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Causality between openness and indigenous factors among world economies

Abstract

The paper studies the causality relationship between economic openness and indigenous factors. The construction of the Openness Index and the Indigenous Index provides a measure on the extent of openness and indigenous development among world economies. The two indices are used to study their causality. The empirical findings show that there are bi-directional dynamic causality relationships between openness and indigenous factors. Indigenous factors help to forecast openness factors and vice versa.

Keywords: openness, indigeneity, panel data model, causality test.
JEL Classification: C33, F02, O11.

Introduction

While inter-dependence among economies is the ultimate objective of globalization (UNCTAD 2004), the major economic debates on globalization can be condensed into the discussion on the two types of factors: openness factors and indigenous factors. Openness often refers to external factors such as trade, capital flows and foreign direct investment in globalization. For example, Frankel and Romer (1999) show that trade has a positive effect on income growth, while Feldstein (2000) has identified the five aspects of globalization to include the gains from international flows of goods and capital, the increase in foreign direct investment, the occurrence of currency crises, the fluctuation of relative currency values and the segmentation of global capital market.

Other studies on globalization have brought up the relevance of such indigenous factors as the rule of law, political stability, education attainment, democracy and so on in their impact on growth and openness. These factors are among the indigenity of an economy in globalization. For example, Li and Reuveny (2003) provide an empirical study on economic openness and democracy; Mah (2002) examines the impact of globalization with openess on income distribution in Korea; Heinemann (2000) studies whether or not globalization of openness restricts budgetary autonomy which can be seen from the indigeneity of the economy, while Dollar and Kraay (2003) emphasize the importance of institutions in indigeneity and study the empirical relationship between some proxies of institutions and trade.

Conceptually, the dichotomy in the performance of these two groups of factors can be seen as complementary with rather than conflicting to each other. Ng and Yeats (1998), for example, show that economies that are more outward oriented in trade and governance policies generally achieved a higher level of GDP per capita. Wei (2003) looks at Asia's globalization experience and finds that the risk and reward for an economy to embrace globalization depends in part on the quality of its public governance. The importance of good governance has also been studied by Basu (2003), Brusis (2003) and the World Bank (World Bank, 2005).

Most of the studies in the literature above concentrated mainly on the causality from one factor to the other in the two sub-dimensions of globalization, but not on the overall relationship between the two aspects. It is of interest to distinguish indigenous factors from the openness factors and study their relationship with each other. While it is generally accepted that openness factors do have a direct impact on globalization, it is possible that indigenous factors can have both a direct impact on globalization and economic growth, and an indirect impact through improvement in the performance of openness factors.

This paper raises the importance of indigenous factors. Instead of looking at some single subdimensions in either the openness or the indigenous factors, in this paper we contribute to the literature by examining the overall causality relationship between these two groups of factors. Due to the same reasons as in the other studies on the construction of the globalization index (see, e.g., Dreher 2006, Heshmati 2006, and Li et al., 2007), we will aggregate both the indigenous factors and the openness factors, respectively, into two kinds of composite indices for our empirical study on the bi-directional causality.

As is known, recent studies on globalization tend to use a mixture of openness and indigenous factors in constructing an index to rank different economies (Kearney, 2002; Lockwood, 2004; Anderson and Herbertsson, 2005; Dreher, 2006; Heshmati, 2006 and Li et al., 2007). One advantage in constructing a

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globalization index is that it can be used for empirical study with a parsimonious regression model in which the multi-linearity or omitted variables problems can effectively be avoided. Such empirical studies can also be used in comparative analysis on the different performance of globalization among economies. However, in these studies openness and indigenous factors are not separated in the construction of the globalization index.

For our empirical study of the relationship between the two groups of globalization, two composite indices are constructed by the principal component analysis (see, e.g., Rencher, 2002 or Li et al., 2007), respectively, for 13 openness factors and 14 indigenous factors to provide an overall and separate measurement of openness and indigeneity among 122 world economies for the period of eight years (1998-2005). The definition of factors and the data sources are given in the Appendix. With the available data, the two indices have covered the most important aspects of openness and indigeneity in an economy, respectively. To study the relationship between openness and indigeneity, we specify a static panel data models and estimate their contemporaneous commutative effects. Then we turn to the dynamic panel data model to test their Granger causality using a recent approach in Hurlin and Venet (2001) and Hurlin (2007). Our empirical study shows that there is a bi-directional causality relationship between openness and indigeneity. Indigeneity helps to forecast openness and at the same time openness helps to forecast indigeneity.

The remainder of this paper is organized as follows. Section 1 briefly illustrates the openness index and the indigenous index and presents rankings of the two indices for the world economies in our sample. Section 2 conducts the Granger causality test by specifying a dynamic panel data model. The last section concludes the paper.

1. The two indices

It is generally known that there exists no uniformly agreed methodology to weight individual indicators before aggregating them into a composite index. One commonly applied method for weighting the indicators for the construction of a globalization index is the principal component analysis (PCA) (Lockwood, 2004; Dreher, 2006; Heshmati 2006; Li et al., 2007). In this section, we use the multivariate technique of factor analysis and PCA to construct two indices of openness and indigeneity (see, e.g., Rencher, 2002; Andersen and Herbertsson, 2005.

In the construction of the Openness Index, we follow Kearney (2004) to group the openness factors into four categories of Economic Integration, Technology Connectivity, Personal Contact, and International Engagement; though the factors in each category are slightly modified due to data differences (see also Lockwood, 2004; Dreher, 2006; and Heshmati, 2006). However, we also include Economic Freedom as an additional category in the list of openness factors as freedom of an economy can greatly affect the openness extent in globalization. In constructing the Indigenous Index, we follow Li et al. (2007) in grouping the factors into the two categories of Institutional Establishment, and Education and Health. Besides, we include Inflation as an additional category as inflation provides a good summary indicator on economic indigeneity. The various categories of openness and indigenous factors are shown in Table 1.

Table 1. Openness Index and Indigenous Index: factors and categories

Openness factors	Indigenous factors
I. Economic integration	I. Institutional establishment
1) Total trade flow (% GDP)	1) Corruption perception index
2) Foreign direct investment (% GDP)	2) Voice and accountability
3) Gross private capital flow (% GDP)	3) Political stability
4) Restrictions: Average applied tariff rates (unweighted in %)	4) Government effectiveness
II. Economic freedom	5) Regulatory quality
5) Trade freedom (%)	6) Rule of law
6) Financial freedom (%)	7) Control of corruption
7) Investment freedom (%)	8) Property rights protection
III. Technology connectivity	9) Regulatory scores
8) Internet users	II. Education and Health
IV. Personal contact	10) Primary school enrollment rate
9) International tourism (% population)	11) Public spending on education
10) International voice traffic	12) Primary school pupil-teacher ratio
V. International engagement	13) Total health expenditure
11) Membership of international organizations	III. Inflation
12) Government transfer (% GDP)	14) Growth rate of implicit GDP deflator (annual %)
13) Troop contribution (% of total)	

Note: See Appendix table for definitions and sources of data.

To construct the two indices, we first transform each variable to a unit-free index as Lockwood (2004) and Dreher (2006) did. Since we use panel data, the transformation is conducted on an annual basis. We denote the original variable as z_{it}. Then the correspondingly transformed variable is

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

The multiple factor analysis is then applied to the transformed data to construct the two indices (see Rencher, 2002; Andersen and Herbertsson, 2005). Compared with the average or other subjective weighting methods (Kearney, 2004), different weights in our construction are objectively assigned to component series to reflect their different economic significance. Therefore, non-stability of weights for the factors in the indices is not an issue since our construction of the two indices is data-driven and adaptive.

Table 2. Openness Index (average of 1998-2005)

Ranking	Economy	Score	Ranking	Economy	Score	Ranking	Economy	Score
1	Hong Kong	0.656	42	Bolivia	0.371	83	Mauritius	0.270
2	Singapore	0.642	43	Greece	0.370	84	Russia Fed.	0.269
3	Ireland	0.630	44	Uruguay	0.376	85	Senegal	0.268
4	Netherlands	0.581	45	Botswana	0.365	86	Kenya	0.268
5	Switzerland	0.580	46	Armenia	0.357	87	Indonesia	0.268
6	Sweden	0.563	47	Japan	0.356	88	Ecuador	0.265
7	United Kingdom	0.537	48	Croatia	0.353	89	Tunisia	0.265
8	New Zealand	0.524	49	Turkey	0.342	90	Brazil	0.260
9	Denmark	0.519	50	Malaysia	0.341	91	Tanzania	0.259
10	Estonia	0.510	51	Costa Rica	0.338	92	Bangladesh	0.259
11	Austria	0.509	52	Peru	0.332	93	Nigeria	0.258
12	Czech Republic	0.508	53	Colombia	0.328	94	Georgia	0.255
13	Belgium	0.508	54	Bulgaria	0.325	95	Morocco	0.255
14	Finland	0.502	55	Lesotho	0.323	96	Venezuela, RB	0.250
15	United States	0.488	56	Albania	0.321	97	Malawi	0.247
16	Canada	0.484	57	Argentina	0.320	98	Gabon	0.245
17	Australia	0.475	58	South Africa	0.320	99	Papua N. Guinea	0.245
18	Iceland	0.471	59	Nicaragua	0.319	100	Saudi Arabia	0.241
19	Germany	0.463	60	Ghana	0.317	101	Egypt Arab Rep.	0.240
20	Italy	0.450	61	Paraguay	0.312	102	Madagascar	0.238
21	France	0.439	62	Macedonia	0.311	103	Eritrea	0.231
22	Spain	0.437	63	Mexico	0.309	104	Rwanda	0.220
23	Portugal	0.433	64	Moldova	0.306	105	China	0.218
24	Norway	0.424	65	Guatemala	0.305	106	Yemen, Rep.	0.218
25	Malta	0.419	66	Romania	0.305	107	Belarus	0.215
26	Hungary	0.419	67	Thailand	0.310	108	Kazakhstan	0.214
27	Israel	0.413	68	Philippines	0.299	109	India	0.214
28	Poland	0.408	69	Guyana	0.295	110	Niger	0.209
29	El Salvador	0.406	70	Kuwait	0.295	111	Sierra Leone	0.205
30	Cyprus	0.405	71	Mali	0.291	112	Tajikistan	0.205
31	Trinidad/Tobago	0.388	72	Honduras	0.287	113	Angola	0.200
32	Swaziland	0.384	73	Zambia	0.287	114	Ethiopia	0.193
33	Chile	0.384	74	Ukraine	0.285	115	Vietnam	0.187
34	Slovak Republic	0.383	75	Uganda	0.283	116	Burundi	0.180
35	Lithuania	0.383	76	Kyrgyz Rep.	0.283	117	Congo, Rep.	0.180
36	Taiwan	0.380	77	Cambodia	0.283	118	Azerbaijan	0.173
37	Latvia	0.380	78	Pakistan	0.282	119	Sudan	0.166
38	Korea Republic	0.380	79	Fiji	0.280	120	Lao PDR	0.142
39	Jordan	0.377	80	Dominican Rep.	0.280	121	Iran Islamic Rep.	0.123
40	Panama	0.376	81	Sri Lanka	0.277	122	Syrian Arab Rep.	0.113
41	Slovenia	0.371	82	Oman	0.275			

Table 2 and Table 3 show, respectively, the ranking of the 8-year average of the Openness Index and the Indigenous Index for our sample economies[1]. In the Openness Index, the two most open or globalized world economies are Hong Kong with an average score of 0.656 and Singapore with an average score of 0.642[2]. The United States ranks 15th in the Openness Index with the average score of 0.488. The ranking of China (105th) and India (109th) are similar in the Openness Index. When considering the two indices, there are 16 economies in the top 20 of the Indigenous Index that are also listed in the top 20 of the Openness Index. For example, Hong Kong ranks higher in the Openness Index than in the Indigenous Index. The United States have the same ranking in the two indices. Although China ranks low in the two indices, the country has a higher ranking (ranked 89th) in Indigenous Index than in the Openness Index (ranked 105th).

[1] The rankings will not make a difference whether one uses the calculated indices here or the further panel normalized indices introduced in the beginning of the next section as the latter is equal to the former scaled by a positive constant.

[2] Due to the difference in the methodology, categorization of factors and the sample of economies in construction, the rankings according to the Openness Index in this study are not completely the same as the rankings in Dreher (2006). However, the rankings are generally consistent with each other. For example, between the two rankings, there are 16 world economies which are similarly included in top 20 of the two indices.

Table 3. Indigenous Index (average of 1998-2005)

Ranking/Economy	Score	Ranking/Economy	Score	Ranking/Economy	Score
1 Denmark	0.856	42 Malaysia	0.538	83 Nicaragua	0.372
2 Iceland	0.835	43 Slovak Republic	0.536	84 Moldova	0.369
3 New Zealand	0.828	44 Latvia	0.525	85 Zambia	0.362
4 Finland	0.827	45 Tunisia	0.523	86 Guatemala	0.349
5 Sweden	0.814	46 Lesotho	0.518	87 Tanzania	0.349
6 Norway	0.807	47 Tunisia	0.518	88 Kenya	0.348
7 Switzerland	0.803	48 Jordan	0.504	89 China	0.342
8 Canada	0.798	49 Brazil	0.489	90 Armenia	0.340
9 United Kingdom	0.789	50 Panama	0.489	91 Albania	0.335
10 Australia	0.781	51 El Salvador	0.487	92 Ethiopia	0.334
11 Singapore	0.766	52 Netherlands	0.478	93 Papua	0.330
12 Germany	0.762	53 Bulgaria	0.473	94 Yemen, Rep.	0.330
13 Austria	0.760	54 Thailand	0.473	95 Russia Fed.	0.326
14 Ireland	0.756	55 Croatia	0.468	96 Ukraine	0.324
15 United States	0.755	56 Guyana	0.463	97 Venezuela, RB	0.320
16 Hong Kong	0.741	57 Saudi Arabia	0.454	98 Cambodia	0.316
17 France	0.708	58 Mexico	0.452	99 Ecuador	0.309
18 Belgium	0.704	59 Argentina	0.452	100 Eritrea	0.306
19 Portugal	0.695	60 Malawi	0.447	101 Paraguay	0.306
20 Chile	0.684	61 Morocco	0.445	102 Kyrgyz Rep.	0.302
21 Japan	0.682	62 Fiji	0.443	103 Syrian Arab	0.301
22 Spain	0.677	63 Swaziland	0.441	104 Kazakhstan	0.297
23 Malta	0.676	64 Turkey	0.424	105 Rwanda	0.294
24 Slovenia	0.649	65 Mali	0.419	106 Niger	0.292
25 Cyprus	0.644	66 Egypt	0.418	107 Belarus	0.291
26 Taiwan	0.641	67 Madagascar	0.417	108 Bangladesh	0.288
27 Israel	0.638	68 Gabon	0.414	109 Iran	0.284
28 Estonia	0.637	69 Colombia	0.410	110 Georgia	0.274
29 Hungary	0.612	70 Bolivia	0.410	111 Vietnam	0.269
30 Italy	0.609	71 India	0.407	112 Pakistan	0.267
31 Czech Republic	0.603	72 Ghana	0.407	113 Indonesia	0.263
32 Lithuania	0.595	73 Philippines	0.405	114 Azerbaijan	0.255
33 Costa Rica	0.590	74 Sri Lanka	0.402	115 Sierra Leone	0.253
34 Botswana	0.584	75 Peru	0.401	116 Nigeria	0.247
35 Greece	0.571	76 Senegal	0.399	117 Lao PDR	0.230
36 Korea, Rep.	0.567	77 Uganda	0.395	118 Burundi	0.228
37 Uruguay	0.559	78 Romania	0.385	119 Sudan	0.211
38 Poland	0.559	79 Mauritius	0.379	120 Tajikistan	0.207
39 Kuwait	0.558	80 Dominican	0.378	121 Angola	0.168
40 Oman	0.545	81 Macedonia	0.377	122 Congo, Rep.	0.157
41 South Africa	0.543	82 Honduras	0.375		

In both of the indices, there are seven European Economies in the top 10. In the Openness Index, Hong Kong and Singapore are the two Asian economies that are ranked first and second and the other one is New Zealand (8^{th}) from Oceania. For the Indigenous Index, Canada, Australia and New Zealand are the other ones in the top 10 except the seven European economies. Asian economies fail to enter the top 10 in the Indigenous Index, though both Hong Kong and Singapore are situated in the top 20.

Figure 1 presents the scatter plot diagram and the trend line for the panel data of the two indices in our sample. A general impression is that the economies with a high level of openness also perform highly in indigenous factors, and vice versa. We will present a formal study on the causality relationship between the two indices.

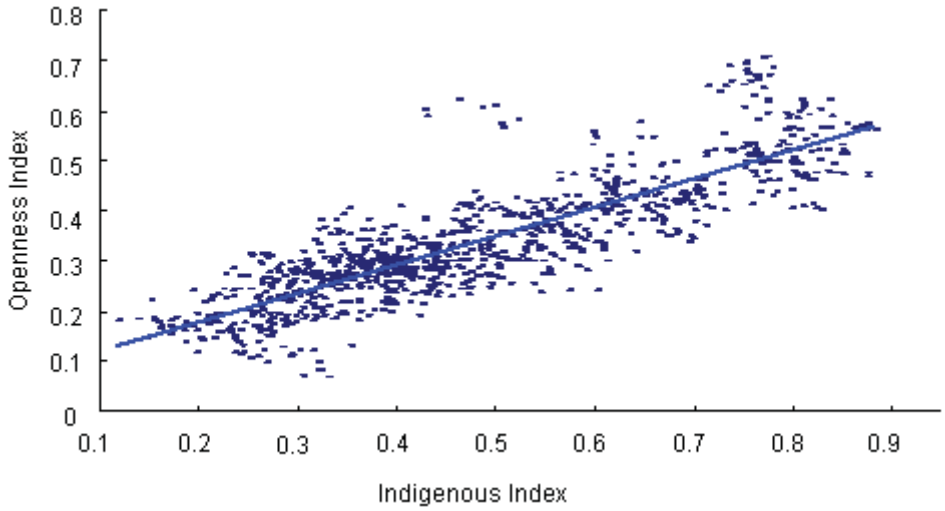

Fig. 1. Scatter plot of the Openness Index and Indigenous Index

2. Granger causality test

It is noted that the causality relationship between openness and indigeneity may be heterogeneous across worldwide economies. Hence, in this section, we follow Hurlin and Venet (2001) and Hurlin (2005, 2007) for a new causality test about the heterogeneity. Hurlin (2007) presents Monte Carlo simulations which show that the test statistics lead to substantially augment the power of the Granger non-causality tests even for samples with very small T and n dimensions. This new causality test allows one to take into account both the heterogeneity of the causal relationships and the heterogeneity of the data generating process, contrary to the conventional causality test in panel data dynamic models (for example, Holtz-Eakin et al. 1988).

First, we need to deal with the annual index data by further conducting panel normalization. Denote the originally calculated index $\{z_{it}\}$. We transform $\{z_{it}\}$ to $\{x_{it}\}$ with $x_{it} = (z_{it} - a)/(b - a)$ for the two indices, where a and b are the worst and best levels of the openness or indigeneity in an economy. Assume that the worst levels for the two indices are both zero, i.e. $a = 0$, and that the best levels of the two indices are their respective sample maximum, i.e. $b = \max_{i,t}\{z_{it}\}$. Then the normalized index is $x_{it} = z_{it}/(\max_{i,t}\{z_{it}\})$ with $x_{it} > 0$ in the sample.

Then, to allow for the heterogeneity of the data generating process and the causality, we specify the following dynamic linear model:

$$y_{it} = \gamma_i y_{i,t-1} + \beta_i x_{i,t-1} + \alpha_i + u_{it}, \quad (3)$$

where y is the openness (indigeneous) index variable while x is the indigeneous (openness) index; u_{it} are independently and identically distributed $(0, \sigma_u^2)$, α_i are the economy specific effects, and autoregressive parameters γ_i and regression coefficients β_i differ across economies showing heterogeneity. Here a lag length of one is chosen due to the relatively short time series $(T = 8)$ for each economy and according to the requirement $T > 5 + 2k$ in Proposition 5 and Proposition 6 of Hurlin (2007), where k is the lagged order. Here we use the same notations as those in Hurlin and Venet (2003) and Hurlin (2007).

We first conduct the homogeneity test for the coefficients β_i:

$$H_0: \ \beta_i = \beta_j \quad \forall (i, j). \quad (4)$$

The test statistic is

$$F_H = \frac{(RSS_0 - RSS_1)/(n-1)}{RSS_1/(n(T-4))},$$

which is distributed as $F(n-1, n(T-4))$, where RSS_0 is the residual sum of squares from the within estimator and $RSS_1 = \sum_{i=1}^{n} RSS_{1,i}$, where $RSS_{1,i}$ is the residual sum of squares of the individual estimation obtained under the alternative hypothesis $\beta_i \neq \beta_j \ \exists i, j$. Our calculation using the Gauss program shows that the null hypothesis of homogeneity is rejected for the model with openness or indigeneity as the dependent variable (see the second row in Table 4). Therefore, the regression coefficients β_i are heterogeneous.

The homogeneity test implies that we next need to test the homogeneous non-causality (HNC) hypothesis under the heterogeneity of regression coefficients β_i. The null is

$$H_0:\ \beta_i = 0 \quad \forall i = 1,\cdots,n. \tag{5}$$

The alternative is $H_1: \beta_i = 0\ \forall i = 1,...,n_1;$ $\beta_i \neq 0\ \forall i = n_1+1,...,n,$ which means that there exists a subgroup of economies (with dimension n_1) for which the variable x does not Granger cause y and another subgroup (with dimension $n-n_1$) for which x Granger causes y. Under the alternative we allow β_i to differ across economies, which is consistent with the test result of the null (4). This alternative is more general than that of Holtz-Eakin et al. (1988) as there is causality for all the economies in the sample when $n_1 = 0$; no causality for all the economies when $n_1 = n$; no causality for some economies when $0 < n_1 < n$. Therefore, in our case, if the null (5) is accepted, the variable x does not Granger cause y for all the economies in the sample. If (5) is rejected and $n_1 = 0$ the variable x Granger causes y for all economies. On the contrary, if $n_1 > 0$, the variable x Granger causes y, but the causality relationship is heterogeneous. Hurlin's (2007) test fails to determine whether $n_1 = 0$ or $n_1 > 0$ when the HNC hypothesis (5) is rejected, but it can be concluded that the variable x does Granger cause y, no matter whether the causality is homogeneous or heterogeneous.

The statistic associated to the HNC null hypothesis (5) is given by

$$W_{HNC} = \frac{1}{n}\sum_{i=1}^{n}\frac{RSS_{2,i} - RSS_{1,i}}{RSS_{1,i}/(T-3)},$$

where $RSS_{2,i}$ is the residual sum of squares under the null (4) for the i-th economy and $RSS_{1,i}$ is defined as above. This statistic does not have a Fischer distribution as the statistic F_H above. By Hurlin's (2007) result, for a fixed T with $T > 5 + 2k$ and some assumptions on the data generating process,

$$Z_{HNC} \equiv \frac{\sqrt{n}\left(W_{HNC} - \mu_T\right)}{\delta_T} \rightarrow N(0,1) \text{ as } n \rightarrow \infty,$$

where $\mu_T = k(T-2k-1)/(T-2k-3)$ and $\delta_T = (T-2k-1)/(T-2k-3)\sqrt{2k(T-k-3)/(T-2k-5)}$. In our case, $\mu_T = 5/3$ and $\delta_T = 10\sqrt{2}/3$ since $T = 8$ and $k = 1$. Therefore, we can construct the z-statistic Z_{HNC} and conduct the z-test of normality.

Table 4. Homogeneity test and homogeneous non-causality test

	Openness as the dependent variable	Indigeneity as the dependent variable
Homogeneity test for $H_0:\ \beta_i = \beta_j \quad \forall (i,j)$	$F_H(121, 488) = 5.157$, reject H_0 at 1% level $\Rightarrow$ β_i are heterogenous	$F_H(121, 488) = 2.321$, reject H_0 at 1% level $\Rightarrow$ β_i are heterogenous
Homogenous non-causality test for $H_0:\ \beta_i = 0 \quad \forall i$	Z_{HNC} = 23.541, reject H_0 at 1% level $\Rightarrow$ Indigeneity Granger causes openness	Z_{HNC} = 25.289, reject H_0 at 1% level $\Rightarrow$ Openness Granger causes indigeneity

The HNC test results are listed in the third row in Table 4. The HNC null hypothesis (5) is rejected in both the models with openness and indigeneity dependent variables. It follows that openness Granger causes indigeneity and indigeneity also Granger causes openness, no matter whether the causality is homogeneous or heterogeneous in the sense of Hurlin and Venet (2001). There are bi-directional significant causality relationships between openness and indigeneity.

Conclusion and discussion

Recent studies on globalization have considered the importance of both the quantifiable variables that measure an economy's gain in the globalization process, and domestic factors whose development may impact an economic growth. This paper brings together two sets of factors: openness factors that relate mainly to the external aspect of an economy, and indigenous factors that reflect the internal performance of an economy.

Armed with the data for 122 world economies for the period of eight years, and contrary to the conventional approach of the principle component analysis, a factor analysis method is used to construct the Openness Index and the Indigenous Index to rank the economies in our sample. The result shows that economies that rank high in the Openness Index also rank high in the Indigenous Index, though there are exceptions. The two indices provide clear indications as to the importance in the successful performance of the two sets of factors. There is a positive relationship between openness and indigeneity. According to the Hurlin-Venet Granger causality test using a heterogeneous dynamic panel data model, we show that there is a bi-directional relationship between

openness and indigeneity. Improved performance in indigeneity helps to enhance and forecast openness, while at the same time improved openness performance helps to forecast indigeneity.

The empirical results in this paper raise the importance of indigenous factors. It is often taken for granted that such openness factors as trade, foreign direct investment, and international engagement are all there is in globalization. The missing link is the performance in indigenous factors, which can have a two-folded relationship in the globalization performance of an economy. The direct relationship is one in which the performance of indigenous factors does act as an effective indicator on an economy's external or openness relationship. A more reliable rule of law, for example, provides convincingly the legal protection the economy provides. Indirectly, the successful performance of openness factors depends significantly on the performance of the indigenous factors. For a developing economy to attract foreign direct investment, for example, a reliable education system guarantees a good supply of human capital.

There are also policy implications for both advanced and less developed economies from the empirical results. Economies that rank low in the two indices tend to be the less developed economies, which can exercise separately a policy on economic openness and a policy on the improvement in the performance of indigenous factors. The introduction and promotion of an appropriate and effective policy on internal factors can improve the image of a less developed economy both at the international level, which in turn facilitates further development in economic openness. For the advanced economies, their difference in the performance between the two indices requires the introduction of relevant policies that can improve the weaker performance in the two indices.

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Appendix. Data and definition of variables

The data set consists of a total of 122 world economies and twenty eight factors for the period of 1998-2006. Table A below summarizes the definitions and data sources of the twenty eight factors.

Table A. Definitions and data sources 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 values of inflows and outflows of FDI recorded in the balance of payments measured as a share of GDP.
Gross private capital flows (% of GDP): Sum of the absolute values of direct, portfolio, and other investment inflows and outflows recorded in the balance of payments financial account, excluding changes in the assets and liabilities of monetary authorities and general government. The indicator is calculated as a ratio to GDP in U.S. dollars.
Average applied tariff rates (unweighted in %): Unweighted averages for 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 imports and exports 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 worldwide network.
International tourism (% of population): Sum of 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: Absolute number of international inter-governmental organizations.
Government transfer (% of GDP): Sum of credit and debit divided by GDP.
Troop contribution (% of total): The number of peacekeeping troop contribution to UN as the ratio of total peacekeeping troop to UN.
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, as well as freedom of expression, freedom of association, and a free media.
Political stability index: The perception on 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 control, adequacy in bank supervision and other regulation 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 in the society, including perceptions in the incidence of crime, 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. It is based on the scores of variables from polls of experts and surveys.
Property right protection: The degree of property right protection and the extent property right law enforcement.
Regulatory scores: A measure on how easy or difficult it is to open and operate a business, and whether 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 to primary school education.
Public spending on education (% of GDP): The 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): This consists of recurrent and capital spending from central and local government budgets, external borrowings and 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 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 Operation, United Nations; *Corruption Index*, Transparency House (1999-2006); *Aggregating Governance Indicators*, World Bank (1999-2006); and *National Accounts*, OECD.