A Study on the Impact of Economic Openness and Indigeneity on Growth Using the Nonparametric Estimation of a Two-Way Random Effects Model

By

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Abstract

This paper contributes to the globalization debate by studying the overall effect on growth of openness and indigenous factors. The data from 1998-2005 covers 122 economies. The result of a nonparametric estimation of a two-way random effects model show that both the openness and indigeneity factors promote growth. Industrialized economies score relatively high in terms of performance in both factors, but there is a high threshold beyond which the effects of these factors on growth are slower. Among the developing economies, openness is a necessary and pre-requisite condition for growth, but the achievement of a high level of indigeneity is more important for sustainable growth.

JEL Classifications: C33, F02, O11.

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I. Introduction

In the globalization debate, pro-globalization advocates consider the contribution of openness or external economic factors, whereas the proponents of anti-globalization are concerned with the domestic cost of globalization (for example, Feldstein 2000; Wallach and Woodall 2004; Stiglitz 2002). Contemporary studies of globalization and growth are restricted by the selection of factors and methodology. Most studies that use a globalization index to rank economies or examine the impact of globalization on growth focus mainly on openness factors, and exclude domestic factors (Dreher 2006; Lookwood 2004; Anderson and Herbertsson 2005; Heshmati 2006). However, more recent studies (for example, Galbraith and Kum 2002; Mah 2002; Dollar and Kraay 2003) show that national institutions and various domestic factors do play an important role in enhancing economic growth.

Another limitation is that the various globalization measures that are used to study the impact of factors on growth are usually based on the parametric estimation of either panel data or cross-section data models. However, this approach provides only the mean effect and fails to address the mean effect at different levels of openness or globalization (Dollar 1992; Frankel and Romer 1996; Rodrik 1998; Heinemann 2000; Mah 2002; Li and Reuveny 2003; Dollar and Kraay 2004; Greenaway *et al* 1999; Carkovic and Levine

2002). Furthermore, a pre-selected parametric model may be too restrictive and may exclude unexpected features, and the misspecification of linear or nonlinear parametric models can lead to inconsistent and inefficient estimates and suboptimal test statistics (Härdle 1989; Ullah and Roy 1998).

This paper seeks to overcome these factorial and methodological restrictions on the study of globalization and growth. We achieve this first by distinguishing between the factors of openness and indigeneity in an economy (see Appendix A for details of the data and the use of factors) by constructing an Openness Index and Indigenous Index to measure the overall openness and indigeneity of an economy. Constructing these two indices by the principle component analysis method, we group the thirteen openness factors into the five categories of Economic Integration, Economic Freedom, Technology Connectivity, Personal Contact and International Engagement (see Kearney 2002) and the fourteen indigenous factors into the three categories of Institutional Establishment, Education and Health, and Inflation (see Appendix B). The advantage of constructing the two indices is that it allows us to examine the overall effect of openness and indigeneity on growth using a more parsimonious regression model.

The second improvement is in the methodology of the paper. We undertake a nonparametric local linear estimation of a panel data model with two-way random effects to estimate the partial derivative functions, which effectively shows the effects on growth at different levels of openness and indigeneity.[1] The use of nonparametric estimation of the random effects model is robust to the misspecification of the functional forms and provides added information about the effects on growth at different levels of globalization, in addition to the information about the average effects on growth that is similar to that which can be obtained with a parametric estimation. A further advantage is that comparative static analysis can be applied to the estimated nonparametric functions to study how different levels of openness and indigeneity can affect growth.

The remainder of this paper is organized as follows. Section II explains the local linear nonparametric estimation of the panel data model with two-way random effects. Section III presents the nonparametric estimation results for the effects of openness and indigeneity on growth at the mean values of the two indices and some equally spaced points between the sample minimum and maximum. Section IV presents a comparative static study of the two effects on growth based on the nonparametric estimation of the two partial derivatives at different levels of openness and indigeneity. Section V concludes the paper.

[1] Nonparametric estimation methods have been extensively applied in the empirical research on consumer theory (for example, Bierens and Pott-Buter 1990; Lewbel 1991; Banks *et al* 1997; Ullah and Roy 1998) and other fields.

II. A Nonparametric Estimator for a Two-way Random Effects Model

In this section, we explain the nonparametric methodology that we use in this paper. As the two-way random effects model[2] is more general and less restrictive, we specify its nonparametric form as

$$\log(GDP_{it}) = f\left(\log(OPE_{it}), \log(IND_{it})\right) + u_i + v_t + \varepsilon_{it} . \qquad (1)$$

The random effects u_i and v_t show the combined effects of unobserved individual economy and periodic characteristics, and the error term ε_{it} should satisfy the traditional assumptions (Judge *et al.* 1985, Chapter 13). In other words, ε_{it}, u_i and v_i are independent and identically distributed with a mean of zero and a constant variance of σ_ε^2, σ_u^2 and σ_v^2, respectively. In addition, $E[u_j \varepsilon_{it}] = 0$ and $E[v_s \varepsilon_{it}] = 0$ for all i, j, s, t. Let $y = \log(GDP)$, $x_1 = \log(OPE)$, $x_2 = \log(IND)$ and $x = (x_1, x_2)$. We also assume that x_1 and x_2 are not correlated with the error term, that is, that they are exogenous[3]. The nonparametric model can then be written as

$$y_{it} = f(x_{it}) + u_i + v_t + \varepsilon_{it}, i = 1, \cdots, n; t = 1, \cdots, T, \qquad (2)$$

where n =122 and T = 8 in our sample. The nonparametric function $f(\cdot)$ is unknown, which is of interest, but we are more concerned with the estimation of the two partial

2 Refer to Ullah and Roy (1998) for details of the nonparametric estimation of the one-way random effects model.

3 See Appendix C for more details about the exogeneity assumption.

derivatives of $f(x)$, which show the effects of openness (*OPE*) and indigeneity (*IND*) on growth. A Taylor expansion of $f(x_{it})$ around *x* in Model (2) can be derived as

$$y_{it} = f(x) + (x_{it} - x)\beta(x) + u_i + v_t + \varepsilon_{it}\,, \tag{3}$$

where $\beta(x) = \partial f(x)/\partial x$. Here ε_{it} includes the Taylor expansion residuals. For each i, by averaging with respect to t in (3), we have

$$\bar{y}_{i\bullet} = f(x) + (\bar{x}_{i\bullet} - x)\beta(x) + u_i + \bar{\varepsilon}_{i\cdot}\,, \tag{4}$$

with $\bar{v} = 0$, where $\bar{y}_{i\cdot} = \sum_{t=1}^{T} y_{it}/T$, $\bar{x}_{i\bullet}$ and $\bar{\varepsilon}_{i\cdot}$ are defined as before. For each *t*, by averaging with respect to i in (3), we have

$$\bar{y}_{\bullet t} = f(x) + (\bar{x}_{\bullet t} - x)\beta(x) + v_t + \bar{\varepsilon}_{\bullet t}\,, \tag{5}$$

with $\bar{u} = 0$, where $\bar{y}_{\cdot t} = \sum_{i=1}^{n} y_{it}/n$, $\bar{x}_{\bullet t}$ and $\bar{\varepsilon}_{\cdot t}$ are defined as before. By averaging with respect to both *i* and *t* in (3), we have

$$\bar{\bar{y}} = f(x) + (\bar{\bar{x}} - x)\beta(x) + \bar{\bar{\varepsilon}}\,, \tag{6}$$

where $\bar{\bar{y}} = \sum_{i=1}^{n}\sum_{t=1}^{T} y_{it}/(nT)$, $\bar{\bar{x}}$ and $\bar{\bar{\varepsilon}}$ are defined as before. Then,

$$y_{it} - \bar{y}_{i\bullet} - \bar{y}_{\bullet t} + \bar{\bar{y}} = (x_{it} - \bar{x}_{i\bullet} - \bar{x}_{\bullet t} + \bar{\bar{x}})\beta(x) + (\varepsilon_{it} - \varepsilon_{i\bullet} - \varepsilon_{\bullet t} + \bar{\bar{\varepsilon}})\,. \tag{7}$$

The local linear nonparametric estimators of $f(x)$ and $\beta(x)$, $\hat{f}(x)$ and $\hat{\beta}(x)$ can then be obtained by minimizing

$$(y^* - Z^*(x)\delta(x))' K(x)(y^* - Z^*(x)\delta(x)) = \sum_{i=1}^{n}\sum_{t=1}^{T}(y_{it}^* - z_{it}^*\delta(x))^2 K\left(\frac{x_{it} - x}{h}\right). \tag{8}$$

Here, $\delta(x) = (f(x), \beta'(x))'$, $Y^* = \Phi^{-1/2}Y$ with elements y_{it}^*, and $Z^*(x) = \Phi^{-1/2}Z(x)$

with elements z_{it}^*, Y is the data vector with its it-th element y_{it}, and $Z(x)$ is an $nT \times (k+1)$ matrix with its it-th element $z_{it} = (1, x_{it} - x)$ and $k = 2$. $K(x)$ is the diagonal matrix with the diagonal element $K_{it} = K((x_{it} - x)/h)$, which is a kernel function that takes low values for x_{it} far away from x, but high values for x_{it} close to x (Ullah and Roy 1998; Henderson and Ullah 2004; Pagan and Ullah 1999). h is the bandwidth. The transformation matrix Φ is determined by $\Phi^{-1} = \frac{Q}{\sigma_\varepsilon^2} + \frac{Q_1}{\sigma_1^2} + \frac{Q_2}{\sigma_2^2} + \frac{Q_3}{\sigma_3^2}$ (Judge *et al*. 1985), with

$$\sigma_1^2 = \sigma_\varepsilon^2 + T\sigma_u^2, \quad \sigma_2^2 = \sigma_\varepsilon^2 + N\sigma_v^2, \quad \sigma_3^2 = \sigma_\varepsilon^2 + T\sigma_u^2 + N\sigma_v^2,$$

$$Q = I_{NT} - I_N \otimes \frac{j_T j_T^{'}}{T} - \frac{j_N j_T^{'}}{N} \otimes I_T + \frac{j_{NT} j_{NT}^{'}}{NT},$$

$$Q_1 = I_N \otimes \frac{j_T j_T^{'}}{T} - \frac{j_{NT} j_{NT}^{'}}{NT},$$

$$Q_2 = \frac{j_N j_N^{'}}{N} \otimes I_T - \frac{j_{NT} j_{NT}^{'}}{NT}, \text{ and}$$

$$Q_3 = \frac{j_{NT} j_{NT}^{'}}{NT}.$$

To solve the minimization problem in (8), we define the nonparametric estimator as

$$\hat{\delta}(x) = \left(\hat{f}(x), \hat{\beta}_{RE}^{'}(x)\right)^{'} = \left(Z^{*'}(x)K(x)Z^*(x)\right)^{-1}\left(Z^{*'}(x)K(x)y^*\right). \qquad (9)$$

The optimal bandwidth satisfies $h \propto (nT)^{-1/(6+k)} = (nT)^{-1/8}$ in accordance with the rule in Ullah and Roy (1998).

Before estimating the nonparametric model, we first estimate the three variances of the two random effects and the error term. We generalize the nonparametric estimation of the one-way random effects model in Ullah and Roy (1998) to a two-way random effects alternative in the following steps

1) We estimate $Var\left(u_i+\bar{\varepsilon}_{i\bullet}\right)=\sigma_u^2+\sigma_\varepsilon^2/T$ with $s_1^2=\sum_{i=1}^{n}\left(\bar{y}_{i\bullet}-\tilde{f}(\bar{x}_{i\bullet})\right)^2/n$, where $\tilde{f}(\bar{x}_{i\bullet})=\tilde{f}(x)$ at $x=\bar{x}_{i\bullet}$ is obtained by the local least-squares estimation of model (4).

2) We estimate $Var\left(v_t+\bar{\varepsilon}_{\bullet t}\right)=\sigma_v^2+\sigma_\varepsilon^2/N$ with $s_2^2=\sum_{t=1}^{T}\left(\bar{y}_{\bullet t}-\widehat{f}(\bar{x}_{\bullet t})\right)^2/T$, where $\widehat{f}(\bar{x}_{\bullet t})=\widehat{f}(x)$ at $x=\bar{x}_{\bullet t}$ is obtained by the local least-squares estimation of model (5).

3) We estimate σ_ε^2 from the fixed effects estimator $\hat{\beta}_{FE}(x)$, which can be obtained from the model (7) with $\hat{\beta}_{FE}(x)=(X'QK(x)QX)^{-1}X'QK(x)Qy$, and

$$\hat{\sigma}_\varepsilon^2=\sum_{i=1}^{N}\sum_{t=1}^{T}\left(y_{it}-\bar{y}_{i\bullet}-\bar{y}_{\bullet t}+\bar{\bar{y}}-(x_{it}-\bar{x}_{i\bullet}-\bar{x}_{\bullet t}+\bar{\bar{x}})\hat{\beta}_{FE}(x)\right)^2/(NT).$$

4) We calculate

$\hat{\sigma}_1^2=\hat{\sigma}_\varepsilon^2+T\hat{\sigma}_u^2=Ts_1^2$,

$\hat{\sigma}_2^2=\hat{\sigma}_\varepsilon^2+N\hat{\sigma}_v^2=Ns_2^2$,

$\hat{\sigma}_3^2=\hat{\sigma}_\varepsilon^2+T\hat{\sigma}_u^2+N\hat{\sigma}_v^2=\hat{\sigma}_1^2+\hat{\sigma}_2^2-\hat{\sigma}_\varepsilon^2$ and

$\theta_1=1-\hat{\sigma}_\varepsilon/\hat{\sigma}_1$, $\theta_2=1-\hat{\sigma}_\varepsilon/\hat{\sigma}_2$, $\theta_3=\theta_1+\theta_2-1+\hat{\sigma}_\varepsilon/\hat{\sigma}_3$.

5) Finally, we construct the weighted series as $y_{it}^*=y_{it}-\theta_1\bar{y}_{i\bullet}-\theta_2\bar{y}_{\bullet t}+\theta_3\bar{\bar{y}}$ and $z_{it}^*=z_{it}-\theta_1\bar{z}_{i\bullet}-\theta_2\bar{z}_{\bullet t}+\theta_3\bar{\bar{z}}$ and calculate the estimator using (9).

III. Empirical Results of the Nonparametric Estimation

Before carrying out the nonparametric estimation, we conduct the more familiar parametric estimation of the panel data model with two-way effects (shown in Appendix D), and find that the random effects model is more appropriate for our sample, although we do gain an impression of the impact of openness and indigeneity on growth (as indicated by GDP per capita) with the two-way effects. The estimation shows that the two indices have a positive effect on GDP per capita, and that the indigeneity factors tend to exert a greater impact on growth than the openness factors, which suggests that domestic performance is more crucial in promoting growth. However, as is pointed out in Section I, the multicollinearity of openness and indigeneity may have affected this result. The advantage of the nonparametric kernel estimation is that this problem can be avoided.

We then estimate the average effects of openness and indigeneity on growth at the mean values of the two indices using the nonparametric estimator (9). The sample means of the Openness Index and Indigenous Index are, respectively, 0.3346 and 0.4769. We denote $\bar{\bar{x}} = \left(\bar{\bar{x}}_1, \bar{\bar{x}}_2\right) =$ (log(0.3346), log(0.4769)). The results of the nonparametric estimation for $f(\bar{\bar{x}}_1, \bar{\bar{x}}_2)$ and the two partial derivatives are presented in Table 1, where the bandwidth is chosen to be $h = 1.2\left(nT\right)^{-1/8} = 1.2 \times 976^{-1/8} \approx 0.51$.

Table 1 Nonparametric Estimation at the Pooled Sample Mean

	$f(\bar{\bar{x}})$	$\partial f(\bar{\bar{x}}) / \partial x_1$	$\partial f(\bar{\bar{x}}) / \partial x_2$
Estimated value	7.8438	0.0674	0.7785
t-ratio	87.7030	0.9141	7.9413

The estimated effects of openness and indigeneity on growth as calculated from the nonparametric panel data model shown in Table 1 produce growth effects that run in the same direction as those derived from the parametric model shown in Appendix D. The nonparametric estimations of the effects of openness on growth (0.0674) and the effect of indigeneity on growth (0.7785) are close to their parametric counterparts (0.1077 and 0.7045, respectively) (see the last column of Table A3 in Appendix D). As Ullah and Roy (1998) pointed out, nonparametric estimates approximate the parametric estimates as the bandwidth becomes infinitely large. In addition to the multicollinearity problem that occurs with the linear model, the difference between the nonparametric estimation and the parametric estimation may be due to the specification of linear model which may have led to some biased estimates because it restricts the functional form of the relationship between growth, openness and indigeneity. An alternative explanation is that the nonparametric estimation is the estimated value of the functions at the mean values of the two indices in the sample, which consists of countries with diverse magnitudes and large differences in growth and development.

Nonetheless, although both methods give us openness and indigeneity effects that run in the same direction, the nonparametric estimation is able to show the estimates of the effects on growth at different levels of openness and indigeneity. We next use the nonparametric estimation procedure to estimate the following three functions[4]

$$f(\ln(x_1), \ln(x_2)),\ \partial f(\ln(x_1), \ln(x_2))/\partial(\ln(x_1)) \text{ and } \partial f(\ln(x_1), \ln(x_2))/\partial(\ln(x_2)).$$

Here and in the following section, we denote $x_1 = OPE$, $x_2 = IND$, and $x = (x_1, x_2)$. The function $f(\ln(x_1), \ln(x_2))$ is the average log GDP per capita at (x_1, x_2). The two partial derivative functions $\partial f(\ln(x_1), \ln(x_2))/\partial(\ln(x_1))$ and $\partial f(\ln(x_1), \ln(x_2))/\partial(\ln(x_2))$, which are denoted as $\beta_1(x_1, x_2)$ and $\beta_2(x_1, x_2)$, respectively, show the effects of openness and indigeneity on growth at (x_1, x_2). This is equivalent to the percentage increase in GDP per capita when there is a one-percent increase either in openness or indigeneity, all other things being equal.

To study the effects of openness and indigeneity on growth at different levels of openness and indigeneity, we first equally space the Cartesian product set $[0.086, 0.688] \times [0.118, 0.881]$, that is

$$[\min_{i,t}(OPE_{it}), \max_{i,t}(OPE_{it})] \times [\min_{i,t}(IND_{it}), \max_{i,t}(IND_{it})]$$

[4] The Gauss program, which is available upon request, is used to conduct the nonparametric estimation.

into 19×19 small rectangles and conduct nonparametric estimation at each of the 400 equally spaced points by using (9) to estimate $f(\cdot,\cdot)$ and its two partial derivatives $\beta_1(\cdot,\cdot)$ and $\beta_2(\cdot,\cdot)$. We choose the same bandwidth for all of the estimations. The estimation results at each level of openness and indigeneity are shown in Table A4 in Appendix E, in which the same Openness Index (Indigenous Index) is matched with different levels of the Indigenous Index (Openness Index), together with estimates of the log GDP per capita and the two partial effects of openness and indigeneity. The estimates of GDP per capita, namely $\exp(f(x))$, are also given. For simplicity, in Table A4 we only report the results with 8 of the 20 equally spaced points in each interval of the Cartesian product set.

Several observations can be made from the estimates of the openness effect $\beta_1(x)$, and the indigeneity effect $\beta_2(x)$ in Table A4. Firstly although both openness and indigeneity have a positive effect on growth when the two indices are high, they have a negative effect on growth when they are both very low or when either one of them is high but the other is very low. Secondly the effect of indigeneity on growth is generally larger than the openness effect unless the two indices are both very low. When the Openness Index is greater than or equal to 0.118, the indigeneity effect is always greater than the openness effect whereas when the Openness Index is very low (e.g. *OPE* = 0.086), the openness effect is always greater than the indigeneity effect for all levels of indigeneity. For an economy with an Openness Index of between 0.086 and 0.118, the openness effect is greater than the indigeneity effect when the indigeneity level is low, but the reverse is true when the indigeneity level is high. For most economies, and this is similar to the findings of the parametric estimations shown in Appendix E, indigeneity has a greater effect on growth. Therefore, although openness is important, indigenous development in an economy plays a more important role in improving economic performance.

IV. Comparative Static Analysis

This section presents two comparative static analyses on the trend of the estimated functions $\beta_1(x_1, x_2)$ and $\beta_2(x_1, x_2)$, where $x_1 =$ Openness Index (*OPE*) and $x_2 =$ Indigenous Index (*IND*). The analyses are carried out by fixing one variable in an interval and letting the other vary. The values of x_1 and x_2 that exceed the range of the sample (denoted as "out of sample" as distinct from "in sample") are also used to forecast the effects, which allows us to see how the estimated functions behave when the indices exceed the sample range. To obtain a more comprehensive understanding of the estimates of the two functions, $\beta_1(x_1, x_2)$ and $\beta_2(x_1, x_2)$, we graph them by the nonparametric point-wise estimates, study the trends, and apply them to the eight-year average sample in our study. The estimations are conducted using the following two designs

Design 1: The Openness Index x_1, denoted as x_1^0, to set at the minimum value of 0.086 in our sample and other higher values of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9. As the maximum value of the Openness Index is 0.688, the last three values are "out of sample" values. We set the range of the Indigenous Index x_2 to [0.05, 0.998], which is beyond the minimum and maximum values of 0.118 and 0.881, respectively, to capture the out of sample result. We equally space the interval [0.05, 0.998] and obtain 40 points for x_2. For each x_1^0, the three functions at x_1^0 and each of the 40 equally spaced points of x_2 are estimated using the nonparametric estimator (9). The smooth points of $\{(x_2, \beta_1(x_1^0, x_2))\}$ and $\{(x_2, \beta_2(x_1^0, x_2))\}$ are then collected to analyze the trend of the two effects.

Design 2: The Indigenous Index x_2, denoted as x_2^0, to set to the minimum value of 0.118 in our sample and other higher values of 0.15, 0.2, 0.25, 0.35, 0.45, 0.55, 0.65, 0.75, 0.85 and 0.95. The last value of 0.95 exceeds the range of our sample. Note that the minimum and maximum values of the Openness Index x_1 in our sample are 0.086 and 0.688, respectively. We set the change range of x_1 to be [0.05, 0.95], which is equally spaced with 40 points, and then we estimate the functions by using (9) at each of the equally spaced points of x_1 and each of x_2^0. Again, the smooth points of $\{(x_1, \beta_1(x_1, x_2^0))\}$ and $\{(x_1, \beta_2(x_1, x_2^0))\}$ are then collected to analyze the trend of the two effects.

The four Figures A1, A2, A3 and A4 in Appendix E show the effects of openness and indigeneity on growth with Designs 1 and 2, and Table 2 summarizes the major characteristics and implications of the four functions. We observe that as most of the economies in our sample have an openness of greater than 0.2, the effect of openness on growth is increasingly concave with a decreasing but positive marginal indigeneity effect (see Figure A1). This marginal effect finally becomes horizontal when indigeneity reaches a very high level, and further increases in indigeneity beyond this high level have a negligible marginal effect. A typical example is the Netherlands, which could gain a higher GDP per capita simply by improving its indigeneity. China, India and the majority of the developing countries, in contrast, need to improve both their openness and indigeneity to achieve the same gain. For the same level of indigeneity, as shown in Figure A1, a higher level of openness will cause openness to have a greater effect on growth if $x_1^0 \geq 0.2$. Figure A2 shows that if the level of openness in an economy is sufficiently high (≥ 0.55), then openness is unlikely to have a negative effect on growth. As the economies in our sample with as high level of openness are also equipped with a relatively high level of indigeneity, they should be able to improve their indigeneity and openness simultaneously.

Table 2 Characteristics and Implications of the Functions

Effect of Openness		
Design 1: Fix $x_1 = x_1^0$		
	Characteristics	Implications
$x_1^0 \le 0.1$	Convex function of x_2 with decreasing-increasing threshold.	Improvements in indigeneity cause openness to have a greater effect on growth, although the marginal effect of indigeneity is decreasing. Sample economies: China, India, Japan, Norway, Iceland and the United States.
$0.2 < x_1^0 < 0.9$	Increasing concave function of x_2.	The effect of openness on growth reaches saturation point at a certain level of indigeneity, after which further improvement in indigeneity fails to cause openness to have a greater effect on growth, although the effect is still positive.
$x_1^0 \ge 0.9$	Concave function of x_2 with increasing-decreasing threshold.	Regardless of the relatively low level of openness and indigeneity, economies can achieve an increase in the effect of openness on growth by improving their indigeneity performance.
Design 2: Fix $x_2 = x_2^0$		
$x_2^0 < 0.2$	Convex function of x_1 with decreasing-increasing threshold.	Countries should first enhance their indigeneity to achieve greater economic growth through the openness effect. Sample economies: Congo, Sudan, Burundi, Vietnam and Laos.
$0.2 \le x_2^0 \le 0.65$	Increasing concave function of x_1 .	The more advanced the level of indigeneity is, the greater the effect of openness on growth, but its marginal effect is decreasing. Most of the developing countries in our sample fall into this category.
$x_2^0 \ge 0.75$	Concavo-convex function of x_1 with inflexion.	If an economy improves its openness and the level of indigeneity remains unchanged, then the openness effect increases rapidly at the beginning of the process before it is maximized.
Effect of Indigeneity		
Design 1: Fix $x_1 = x_1^0$		
$x_1^0 \le 0.1$	Convex function of x_2 with decreasing-increasing threshold.	Economies with a very low level of openness will experience an increase in the effect of indigeneity on growth by improving the level of indigeneity. Such economies should therefore first improve their

		openness to enhance growth. Sample economies: Iran, Syrian Arab, and Laos.
$0.2 < x_1^0 < 0.5$	Increasing concave function of x_2.	Improvements in indigeneity cause indigeneity to have a higher effect on growth, even though the marginal effect of indigeneity is decreasing.
$x_1^0 \geq 0.5$	Concave function of x_2 with increasing-decreasing threshold.	It is necessary for economies to improve their openness to a greater level (> 0.4) for indigeneity to have a positive effect on growth.

Design 2: Fix $x_2 = x_2^0$

$x_2^0 \leq 0.15$	Convex function of x_1 with decreasing-increasing threshold.	Improving the openness of a country with low indigeneity will cause indigeneity to have an increasing (or even positive) effect on growth. Openness helps to enhance the effect of indigeneity on growth. This is particularly useful for countries with low indigeneity.
$0.25 < x_2^0 < 0.55$	Increasing concave function of x_1.	The higher the level of openness the greater the effect of indigeneity on growth, but its marginal effect is decreasing. Most of the developing countries in our sample fall into this category.
$x_2^0 \geq 0.55$	Concave function of x_1 with increasing-decreasing threshold.	Economies with a high level of indigeneity must maintain a suitable level of openness if indigeneity is to have a maximum effect on growth. Sample economies: Japan, Norway, Iceland, and the United States, among others.

The finding that indigeneity has a greater effect than openness on growth when openness is not too low ($x_1^0 \geq 0.2$) is confirmed by examining Figure A1 and Figure A3, in which we can see that $\beta_2(0.2, x_2) > \beta_1(0.2, x_2)$. However, our concern is for those economies with a very low openness of say $x_1^0 < 0.2$.

Figure 1 shows that it is also true that $\beta_2(0.16, x_2) > \beta_1(0.16, x_2)$ because the effect of indigeneity on the growth curve of $x_1 = 0.16$ (marked as "*IND*: $x_1 = 0.16$") is above the effect of openness on the growth curve of $x_1 = 0.16$ (marked as "*OPE*: $x_1 = 0.16$"). When x_1^0 = 0.15, the two curves intersect at points A_1 and A_2. Between the two curves, the openness effect is larger than the indigenous effect.

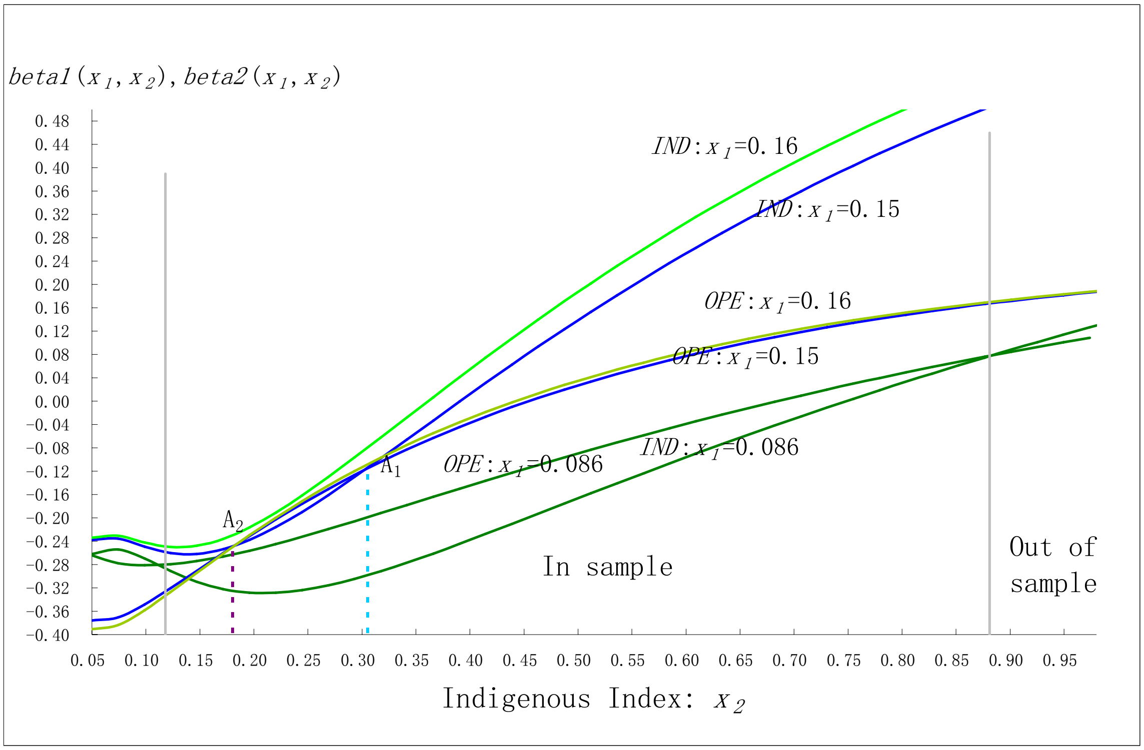

Figure 1 Comparison of the Openness and Indigenous Effects: x_1 = Constant

For other cases with a lower level of indigeneity the two curves also intersect. For example, for $x_1^0 = 0.086$, which is the minimum Openness Index value in our sample, the openness effect is always larger than the indigeneity effect. This implies that even though the indigeneity effect on growth is generally greater than the openness effect, the openness effect is greater when the economy has a very low level of openness. Therefore, for an economy with a low Openness Index, an openness policy is a better choice for enhancing economic growth.

Figure 2 shows that, regardless of how high the level of indigeneity, there is a point (for example, the intersect point B of the curve x_2 = 0.85 for the indigeneity effect and the curve x_2 = 0.85 for the openness effect, the intersect point C of the two curves of x_2 = 0.35, the intersect point D of the two curves of x_2 = 0.15, and the intersect point E of the two curves of x_2 = 0.118) to the right of which the indigenous effect is greater than the openness effect, and to the left of which the indigenous effect is smaller than the openness effect. This intersection points have a relatively low x_1 coordinate, which implies that although the economy on the left of an intersected point has a relatively low openness level, openness has a greater effect than indigeneity.

The implication is that although the effect of indigeneity on growth is generally greater than the effect of openness, openness has a greater effect when the economy has a very low level of openness regardless of the level of indigeneity. When faced with the two alternatives therefore, a policy of openness is again a better choice for an economy with a low level of openness for improving economic growth.

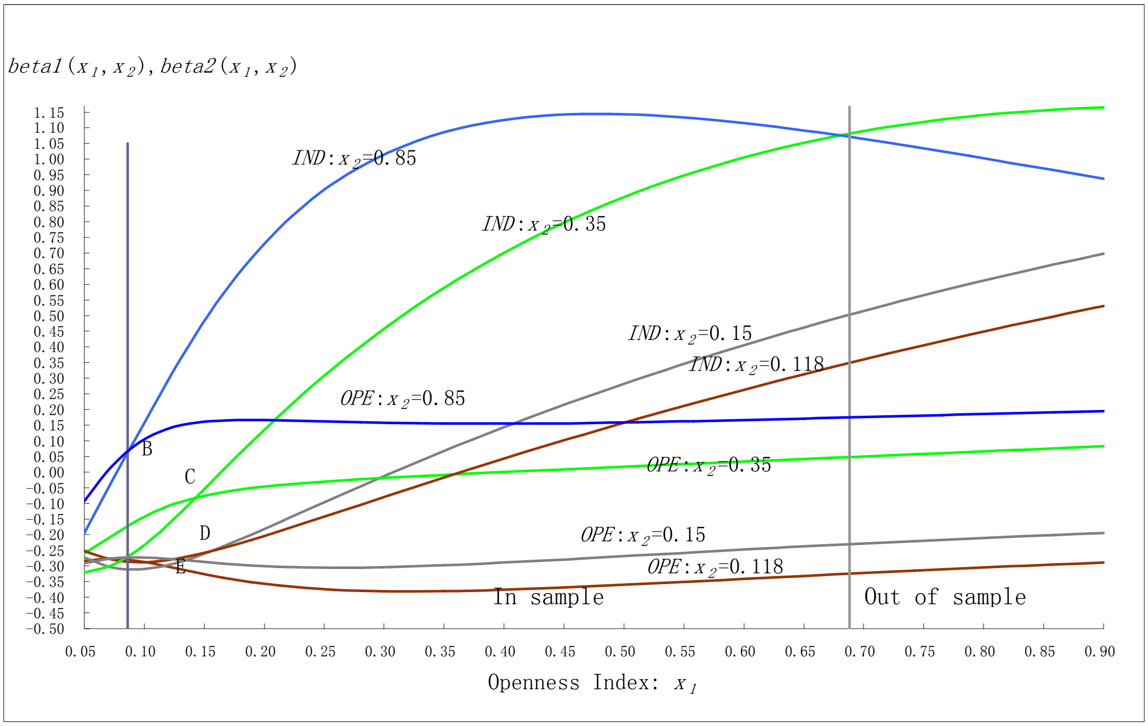

Figure 2 Comparison of the Openness and Indigenous Effects: x_2 = Constant

V. Conclusion

This paper makes two contributions to the study of growth and globalization. First, by constructing an Openness Index and an Indigenous Index we provide additional information on an economy's performance in the globalization rankings. Secondly, we use nonparametric estimation to successfully reveal the elasticity and trends of openness and indigeneity at all levels of development. The comparative analysis of the nonparametric estimation gives the following relevant and interesting findings on the implications of openness and indigenous development that apply specifically to the countries in our sample.

The empirical evidence shows that when the effects of openness and indigeneity on growth are well matched, both are positive. However, the effects are negative in an economy with quite a low level of openness or indigeneity (for example, when one of the indices is less than 0.1). This result makes a reasonable and useful contribution to the globalization debate because the distinction between the openness and indigeneity factors shows how different economies can perform and improve in these areas. The policy implication for most developing countries with low levels of both openness and indigeneity is that although they should first improve their openness to achieve better economic performance, indigenous improvement plays a more crucial important role in improving overall economic performance.

The empirical evidence from the nonparametric estimation further shows that the two effects are distinguished by the characteristics that are summarized in Table 2. If an economy is poorly developed in both openness and indigeneity and the two indices are less than about 0.1, then the effects of the two factors on growth are negative, a situation that may worsen if the economy fails to improve its openness or indigeneity to a certain threshold level. For those economies with a medium level of openness and indigeneity (with indices greater than about 0.2), the two effects on growth enter into an increasing and concave development process with decreasing marginal effects. For economies with very high levels of both openness and indigeneity, the effects of the two factors on growth differ slightly: they are increasing concave functions of the indigeneity index with an increasing-decreasing threshold when they are maximized, but the effect of openness on growth is a concave-convex function of the openness index with an inflexion and the effect of indigeneity is a concave function of the openness index with an increasing-decreasing threshold.

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Appendix A Data and Definition of Variables

The data set comprises 122 world economies and 28 factors for the period 1998-2006. Table A1 summarizes the definitions and data sources of the 28 factors. The missing datum x_t can either be followed by two known data in two subsequent years, or between two known data, or after two known data, in which cases we let $x_t = (x_{t+1}+x_{t+2})/2$, or $x_t = (x_{t-1}+x_{t+1})/2$, or $x_t = (x_{t-2}+x_{t-1})/2$, respectively. For the few, mostly developing, countries with a single observed datum (e.g., tourist flow) all of the missing data are estimated with this known datum in each period of the sample. For the few countries with only two observed data, we estimate all of the missing data with the average of the two known numbers in each period of the sample. For those countries without any data on a variable, the data of neighboring countries with similar characteristics (economy, populations and so on) are considered and compared. For example, the data on Nicaragua's total public spending on education are used for Guatemala and Honduras. The "government transfer" data for Ethiopia, Guyana, Madagascar, Nicaragua, Oman and Tajikistan are not available, but as the geographical and population sizes of these six countries are relatively small we give these countries zero entries for these data.

Table A1 Definition and Source of Factors

Total trade flows (% of GDP): Sum of exports and imports of goods and services measured as a share of GDP.

Foreign direct investment (% of GDP): Sum of the absolute value of the inflow and outflow of FDI recorded in the balance of payments measured as a share of GDP.

Gross private capital flows (% of GDP): Sum of the absolute value of the direct, portfolio, and other investment inflow and outflow recorded in the balance of payments financial account, excluding changes in the assets and liabilities of monetary authorities and the government in general. The indicator is calculated as a ratio of GDP in U.S. dollars.

Average applied tariff rates (unweighted in %): The unweighted averages of all goods in ad valorem, applied, or MFN rates whichever is available.

Trade freedom (%): A composite measure of the absence of tariff and non-tariff barriers that affect the import and export of goods and services.

Financial freedom (%): A measure of banking security and independence from government control.

Investment freedom (%): An assessment of the free flow of capital, especially foreign capital.

Internet users (per 1,000 people): The number of people with access to the Internet.

International tourism (% of population): The sum of the arrivals and departures of international tourists.

International voice traffic (in minutes per person): The sum of international incoming and outgoing telephone traffic.

Membership in international organizations: The absolute number of international inter-governmental organizations.

Government transfer (% of GDP): The sum of credit and debit divided by GDP.

Troop contribution (% of total): The number of peacekeeping troop contributed to the UN as a ratio of total UN peacekeeping troop.

Corruption perception index: The degree to which corruption (defined as the abuse of entrusted power for private gain) is perceived to exist among public officials and politicians.

Voice and accountability index: The extent to which a country's citizens are able to participate in selecting their government, freedom of expression, freedom of association, and a free media.

Political stability index: The perception of the stability of the government in power.

Government effectiveness: The combined responses to the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the creditability of government commitment to policies.

Regulatory quality: The provision of market-friendly policies, such as price controls, the adequacy of bank supervision and other regulations in such areas as foreign trade and business development.

Rule of law: The extent to which agents are confident in and abide by the rules of society, including perceptions of the incidence of crime, the effectiveness and predictability of the judiciary, and contract enforceability.

Control of corruption: The extent of corruption, defined as the exercise of public power for private gain based on the scores for variables from expert polls and surveys.

Property right protection: The degree protection afforded property right and the extent of property right law enforcement.

Regulatory scores: A measure of how easy or difficult it is to open and operate a business, and whether the regulations are applied uniformly to all businesses.

Primary school enrolment rate: The ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds with the years of primary school education.

Public spending on education (% of GDP): Current and capital public expenditure on education expressed as a percentage of total government expenditure.

Primary school pupil-teacher ratio: The number of pupils enrolled in primary schools divided by the number of primary school teachers.

Total health expenditure (% of GDP): Recurrent and capital spending from central and local government budgets, external borrowings, grants and donations, and health insurance funds.

Growth rate of implicit GDP deflator (annual %): The growth of the GDP implicit deflator, which is the ratio of GDP in the current local currency to GDP in constant local currency.

GDP per capita: Gross domestic product (current dollars) divided by the population.

Sources: *International Financial Statistics*, IMF (May 2007); *World Development Indicators*, World Bank (1998-2006); TRAINS Database, UNCTAD; IDB CD ROMs, WTO; *Index of Economic Freedom*, Heritage Foundation (1998-2006); *The World Factbook*, Central Intelligence Agency; *Balance of Payment Statistics*, United Nations; Department of Peacekeeping Operations, United Nations; *Corruption Index*, Transparency House (1999-2006); *Aggregating Governance Indicators*, World Bank (1999-2006); and *National Accounts*, OECD.

Appendix B The Openness Index and the Indigenous Index

Table A2 Grouping of the Openness Factors and Indigenous Factors

Openness Factors	Indigenous Factors
I. Economic Integration: (y_1, b_1)	I. Institutional Establishment: (y_1, b_1)
1) Total trade flow (% GDP): (x_1, a_1; w_1)	1) Corruption Perception Index: (x_1, a_1; w_1)
2) Foreign direct investment (% GDP): (x_2, a_2; w_2)	2) Voice and accountability: (x_2, a_2; w_2)
3) Gross private capital flow (% GDP): (x_3, a_3; w_3)	3) Political stability: (x_3, a_3; w_3)
4) Restrictions: Average applied tariff rates (unweighted in %): (x_4, a_4; w_4)	4) Government effectiveness: (x_4, a_4; w_4)
II. Economic Freedom: (y_2, b_2)	5) Regulatory quality: (x_5, a_5; w_5)
5) Trade freedom (%): (x_5, a_5; w_5)	6) Rule of law: (x_6, a_6; w_6)
6) Financial freedom (%): (x_6, a_6; w_6)	7) Control of corruption: (x_7, a_7; w_7)
7) Investment freedom (%): (x_7, a_7; w_7)	8) Property rights protection: (x_8, a_8; w_8)
III. Technology Connectivity: (y_3, b_3)	9) Regulatory scores: (x_9, a_9; w_9)
8) Internet users: (x_8, a_8; w_8)	II. Education and Health: (y_2, b_2)
IV. Personal Contact: (y_4, b_4)	10) Primary school enrollment rate: (x_{10}, a_{10}; w_1)
9) International tourism (% population): (x_9, a_9; w_9)	11) Public spending on education: (x_{11}, a_{11}; w_{11})
10) International voice traffic: (x_{10}, a_{10}; w_{10})	12) Primary school pupil-teacher ratio: (x_{12}, a_{12}; w_{12})
V. International Engagement: (y_5, b_5)	13) Total health expenditure: (x_{13}, a_{13}; w_{13})
11) Membership of international organizations: (x_{11}, a_{11}; w_{11})	III. Inflation: (y_3, b_3)
12) Government transfer (% GDP): (x_{12}, a_{12}; w_{12})	14) Growth rate of implicit GDP deflator (annual %): (x_{14}, a_{14}; w_{14})
13) Troop contribution (% of total): (x_{13}, a_{13}; w_{13})	

In constructing the two indices, each factor is first transformed into a unit-free index on a yearly basis (Lockwood 2004; Dreher 2006). The original factors are denoted as z_{it}. The transformed index is defined as

$$Z_{it} = \begin{cases} \dfrac{z_{it} - \min_t z_{it}}{\max_t z_{it} - \min_t z_{it}}, & \text{if higher } z_{it} \text{ indicates higher openness (indigeneity),} \\ \dfrac{\max_t z_{it} - z_{it}}{\max_t z_{it} - \min_t z_{it}}, & \text{if higher } z_{it} \text{ indicates less openness (indigeneity).} \end{cases}$$

These transformed indices are then used to construct the two indices. The factor analysis is combined with the PCA to determine the weights of the factors in constructing the Indigenous Index (see Anderson et al. 2005). Suppose that there are p factors, $x_1, \ldots, x_p$, and m underlying common factors $f_1, \cdots, f_m$ that are orthogonal to each other. The basic model is: $x_k - \mu_k = \alpha_{k1} f_1 + \alpha_{k2} f_2 + \cdots + \alpha_{km} f_m + \varepsilon_k$, $k = 1, 2, \cdots, p$, where each error term accounts for that part of the factor that is not common with the other factors and the coefficients α_{ij} are factor loadings that show how each x_i individually depends on the common factors $f_1, \cdots, f_m$. See Rencher (2002, Chapter 13). We choose $f_1, \cdots, f_m$ as the first m principal components of the correlation matrix of the p factors, $x_1, \ldots, x_p$. The variance of x_i can be partitioned into the component that is due to the presence of the common factors $\sigma_{ii} = Var(x_i) = h_i^2 + \psi_i$, where communality is indicated by $h_i^2 = \alpha_{i1}^2 + \alpha_{i2}^2 + \cdots + \alpha_{im}^2$ and specific variance is represented by ψ_i. The factor loadings ($\alpha_{i1}, \alpha_{i2}, \cdots, \alpha_{im}$) and the communality h_i^2 reflect the contribution of x_i to the principal components. The greater the communality h_i^2, the higher the contribution communality makes to the variance of x_i, and the more information about x_i is given. Therefore, communality can be used as a gist to determine the weight of each of the individual factors. The weights of $x_1, \ldots, x_p$ are defined as $w_i = h_i^2 / \sum_{i=1}^{p} h_i^2$, $i = 1, \cdots, p$, with $0 < w_i < 1$ and $\sum_{i=1}^{p} w_i^2 = 1$.

It can be argued that each of the two indices that are used to rank the economies should be calculated by further normalizing the original yearly index on a whole-panel basis before making the ranking, as the index is not comparable over time. However, the rankings are not affected by whether yearly or panel normalizing is used. This can be observed by denoting $a = \max_{i,t}\{Z_{it}\}, b = \min_{i,t}\{Z_{it}\}$, which are constants that are uncorrelated with i and t. The panel-normalized index is defined as

$$\tilde{Z}_{it} = \frac{Z_{it} - \min_{i,t} Z_{it}}{\max_{i,t} Z_{it} - \min_{i,t} Z_{it}}.$$

Then $\tilde{Z}_{it} = Z_{it} / (a-b) - b/(a-b)$, where $\tilde{Z}_{it}$ is the panel-normalized Openness Index (Indigenous Index), and Z_{it} is the original yearly-normalized Openness Index (Indigenous Index). As $(a-b) > 0$, the ranking by $\tilde{Z}_{it}$ is identical to that by Z_{it} .

In the regression estimation, as $\tilde{Z}_{it} = 0$ for the country with the minimum Openness Index or Indigenous Index, the data of that country are not usable because taking the log of the data is not allowed. We do not want to lose this information in our sample, so as the indices satisfy $0 < Z_{it} < 1$ and the minimum of the indices is small, we can assume that the worst level of both the Openness Index and the Indigenous Index is zero and take that as the floor level of the base. The panel normalizing indices are then $\tilde{Z}_{it} = Z_{it} / (\max_{i,t} Z_{it}) = Z_{it} / a$. As $\partial \log(GDP) / \partial \log(Z_{it}) = \partial \log(GDP) / \partial \log(\tilde{Z}_{it})$, the effect of openness (indigeneity) on growth is not affected by whether the original yearly normalizing or the panel normalizing approach is used. Therefore, the data based on the original yearly normalized indices are used in the parametric and nonparametric regression estimation.

Appendix C About the model Specification

In the nonparametric model (1) in Section II, we assume that x_1 and x_2 are exogenous for the following reasons.

1. As we use a much greater number of factors and the principle component analysis (PCA) which assigns the weighting of the factors automatically, to construct the two composite indices[5], the two indices that serve as regressors in our model can explain the dependent variable for almost all aspects of an economy. They effectively reduce the possible presence of omitted variables, which is the main source of endogeneity in a regression model. The error term in our model can thus approximately be assumed to be uncorrelated with the two regressors.

2. The two-way random effects panel data model allows for both country and time heterogeneity, which would in some extent counteract the degree of endogeneity of the two indices should there be any.

3. The local averaging difference in the nonparametric local linear estimation (see Section II (7) in the text) can reduce the degree of the heterogeneity in the model. A similar approach is used in Caselli *et al* (1996) and adopted in Dollar and Kraay (2003, p. 152 (2)).

4. The relatively short period of our panel data ($T = 8$) does not allow us to use the lags of the per capita GDP variable to conduct the nonparametric estimation as is employed in the parametric literature, such as the application of the Arellano-Bond GMM estimator in Dreher (2006) ($T = 31$) and the adoption of the dynamic regressions (using decadal data) to conduct

[5] Dollar and Kraay (2003) use only the trade/GDP ratio as the external factor, and five institutional factors (the rule-of-law, freedom index, money supply, revolution, and war deaths).

parametric estimations in Dollar and Kraay (2003). The requirement of a large dataset and the curse of dimensionality inherent in nonparametric estimation prevent us from applying too many lagged variables in the regressor vector.

5. The difficulty in finding suitable instruments inhibits researchers from conducting nonparametric estimation with endogenous regressors, as is shown in Newey *et al.* (1999) and Dorolles *et al.* (2002) for cross-section data models and in Li and Racine (2007, Section 19.6, p. 594) for partially linear panel data model.

For these reasons we ignore the endogeneity of the Openness Index and the Indigenous Index in the nonparametric specification of the two-way random effects model in Section II.

Appendix D Parametric Specification and Estimation

The effects of openness and indigeneity on growth can be examined by specifying a two-way panel data parametric model as follows.

$$\log(GDP_{it}) = c_0 + c_1 \log(OPE_{it}) + c_2 \log(IND_{it}) + u_i + v_t + e_{it} ,$$

where *GDP* is the nominal GDP per capita; *OPE* and *IND* are, respectively, the Openness Index and the Indigenous Index; e_{it} is the stochastic term; u_i and v_t can either be the economic and time fixed effects if they are fixed unknown parameters, or the random effects if both are random variables.

Table A3 Parametric Model Specification Test and Estimation

	Fixed effects	Random effects
log(EXO)	-0.0623	0.1077
(t-ratio)	(-0. 9856)	(1.4640)
log(IND)	0.2554	0.7045
(t-ratio)	(2.8639)	(7.1842)
Wald F-Test for no Fixed Effects	219.43	
Breusch-Pagan Test: Random Effects	2667.7	
Hausman Test: Fixed or Random	233.17	

Table A3 shows the results of the specification test and the estimation of the models. The Wald F-test reject the homogeneity of the intercept, and hence the coefficient estimate of the constant intercept models in both the one-way and the two-way specification is biased, thus implying that the heterogeneity of countries or periods in our sample is not taken into account. The Breusch-Pagan Test for Random Effects shows that the random effects model is preferred. The Hausman's specification tests reject the null hypothesis of no systematic difference between the two coefficients, which also indicates the suitableness of a random effects specification. The elasticities of the Openness Index and Indigenous Index on GDP per capita are 0.1637 and 0.6409, respectively, which implies that the indigenous factors are more influential than the openness factors in enhancing growth.

Appendix E Nonparametric Estimation

Table A4 Nonparametric Estimation at Different Levels of the Openness Index and Indigenous Index

OPE	*IND*	$f(x)$	$\beta_1(x)$	$\beta_2(x)$	GDPpc	*IND*	*OPE*	$f(x)$	$\beta_1(x)$	$\beta_2(x)$	GDPpc
0.086	0.118	6.797	-0.280	-0.287	894.889	0.118	0.086	6.797	-0.280	-0.287	894.889
	0.158	6.746	-0.271	-0.316	850.819		0.118	6.728	-0.301	-0.282	835.141
	0.198	6.715	-0.255	-0.329	824.272		0.149	6.678	-0.326	-0.259	795.046
	0.238	6.696	-0.236	-0.326	809.001		0.181	6.638	-0.347	-0.227	763.490
	0.279	6.689	-0.214	-0.312	803.358		0.213	6.602	-0.363	-0.189	736.788
	0.319	6.693	-0.192	-0.291	806.336		0.244	6.570	-0.373	-0.150	713.655
	0.359	6.705	-0.168	-0.266	816.723		0.276	6.542	-0.379	-0.110	693.464
	0.399	6.726	-0.146	-0.239	833.889		0.308	6.516	-0.381	-0.070	675.869
	0.439	6.753	-0.123	-0.211	856.968		0.339	6.493	-0.381	-0.031	660.370
	0.479	6.786	-0.101	-0.182	885.454		0.371	6.472	-0.379	0.008	646.841
	0.519	6.823	-0.080	-0.153	919.013		0.403	6.454	-0.376	0.046	634.984
	0.560	6.864	-0.059	-0.125	957.188		0.434	6.437	-0.371	0.083	624.593
	0.600	6.908	-0.040	-0.097	999.945		0.466	6.423	-0.366	0.120	615.540
	0.640	6.954	-0.021	-0.070	1047.017		0.498	6.410	-0.361	0.155	607.651
	0.680	7.002	-0.002	-0.044	1098.279		0.530	6.398	-0.355	0.190	600.763
	0.720	7.051	0.015	-0.018	1153.781		0.561	6.388	-0.349	0.223	594.844
	0.760	7.101	0.032	0.007	1213.301		0.593	6.380	-0.343	0.256	589.810
	0.801	7.152	0.048	0.031	1277.040		0.625	6.373	-0.337	0.288	585.520
	0.841	7.204	0.063	0.054	1345.068		0.656	6.366	-0.331	0.319	581.901
	0.881	7.256	0.077	0.076	1417.146		0.688	6.361	-0.325	0.349	578.941
0.118	0.118	6.728	-0.301	-0.282	835.141	0.158	0.086	6.746	-0.271	-0.316	850.819
	0.158	6.694	-0.270	-0.301	807.223		0.118	6.694	-0.270	-0.301	807.223
	0.198	6.682	-0.236	-0.298	797.674		0.149	6.668	-0.277	-0.261	786.663
	0.238	6.686	-0.202	-0.277	801.031		0.181	6.652	-0.284	-0.208	774.254
	0.279	6.704	-0.168	-0.245	815.744		0.213	6.640	-0.288	-0.151	764.942
	0.319	6.734	-0.136	-0.208	840.671		0.244	6.630	-0.289	-0.093	757.255
	0.359	6.774	-0.106	-0.167	874.979		0.276	6.621	-0.288	-0.037	750.695
	0.399	6.822	-0.077	-0.125	918.002		0.308	6.614	-0.285	0.019	745.235
	0.439	6.877	-0.051	-0.083	969.519		0.339	6.608	-0.281	0.072	740.777
	0.479	6.937	-0.026	-0.042	1029.162		0.371	6.603	-0.275	0.124	737.378
	0.519	7.000	-0.003	-0.002	1096.853		0.403	6.600	-0.269	0.173	735.022
	0.560	7.067	0.019	0.037	1172.625		0.434	6.598	-0.262	0.221	733.626
	0.600	7.136	0.039	0.075	1256.644		0.466	6.597	-0.256	0.266	733.113
	0.640	7.207	0.057	0.111	1348.975		0.498	6.598	-0.249	0.310	733.480
	0.680	7.279	0.075	0.146	1449.828		0.530	6.600	-0.242	0.352	734.728
	0.720	7.352	0.091	0.179	1559.312		0.561	6.602	-0.235	0.393	736.788
	0.760	7.425	0.106	0.211	1677.903		0.593	6.606	-0.229	0.432	739.519
	0.801	7.499	0.120	0.242	1805.874		0.625	6.611	-0.222	0.469	743.077
	0.841	7.572	0.133	0.271	1943.217		0.656	6.617	-0.216	0.505	747.325
	0.881	7.645	0.145	0.299	2090.169		0.688	6.623	-0.210	0.539	752.198
0.181	0.118	6.638	-0.347	-0.227	763.490	0.238	0.086	6.696	-0.236	-0.326	809.001
	0.158	6.652	-0.284	-0.208	774.254		0.118	6.686	-0.202	-0.277	801.031
	0.198	6.688	-0.224	-0.166	802.795		0.149	6.709	-0.183	-0.199	819.832
	0.238	6.741	-0.171	-0.111	846.237		0.181	6.741	-0.171	-0.111	846.237
	0.279	6.808	-0.125	-0.049	904.606		0.213	6.773	-0.163	-0.023	873.930
	0.319	6.886	-0.084	0.015	977.991		0.244	6.804	-0.155	0.063	900.995
	0.359	6.973	-0.048	0.078	1066.993		0.276	6.832	-0.148	0.144	927.321
	0.399	7.067	-0.017	0.140	1172.039		0.308	6.860	-0.141	0.220	953.176
	0.439	7.165	0.011	0.200	1293.879		0.339	6.886	-0.134	0.292	978.773
	0.479	7.268	0.036	0.257	1433.537		0.371	6.912	-0.126	0.360	1004.354
	0.519	7.373	0.057	0.311	1591.767		0.403	6.938	-0.119	0.423	1030.295
	0.560	7.478	0.077	0.362	1769.407		0.434	6.963	-0.112	0.482	1056.694
	0.600	7.585	0.094	0.409	1967.856		0.466	6.988	-0.106	0.538	1083.769
	0.640	7.691	0.109	0.454	2187.687		0.498	7.013	-0.099	0.590	1111.427
	0.680	7.796	0.123	0.496	2429.887		0.530	7.039	-0.093	0.639	1140.019
	0.720	7.899	0.135	0.535	2695.664		0.561	7.064	-0.087	0.685	1169.463
	0.760	8.002	0.146	0.572	2985.433		0.593	7.090	-0.080	0.728	1199.908
	0.801	8.102	0.155	0.606	3299.743		0.625	7.116	-0.075	0.768	1231.515
	0.841	8.200	0.164	0.637	3639.858		0.656	7.142	-0.069	0.805	1264.333
	0.881	8.296	0.172	0.667	4005.806		0.688	7.169	-0.063	0.840	1298.286
0.276	0.118	6.542	-0.379	-0.110	693.464	0.359	0.086	6.705	-0.168	-0.266	816.723
	0.158	6.621	-0.288	-0.037	750.695		0.118	6.774	-0.106	-0.167	874.979
	0.198	6.719	-0.211	0.051	828.155		0.149	6.872	-0.069	-0.046	965.262

	0.238	6.832	-0.148	0.144	927.321		0.181	6.973	-0.048	0.078	1066.993
	0.279	6.957	-0.096	0.236	1050.898		0.213	7.066	-0.035	0.196	1171.804
	0.319	7.091	-0.053	0.324	1201.469		0.244	7.152	-0.025	0.306	1277.040
	0.359	7.231	-0.017	0.406	1382.018		0.276	7.231	-0.017	0.406	1382.018
	0.399	7.375	0.013	0.483	1595.113		0.308	7.304	-0.010	0.498	1486.530
	0.439	7.519	0.039	0.554	1843.461		0.339	7.372	-0.004	0.581	1590.971
	0.479	7.664	0.061	0.618	2129.835		0.371	7.436	0.002	0.657	1695.614
	0.519	7.807	0.079	0.676	2456.518		0.403	7.496	0.007	0.725	1800.825
	0.560	7.946	0.095	0.729	2825.385		0.434	7.553	0.013	0.787	1906.644
	0.600	8.083	0.109	0.775	3238.288		0.466	7.608	0.018	0.843	2013.843
	0.640	8.215	0.121	0.817	3696.715		0.498	7.660	0.023	0.893	2122.182
	0.680	8.343	0.131	0.854	4201.513		0.530	7.711	0.028	0.938	2232.327
	0.720	8.467	0.139	0.887	4752.851		0.561	7.760	0.034	0.978	2344.670
	0.760	8.585	0.147	0.915	5350.793		0.593	7.808	0.039	1.013	2459.221
	0.801	8.699	0.153	0.940	5995.114		0.625	7.854	0.044	1.043	2576.533
	0.841	8.808	0.159	0.962	6684.188		0.656	7.900	0.049	1.070	2696.743
	0.881	8.912	0.163	0.981	7417.520		0.688	7.945	0.054	1.093	2820.022
0.371	0.118	6.472	-0.379	0.008	646.841	0.479	0.086	6.786	-0.101	-0.182	885.454
	0.158	6.603	-0.275	0.124	737.378		0.118	6.937	-0.026	-0.042	1029.162
	0.198	6.751	-0.192	0.243	854.999		0.149	7.106	0.015	0.110	1219.383
	0.238	6.912	-0.126	0.360	1004.354		0.181	7.268	0.036	0.257	1433.537
	0.279	7.082	-0.074	0.468	1190.823		0.213	7.415	0.048	0.391	1659.879
	0.319	7.258	-0.032	0.568	1419.557		0.244	7.546	0.055	0.512	1892.966
	0.359	7.436	0.002	0.657	1695.614		0.276	7.664	0.061	0.618	2129.835
	0.399	7.613	0.030	0.736	2023.735		0.308	7.770	0.065	0.712	2369.182
	0.439	7.787	0.053	0.805	2407.875		0.339	7.867	0.069	0.794	2609.986
	0.479	7.956	0.073	0.865	2851.784		0.371	7.956	0.073	0.865	2851.784
	0.519	8.119	0.089	0.916	3357.661		0.403	8.037	0.077	0.926	3094.557
	0.560	8.276	0.103	0.959	3927.271		0.434	8.113	0.080	0.979	3338.243
	0.600	8.425	0.115	0.995	4561.469		0.466	8.184	0.084	1.024	3583.159
	0.640	8.568	0.124	1.025	5259.020		0.498	8.251	0.088	1.062	3829.540
	0.680	8.703	0.133	1.049	6019.142		0.530	8.313	0.093	1.094	4078.155
	0.720	8.830	0.140	1.069	6839.022		0.561	8.373	0.097	1.120	4328.602
	0.760	8.951	0.145	1.084	7716.375		0.593	8.430	0.101	1.140	4582.500
	0.801	9.065	0.150	1.096	8646.414		0.625	8.485	0.106	1.156	4839.177
	0.841	9.172	0.154	1.104	9625.778		0.656	8.537	0.111	1.168	5100.021
	0.881	9.273	0.157	1.110	10649.838		0.688	8.588	0.116	1.176	5365.259
0.466	0.118	6.423	-0.366	0.120	615.540	0.600	0.086	6.908	-0.040	-0.097	999.945
	0.158	6.597	-0.256	0.266	733.113		0.118	7.136	0.039	0.075	1256.644
	0.198	6.788	-0.171	0.408	886.694		0.149	7.371	0.076	0.249	1588.428
	0.238	6.988	-0.106	0.538	1083.769		0.181	7.585	0.094	0.409	1967.856
	0.279	7.195	-0.055	0.654	1332.351		0.213	7.773	0.102	0.551	2376.300
	0.319	7.403	-0.014	0.756	1640.080		0.244	7.938	0.106	0.672	2802.312
	0.359	7.608	0.018	0.843	2013.843		0.276	8.083	0.109	0.775	3238.288
	0.399	7.808	0.045	0.916	2459.467		0.308	8.210	0.111	0.863	3679.014
	0.439	8.000	0.066	0.976	2981.554		0.339	8.324	0.113	0.935	4120.789
	0.479	8.184	0.084	1.024	3583.159		0.371	8.425	0.115	0.995	4561.469
	0.519	8.358	0.099	1.063	4265.011		0.403	8.517	0.117	1.044	4999.534
	0.560	8.523	0.112	1.092	5026.605		0.434	8.600	0.119	1.083	5433.833
	0.600	8.677	0.122	1.114	5865.248		0.466	8.677	0.122	1.114	5865.248
	0.640	8.821	0.131	1.130	6777.069		0.498	8.747	0.125	1.138	6293.672
	0.680	8.956	0.138	1.140	7756.605		0.530	8.813	0.129	1.155	6719.036
	0.720	9.082	0.144	1.146	8797.299		0.561	8.874	0.133	1.166	7142.370
	0.760	9.200	0.149	1.149	9892.182		0.593	8.931	0.137	1.173	7564.337
	0.801	9.309	0.153	1.148	11035.802		0.625	8.985	0.141	1.175	7985.638
	0.841	9.411	0.156	1.145	12219.643		0.656	9.037	0.145	1.174	8406.832
	0.881	9.506	0.158	1.141	13437.438		0.688	9.086	0.150	1.170	8827.261
0.561	0.118	6.388	-0.349	0.223	594.844	0.720	0.086	7.051	0.015	-0.018	1153.781
	0.158	6.602	-0.235	0.393	736.788		0.118	7.352	0.091	0.179	1559.312
	0.198	6.830	-0.151	0.548	924.821		0.149	7.643	0.123	0.368	2085.992
	0.238	7.064	-0.087	0.685	1169.463		0.181	7.899	0.135	0.535	2695.664
	0.279	7.301	-0.037	0.802	1481.337		0.213	8.119	0.139	0.676	3357.661
	0.319	7.534	0.002	0.899	1870.386		0.244	8.306	0.140	0.792	4048.898
	0.359	7.760	0.034	0.978	2344.670		0.276	8.467	0.139	0.887	4752.851
	0.399	7.976	0.059	1.039	2910.558		0.308	8.605	0.139	0.963	5457.248
	0.439	8.181	0.080	1.086	3571.711		0.339	8.725	0.139	1.023	6154.877
	0.479	8.373	0.097	1.120	4328.602		0.371	8.830	0.140	1.069	6839.022
	0.519	8.553	0.111	1.143	5179.687		0.403	8.924	0.141	1.104	7508.568
	0.560	8.719	0.123	1.158	6119.894		0.434	9.007	0.142	1.129	8160.821
	0.600	8.874	0.133	1.166	7142.370		0.466	9.082	0.144	1.146	8797.299
	0.640	9.017	0.141	1.168	8238.718		0.498	9.150	0.147	1.156	9417.265

	0.680	9.148	0.148	1.166	9399.389		0.530	9.213	0.150	1.161	10021.620
	0.720	9.270	0.153	1.161	10613.690		0.561	9.270	0.153	1.161	10613.690
	0.760	9.382	0.157	1.153	11871.549		0.593	9.323	0.156	1.157	11191.390
	0.801	9.485	0.160	1.144	13164.775		0.625	9.372	0.160	1.150	11759.304
	0.841	9.581	0.163	1.133	14484.002		0.656	9.419	0.164	1.140	12315.329
	0.881	9.669	0.164	1.121	15819.522		0.688	9.462	0.168	1.128	12862.868
0.656	0.118	6.366	-0.331	0.319	581.901	0.841	0.086	7.204	0.063	0.054	1345.068
	0.158	6.617	-0.216	0.505	747.325		0.118	7.572	0.133	0.271	1943.217
	0.198	6.878	-0.132	0.668	970.198		0.149	7.911	0.158	0.470	2726.844
	0.238	7.142	-0.069	0.805	1264.333		0.181	8.200	0.164	0.637	3639.858
	0.279	7.404	-0.020	0.917	1642.706		0.213	8.440	0.164	0.773	4629.481
	0.319	7.658	0.018	1.005	2117.095		0.244	8.640	0.161	0.879	5654.461
	0.359	7.900	0.049	1.070	2696.743		0.276	8.808	0.159	0.962	6684.188
	0.399	8.128	0.074	1.117	3386.662		0.308	8.949	0.156	1.025	7697.108
	0.439	8.340	0.094	1.149	4188.927		0.339	9.069	0.155	1.071	8680.201
	0.479	8.537	0.111	1.168	5100.021		0.371	9.172	0.154	1.104	9625.778
	0.519	8.718	0.125	1.177	6113.777		0.403	9.262	0.154	1.126	10531.226
	0.560	8.885	0.136	1.178	7219.926		0.434	9.341	0.155	1.139	11394.659
	0.600	9.037	0.145	1.174	8406.832		0.466	9.411	0.156	1.145	12219.643
	0.640	9.176	0.153	1.165	9660.493		0.498	9.473	0.158	1.146	13007.742
	0.680	9.303	0.159	1.154	10967.592		0.530	9.530	0.160	1.141	13761.086
	0.720	9.419	0.164	1.140	12315.329		0.561	9.581	0.163	1.133	14484.002
	0.760	9.525	0.167	1.125	13692.452		0.593	9.628	0.165	1.122	15176.448
	0.801	9.622	0.170	1.109	15085.661		0.625	9.671	0.168	1.108	15844.853
	0.841	9.710	0.171	1.092	16488.196		0.656	9.710	0.171	1.092	16488.196
	0.881	9.792	0.172	1.076	17890.051		0.688	9.747	0.174	1.075	17109.686
0.688	0.118	6.361	-0.325	0.349	578.941	0.881	0.086	7.256	0.077	0.076	1417.146
	0.158	6.623	-0.210	0.539	752.198		0.118	7.645	0.145	0.299	2090.169
	0.198	6.895	-0.126	0.704	987.128		0.149	7.998	0.167	0.500	2975.002
	0.238	7.169	-0.063	0.840	1298.286		0.181	8.296	0.172	0.667	4005.806
	0.279	7.438	-0.015	0.949	1699.858		0.213	8.541	0.170	0.799	5120.462
	0.319	7.698	0.024	1.032	2204.156		0.244	8.744	0.167	0.902	6270.429
	0.359	7.945	0.054	1.093	2820.022		0.276	8.912	0.163	0.981	7417.520
	0.399	8.176	0.079	1.135	3552.831		0.308	9.052	0.160	1.039	8539.007
	0.439	8.390	0.099	1.162	4402.818		0.339	9.172	0.158	1.081	9619.042
	0.479	8.588	0.116	1.176	5365.259		0.371	9.273	0.157	1.110	10649.838
	0.519	8.769	0.129	1.180	6431.738		0.403	9.361	0.157	1.128	11629.497
	0.560	8.935	0.141	1.178	7590.100		0.434	9.438	0.157	1.138	12557.834
	0.600	9.086	0.150	1.170	8827.261		0.466	9.506	0.158	1.141	13437.438
	0.640	9.223	0.157	1.158	10128.414		0.498	9.566	0.160	1.138	14272.644
	0.680	9.348	0.163	1.144	11478.144		0.530	9.620	0.162	1.132	15064.556
	0.720	9.462	0.168	1.128	12862.868		0.561	9.669	0.164	1.121	15819.522
	0.760	9.566	0.171	1.111	14271.217		0.593	9.714	0.167	1.108	16541.043
	0.801	9.661	0.173	1.093	15690.332		0.625	9.754	0.169	1.093	17229.874
	0.841	9.747	0.174	1.075	17109.686		0.656	9.792	0.172	1.076	17890.051
	0.881	9.827	0.175	1.058	18525.436		0.688	9.827	0.175	1.058	18525.436

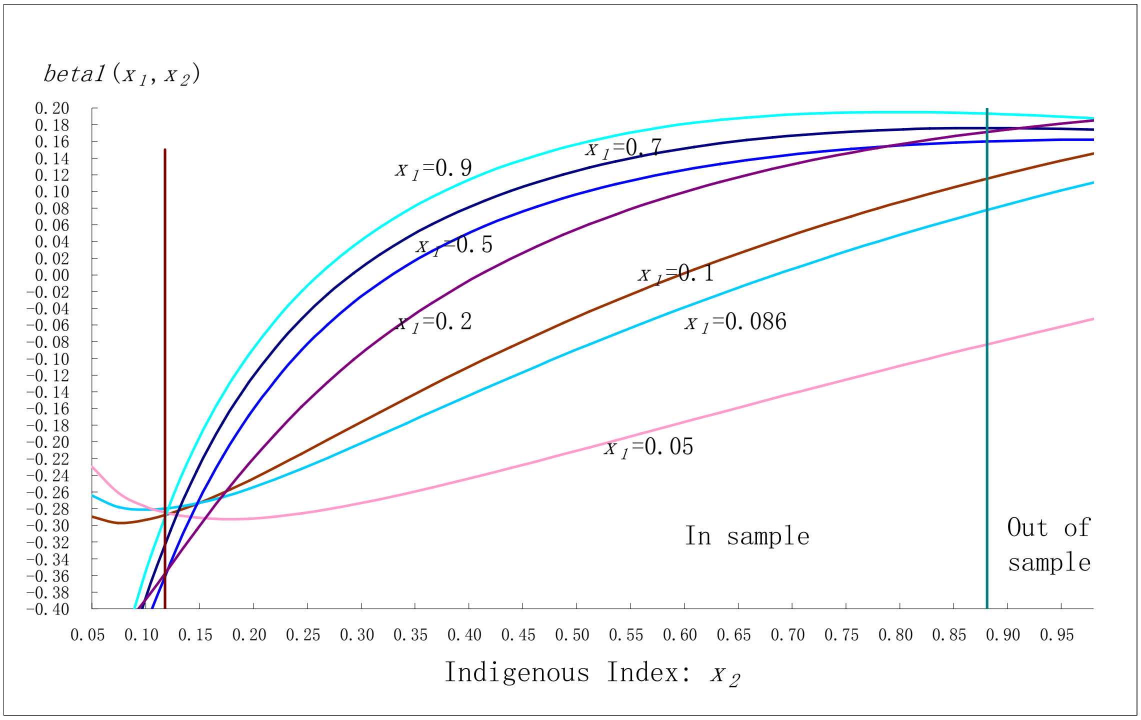

Figure A1 Effect of Openness on Growth: x_1 = Constant

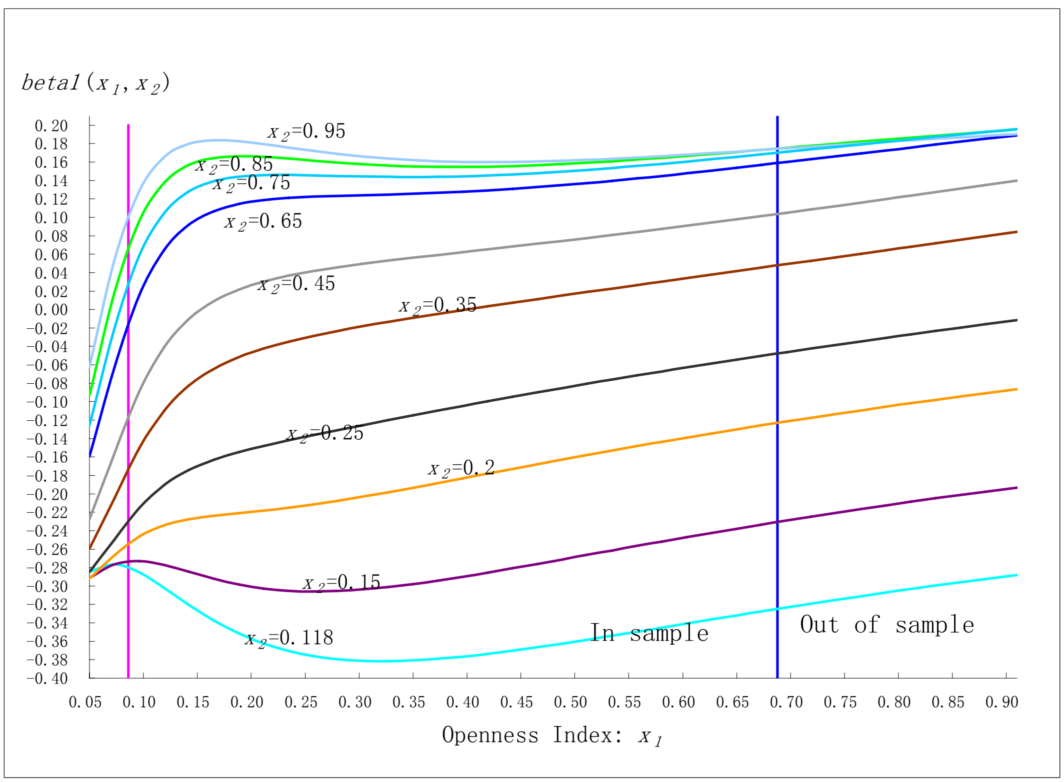

Figure A2 Effect of Openness on Growth: x_2 = Constant

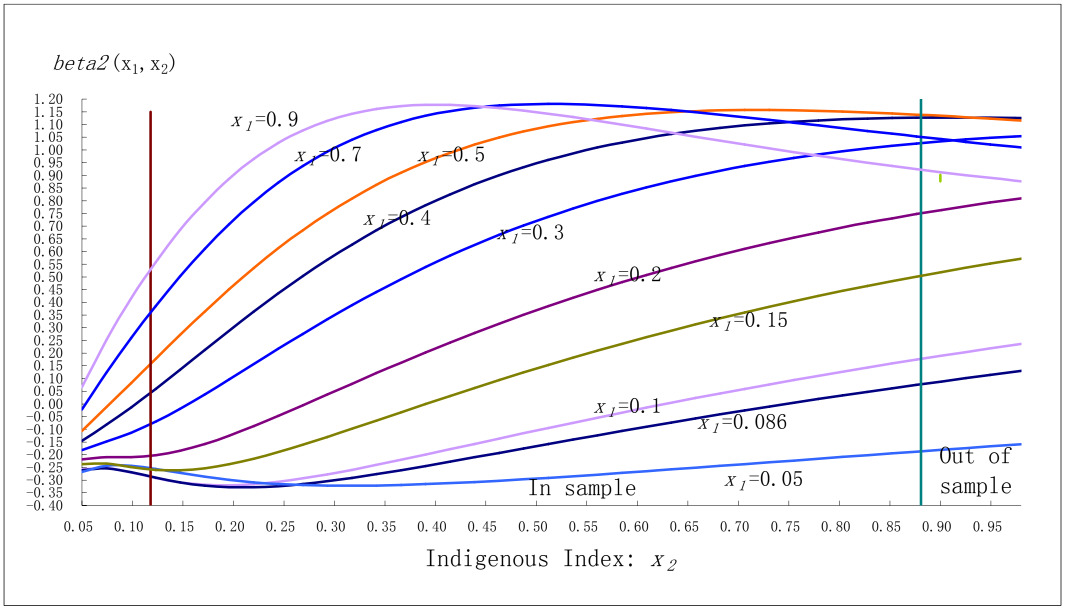

Figure A3 Effect of Indigeneity on Growth: x_1 = Constant

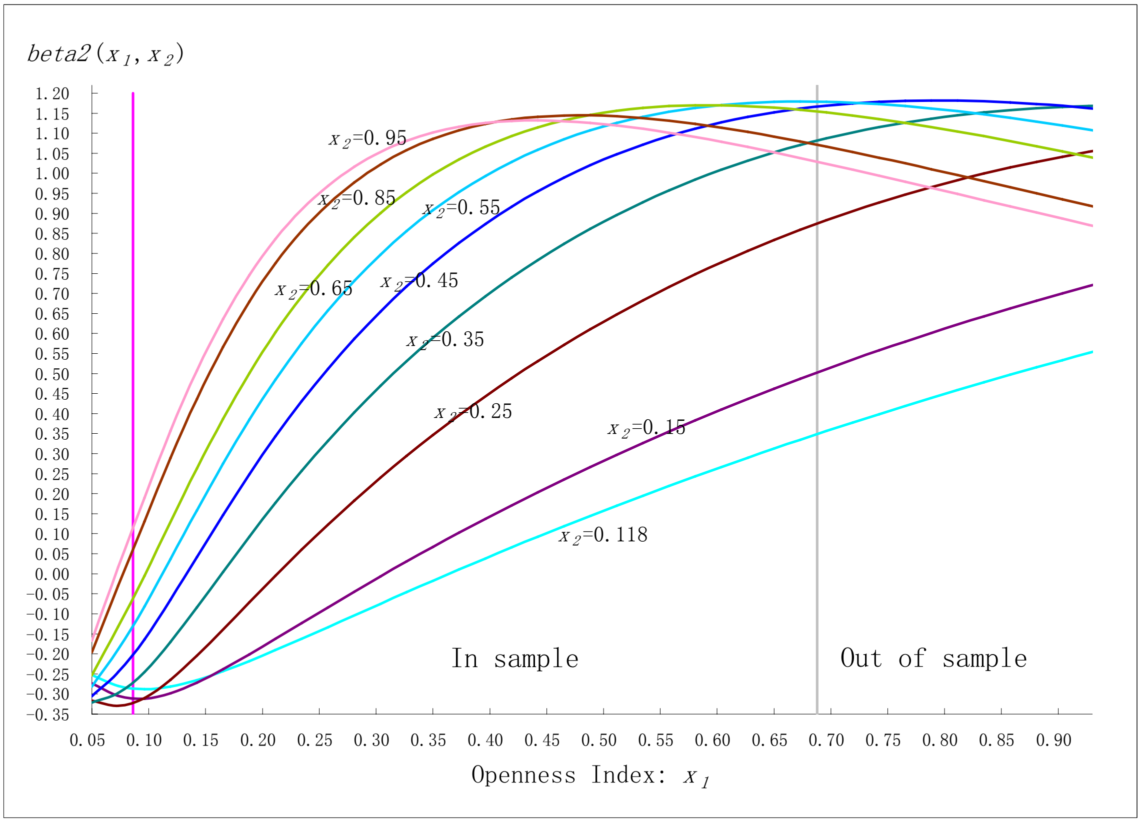

Figure A4 Effect of Indigeneity on Growth: x_2 = Constant