs with spatial considerations and the spatial error and lag models. Section VII concludes.

II. Empirical and Theoretical Evidence of Tax Haven Impacts on Non-Tax Havens

Based on our review of the main threads in the literature related to tax haven activity, we draw two important conclusions. First, the impact of tax haven activity on non-tax haven countries as a whole is ambiguous from a theoretical and empirical perspective. Second, the literature does little to distinguish between potential implications for LDCs compared with DCs.

Theoretical and empirical evidence suggests that tax haven activity can be associated with both positive and negative spillover effects on non-tax haven countries.[3] Tax competition can lead to negative effects: tax havens are likely to attract capital that would have otherwise gone to non-tax havens if taxation policies were equal. Slemrod and Wilson (2009) present a theoretical model in which attempts of national firms to take advantage of reduced corporate taxes in tax havens cause capital to flow out of non-tax haven countries. Tax havens not only offer low rates of taxation, but are also likely to offer an environment friendly to foreign capital. This makes it easier for multinational corporations (MNCs) to locate operations in tax havens. Thus, the presence of tax havens in a given region will influence location decisions of MNCs.

On the other hand, non-tax havens may be positively impacted if tax haven policies enable MNCs to significantly reduce capital costs by increasing foreign investment in tax havens. For instance, Dyreng and Lindsey (2009) estimate that American firms with activity in

[3] See Dharmapala (2008) for a discussion.

at least one tax haven face a tax rate on pre-tax income that is 1.5 percentage points lower on average than firms with no activity in tax havens. These reductions in capital costs allow MNCs to increase investment in non-tax havens (DFH, 2006a; Hong and Smart, 2007). In fact, DFH (2006b) find a positive relationship between the establishment of tax haven subsidiaries and sales and investment growth in neighboring non-tax havens.

In a related vein, Rose and Spiegel (2007) argue that proximity to offshore financial centers, which are likely to be tax havens, leads to greater competitiveness in the domestic banking sector and financial depth of nearby non-tax haven countries. They provide empirical evidence of this positive spillover in capital markets. And, while they argue that the importance of geography is not obvious for the flow of capital, we content that geographic proximity could affect the flow of information about investment opportunities. In particular, MNCs are more likely to become aware of investment opportunities in countries near tax havens that would otherwise go unnoticed. Rose and Spiegel (2007) use distance to the nearest tax haven as an instrument for distance to the nearest offshore financial center. The argument is that activity in the nearest tax haven is an important factor in cross-country capital flows. We follow their approach by considering the level of FDI in the nearest tax haven as well as geographic distance.

The ambiguity of tax haven impacts on LDCs in particular is not addressed in the literature. To the extent that LDCs have fundamentally different economic structures and challenges compared with DCs, tax haven activities are likely to be particularly salient for LDCs relative to DCs (Bloningen and Wang, 2005). Tax haven activity could reduce capital inflows to a nearby LDC as firms are seduced away by the lower capital costs associated with tax haven operations (e.g. a diversion effect). On the other hand, to the extent that tax haven activity leads to increased capital inflows in the surrounding region, MNCs increase investment in nearby

countries via a regional agglomeration effect. Furthermore, the savings in capital costs could translate into greater capital inflows to LDCs and the world as a whole via a global agglomeration effect.[4] Finally, the geographical spillovers observed by Rose and Spiegel (2007) are likely to be important for LDCs as well.

Our analysis investigates the channels through which capital inflows in tax havens affect capital inflows in non-tax haven, with a particular focus on LDCs. Following the literature we consider agglomeration aspects as measured by FDI levels as well as the role of geographic proximity to the nearest tax haven.

III. General Empirical Specification

We begin by investigating the tax haven consequences for non-tax haven countries, using data between 1990 and 2008 for a panel of 142 non-tax haven countries (34 DCs and 108 LDCs; see Appendix, Table A1 for a list of countries included).[5] We limit our panel to non-tax haven because the mechanisms through which tax havens attract FDI are likely to be different from those of non-tax havens. Evidence suggests that the common characteristics and low tax rate policies of tax havens are associated with higher levels of FDI. As a result, tax policies are suspected to be endogeneous in typical empirical investigations.[6]

Our general model captures two key aspects of tax haven spillover impacts: regional agglomeration and geographic diffusion and is specified as follows:

[4] A recent study by Chantasasawat et al. (2010) has shown evidence of FDI spillovers effects from China to other East Asian countries. While this does not pertain specifically to tax havens, it relates to the potential agglomeration effects of FDI that accrue to LDCs when MNCs locate in nearby tax haven countries.

[5] Due to missing observations, the estimations for the full sample are based in an unbalanced panel framework. Non-tax havens are those countries which are not designated as a tax haven by Dharmapala and Hines (2009). Countries are classified as developed and less developed using the World Bank's Country and Lending Groups classification as of September of 2010 (see the website listed in references).

[6] De Mooij and Ederveen (2003) and DFH (2004) discuss empirical analyses of FDI response to tax rates. Hines (2005) documents the conspicuous degree to which tax havens attract FDI.

$$FDI_{it} = \alpha_1 TH\_FDI_{it} + \alpha_2 LDC\_DUMMY_{it} + X_{it}B_i + \varepsilon_{it} \quad (1)$$

The dependent variable, FDI_{it}, is the natural logarithm of total FDI inflows in US dollars (millions) for country *i* in year *t*, where t ranges from 1990 to 2008. FDI inflows were obtained from the United Nations Conference on Trade and Development (UNCTAD) website. *TH_FDI* is the natural log of FDI inflows in the nearest tax haven to country *i* in year *t*. We estimate distance to the nearest tax haven using Mayer's and Zignago (2006) distance data.[7] Listed in Appendix, Table A2, the tax haven countries used to calculate *TH_FDI* include those identified by Dharmapala and Hines (2009) for which the distance to other countries and data on FDI is available. Our approach to modeling tax haven impacts is similar to that of Rose and Spiegel (2007).

We attribute activity in the nearest tax haven as an important indicator of great FDI spillovers to non-tax havens because of the importance of increasing familiarity with the nearby non-tax haven country and strategic agglomeration among MNCs. MNCs locating subsidiaries in tax havens might feel more comfortable and have more information about investment opportunities in nearby countries. In addition, following DFH (2006b), large firms with significant intra-firm trade and high R&D are more likely to have tax haven operations. Therefore, positive spillovers in terms of FDI flowing to nearby countries are expected to be associated with intra-firm trade. DFH (2006b) also find that companies with tax haven operations pay lower taxes as a fraction of sales, where the amount saved in taxes might translate into higher investment in non-haven affiliates. Following Rose and Spiegel (2007) we can also allow FDI activity in the nearest tax haven to serve as an instrument for financial flows in the area.

[7] Mayer and Zignago (2006) use the great circle formula to calculate the distance from the most important cities and agglomerations of one country to another (website noted in the references section).

Given that geographic proximity matters for cross-country capital flows, we take the nearest tax haven to be pertinent for our analysis. Accordingly, we focus on the nearest tax haven to evaluate the direct impact of tax haven operations in relation to strategic agglomeration and geographic spillovers.

In Equation 1, the LDC dummy variable allows LDCs to differ from DCs in relation to attracting FDI because of underlying country characteristics. The vector X represents a set of control variables identified in previous empirical analyses as important determinants of FDI.[8] The general model includes typical control variables such as the initial level of real GDP, population, exchange rate, and trade openness (all in natural logs).[9] Geographic conditions are accounted for by including a landlocked dummy variable, and a set of regional dummy variables for Africa, America, Asia, Europe, and Pacific.[10] Furthermore, we control for institutions by including an indicator that measures fiscal freedom and dummies to control for high corruption and British legal origin. Time dummies are also included in all estimations to control for time specific variation.[11] Table 1 describes all the variables used in this analysis and their sources. Table 2 (part a) presents the summary statistics for the data corresponding to the full sample of countries.

[8] Blonigen (2005) presents a comprehensive review of literature related to the determinants of FDI. Biswaz (2002) provides another useful review of the determinants of FDI.

[9] Although several empirical analyses use the current level of GDP as a control variable, we use the initial level of GDP because FDI and GDP may be simultaneously determined. See Aharonovitz and Miller (2010), Choe (2003), Chowdhury and Mavrotas (2006), Hansen and Rand (2006) and Sylwester (2005) for a discussion and empirical evidence on the simultaneous determination of FDI and GDP growth. We consider initial levels of real GDP per capita in 1990. If data are not available for 1990, we use the earliest available observation for the real GDP per capita between 1991 and 1994.

[10] We omit the dummy for African countries in our estimations.

[11] Coefficients for time dummies not included for purpose of space. We do not include country dummies since several independent variables are time invariant. The variables includes in the right hand side are controlling for specific country characteristics. We take into consideration the cross-country variation for the error term by using cross sectional panel corrected standard errors.

The model is first estimated using the ordinary least squares (OLS) estimator with panel corrected standard errors (cross section). By using panel corrected standard errors we control for the fact that disturbances are heteroskedastic and contemporaneously correlated across panels. The estimates shown in column 1 of Table 3 correspond to estimation of Equation 1 using the full sample of 34 DCs and 108 LDCs.

In terms of our variable of interest, the estimated coefficient for *TH_FDI* is found to be positive and statistically significant at the 5 percent level implying that FDI inflows in the nearest tax haven are positively related to FDI in non-tax haven countries. This finding suggests the presence of positive spillovers, even controlling for common regional and other factors related to FDI inflows. As expected, we find that LDCs have lower levels of FDI compared with DCs: the estimated coefficient for the LDC dummy is negative and statistically significant at the 5 percent level.

The estimated coefficients of the majority of the control variables (initial GDP, population, exchange rate, and openness) are significant at the 1 percent level and have the expected signs.[12] In relation to the regional dummies, countries in America and Europe have higher levels of FDI relative to countries in the African region (the omitted category) while the Asia dummy coefficient is unexpectedly negative and statistically significant. Regarding institutional variables, we find that only the indicator of fiscal freedom coefficient to be statistically significant (at the 5 percent level or greater), where it has a positive sign. The dummy coefficient for high corruption is negative, but marginally significant (10 percent level).

[12] Our exchange rate variable is the local currency unit per US dollar. The positive sign of the exchange rate variable means that as currency depreciates (you need more of local currency to buy US dollar) then FDI increases. Blonigen (2005) presents a good discussion on the effect of exchange rates on FDI. He also provides a good discussion on the expected signs of the other variables.

We explore whether the effect of tax haven FDI inflows differs for LDCs by including an interaction term between the LDC dummy and FDI inflows to the nearest tax haven. Estimates including this interaction term are shown in column 2 of Table 3. Interestingly, we find that the estimated coefficient for the interaction term is positive and statistically significant at the 1 percent level, while the estimated coefficient for *TH_FDI* became insignificant. This provides evidence that FDI inflows to tax havens are influential for LDCs but not for DCs. It also suggests that the significance of the estimated coefficient for *TH_FDI* in the first set of estimates (without the interaction term) was primarily driven by the effect on LDCs. Further, the results support the argument that, because LDCs and DCs do not share the same coefficients in FDI models (Bloningen and Wang, 2005), pooling them together is inappropriate. Accordingly, the specifications to follow exclude DCs from our sample, allowing us to focus on the impact of tax havens on FDI inflows for LDCs in an appropriate fashion.

IV. Estimation Results using LDCs only

To further investigate the implications of tax haven activity for LDCs, we first estimate equation 1 using all available observations for LDCs during the 1990-2008 period (108 countries, unbalanced panel estimation). Estimates for the unbalanced panel of LDCs are shown in column 3 of Table 3. The estimated coefficient for *TH_FDI* is positive and statistically significant at the 1 percent level, similar to our findings in column 1.

We estimate our model in a balanced panel framework to obtain more consistent results and to allow further exploration into the role of geography. For the balanced panel of LDCs, we restrict our sample to LDCs for which complete data is available, yielding a sample of 94 LDCs

with observations between 1995 and 2007.[13] Summary statistics for the balanced panel composed of only LDCs are shown in Table 2 (part b). Estimates of the balanced panel of LDCs are given in column 4 of Table 3. In this estimation, we observe the estimated coefficient on *TH_FDI* to be positive and statistically significant at the 5 percent level. Notably, the *TH_FDI* coefficient (0.046) is of similar magnitude to the one obtained for the unbalanced panel of LDCs (0.06) as well as the full sample including both DCs and LDCs (0.042). Looking at the estimates shown in column 4 of Table 3, a 1 percent increase in FDI inflows in the nearest tax haven is associated with an estimated 0.05 percent increase in FDI on average.[14] Quantifying this effect in US dollar terms using mean values, we find that a 0.38 million dollar or 1 percent increase in FDI in the nearest tax haven leads to a predicted 0.03 million dollar or 0.05 percent increase in FDI for the average country. This effect can also be expressed as follows: a one dollar increase in FDI in the nearest tax haven will lead to a predicted 0.09 dollar increase in FDI in the average LDC. Thus, the magnitude of the effect seems significant in terms of FDI inflows for LDCs.

The coefficients for the control variables were largely similar across the first three specifications (Table 3, columns 1, 2, and 3). In the last specification (where we use the balanced panel of LDCs; Table 3, column 4) the estimated coefficients for initial GDP, population, and openness continue to be positive and statistically significant at the 1 percent level. In contrast, the estimated coefficient for exchange rate switches from positive to negative and becomes statistically insignificant. The control variable coefficients related to institutions are also no longer significant. In relation to the regional dummies, the estimated coefficients for America, Asia and Europe retain the same signs, but the coefficients for America and Asia are less

[13] In some cases, linear interpolation was used to ensure that there were no gaps in the series, allowing us to estimate our model in a balanced panel.

[14] All the variations of the model in Table 3 were estimated using a variable that included FDI to nearest tax haven weighted by the distance. Previous results are robust to including the distance weighted tax haven FDI indicator, and these results were not include for the purpose of brevity (available upon request).

significant. The Pacific dummy becomes negative and significant at the 10 percent in this estimation.

The potential endogeneity of tax haven FDI is an important consideration. Although it is possible that FDI inflows to a LDC drive FDI inflows to nearby tax havens, there is no theoretical basis to expect this sort of causality. The essential motivation for investing in a LDC is different from that of a tax haven because of country characteristics. As defined by Hines (2007), tax havens tend to be small, well governed countries with low tax rates. Thus, FDI inflows to LDCs and tax havens are not likely to be endogenously determined. It could be argued, however, that positive spillovers in terms of FDI flows from LDCs to tax havens might still be present. In this case, an endogeneity test is recommended to determine whether there is evidence of endogenous determination of tax haven FDI in our data.

Following the model specified in column 4 of Table 3, we perform a Durbin-Wu-Hausman test. Our instrument is the amount of FDI outflows from a LDC. This variable is an appropriate instrument for two reasons. First, when regressing *TH_FDI* on FDI outflows of LDCs, we find that FDI outflows in LDCs have a positive and significant effect on *TH_FDI* inflows at the 1 percent level. Furthermore, we find that FDI outflows are not endogenously determined because FDI outflows have no significant effect on the residual of the estimation shown in column 4 of Table 3. To perform the endogeneity test, we regress our suspected endogenous variable, *TH_FDI,* on all exogenous variables specified in our model and the proposed instrument. The residual from this estimation is included on the right hand side of the equation of our model specified in column 4 of Table 3. We find that the residual is not

statistically significant even at the 40 percent level, implying that OLS estimates are consistent and there is no endogeneity.[15]

V. Estimation of Balanced Panel of LDCs with Spatial Considerations

Next we refine our estimations using a balance panel of LDCs. Results are given in Table 4. To further determine the nature of geographic spillovers in our analysis of tax haven FDI inflows on LDCs, we construct three dummy variables that account for different levels of proximity to the closest tax haven: *CLOSE*, *MEDIUM*, and *FAR*. The categories create a fairly equal distribution of countries among the three groups, where the cut off points are related to the mean plus/minus one half the standard deviation.[16] The *MEDIUM* dummy variable is the omitted category in our estimations, making this group the benchmark. We also include interaction terms of the distance dummies and TH_FDI. The distance dummies are also interacted with *TH_FDI* to capture geographic diffusion of spillovers. Positive (negative) estimated coefficients of the distance dummies and the interaction term would indicate that greater FDI inflows in the nearest tax haven are associated with greater (lower) FDI inflows for countries in that distance group compared with the omitted group (countries that are in the medium range).

OLS Estimates in column 1 of Table 4 suggest that the impact of tax haven activities on FDI inflows to LDCs comes from both agglomeration and geographic diffusion effects. In terms of the agglomeration, we find that FDI inflows to tax havens have a positive and significant

[15] Results for the endogeneity test are not included to conserve space but are available upon request. The estimations for the endogeneity test are unbalanced due to missing observations for the instrumental variable (natural log of FDI ouflows in US dollars, truncated for negative values with a value close to zero).

[16] See Table 1 for an explanation on how these dummies were constructed. The standard deviation of the distance to the nearest tax haven category is almost 71 percent of its mean value. Thus, using half standard deviation allows for a more equal distribution of countries among groups.

effect (at 5 percent level) on LDC FDI inflows. In relation to geographic diffusion, the positive coefficient for the *TH_CLOSE* and its statistical significance at the 5 percent level suggest that LDCs within a close distance of a tax haven experience higher levels of FDI inflows than those that are in the medium range, ceteris paribus. The coefficient on *TH_FAR* is smaller and is marginally significant (significance at the 10 percent level) suggesting that LDCs with a distant tax haven do not seem to benefit more than those LDCs with a tax haven in the medium range. Taken together this suggests that a proximity premium accrues to the LDCs within a close range of a tax haven. In this estimation, a 1 percent increase in FDI to the nearest tax haven is associated with an increase in FDI of 0.12 percent. On average, LDCs with the nearest tax haven in the close range have 109 percent higher levels of FDI than those LDCs with a tax haven in the medium range. The impact of tax haven proximity seems to have an effect of significant magnitude under this estimation.

To check for the robustness of our estimations for the balanced panel of LDCs, it is important to consider other factors that relate to regional capital inflows. For example, if our previous findings are just representative of omitted, underlying regional factors, then the estimated effects of tax haven activity could be biased. Accordingly, we estimate our model of FDI for the balanced panel including the lag of the dependent variable. Including the lag of the dependent variable, corrects for autocorrelation, where there is the possibility that FDI inflows to the nearest tax haven might be just capturing FDI inflows to a specific geographic region or country.

OLS estimates including the lag of the dependent variable are shown in column 2 of Table 4. While the estimated coefficient for the lag of the dependent variable is positive and statistically significant at the 1 percent level, the estimated *TH_FDI* coefficient becomes

insignificant. The estimated coefficient for *TH_CLOSE*, however, continues to be positive and statistically significant at the 5 percent level. These estimates support Rose and Spiegel's (2007) conclusion that geographic diffusion matters. In particular, we estimate that countries with a nearby tax haven have levels of FDI that are 83 percent higher, even controlling for lagged values of FDI and for the level of FDI in the nearest tax haven.

VI. Estimation with Spatial Error and Spatial Lag

Finally, we investigate the potential for spatial interdependence of FDI. Specifically, we estimate a model that considers structural instability in the form of non-constant error variances. The spatial error model corrects for the potential bias resulting from the possibility that FDI inflows in one country may be dependent on the FDI inflows of nearby countries.[17] This model is recommended when spatial dependence is expected in the disturbance term because the OLS estimator is no longer efficient and provides biased standard errors (Anselin, 1988, 1999).

The error term in the spatial error model is specified as $\lambda W_{\varepsilon} + u_{i,t}$, where λ represents the coefficient for the spatially correlated error and W, which is the weighting matrix, is an NxN symmetric matrix that represent proximity between country i and country j. For the spatial error model in a panel framework, following Bloningen et al. (2007), W is composed by TxT matrices of dimension IxI (T=time periods, I=countries). In this estimation, W is a diagonal matrix where there are 26 matrices of dimension 94x94 in the main diagonal (W is a 1222x1222 matrix). The elements of the diagonal matrices are constructed in a way where the inverse of the distance from country i to country j is used for all non-diagonal terms and zeros for the diagonal terms. Elements of the diagonal matrices are weighted so that one element of the matrix is equal to 1 for

[17] Refer to Kelejian and Prucha (1999) and Kapoor et al. (2007) for a discussion of the problems that arise when errors are spatially correlated.

the two countries with the shortest bilateral distance, and all the other non-diagonal elements of the matrix are decreasing as distance increases.[18]

We also consider spatial interdependence by estimating a spatial lag model by including a spatially lagged dependent variable on the right hand of the equation.[19] A spatial autoregressive term is included as an independent variable. The spatial autoregressive parameter is specified as $\rho W_y FDI_{i,t}$, where W represents the same weighting matrix described above and ρ is the parameter to be estimated to account for the spatial autocorrelation of FDI.

The spatial error and lag models are estimated with the maximum likelihood estimator (MLE) and W is normalized so that each row sums to unity.[20] The Lagrange multiplier test will be used to determine whether errors are spatially correlated (spatial error) or there is a spatial autocorrelation (spatial lag).[21] When comparing which model is more adequate, the model that gives the largest value for the Lagrange multiplier test statistic is preferred (Anselin, 2005).

The estimates obtained when using MLE estimation and allowing for spatial correlation of the error term and spatial autocorrelation are shown in columns 3 and 4 of Table 4, respectively. For the spatial error model (column 3), we find evidence of a spatially correlated error term from the Lagrange multiplier test: we reject the hypothesis that the error term is not spatially correlated (Ho: λ=0) at the 1 percent level. These estimates are similar to previous ones. We find that the estimated coefficient for *TH_FDI* is positive and statistically significant at the 10 percent level. The estimated *TH_CLOSE* remains positive and statistically significant at

[18] For the non-diagonal terms in the diagonal matrices of the W matrix, we use the distance between the most important cities and agglomerations in countries (provided by Mayer and Zignago, 2006). See Blonigen et al. (2007) for further explanation on the construction of the W matrix.
[19] Blonigen et al. (2007) empirically analyze the determinants of FDI and find that there is spatial interdependence. They use a spatial lag model since they are interested in determining the existence and the nature of spatial interdependence.
[20] Our MLE estimates show robust standard errors since the estimator of variance uses the Huber/White estimator instead of the traditional calculation.
[21] Refer to LeSage (1999) for a discussion on how to estimate the spatial error and lag models and how to test for the presence of spatially correlated errors and spatial autocorrelation.

the 5 percent level, where LDCs with the nearest tax haven in close range have a predicted 123 percent higher level of FDI compared with LDCs whose nearest tax haven is in the medium range. Quantifying the effect of in dollar terms, we compare LDCs with a tax haven in the close range with LDCs with a tax haven in the medium range using the coefficients from the spatial error model and mean values. We find that LDCs with a tax haven in the close range have on average a 270 million dollars more in FDI than those LDCs with a tax haven in the medium range.

The estimates for the spatial lag model are shown in column 4 of Table 4. Again, we reject the null that FDI is not spatially autocorrelated (Ho: $\rho=0$). The results suggest that our previous estimates of tax haven impacts and proximity are robust. Similar to the spatial error results, the estimated *TH_FDI* coefficient is positive and statistically significant at the 10 percent level. The estimated *TH_CLOSE* coefficient is positive and statistically significant at the 5 percent. Investigation of the Lagrange multiplier test results, suggest that the spatial error model is preferred to the spatial lag model.

To summarize, our analysis supports the argument that tax haven activity creates positive FDI spillovers to LDCs. Out of the eight estimations presented in this paper, the estimated impact of FDI in the nearest tax haven is found to be statistically significant at the 5 percent level in 5 specifications, and significant at the 10 percent level in 2 specifications. Furthermore, the dummy variable for close proximity to the nearest tax haven has a statistically significant impact at the 5 percent level in all the estimations included. We address potential endogeneity of tax haven FDI inflows and FDI autocorrelation. Our estimations give credence to the spatial error and spatial autocorrelation specifications and alleviate concern that estimated impacts reflect potentially omitted regional effects. Interestingly, these spatial models suggest that LDCs that are

within a close range of the nearest tax haven display higher levels of FDI in all estimations. These findings are consistent with the arguments found in the literature concerning the potential for positive spillovers to accrue to LDCs as a result of tax haven activities and highlight the importance of geographic location.

VII. Conclusion

Using a panel data framework and a variety of estimation procedures, the empirical analysis developed in this paper suggests that FDI activity in tax havens leads to greater FDI in nearby non-tax haven countries, and that impacts on LDCs are likely to differ from impacts on DCs. We find that the overall spillover effects of tax havens are greater for LDCs with a tax haven nearby compared with LDCs which are situated farther from the nearest tax haven. This finding runs contrary to the popular argument that tax haven activity is likely to be especially damaging to LDCs.

Looking at our particular sample and focusing on the role of proximity to a given tax haven we can see how there might be important spillover effects at play. Taking the tax haven of Belize, for example, we observe that El Salvador, Guatemala, Honduras, Mexico and Nicaragua benefit in terms of FDI by being in close proximity to Belize. Furthermore, in relation to another tax haven in Latin America, say Panama, we also observe that some countries might accrue greater FDI spillovers by being in closer proximity than others. Colombia, Costa Rica and Ecuador are in the close range to Panama, while Bolivia, Chile and Peru are in the middle and far range.

Our results warrant a few caveats. In contrast to typical tax haven studies where exogeneity of FDI is problematic, the FDI inflows to tax havens are likely to be exogenous to

FDI inflows of non-tax haven LDCs as discussed before. Even if tax havens are drawn to areas with an agglomeration of FDI activity (DFH 2006b), this activity is not likely driven by non-tax haven LDC activity. To the extent that it affects our results, we argue that it may not be the tax haven per se that drives the spillovers, but rather the effect of being in a FDI-rich region. We mitigate omitted bias concerns by including regional dummies and institutional features, and by correcting for autocorrelation, spatial error correlation, and spatial autocorrelation. While we address endogeneity in our analysis, omitted variable bias may still be present. In addition, the exact form of spatial diffusion of tax haven impacts is unknown. Accordingly, the precise nature of geographic diffusion warrants further investigation.

Notably, our general conclusions are based on a single outcome measure, FDI inflows. To the extent that FDI inflows are related to growth outcomes (Hansen and Rand, 2006; Oliva and Rivera-Batiz, 2002), our results suggest that there is a positive neighborhood effect for LDCs. The importance of proximity to tax havens, however, is likely to have differential impacts on other outcome measures, particularly those that more closely capture welfare measures. For such outcomes, it is possible that tax competition factors could be more important than spillover influences for LDCs. Our analysis provides a starting point for such future investigations.

From a policy perspective, we support Altshuler's (2006) suggestion that the limited ability of LDCs to combat tax haven policies in other countries need not doom LDCs to a bleak future. That is, if indeed the net overall benefits to multinational firms result in greater capital investments in non-tax havens, including LDCs, then there is a potential that LDCs may fare better with the tax haven crumbs that spill over to them than they would in a world with less tax haven activity. In such a scenario, LDCs should design policy with the goal of reaping

additional benefits from tax haven proximity. Policies such as improving the regulatory environment, making it easier to do business, reducing red tape, and increasing transparency might allow LDCs to benefit the most from potential positive spillovers derived from tax haven proximity. We conclude that tax havens appear to be good neighbors for LDCs in terms of FDI inflows.

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Table 1. Variable description and source

	Variable description and source
FDI	Natural log of FDI inflows in millions of US dollars. Negative values are imputed using a number close to zero (1e-10). Source: UNCTAD (2010)
TH_FDI	Natural log of FDI inflows to the closest tax haven, in millions of US dollars. Negative values are imputed using a number close to zero (1e-10). Source: UNCTAD (2010)
TH_distance	Natural log of the distance to the closest tax haven in kilometers (tax havens are those countries defined by Dharmapala and Hines (2009), see table A2). Distance is calculated with the latitudes and longitudes of the most important cities and agglomerations. Source: Mayer and Zignago (2006)
Distance dummies: *CLOSE*, *MEDIUM*, and *FAR*	Dummies are constructed using the distance to the closest tax haven, by grouping countries using the mean plus and minus one half of the standard deviation. *FAR* is equal to 1 if the distance to the closest tax haven is greater or equal to 2875 kilometers, and zero otherwise. *MEDIUM* is equal to 1 if the distance to the closest tax haven is less than 2875 but greater than 1369 kilometers, and zero otherwise. *CLOSE* is equal to 1 if the distance to the closest tax haven is lesser or equal to 1369 kilometers, and zero otherwise.
GDP_initial	Natural log of the initial level of real GDP per capita at the beginning of the period (constant 2000 US dollars). When it was not available for the full sample, we use the available value between 1991 and 1995. Source: WDI (2010)
Population	Natural log of population. Source: WDI (2010)
Exchange_rate	Natural log of exchange rate (LCU per US$). Source: WDI (2010)
Openness	Natural log of exports plus imports divided by real GDP. Source: WDI (2010).
Landlocked	Dummy equal to 1 for landlocked countries, and equal to zero otherwise. Source: Mayer and Zignago (2006).
Regional_dummies	Set of dummies equal to 1 for countries in Africa, America, Asia, Europe, and Pacific, respectively. Source: Mayer and Zignago (2006)
Corruption	Equal to 1 if a country has an index of control of corruption one standard deviation below the mean, and equal to zero otherwise (average from 1996 to 2008). Source: Kaufmann, Kraay, and Mastruzzi (2009)
British_legal_origin	Dummy equal to 1 if the country has a British legal origin, and zero otherwise. Source: La Porta et al. (1999)
Fiscal_freedom	Average of the fiscal freedom index using available observations (1995 to 2006). Index takes into consideration tax on individual and corporate income and tax revenue as a percentage of GDP. Source: Heritage Foundation (2010)

Table 2A. Summary statistics – Full sample (DCs and LDCs)

	Mean	Max.	Min.	Std. Dev.	Obs.
FDI	4.1970	12.6902	-23.0259	6.8791	2629
TH_FDI	3.1808	11.6927	-23.0259	8.3513	2677
TH_Distance	7.1812	8.6480	4.4537	0.8582	2698
LDC	0.7606	1.0000	0.0000	0.4268	2698
GDP_initial	7.2981	10.4154	4.8604	1.4819	2679
Population	16.0135	21.0044	11.1563	1.7173	2695
Exchange_rate	2.9630	9.6991	-19.8478	3.0579	2601
Openness	4.2276	5.6470	2.3824	0.4969	2635
Landlocked	0.2254	1.0000	0.0000	0.4179	2698
High_corruption	0.0634	1.0000	0.0000	0.2437	2698
British_legal_origin	0.2817	1.0000	0.0000	0.4499	2698
Fiscal_freedom	69.7271	99.9000	32.6805	12.5826	2698

Summary statistics constructed with available data between 1990 and 2008 for 142 countries (34 DCs and 108 LDCs). In terms of regional location, 48 of the sample are in Africa, 23 in America, 34 in Asia, 30 in Europe, and 7 in the Pacific.

Table 2B. Summary statistics – Balanced panel of LDCs (Obs=1222)

	Mean	Max.	Min.	Std. Dev.
FDI	4.4530	11.3329	-23.0259	5.6696
TH_FDI	3.6308	11.6927	-23.0259	6.8916
TH_Distance	7.3760	8.6480	5.6201	0.7998
GDP_initial	6.6432	8.8814	4.7446	1.0548
Population	16.1737	20.9993	11.2293	1.7278
Exchange_rate	3.9570	10.1266	-5.8962	2.6814
Openness	4.2573	5.5323	2.6928	0.4874
Landlocked	0.2447	1.0000	0.0000	0.4301
High_corruption	0.1170	1.0000	0.0000	0.3216
British_legal_origin	0.2766	1.0000	0.0000	0.4475
Fiscal_freedom	72.0338	91.4465	39.9587	9.9583

Country locations are as follows: 42 in Africa, 19 in America, 22 in Asia, 9 in Europe, and 2 in the Pacific. Regarding proximity, 38 countries are in the closest range, 29 in the medium range, and 27 in the far range. For balanced panel we use linear interpolation when there are missing observations.

Table 3. General Estimations

Independent Variable	(1) Full sample DCs and LDCs	(2) Full Sample DCs and LDCs	(3) LDCs Unbalanced panel	(4) LDCs Balanced panel
TH_FDI	0.042 (0.020)**	-0.022 (0.030)	0.060 (0.024)***	0.046 (0.023)**
LDC	-1.153 (0.484)**	-1.558 (0.490)***		
*TH_FDI*LDC*		0.091 (0.036)**		
GDP_initial	0.578 (0.140)***	0.577 (0.140)***	0.758 (0.192)***	0.545 (0.165)***
Population	1.564 (0.152)***	1.556 (0.152)***	1.492 (0.165)***	1.097 (0.140)***
Exchange_rate	0.151 (0.058)***	0.151 (0.058)***	0.138 (0.069)**	-0.122 (0.080)
Openness	2.489 (0.416)***	2.480 (0.409)***	2.375 (0.453)***	0.871 (0.325)***
Landlocked	-0.417 (0.365)	-0.401 (0.370)	-0.544 (0.438)	-0.531 (0.571)
High_corruption	-0.904 (0.535)*	-0.953 (0.539)*	-0.909 (0.562)	-0.424 (0.450)
British_legal_origin	0.351 (0.287)	0.343 (0.285)	0.299 (0.303)	-0.038 (0.219)
Fiscal_freedom	0.028 (0.013)**	0.025 (0.013)*	0.061 (0.018)***	0.010 (0.020)
America	1.663 (0.390)***	1.643 (0.399)***	0.975 (0.388)**	0.943 (0.540)*
Asia	-1.035 (0.335)***	-1.077 (0.333)***	-1.009 (0.383)***	-0.551 (0.298)*
Europe	1.645 (0.410)***	1.588 (0.418)***	1.094 (0.303)***	1.008 (0.293)***
Pacific	1.032 (1.020)	1.015 (1.013)	0.236 (1.201)	-2.353 (1.388)*
Constant	-37.619 (4.152)***	-36.906 (4.112)***	-40.484 (4.873)***	-20.964 (4.012)***
R-squared	0.224	0.226	0.214	0.176
Observations	2492	2492	1888	1222
Number of Countries	142	142	108	94

OLS estimates with panel corrected standard errors in parenthesis. *, **, and *** indicate significance at 10, 5 and 1 percent level, respectively. The dependent variable is total FDI inflows. Time dummies included in all estimations.

Table 4. Estimations Related to Space (Balance Panel of LDCs)

Independent Variable	(1) OLS Panel corrected standard errors	(2) OLS Panel corrected standard errors	(3) MLE Spatial Error robust errors	(4) MLE Spatial Lag robust errors
TH_FDI	0.119 (0.059)**	0.082 (0.053)	0.117 (0.071)*	0.119 (0.071)*
TH_close	1.093 (0.463)**	0.829 (0.423)**	1.235 (0.616)**	1.191 (0.612)**
TH_far	0.995 (0.529)*	0.939 (0.515)*	0.994 (0.732)	0.936 (0.722)
*TH_FDI*TH_close*	-0.097 (0.069)	-0.062 (0.062)	-0.095 (0.078)	-0.096 (0.078)
*TH_FDI*TH_far*	-0.102 (0.072)	-0.095 (0.068)	-0.087 (0.081)	-0.094 (0.081)
FDI_lag		0.352 (0.095)***		
GDP_initial	0.577 (0.190)***	0.315 (0.242)	0.517 (0.285)*	0.537 (0.276)**
Population	1.038 (0.136)***	0.600 (0.164)***	1.032 (0.131)***	1.001 (0.129)***
Exchange_rate	-0.132 (0.083)	-0.115 (0.074)	-0.134 (0.093)	-0.141 (0.092)
Openness	0.688 (0.329)**	0.215 (0.362)	0.795 (0.374)**	0.708 (0.357)**
Landlocked	-0.600 (0.614)	-0.727 (0.513)	-0.696 (0.478)	-0.623 (0.470)
High_corruption	-0.203 (0.465)	0.208 (0.357)	-0.293 (0.515)	-0.231 (0.507)
British_legal_origin	-0.040 (0.189)	-0.094 (0.189)	0.138 (0.354)	0.076 (0.329)
Fiscal_freedom	0.011 (0.019)	0.003 (0.017)	0.012 (0.018)	0.008 (0.018)
America	0.686 (0.520)	0.484 (0.551)	0.756 (0.464)*	0.693 (0.451)
Asia	-0.383 (0.327)	-0.162 (0.441)	-0.441 (0.514)	-0.442 (0.479)
Europe	1.042 (0.382)***	0.830 (0.420)**	0.884 (0.420)**	0.930 (0.378)***
Pacific	-1.447 (1.535)	-1.181 (1.836)	-1.794 (1.846)	-1.752 (1.770)
Constant	-20.218 (4.060)***	-10.164 (4.610)**	-18.835 (4.540)***	-18.548 (4.346)***
Lambda/Rho			0.228 (0.098)**	0.180 (0.088)**
Lagrange mult. test (prob)			6.163(0.01)	5.007(0.03)
R-squared/Log-likelihood	0.180	0.286	-3729.198	-3729.896
Observations	1222	1128	1222	1222

MLE estimates in columns 3 and 4 with robust standard errors in parenthesis. *, **, and *** indicate significance at 10, 5 and 1 percent level, respectively. The dependent variable is total FDI inflows. Time dummies included in all estimations.

Appendix:

Table A1. Country Sample

LDCs (n=108)			DCs (n=34)
Albania	Gabon	*Niger*	Australia
Algeria	Gambia, The	Nigeria	Austria
Angola	*Georgia*	Pakistan	Canada
Argentina	Ghana	Papua New Guin.	Croatia
Armenia	Guatemala	Paraguay	Czech Republic
Azerbaijan	Guinea	Peru	Denmark
Bangladesh	Guinea-Bissau	Philippines	Equatorial Guin.
Belarus	Guyana	Romania	Estonia
Benin	Honduras	Russian Fed.	Finland
Bhutan	India	Rwanda	France
Bolivia	Indonesia	Senegal	Germany
Botswana	Iran, Islamic Rep.	Seychelles	Greece
Brazil	*Jamaica*	Sierra Leone	Hungary
Bulgaria	Kazakhstan	*Solomon Islands*	Iceland
Burkina Faso	Kenya	South Africa	Israel
Burundi	*Kiribati*	Sri Lanka	Italy
Cambodia	Kyrgyz Republic	Sudan	Japan
Cameroon	Lao PDR	*Suriname*	Korea, Rep.
Cape Verde	Lesotho	Swaziland	Kuwait
Cen. African Rep.	*Libya*	*Syrian Arab Rep.*	Latvia
Chad	Lithuania	Tajikistan	New Zealand
Chile	Macedonia, FYR	*Tanzania*	Norway
China	Madagascar	Thailand	Oman
Colombia	Malawi	Togo	Poland
Comoros	Malaysia	Tonga	Portugal
Congo, Dem. Rep.	Mali	Tunisia	Saudi Arabia
Congo, Rep.	Mauritania	Turkey	Slovak Republic
Costa Rica	Mauritius	*Turkmenistan*	Slovenia
Cote d'Ivoire	Mexico	Uganda	Spain
Djibouti	Moldova	Ukraine	Sweden
Dominican Rep.	Mongolia	Uruguay	Trin. and Tob.
Ecuador	Morocco	*Uzbekistan*	United Arab Em.
Egypt, Arab Rep.	Mozambique	Venezuela, RB	United Kingdom
El Salvador	Namibia	Vietnam	United States
Ethiopia	Nepal	*Yemen, Rep.*	
Fiji	Nicaragua	Zambia	

Italics indicate the 15 LDCs which were not included in the balanced panel estimation.
Note: Haiti was not included in the initial estimation with all countries due to unavailability of data for the early 1990s, but was included in the balanced panel estimation.

Table A2. Tax havens (N= 34)

Anguilla	Gibraltar	Montserrat
Antigua & Barbuda	Grenada	Netherlands Antilles
Bahamas	Hong Kong	Panama
Bahrain	Ireland	Singapore
Barbados	Jordan	St. Kitts and Nevis
Belize	Lebanon	St. Lucia
Bermuda	Liberia	St. Vincent & Gren.
British Virgin Is.	Luxembourg	Switzerland
Cayman Islands	Macao	Turks & Caicos Islands
Cook Islands	Maldives	Vanuatu
Cyprus	Malta	
Dominica	Marshall Islands	

Tax havens used to compute tax haven distance and FDI inflows to closest tax haven variables.