

# Robust FDI Determinants: Bayesian Model Averaging In The Presence Of Selection Bias<sup>1</sup>

Theo S. Eicher  
University of Washington, Seattle

Lindy Helfman  
University of Washington, Seattle

Alex Lenkoski  
Heidelberg University

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The literature on Foreign Direct Investment (FDI) determinants is remarkably diverse in terms of competing theories and empirical results. We utilize Bayesian Model Averaging (BMA) to resolve the model uncertainty that surrounds the validity of the competing FDI theories. Since the structure of existing FDI data is known to induce selection bias, we extend BMA theory to HeckitBMA to address model uncertainty in the presence of selection bias. We then show that more than half of the previously suggested FDI determinants are no longer robust and highlight theories that receive support from the data. In addition, our selection approach allows us to highlight that the determinants of margins of FDI (intensive and extensive) differ profoundly in the data, while FDI theories do not usually model this aspect explicitly.

<sup>1</sup> Theo Eicher is Professor of Economics, Department of Economics, University of Washington, Box 353330, Seattle WA 98195. E-mail: te@uw.edu. Web: faculty.washington.edu/te. We thank Christian Lorenczik, Monique Newiak, and Chris Papageorgiou for helpful suggestions. Assaf Razin and Hui Tong kindly shared their data. Lenkoski gratefully acknowledges support by the joint research project "Spatio/Temporal Graphical Models and Applications in Image Analysis" funded by the German Science Foundation (DFG), grant GRK 1653 as well as the MAThematics Centre Heidelberg (MATCH).

## 1. Introduction

Global FDI flows increased tenfold, or by about \$2 trillion, from 1990 to 2008 (UNCTAD, 2009), nevertheless a consensus on robust FDI determinants is still elusive. While remarkably diverse FDI theories have motivated a wide range of potential FDI determinants, empirical FDI approaches commonly juxtapose only limited subsets of candidate regressors.<sup>1</sup> In light of this model uncertainty, it comes as no surprise that FDI coefficient estimates are well known to be ambiguous and at times contradictory. In the most comprehensive survey to date, Blonigen (2005) summarizes the FDI model uncertainty succinctly: “in the final analysis, the empirical literature on determinants of FDI is still young enough that most hypotheses are still up for grabs.”

Using Extreme Bound Analysis, Chakrabarti (2001) provided the first systematic evidence of the fragility of FDI determinants.<sup>2</sup> The ad hoc Extreme Bound approach has since been superseded by statistical theory, which developed Bayesian Model Averaging (BMA) to account for model uncertainty as part of the estimation procedure (Raftery, 1995). The BMA approach is important since Berger and Sellke (1987) have shown that conventional sensitivity analyses overstate significance and confidence intervals in the absence of a full account of model uncertainty. When model uncertainty is not addressed comprehensively, it remains unclear whether a statistically significant FDI determinant remains relevant when alternative specifications/theories are considered. BMA methodology is thus tailor-made to examine the large set of candidate regressors that have been proposed as FDI determinants by alternative FDI theories.

An added complication in FDI empirics is that even the most comprehensive FDI datasets contain large sections of missing data. Selection bias may thus contaminate coefficient estimates, since it is unclear whether the nature of FDI forces the lion’s share of investment to occur among OECD countries, or whether this observed FDI pattern is

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<sup>1</sup> For example, Blonigen and Piger (2011) note that three key empirical FDI studies include no fewer than 22 different FDI determinants, but with little overlap. Baltagi et al. (2007) include a table that juxtaposes 4 alternative FDI theories that motivate 15 different FDI determinants.

<sup>2</sup> Leamer (1978) suggested Extreme Bound Analysis as an ad hoc sensitivity analysis in the presence of model uncertainty. EBA has been criticized for its lack of statistical foundations. His implementation also restricted Chakrabarti (2001) to a limited number of models.

an artifact of systematically missing observations.<sup>3</sup> To address both model uncertainty and selection bias we introduce HeckitBMA, which extends the statistical foundations of BMA to include Heckman's (1979) selection bias procedure.

HeckitBMA reveals not only the determinants of the intensive and extensive margins of FDI ("the volume of investment flows" and "the decision to invest", respectively), it also permits us to estimate FDI determinants without having to constrain parameter estimates to be identical across both margins. There is no reason to suspect that the margins of FDI should feature identical determinants, or that the same determinant has the identical impact on both margins. Our selection criterion is based on Razin, Rubinstein and Sadka (2004), who note that FDI involves fixed costs that give rise to two-part decisions: a marginal productivity condition that determines *how much* to invest, and a total profitability condition that indicates *whether or not* to invest abroad. Previous studies have confirmed the relevance of such FDI fixed costs.<sup>4</sup>

Our results show that the impact of model uncertainty on FDI estimates is substantial and that the Heckman selection methodology is necessary. Without controlling for model uncertainty, the conventional Heckit procedure suggests nearly twice as many FDI determinants as HeckitBMA at the extensive margin and 12 additional regressors (33%) at the intensive margin. This is not surprising, since Heckit is not designed to consider models associated with alternative theories. Instead, HeckitBMA discovers much more parsimonious models of FDI that score decisively better in terms of joint likelihoods or Bayesian Information Criteria (BIC).

According to HeckitBMA, the intensive margin of FDI is influenced by *country characteristics* such as common history/language, and the absence of corruption and religious/internal conflict in the host country, as well as better democratic/bureaucratic/corruption institutions in source countries. Robust *economic determinants* of greater FDI flows at the intensive margin include common currencies/RTAs (specifically, the dollar and APEC), larger market sizes, and lower taxes

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<sup>3</sup> This FDI data issue has been well documented as early as Soto (2000). OECD data covers FDI activity among OECD countries comprehensively, but OECD/Non-OECD coverage is spotty and Non-OECD country-pairs are nonexistent.

<sup>4</sup> Caballero and Engel (1999, 2000), Razin, Rubenstein, and Sadka (2004), Razin and Sadka (2006).

in the host and source countries. In addition, market potential, lower growth, development, and productivity in host countries reduce FDI flows.

In stark contrast, the decision to invest has markedly fewer determinants. Country characteristics that affect the extensive margin are common colonial history/borders, as well as the lack of religious tension in the host and lower corruption in source countries. Economic factors that increase the likelihood of FDI investment include host and source country market size, as well as the hosts market potential and level of development. Greater source country productivity, taxation, or economic tensions decrease the likelihood that FDI is undertaken.

The importance of these FDI determinants is best appreciated once we relate the individual regressors back to specific FDI theories. We find only mixed support for horizontal or export platform FDI theories (Markusen, 1984). Trade agreements and currency unions do not encourage FDI across the board but only in specific instances (e.g., dollarization and APEC membership), while host market potential exerts a decisive effect on FDI that runs contrary to the theory prediction. As in Blonigen et al. (2007), we find that a host's proximity to large markets results in *less* FDI – as large, proximate markets divert FDI from a potential small host, perhaps to take advantage of scale economies. Vertical FDI theory (Helpman, 1984) is not strongly supported since FDI is sensitive to higher levels of development and contrary to the knowledge-capital model that unified the horizontal and vertical theories (Markusen et al., 1996 and Markusen, 1997), we find no evidence that educational differences exert robust effects on either the intensive or extensive margins. HeckitBMA does confirm the Razin et al. (2007a) hypothesis that productivity is a crucial determinant of the decision to invest, together with corporate taxes in source and host countries. Bilateral tax treaties, in contrast, are shown to exert no impact on FDI, supporting the view that such treaties are created not only to facilitate investment, but also to restrict tax evasion and transfer pricing (the latter reduce FDI incentives).

Closely related to our paper is the body of work of Razin and Sadka (2007b), who separate the decision to invest from the quantity of FDI flows. Their pioneering empirical

work also consistently documents evidence for selection bias in FDI regressions.<sup>5</sup> We expand their approach to include the large number of regressors that have been suggested by alternative FDI theories. Methodologically, our approach is related to Chakrabarti's (2001) extreme bound analysis and to Blonigen and Piger (2011) who use Bayesian methods to analyze model uncertainty surrounding FDI stocks in a cross section. In contrast, we examine the dynamics of FDI flows from 1988-2000 and control for selection bias.

## 2. Empirical Methodology

Bergstrand and Egger (2007) provide theoretical foundations that motivate the use of gravity equations to analyze FDI patterns. The gravity equation has become the most popular approach in examining FDI determinants (see Barba Vanaretti and Venables, 2004), suggesting that FDI flows can be modeled according to

$$Y_{ijt} = \alpha_0 + \alpha_t + \beta_1 \log GDP_{it} + \beta_2 \log GDP_{jt} + \beta_3 \log D_{ij} + \beta_4 X_{ijt} + \varepsilon_{ijt}, \quad (1)$$

where the log of bilateral FDI at time  $t$ ,  $Y_{ijt}$ , depends positively on the market size of host,  $j$ , and source,  $i$ , countries,  $GDP_{jt}$ , and  $GDP_{it}$ , as well as on their bilateral distance,  $D_{ij}$ . Typically a matrix of covariates,  $X_{ijt}$ , is included to represent alternative FDI theories. These regressors are motivated at length in Section 4 below. The inclusion of time fixed effects,  $\alpha_t$ , is standard to eliminate bias resulting from aggregate global shocks. Time fixed effects also mitigate possible spurious correlation that could be introduced, for example, by the use of the U.S. CPI to deflate FDI flows.

The canonical selection bias framework is given by the system of equations<sup>6</sup>

$$\begin{aligned} Z &= \theta'W + \varepsilon \\ Y &= \beta'X + \eta \text{ (if } Z > 0) \end{aligned} \quad (1)$$

where  $Y$  is the dependent variable,  $X$  is a set of covariates, and  $Z$  is an unobserved factor that dictates whether  $Y$  is observed.  $Z$  is determined by a set of variables  $W$ , where  $X$  and  $W$  may share several variables. The error term of (1) is jointly distributed

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<sup>5</sup> FDI selection bias is also prominent in Davies and Kristjansdottir (2010), and Balsvik and Haller (2011).

<sup>6</sup> Whenever possible, we suppress subscripts to simplify notation.

$$\begin{pmatrix} \eta \\ \varepsilon \end{pmatrix} \sim N \left( \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\varepsilon^2 & \sigma_{\eta\varepsilon} \\ \sigma_{\eta\varepsilon} & \sigma_\varepsilon^2 \end{pmatrix} \right). \quad (2)$$

The classical selection bias arises when  $\sigma_{\eta\varepsilon}^2 \neq 0$ , which causes the OLS estimates of  $\beta$  that use only the observed values of  $Y$  to be biased.

Heckman (1979) proposes a method to correct this bias. His Heckit model first performs a probit regression on  $Z$ , which is equal to 1 if  $Y$  is observed and 0 otherwise, using  $W$  as covariates and yielding vector estimates,  $\hat{\theta}$ . Once  $\hat{\theta}$  is found,  $\tilde{Z} = \hat{\theta}'W$  is formed to obtain the Inverse Mills Ratio,  $\hat{\lambda} = \phi[\tilde{Z}]/\Phi[\tilde{Z}]$ , which is the ratio of the probability density function over the cumulative distribution function of  $\tilde{Z}$ . In a second stage, those  $Y$  that are observed are regressed on  $X$  and the Inverse Mills Ratio,  $\hat{\lambda}$ , yielding the consistent vector estimates,  $\hat{\beta}$ . The Inverse Mills Ratio (sometimes called “selection hazard”) is a function that is motivated by the properties of truncated normal distributions to control for selection bias. When the null hypothesis that the coefficient on the Inverse Mills Ratio is zero is rejected, selection bias is present and OLS estimates are downward biased.

HeckitBMA combines Heckit and BMA methodologies. Just like the Heckit methodology, HeckitBMA processes the data as a two stage estimator, but it also addresses model uncertainty in both stages. The first stage is an application of BMA for logistic regression based on Viallefont, Raftery and Richardson (2001) to form model averaged estimates of  $Z$  and  $\lambda$ . Below we introduce the two HeckitBMA stages in detail.

As we introduce HeckitBMA notation, it is helpful to review BMA properties that are implied in stage 1. Let  $Z = \alpha + \sum_{i=1}^p \theta_i W_i + \varepsilon$ , where  $W_1, W_2, \dots, W_p$  is a subset of  $W_1, W_2, \dots, W_n$ .<sup>7</sup> The set of potential models is comprised of the individual models  $\{M_1, \dots, M_S\}$ . BMA stipulates that the posterior distribution of  $\theta$  given the data,  $D$ , is given by the weighted average of the predictive distribution under each model. The specific weights are derived from the models’ corresponding posterior probabilities,

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<sup>7</sup> For a comprehensive BMA survey, see Raftery (1995) for detailed discussions and derivations.

$$pr(\theta_n | D) = \sum_{n \in M_s} pr(\theta_n | M_s, D) \pi_s \quad (3)$$

where  $pr(\theta_n | M_s, D)$  is the predictive distribution given model  $M_s$ , and  $\pi_s = pr(M_s | D)$  is the model's prior probability. The posterior model probability for each first stage model is

$$\pi_s = pr(M_s | D) = pr(D | M_s) pr(M_s), \text{ where} \quad (4)$$

$$pr(D | M_s) = \int pr(D | \theta_s, M_s) pr(\theta_s | M_s) d\theta_s \quad (5)$$

is the integrated likelihood of model  $M_s$  with parameters  $\theta_s$ . The prior densities for parameters and models are  $pr(\theta_s | M_s)$  and  $pr(M_s)$ , respectively.<sup>8</sup>

Posterior model probabilities are also the weights used to establish the posterior means and variances

$$\hat{\theta}^{BMA} = \sum_{s=1}^S \pi_s \hat{\theta}_s \quad (6)$$

$$\hat{\sigma}^{BMA} = \sum_{s=1}^S \left( Var[\theta_s | D, M_s] + (\hat{\theta}_s)^2 \right) \pi_s - E[\theta_s | D]^2 \quad (7)$$

The posterior distribution for a parameter is a mixture of a regular posterior distribution and a point mass at zero, which represents the probability that the parameter equals zero. The sum of the posterior probabilities of the models that contain a variable yields its inclusion probability, which is taken as a measure of the importance of that variable. For instance, for variable  $W_k$  we may write,

$$\mu^{BMA}(\theta_{W_k}) = pr(\hat{\theta}_{W_k} \neq 0 | D) = \sum_{s \in M_k} \pi_s \quad (8)$$

where  $M_k$  is a collection of indices for which  $s \in M_k$  implies model  $M_s$  does not restrict the parameter  $\theta_k$  to zero. The general rule developed by Jeffreys (1961) and refined by

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<sup>8</sup> We follow the literature with the standard assumption of uniform model priors (so that, ex ante, each model is presumed equally likely). Our parameter prior is the Unit Information Prior (see Raftery, 1995). This prior has been criticized as too conservative (e.g., returning too few effective regressors), but Eicher, Papageorgiou and Raftery (2011) show that in economic applications the prior density is sufficiently spread out to be reasonably flat over the region of the parameter space where the likelihood is substantial. Fernandez, Ley and Steel (2001) propose an alternative prior, which is also popular in economic applications, it is however, significantly more conservative and can have lower predictive performance.

Kass and Raftery (1995) stipulates effect-thresholds for posterior probability. Posterior probabilities  $< 50\%$  are seen as *evidence against* an effect, and the evidence for an effect is either *weak*, *positive*, *strong*, or *decisive* for posterior probabilities ranging from 50-75%, 75-95%, 95-99%, and  $> 99\%$ , respectively. In our analysis, we refer to a regressor as “effective,” if its posterior inclusion probability exceeds 50%.

## 2.1. Selection Bias and HeckitBMA

While BMA has previously been applied in the context of international economics,<sup>9</sup> our specific FDI application requires an extension of the canonical BMA theory to account for selection bias. When the structure of the data suggests the potential of selection bias, the BMA framework can be extended to a two-step Heckit model averaging procedure in which estimation is performed. HeckitBMA documents whether the absence of observed FDI flows is the result of randomly missing observations or due to endogenous FDI selection decisions that introduce bias to OLS coefficient estimates in previous FDI studies.

HeckitBMA is a nested BMA approach that establishes the posterior model probabilities in the first stage according to the BMA methodology, determining both  $\pi_s$  and  $\tilde{Z}_s$ , as well as the first stage fitted values for each model  $M_s$ . The methodology then forms the model averaged fitted value according to

$$\tilde{Z}^{BMA} = \sum_{s=1}^S \pi_s \tilde{Z}_s \quad (9)$$

and derives from this the Inverse Mills Ratio,  $\hat{\lambda}^{BMA} = \phi[\tilde{Z}^{BMA}] / \Phi[\tilde{Z}^{BMA}]$ .<sup>10</sup>

Denoting by  $L = \{L_1, \dots, L_N\}$  the set of second stage models, HeckitBMA uses  $\hat{\lambda}^{BMA}$  and the data,  $D$ , to derive the second stage posterior model probabilities,

<sup>9</sup> See e.g., Eicher, Henn, and Papageorgiou (2008) and Blonigen and Piger (2011). Other BMA applications in economics include investigations of growth determinants such as Fernandez, Ley and Steel (2001) and Eicher, Papageorgiou and Raftery (2011), Iterative BMA in Eicher, Papageorgiou and Roehn (2007) and 2SLSBMA in Eicher, Lenkoski, and Raftery (2009).

<sup>10</sup> An alternative Bayesian approach to sample selection models involves the imputation of the censored observations (see e.g. Chapter 14 of Koop et al.). On paper, such an approach is appealing, since the posterior distribution can be approximated through the seemingly straightforward application of a Gibbs sampler. However, in practice the requirement that such a large number of missing values be imputed at each step of the sampler may lead to considerable autocorrelation in the Markov Chain (see Omori 2007), thereby causing convergence to be extremely slow, if not practically impossible.



$v_n = pr(L_n | D)$ , and estimates,  $\hat{\beta}_n$ , for each model  $L_n \in L$ .<sup>11</sup> The HeckitBMA posterior mean and variance are then given by

$$\hat{\beta}^{HeckitBMA} = \sum_{n=1}^N v_n \hat{\beta}_n \quad (10)$$

$$\hat{\sigma}^{HeckitBMA} = \sum_{n=1}^N \left( Var[\beta_n | D, L_n, \hat{\lambda}^{BMA}] + (\beta_n)^2 \right) v_n - E[\beta_n | D, \hat{\lambda}^{BMA}]^2 \quad (11)$$

Equation (10) shows that the HeckitBMA estimate is formed as the average of each estimate that results from using the combination of  $\hat{\lambda}^{BMA}$  and model  $L_n$  in the second stage, weighted by the second stage probabilities. As in traditional BMA, we can calculate the inclusion probabilities as

$$\mu^{HeckitBMA}(\beta_{X_k}) = pr(\hat{\beta}_{X_k} \neq 0 | D) = \sum_{n \in L_k} v_j \quad (12)$$

The HeckitBMA inclusion probability carries the same interpretation as in the conventional BMA methodology. The only difference is that the inclusion probability is now based on estimates and model probabilities that account for selection bias.

### 3. FDI Theories and Model Uncertainty

This section outlines the model uncertainty surrounding FDI determinants, which requires a brief survey of existing FDI theories. Early FDI theory suggested two distinct motivations for FDI: horizontal FDI, which is undertaken to access markets when firms encounter trade restrictions, and vertical FDI, which leverages low factor prices in host countries to reduce production costs (see, e.g., Markusen, 1984 and Helpman, 1984). Markusen et al. (1996) and Markusen (1997) unified these two FDI motivations in the knowledge-capital model of FDI. Due to its complexity, closed-form solutions of the knowledge-capital model are elusive and simulated results highlight nonlinearities.

New trade theory provides for additional and more intricate FDI patterns. Ekholm, Forslid and Markusen (2007) and Bergstrand and Egger (2007) suggest export platform FDI is undertaken to serve not only the host country, but also to produce goods

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<sup>11</sup> Note this implies that the inverse Mills ratio,  $\hat{\lambda}^{BMA}$ , is not subject to model selection, hence we cannot use its inclusion probability as an indicator for the existence of selection bias. Instead the Mills ratio's Bayesian Credible Interval is used.

that are subsequently exported to neighboring countries. This strand of the literature highlights the importance of a comprehensive account of regional trade agreements in the empirical approach. Vertical interaction FDI is undertaken when subsidiaries in host countries ship intermediate goods back and forth for processing before exporting finished products back to the parent (see, e.g., Baltagi, Egger and Pfaffermayr, 2007).

These theories have been taken to the data with mixed success in a variety of econometric approaches. Carr, Markusen and Maskus (2001) provide evidence in favor of horizontal and vertical FDI that is consistent with the knowledge-capital model. Blonigen, Davies and Head (2003) showed, however, that the evidence is not robust once the econometric model correctly accounts for the fact that the data of Carr, Markusen and Maskus covers only U.S.-bilateral FDI. Bergstrand and Egger (2007) introduce a third mobile factor (physical capital) to the knowledge-capital model to highlight the interaction between trade agreements and FDI flows. They find substantial evidence for effects of RTAs on FDI flows, which vanish, however, when transport and investment costs are included.

Yeaple (2003) utilizes affiliate sales to their parent companies to interact factor endowment differences with industry factor intensities. He reports positive evidence for both vertical and horizontal FDI motivations. Coughlin and Segev (2000) focus on export platform FDI by exploring possible regional/spatial FDI patterns to find evidence for export platform FDI and agglomeration externalities. Further support for export platform FDI is provided by Blonigen, Davies, Waddell, and Naughton (2007), who estimate negative FDI effects associated with neighboring-country FDI, using US/EU data.

Finally, Baltagi, Egger, and Pfaffermayr (2007) develop a general model of FDI in a multi-country world. It predicts how neighboring country characteristics (e.g., GDP, trade costs, endowments, etc.) affect FDI in a given host country, depending on the specific FDI motivation (horizontal, vertical, export-platform, etc.). They find mixed evidence and only weak support for export-platform and vertical interaction FDI.

#### **4. Existing Empirical Approaches and Candidate Regressors**

The above set of FDI theories and their associated empirical approaches motivate a substantial set of candidate regressors that identify FDI determinants. In this section we

outline the set of regressors that have been associated with each of the above mentioned theories as well as the regressors that are commonly added to FDI gravity equations as additional controls (see Table 1 for a summary).

Aside from the typical gravity variables specified in (1), generic regressors such as Language, Border, and Colonial History are usually added to capture country-pair specific effects that might induce/obstruct FDI. In addition, the Real Exchange Rate is included in the gravity model as depreciations in the host country are thought to increase both the intensive and extensive margins of FDI (Goldberg and Klein, 1998). Depreciations reduce the amount of foreign currency needed to purchase assets abroad, and reduce the nominal return to the source in terms of foreign currency. Hence the often insignificant real exchange rate coefficient should not be surprising in large panel FDI studies.

Factor endowments are another key determinant of FDI. GDP Per Capita is commonly included to proxy for FDI that leverages differences in incomes, development, or capital abundance. As a measure of country income level, per capita GDP is expected to increase FDI flows for both source and host countries. As a measure of capital abundance, per capita GDP is predicted to generate positive FDI outflows for source countries and negative flows for host countries, since basic FDI models imply flows from capital-abundant to labor-abundant countries (Egger and Pfaffermayr, 2004). Education differences among country pairs are a proxy for vertical FDI motivations. According to the knowledge-capital model, greater educational disparities are expected to promote larger vertical FDI outflows.

Prospective growth, proxied by GDP Growth, signals higher returns, which attract FDI to a host and reduce outflows from a source country (see Rodrick, 1999 and Lim, 2001). Ekholm, Forslid and Markusen, (2007), Blonigen et al. (2007), and Baltagi, Egger and Pfaffermayr (2007) also include Market Potential (the size of proximate third country markets) to indicate each country's attraction as an export platform. Great market potential signals that the country should receive more export platform FDI as the host can serve relatively large markets in its relative proximity. However, the coefficient of this regressor has seldom been reported to be of the right sign, given large and important

outliers such as Japan. A third economic factor that is seen to exert crucial influence on FDI returns is Country Productivity (see Rodrik, 1999, Razin, Rubenstein, and Sadka 2004, and Razin, Sadka, and Tong, 2008). Razin, Sadka, and Tong (2008) develop a theory where productivity increases affect FDI setup costs such that an increase in host productivity *reduces* the likelihood of new FDI, but *increases* FDI outflows to existing subsidiaries.

Blonigen (2005) highlights how Corporate Tax Rates and Tax Treaties influence FDI flows while Razin and Sadka (2007b, Ch 10) point out the differential impact of source/host tax rates. Host taxes reduce FDI primarily at the intensive margin and source tax rates increase FDI outflow primarily at the extensive margin. Increases in source countries' corporate taxes induce multinationals to establish new affiliates abroad, but the quantity of production transferred abroad increases when host countries' tax rates decline. Although the number of bilateral tax treaties has increased from 100 to over 2,500 since 1960 (Egger et al., 2006), the empirical evidence regarding their effects is ambiguous (see Davies, 2004 for a survey). Studies often do not differentiate between the intensive and extensive margins; when the margins of FDI are considered, as in Blonigen and Davies (2004, 2005), results show strong positive effects of existing tax treaties on FDI, but negative effects of new tax treaties (see also Egger et al., 2006). When Di Giovanni (2005) examines only the extensive margin of FDI, positive effects of tax treaties are reported.<sup>12</sup>

Financial risk also serves as a central determinant of FDI. Razin, Sadka, and Tong (2008) include crucial risk measures in their econometric analysis. Economic and Political Risk have also featured prominently in recent growth regressions; variables that proxy for such risks are included in regressions to capture factors that impact the return on investment. Carr, Markusen, and Maskus (2001) first included variables that relate to economic and political risk, such as the risk of expropriation. It is usually thought that less risk increases inflows to a host and reduces outflows from a source country.

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<sup>12</sup> The design of tax treaties may also contribute to the ambiguous findings. While treaties reduce withholding taxes and double taxation; Radaelli (1997) and Gravelle (1988) assert that reducing tax evasion is the primary goal of U.S. tax treaties via reduced transfer pricing and Hines (1996) shows that the way in which source countries eliminate double taxation can have different implications for FDI activity.

We also include measures of regional trade agreements and currency unions. There is considerable evidence that currency unions affect FDI, although much of the research has focused on Europe only (see e.g., Petroulas, 2007 and Baldwin et al., 2008). Trade and FDI are well known to be closely related, and Bernard, Jensen, and Schott (2009) find that roughly 50 percent of U.S. trade is intra-firm trade between affiliates of the same MNC. Here the thorny issue is endogeneity; hence we focus on the effects of Regional Trade Agreements (RTAs), which have a clear but not necessarily direct impact on FDI via export platform and/or horizontal/vertical FDI incentives.<sup>13</sup> The ambiguity arises as RTAs might increase FDI to an export platform *within* the RTA, and reduce it to all other members of the RTA. In addition, RTAs alter firms' tariff-jumping FDI incentives to amplify export platform FDI effects (Blonigen, 2002). To separate trade effects that arise within and between RTAs, Eicher, Henn, and Papageorgiou (2008) highlight the importance of controlling for all possible individual RTAs rather than including just one average catch-all RTA effect.

Given the diversity of theories, the common approach has been to focus on specific effects, such as tax treaties, or particular RTAs. Since we are proposing to juxtapose alternative theories, we seek to include representative regressors that encompass as many of the previous approaches as possible. The number of previous approaches is only superseded by the remarkable diversity of the associated results. Table 1 summarizes the diversity of positive and negative effects that have been obtained for the same regressors in FDI studies; it highlights not only model uncertainty, but also the fragility of the results when model uncertainty is not accounted for as part of the statistical methodology. If different approaches focus only on particular subsets of the FDI model space, it is no surprise that the associated results generate potentially different conclusions for the same regressor. The purpose of HeckitBMA is to resolve this model uncertainty, which requires this comprehensive set of regressors.

## 5. Data

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<sup>13</sup> The Asia-Pacific Economic Community (APEC), the Dollar Currency Unions (DOLLAR), the European Economic Area (EEA), the European Free Trade Area (EFTA), the EU, the Eurozone (Euro), the Latin American Integration Agreement (LAIA), and the North American Free Trade Agreement (NAFTA) have sufficient observations to be included.

Our dataset is based on Razin, Sadka, and Tong (2008), which includes data on productivity, GDP per capita, skill differences, common language, distance, population, and host and source country financial risk.<sup>14</sup> Their FDI outflow data was obtained from the OECD *International Direct Investment Database* (OECD) and deflated by the U.S. CPI. We augment the Razin et al. (2008) dataset to allow tests of the alternative theories outlined above. The additional data collected includes additional controls for tax rates, tax treaties, trade agreements, currency unions, institutions, market potential, market size, and exchange rate agreements.

Average effective corporate tax rates are calculated using the definition and information in Altshuler et al. (1998), Blonigen and Davies (2004), and U.S. Treasury Corporate Tax Files. A list of bilateral tax treaties was obtained from Neumeyer and Spess (2005). Trade Agreements (multilateral and bilateral), as well as currency union indicators were obtained from Eicher and Henn (2011). Market potential is constructed according to the definition provided in Blonigen et al. (2007).

For institutional variables we include country risk proxies that are obtained from International Country Risk Guides (ICRG 1985-2000), which also provides the exact variable definitions. Information on economic risk covers the host and source country's Corruption, Bureaucratic Efficiency, and Investment Profile.<sup>15</sup> Political risk is proxied by Democratic Accountability, Ethnic Tension, Internal/External Conflict, Government Stability, Political Violence, Rule of Law, Military Government Participation, Religious Tensions, and a Socio-Economic profile (which includes unemployment, consumer confidence, and poverty measures).<sup>16</sup> Our unbalanced panel finally covers years 1988-2000 and includes 46 countries (21 non-OECD), 803 unique country pairs with 14863 total observations, of which 64 percent indicate zero FDI flows. There are small differences between the 55 regressors in our study compared to the 56 regressors in Blonigen and Piger's (2011) cross section that relate to missing time dimensions of some

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<sup>14</sup> Financial risk is an index of five components: foreign debt as a percentage of GDP, foreign debt service as a percentage of exports of goods and services, current account as a percentage of exports of goods and services, net international liquidity as months of import cover, and exchange rate stability.

<sup>15</sup> Investment profile measures government attitude toward inward investment as determined by (i) risk to operations, (ii) taxation, (iii) repatriation, and (iv) labor costs.

<sup>16</sup> ICRG variables are coded such that higher values reflect less risk.

of the data used in the latter study. Sources and summary statistics are provided in Table 2.

## **6. FDI Determinants and Model Uncertainty**

Table 3 reports both Heckit and Heckit BMA results to highlight the impact of model uncertainty on the number and types of reported FDI determinants at the intensive (extensive) FDI margins.<sup>17</sup> The Table is ranked by the regressors' inclusion probabilities at the intensive FDI margin for Heckit and HeckitBMA. The Table highlights the importance of model uncertainty in the analysis of FDI determinants: Heckit suggests 35 (27) FDI determinants at the intensive (extensive) margins, which is dramatically higher than the 24 (14) regressors suggested by HeckitBMA.

The substantially greater number of regressors suggested by Heckit indicates the importance of model uncertainty in FDI regressions. Heckit simply reports statistical significance for the full model, but does not account for the existence of alternative models and theories. Table 3 reports that alternative models, which are much more parsimonious, receive far greater support from the data. This is confirmed by the difference between the joint likelihoods in Heckit and the best models in HeckitBMA. The likelihood-ratio test, which does not penalize for the included number of regressors, easily rejects the Heckit model in favor of the best HeckitBMA model, the model that received the greatest weight in the model averaging procedure. Similarly, the Bayesian Information Criterion (BIC), which is used to compare the performance of nested model specifications, clearly favors HeckitBMA. Hence it is no surprise that Heckit overestimates significance levels to generate an excessively large number of FDI determinants. HeckitBMA provides not only fewer, but also different FDI determinants. It supports two additional FDI determinants (one each at the intensive and extensive margins) that were not significant in the Heckit methodology. This highlights again that Heckit inference was not based on models that received the strongest support from the data. HeckitBMA reveals not only more parsimonious models, but models that also suggest different regressors, regressors that were shown to have no effect in Heckit.

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<sup>17</sup> As in Razin, Rubenstein, and Sadka (2004) we include a negative FDI lag, to account for negative FDI flows (e.g., the liquidation of a foreign subsidiary).

## 6.1. Robust FDI Determinants

In this section we detail robust FDI determinants. We first examine regressors that are associated with the decision to invest. This FDI margin is crucially important given the structure of the data where large segments of observations are either zero because FDI is not profitable, or because the data is systematically missing. Both Heckit and HeckitBMA show that the gravity approach is appropriate and that the Heckman selection methodology is necessary. All gravity regressors exhibit high inclusion probabilities and correct magnitudes at both margins of FDI. In addition, we find that the Inverse Mills Ratio indicates decisive (or highly significant) evidence of selection bias in the HeckitBMA (or Heckit) procedure as reported in Table 3. The exclusion restriction (Past\_FDI\_Dummy) suggested by Razin et al. (2008) is shown to exert a decisive effect on the decision to invest.<sup>18</sup> It is thus clear that a full account of firms' decisions to invest in a selection (or participation) stage is critical to eliminating the omitted variables bias that contaminates parameter estimates in pure OLS approaches.<sup>19</sup>

To simplify the discussion of the effects in Table 3, we group effective FDI determinants into two categories, "economic" and "country characteristics," and consider extensive and intensive FDI determinants in sequence. For the extensive FDI margin, HeckitBMA suggests that country characteristics such as a common colonial background, lacking a common border, the absence of religious tensions (in the host), socio economic tension and corruption (in the source) increase the likelihood of FDI flows. Economic factors that exert a positive effect on the extensive margin of FDI include a host's market size, market potential, and level of development, while higher taxes and productivity negatively impact a source country's decision to invest. Notably, neither trade nor tax agreements, nor educational differences influence the decision to undertake FDI.

At the intensive margin, HeckitBMA identifies a significantly greater number of FDI determinants. Robust FDI determinants at the intensive margin pertain not only

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<sup>18</sup> Razin et al. (2008) propose that FDI setup costs imply a profitability threshold so that past FDI relations can serve as an exclusion restriction.

<sup>19</sup> Goldberger (1972) and Greene (1981) show that in the presence of selection bias, the OLS estimator is biased downward and the degree of the bias is related to the proportion of data censored. Since 64% of the data in the OECD FDI dataset is potentially censored the bias may be substantial. This may be one reason why Blonigen and Piger's (2011) approach does not produce a substantial number of robust FDI determinants.



specifically to the host and source, but also to bilateral characteristics such as common history/language, as well as share membership in an RTA (APEC) or a currency union (Dollar). Country characteristics that increase FDI include the lack of corruption and internal/religious tensions in the host and the absence of corruption, better bureaucratic efficiency and democratic accountability in source countries. Economic characteristics that increase bilateral FDI flows include larger market size and lower taxes (in both source and host), and a higher levels of development, productivity, and growth in the host country. Interestingly large market potential reduces FDI flows to a host and higher levels of development reduce FDI flows from source countries, *ceteris paribus*. As expected a source's investment profile and bureaucratic efficiency increase FDI flows.

The results are also insightful in terms of the absence of effects that are commonly reported in the literature. No RTA other than APEC influences FDI in either the selection or flow equation, and tax treaties are never found to be effective FDI determinants. In addition, skill differences are also shown to exert no effect on FDI. These results confirm the findings of the previous literature that RTA export platform effects may be weak and that tax treaties may not only facilitate, but also impede FDI when treaties are also designed to reduce tax evasion and transfer pricing. Blonigen and Piger (2011) also do not find that skill differences drive knowledge-capital FDI motives.

## **7. Conclusion**

FDI flows increased dramatically in the past 20 years. Over the same time period, the literature produced a dramatic proliferation of FDI theories as well as empirical FDI approaches. The uncertainty surrounding FDI theories and empirical approaches has created the notion that few FDI determinants are truly robust. Numerous empirical studies estimate only subsets of particular FDI theories to produce results that are often either inconclusive or outright contradictory. Statisticians refer to such diversity of theories and results as model uncertainty. When model uncertainty is not addressed comprehensively as part of the empirical strategy, traditional robustness analyses overstate significance levels and confidence intervals.

We extend the FDI literature in two dimensions. First, we construct a large dataset that represents a comprehensive set of FDI determinants that have been proposed by

previous theories. Second, since large shares of FDI data are systematically missing from even the most detailed FDI dataset, we introduce HeckitBMA, which extends Bayesian Model Averaging to resolve the model uncertainty and in the presence of selection bias. Our approach allows us to separate and estimate the determinants of two separate aspects of the FDI decision: a) the decision to invest abroad and b) how much to invest in a particular host country.

Our results show that the impact of model uncertainty on FDI estimates is substantial and that the Heckman selection methodology is necessary. Without controlling for model uncertainty, the conventional Heckit procedure suggests nearly twice as many FDI determinants as HeckitBMA at the extensive margin and 12 additional regressors (33%) at the intensive margin. This is not surprising, since Heckit does not consider the models associated with alternative theories. Instead we find that HeckitBMA assigns the greatest weight to more parsimonious models that score dramatically better in terms of joint likelihoods or Bayesian Information Criteria (BIC). The determinants of the intensive and extensive margins of FDI are also shown to differ profoundly.

We find only mixed support for horizontal or export platform FDI theories (Markusen, 1984). Trade agreements and currency unions do not encourage FDI across the board, but only in specific instances (e.g., dollarization and APEC membership). Host country market potential is shown to exert a decisive effect on FDI flows, but the effect runs counter to the predictions of export platform FDI theory. As in Blonigen et al. (2007), we find that a host's proximity to large markets results in *less* FDI – as large, proximate markets divert FDI from a potential small host, perhaps to take advantage of scale economies. Vertical FDI theory (Helpman, 1984) is not strongly supported since FDI is sensitive to higher levels of development and, contrary to the knowledge-capital model, we find no evidence that educational differences exert robust effects on either the intensive or extensive margins.

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**Table 1: Diversity of FDI Determinants and Their Estimated Effects  
(Gravity Approaches Only)**

Variable Name		Estimated Effect In Past			Variable Description
		+	none	-	
Gravity	DISTANCE <sub>ij</sub>		1	16	natural log of bilateral distance
	MRKT_SIZE <sub>i</sub>	8	2		source natural log of real GDP
	MRKT_SIZE <sub>i</sub>	13	5	2	host natural log of real GDP
Geography / History	BORDER <sub>ij</sub>	2	3		=1 if pair share a common border
	COLONY <sub>ij</sub>	4	2		=1 if pair share colonial relationship
	COM_LANG <sub>ij</sub>	10	3		=1 if pair share common language
Factor Endowment	DEVELOPMENT <sub>i</sub>	3	4		source natural log of real GDP per capita
	DEVELOPMENT <sub>j</sub>	7	7		host natural log of real GDP per capita
	EDU_DIFF <sub>ij</sub>	2	4	2	source minus host education level
Growth & Productivity	GDP_GROWTH <sub>i</sub>				source GDP growth rate
	GDP_GROWTH <sub>j</sub>	2	3		host GDP growth rate
	MRKT_POTENTIAL <sub>j</sub>	1	1		sum of host's distance-weighted GDP to all other countries
	PRODUCTIVITY <sub>j</sub>	1	1		host productivity (real GDP per worker)
Fiscal / Monetary Policy	PRODUCTIVITY <sub>i</sub>	1	1	1	source productivity (real GDP per worker)
	TAX <sub>i</sub>		1		source corporate effective tax rate
	TAX <sub>j</sub>		3	5	host corporate effective tax rate
RTAs / CUs / Investment	RER <sub>ij</sub>		4	2	real exchange rate (host/source currency)
	INVEST_TREATY <sub>ij</sub>	1	3		=1 if both countries are in a treaty
	RTA <sub>ij</sub>	0	0	0	
	Bi_RT <sub>Aij</sub>	1	3	1	
	NAFTA <sub>ij</sub>	1	3	1	
	EU <sub>ij</sub>	1	3		
	EFTA <sub>ij</sub>	1	1		
	EEA <sub>ij</sub>				
	LAIA <sub>ij</sub>				
	APEC <sub>ij</sub>	1	2		
EURO <sub>ij</sub>					
DOLLAR <sub>ij</sub>					
Economic Risk	BUREAU <sub>j</sub>	2			host bureaucratic quality
	BUREAU <sub>i</sub>				source bureaucratic quality
	CORRUPT <sub>j</sub>	3	2		host corruption
	CORRUPT <sub>i</sub>				source corruption
	FIN_RISK <sub>j</sub>	2	2		host financial risk
FIN_RISK <sub>i</sub>	1	2	2	source financial risk	
Political Risk	DEMOCRATIC <sub>j</sub>	1			host democratic accountability
	DEMOCRATIC <sub>i</sub>				source democratic accountability
	ETHNIC_TENSION <sub>j</sub>		1		host ethnic tentions
	ETHNIC_TENSION <sub>i</sub>				source ethnic tentions
	EXTERN_CONFLICT <sub>j</sub>	1			host external conflict
	EXTERN_CONFLICT <sub>i</sub>				source external conflict
	GOV_STABILITY <sub>j</sub>	2			host government stability
	GOV_STABILITY <sub>i</sub>				source government stability
	INTERN_CONFLICT <sub>j</sub>		1		host internal conflict
	INTERN_CONFLICT <sub>i</sub>				source internal conflict
	INV_PROFILE <sub>j</sub>	2			host investment profile
	INV_PROFILE <sub>i</sub>				source investment profile
	LAW_ORDER <sub>j</sub>	2	1		host law and order
	LAW_ORDER <sub>i</sub>				source law and order
	MILITARY <sub>j</sub>		1		host military in politics
MILITARY <sub>i</sub>				source military in politics	
RELIGIOUS_TENSION <sub>j</sub>		1		host religion in politics	
RELIGIOUS_TENSION <sub>i</sub>				source religion in politics	
SOCIO_ECON <sub>j</sub>		1		host socioeconomic conditions	
SOCIO_ECON <sub>i</sub>				source socioeconomic conditions	

Notes: Based on gravity FDI studies. Variables are listed as positive or negative if significant at the 5 percent level.

**Table 2: Descriptive Statistics**  
(Full Sample)

	Mean	StDev	Min	Max	Source
APECij	0.09	0.29	0	1	Eicher & Henn (2011)
BI_RTaj	0.01	0.11	0	1	Eicher & Henn (2011)
BORDERij	0.04	0.19	0	1	Eicher & Henn (2011)
BUREAUi	3.15	0.95	0	4	International Country Risk Guide
BUREAUj	3.18	0.95	0	4	International Country Risk Guide
COLONYij	0.03	0.18	0	1	Eicher & Henn (2011)
COM_LANGij	0.18	0.38	0	1	RST(2008)
CORRUPTi	4.23	1.32	1.08	6	International Country Risk Guide
CORRUPTj	4.25	1.33	1.08	6	International Country Risk Guide
DEMOCRATICi	4.90	1.25	1	6	International Country Risk Guide
DEMOCRATICj	4.96	1.21	1	6	International Country Risk Guide
DISTANCEij	8.24	0.92	4.92	9.42	RST(2008)
DOLLARij	0.00	0.04	0	1	Eicher & Henn (2011)
EDU_DIFFij	-0.06	3.22	-8.50	9.89	RST(2008)
EEAij	0.08	0.26	0	1	Eicher & Henn (2011)
EFTAij	0.01	0.09	0	1	Eicher & Henn (2011)
ETHNIC_TENSIONi	4.82	1.27	1	6	International Country Risk Guide
ETHNIC_TENSIONj	4.81	1.33	1	6	International Country Risk Guide
EUij	0.10	0.29	0	1	Eicher & Henn (2011)
EUROij	0.01	0.10	0	1	Eicher & Henn (2011)
EXTERN_CONFLICTi	10.88	1.50	4.25	12	International Country Risk Guide
EXTERN_CONFLICTj	10.86	1.59	4.25	12	International Country Risk Guide
FDI (log)	9.17	1.17	5.81	10.75	RST(2008)
FIN_RISKi	39.83	7.38	18	50	RST(2008)
FIN_RISKj	39.83	7.28	18	50	RST(2008)
GDP_GROWTHi	0.04	0.04	-0.13	0.14	constructed from RST(2008)
GDP_GROWTHj	0.04	0.05	-0.13	0.45	constructed from RST(2008)
MRKT_SIZEi	5.32	1.37	1.71	9.10	constructed from RST(2008)
MRKT_SIZEj	5.38	1.37	1.71	9.10	constructed from RST(2008)
GOV_STABILITYi	7.61	2.02	1	12	International Country Risk Guide
GOV_STABILITYj	7.57	2.04	1	11	International Country Risk Guide
INTERN_CONFLICTi	10.06	2.21	3	12	International Country Risk Guide
INTERN_CONFLICTj	10.02	2.28	3	12	International Country Risk Guide
INV_PROFILEi	6.97	1.73	2.33	11.17	International Country Risk Guide
INV_PROFILEj	6.97	1.74	2.42	11.17	International Country Risk Guide
INVEST_TREATYij	0.12	0.32	0	1	Neumayer and Spess (2005)
LAIAij	0.02	0.15	0	1	Eicher & Henn (2011)
LAW_ORDERi	4.71	1.40	1	6	International Country Risk Guide
LAW_ORDERj	4.71	1.44	1	6	International Country Risk Guide
MILITARYi	4.82	1.50	1	6	International Country Risk Guide
MILITARYj	4.85	1.52	0	6	International Country Risk Guide
MRKT_POTENTIALj	0.57	0.20	0.34	1.42	constructed see Blonigen et al., 2007)
DEVELOPMENTi	9.24	1.10	6.06	10.75	RST(2008)
DEVELOPMENTj	1.27	2.26	-2.85	11.14	RST(2008)
NAFTAij	0.00	0.06	0	1	Eicher & Henn (2011)
NEG_FDI_LAG	0.05	0.22	0	1	constructed from RST(2008)*
PRODUCTIVITYi	36.32	18.44	2.67	74.66	RST(2008)
PRODUCTIVITYj	37.25	18.00	4.24	74.66	RST(2008)
RELIGIOUS_TENSIONi	5.20	1.07	1	6	International Country Risk Guide
RELIGIOUS_TENSIONj	5.14	1.16	1	6	International Country Risk Guide
RERij	103.51	31.55	16.73	597.64	USDA <a href="http://www.ers.usda.gov">http://www.ers.usda.gov</a>
SOCIO_ECONi	6.66	1.64	2	11	International Country Risk Guide
SOCIO_ECONj	6.68	1.65	2	11	International Country Risk Guide
TAXi	0.23	0.11	0.00	0.73	1980-92: Altshulter et al. (1998); 1994-02: IRS/SOI, World Tax Database
TAXj	0.22	0.11	0.00	0.73	1980-92: Altshulter et al. (1998); 1994-02: IRS/SOI, World Tax Database

\*Note that this estimator is appropriate also in the case where the desired FDI flows were actually negative, as in the case where a foreign subsidiary is liquidated, but were reported as zeros.



**Table 3: Robust FDI Determinants**

	FDI Flow / INTENSIVE MARGIN						SELECTION / EXTENSIVE MARGIN					
	Heckit		HeckitBMA				Heckit		HeckitBMA			
	mean	stdev	incl prob	post mean	post stdev	mean	stdev	incl prob	post mean	post stdev		
APECij	<b>0.843***</b>	0.087	<b>1.00</b>	0.905	0.133	0.098	0.068	0.47	0.203	0.110		
COLONYij	<b>1.091***</b>	0.110	<b>1.00</b>	1.070	0.178	<b>0.409***</b>	0.104	<b>1.00</b>	0.497	0.095		
COM_LANGij	<b>0.551***</b>	0.072	<b>1.00</b>	0.662	0.113	<b>0.113**</b>	0.053	0.02	0.083	0.020		
CORRUPTi	<b>0.180***</b>	0.038	<b>1.00</b>	0.196	0.057	<b>0.075***</b>	0.025	<b>0.65</b>	0.064	0.035		
DISTANCEij	<b>-0.574***</b>	0.037	<b>1.00</b>	-0.651	0.043	<b>-0.193***</b>	0.028	<b>1.00</b>	-0.200	0.023		
DOLLARij	<b>4.545***</b>	0.729	<b>1.00</b>	4.431	1.187	-0.262	0.363	0.00	-0.500	0.022		
GDP_GROWTHj	<b>3.186***</b>	0.707	<b>1.00</b>	3.199	1.061	0.415	0.450	0.00	0.667	0.036		
MRKT_SIZEi	<b>0.818***</b>	0.029	<b>1.00</b>	0.827	0.043	<b>0.297***</b>	0.021	<b>1.00</b>	0.239	0.024		
MRKT_SIZEj	<b>0.943***</b>	0.028	<b>1.00</b>	0.971	0.040	<b>0.318***</b>	0.020	<b>1.00</b>	0.270	0.022		
INTERN_CONFLICTj	<b>0.061**</b>	0.026	<b>1.00</b>	0.108	0.032	-0.018	0.018	0.00	0.000	0.001		
MRKT_POTENTIALj	<b>-0.792***</b>	0.130	<b>1.00</b>	-0.745	0.189	<b>0.258***</b>	0.098	<b>0.71</b>	0.297	0.154		
DEVELOPMENTi	<b>-1.182***</b>	0.086	<b>1.00</b>	-1.087	0.122	<b>-0.010*</b>	0.061	0.02	-0.042	0.009		
DEVELOPMENTj	<b>0.527***</b>	0.081	<b>1.00</b>	0.680	0.105	<b>0.280***</b>	0.051	<b>1.00</b>	0.298	0.066		
PRODUCTIVITYj	<b>0.038***</b>	0.004	<b>1.00</b>	0.039	0.006	-0.002	0.003	0.08	0.000	0.001		
RELIGIOUS_TENSIONj	<b>0.356***</b>	0.036	<b>1.00</b>	0.336	0.053	0.038	0.026	<b>0.74</b>	0.063	0.032		
TAXi	<b>-4.790***</b>	0.275	<b>1.00</b>	-4.717	0.429	<b>-0.774***</b>	0.200	<b>0.62</b>	-0.598	0.327		
TAXj	<b>-4.212***</b>	0.285	<b>1.00</b>	-4.357	0.445	<b>-0.833***</b>	0.197	0.36	-0.545	0.280		
CORRUPTj	<b>0.107***</b>	0.036	<b>1.00</b>	0.143	0.050	0.035	0.026	0.00	0.000	0.002		
NEG_FDI_LAG	<b>-0.293***</b>	0.071	<b>0.99</b>	-0.293	0.118	<b>0.827***</b>	0.078	<b>1.00</b>	0.827	0.077		
ETHNIC_TENSIONi	<b>0.159***</b>	0.031	<b>0.88</b>	0.131	0.064	<b>0.062***</b>	0.019	0.03	0.037	0.005		
INTERN_CONFLICTi	<b>-0.117***</b>	0.029	<b>0.84</b>	-0.095	0.051	-0.023	0.018	0.00	0.000	0.001		
DEMOCRATICi	<b>0.104***</b>	0.038	<b>0.69</b>	0.123	0.076	<b>0.045*</b>	0.024	0.01	0.077	0.006		
BUREAUi	<b>0.221***</b>	0.075	<b>0.65</b>	0.235	0.147	-0.062	0.042	0.00	0.000	0.002		
INV_PROFILEi	0.016	0.027	<b>0.61</b>	0.074	0.044	-0.022	0.019	0.00	0.000	0.001		
LAIaij	<b>-0.642**</b>	0.292	0.49	-0.847	0.533	<b>-0.267*</b>	0.146	0.01	-0.200	0.016		
SOCIO_ECONi	<b>0.071***</b>	0.025	0.42	0.079	0.047	<b>0.062***</b>	0.017	<b>0.82</b>	0.046	0.020		
SOCIO_ECONj	<b>0.010***</b>	0.023	0.18	0.056	0.030	0.0266	0.016	0.00	0.000	0.001		
Bi_RTaij	<b>0.649***</b>	0.195	0.17	0.488	0.248	<b>0.490***</b>	0.135	0.08	0.313	0.083		
PRODUCTIVITYi	<b>0.008*</b>	0.004	0.11	0.009	0.003	<b>-0.009***</b>	0.003	<b>0.84</b>	-0.008	0.004		
BUREAUj	0.036	0.059	0.10	0.115	0.041	-0.047	0.039	0.01	0.000	0.003		
INV_PROFILEj	<b>-0.105***</b>	0.026	0.05	-0.059	0.023	<b>-0.039**</b>	0.019	0.00	0.000	0.000		
INVEST_TREATYij	<b>0.160**</b>	0.081	0.05	0.146	0.040	<b>0.125**</b>	0.053	0.39	0.153	0.082		
GOV_STABILITYj	<b>0.053**</b>	0.022	0.04	0.045	0.013	0.008	0.016	0.00	0.000	0.001		
BORDERij	<b>0.268**</b>	0.125	0.04	0.211	0.052	<b>-0.541***</b>	0.111	<b>1.00</b>	-0.497	0.104		
DEMOCRATICj	<b>0.090**</b>	0.035	0.04	0.053	0.018	0.027	0.025	0.00	0.000	0.001		
LAW_ORDERj	0.01	0.040	0.03	0.065	0.015	0.042	0.029	0.01	0.000	0.004		
NAFTAij	0.334	0.271	0.02	0.417	0.089	0.146	0.377	0.00	0.000	0.016		
RERij	<b>-0.002*</b>	0.001	0.02	0.000	0.000	0.0002	0.001	0.00	0.000	0.000		
EXTERN_CONFLICTj	-0.038	0.025	0.02	-0.056	0.006	0.019	0.016	0.03	0.037	0.007		
FIN_RISKi	0.01	0.006	0.02	0.000	0.002	0.005	0.004	0.00	0.000	0.000		
GOV_STABILITYi	0.036	0.024	0.01	0.000	0.004	-0.019	0.016	0.00	0.000	0.001		
EFTAij	-0.183	0.177	0.01	-0.111	0.028	<b>0.318*</b>	0.192	0.02	0.313	0.046		
MILITARYj	0.049	0.039	0.01	0.000	0.007	0.001	0.026	0.00	0.000	0.001		
ETHNIC_TENSIONj	0.0137	0.028	0.01	0.000	0.004	<b>0.038**</b>	0.019	0.13	0.046	0.014		
EXTERN_CONFLICTi	0.0243	0.026	0.01	0.000	0.003	<b>-0.034**</b>	0.017	0.01	0.000	0.003		
EDU_DIFFij	0.006	0.012	0.01	0.000	0.002	-0.0002	0.009	0.00	0.000	0.001		
EEAij	0.049	0.105	0.01	0.000	0.012	<b>0.239**</b>	0.095	0.00	0.000	0.008		
EUij	0.133	0.093	0.01	0.000	0.010	-0.031	0.083	0.00	0.000	0.002		
FIN_RISKj	0.008	0.007	0.01	0.000	0.001	<b>0.012***</b>	0.004	0.04	0.000	0.002		
LAW_ORDERi	-0.037	0.045	0.01	0.000	0.006	0.013	0.028	0.01	0.000	0.003		
MILITARYi	-0.009	0.047	0.01	0.000	0.006	-0.002	0.027	0.00	0.000	0.002		
RELIGIOUS_TENSIONi	0.019	0.038	0.01	0.000	0.005	-0.036	0.025	0.00	0.000	0.001		
EUOij	0.0384	0.177	0.01	0.000	0.021	-0.033	0.177	0.00	0.000	0.008		
GDP_GROWTHi	-0.512	0.962	0.01	-0.200	0.116	0.032	0.593	0.00	0.667	0.053		
PAST_FDI_DUM						<b>2.179***</b>	<b>0.038</b>	<b>1.00</b>	2.231	0.037		
Inv_MILLS	<b>-0.310***</b>	0.052		<b>-0.315*</b>	0.084							
Joint Log Likelihood <sup>1</sup>	-13598.53			-4673.891								
BIC <sup>1</sup>	28513.18			9933.786								
N	5387			5387		14863			14863			

<sup>1</sup> HeckitBMA statistics are based on best models in the selection and flow equations.

<sup>a</sup> The 95% Credible Interval for the Inverse Mills Ratio does not contain zero.

\*\*\*/\*\*/\* indicate 1, 5, 10 percent frequentist significance levels. Posterior means are conditional on inclusion.