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GROWTH, HUMAN DEVELOPMENT, AND TRADE: THE ASIAN EXPERIENCE

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Growth, Human Development, and Trade: The Asian Experience

This study looks at the three-way relationship between economic growth, human development, and openness to trade in a large panel of developing Asian economies. Using a theoretically motivated simultaneous equations system, we find that although human development contributes positively to economic growth, in the case of our Asian sample growth does not appear to have had a positive influence on human development. Uneven growth accompanied by lagging institutional development, preventing human capital formation, might have inhibited human development in the short to medium run. Complementary to the literature showing that growth is sustainable only when accompanied by human development, we confirm a role for trade liberalisation policies in achieving higher growth as well as human development.

1 Introduction

The subject of this paper is the relationship between economic growth (EG) and human development (HD). Recent work on development and growth has suggested that human capital accumulation may be important in enhancing economic growth *as well as* human development (Suri et al., 2011). We widen the debate by also considering the role of trade liberalisation, which has a long pedigree in the policies of development organisations such as the World Bank, IMF and WTO (Wang et al., 2004).

The empirical literature on the relationship between openness to trade (OT) and economic growth has had somewhat mixed results (see Frankel and Romer, 1999; Greenaway et al., 2002; Falvey et al., 2012). Most authorities conclude that openness has generally improved economic growth in developing countries, however the precise channel through which it can help achieve balanced economic growth does not appear to be straightforward.[1]

The 'conventional' economic approach to development holds that trade liberalisation has a generally positive impact on poverty alleviation. A more sceptical view has seen

[1] For example Cooray et al. (2014) show that the impact of openness on growth is importantly moderated by the gender-specific levels of primary and secondary education.

globalisation as a channel for exploiting developing countries' low labour costs, for example through child labour (Dagdemir and Acaroglu, 2010; Neumayer and De Soysa, 2005). We build on the recent literature, notably Suri et al. (2011), that has uncovered subtle causal interactions between HD and EG in developing countries. But we also build OT into our analysis, since it has long been at the core of economic orthodoxy in development policy.

By examining this three-way link between EG, HD, and OT, the more complete model is capable of addressing not only outcomes but also the factors that drive those outcomes. Our approach is consistent with the recent literature that emphasises the socio-economic role played by institutions (education, governance quality, social development, etc.) as long-run determinants of development and growth (Acemoglu et al., 2005). Our findings suggest that development policy can be considered as a three-way mix of openness, growth and development. Focussing on human development earlier in the process can help sustain growth: while openness to trade may be appropriate in cases where socio-economic conditions and the quality of institutions are at an adequate level.

Despite strong arguments (Acemoglu et al., 2005) that political institutions underlie the poverty traps besetting many countries growth records, there has been relatively little analysis or agreement on whether inadequate HD has a role in sustaining such traps. Barro (2000), for example, sees HD as a 'good' which wealthier countries choose to supply to their population. Against this, we can set Amartya Sen's (1999) argument in favour of all types of HD. This approach found empirical support in Blume and Voigt (2007), who found positive relationships between elements of HD and economic development. Econometric modelling by Suri et al. (2011) has shown that bi-directional causality can exist between HD and EG. Thus the former can be viewed not only as an outcome of EG, but also as an essential precondition for achieving it. Our goal is to test further whether such positive, bi-directional effects are robust to the inclusion of a third explanatory factor - openness to trade – since this has been an important factor in standard growth equations (e.g., Cooray et al., 2014).

The literature on trade liberalisation has generally taken the view that it increases economic growth (e.g., Frankel and Romer, 1999; Greenaway et al., 2002; Wang et al., 2004; Falvey et al., 2012). By contrast, an influential strand of international economics increasingly concerns itself with socio-economic phenomena. Hence we extend the analysis of HD to include trade openness in line with work by Nunn (2007), which has looked at the relative quality of national institutions (security, law, governance) in trade performance. But also this approach is in keeping with work that has looked at the role of social, institutional and political factors in EG (e.g., Acemoglu et al., 2005; Acemoglu et al., 2008; Tabellini, 2010). In this stylised view, the social and institutional components inherent in HD are often not only 'deeply embedded' but usually also long-run in nature. These long-run, deeply-embedded processes may play a part in how EG, HD, and OT interact in the development process. Furthermore, such subtle relationships may not have been easily picked up in 'conventional' economic studies. And this oversight may have been largely due to their use of single equation frameworks, shorter data sets, and pervasive endogeneity problems. Taken together, these difficulties may have served to conceal the economic significance of some deep lying, socio-economic phenomena.

Asian economic development has generally been characterised by a disparity between levels of human development and economic growth (Suri et al., 2011). Not only has the literature on improving HD, and that on generating EG, tended to proceed on separate lines but also the HD literature has tended to view development mainly as an output of economic growth rather than a potential contributing factor.

We focus on estimating a three-way relationship between EG, HD, and OT in the context of Asian economic development. Even if there is no simple association between openness and growth (e.g. Cooray et al., 2014), improvements in human development may be a pre-requisite for sustained growth (Ranis et al., 2000; Suri et al., 2011) since trade openness may interact with both these variables. Our sample of developing countries is highly relevant to investigating this three-way relationship. China and India are countries which adopted trade liberalisation policies only after achieving higher rates of economic growth, while the East Asian smaller economies are often cited as successful examples of export-led growth. Furthermore, Figure 1 shows a strong positive association between openness and human development in the Asian economies.

- Figure 1 here -

Among the key relationships we set out to test are: is trade liberalisation a pre-requisite for economic growth, or the result of sustained output growth? Further, are there any systematic links between trade openness and economic growth and are the welfare consequences from trade liberalisation reflected in the level of human development?

The rest of the paper is organized as follows. In Section 2 we provide a description of the dataset and then set out a theoretically motivated framework for the empirical analysis and econometric methodology. Section 3 reports our initial estimation results, provides robustness checks, and includes a discussion of our main findings. Section 4 provides a brief summary in the context of the literature and draws some broader conclusions.

2 Data and method

2.1 Data

For this paper we assembled a dataset including panel observations from twelve developing Asian countries, over forty-two years (1970-2011). The countries are Bangladesh, India, Nepal, Pakistan, Sri Lanka, Indonesia, Malaysia, Philippines, Singapore, South Korea, Thailand, and

China. The data come from several sources. Real GDP at PPP exchange rates and employment data is collected from the Conference Board (2011). We complement this data with information from Deininger et al. (1996), Dreher (2006), WIDER (2008), Barro and Lee (2010), IMF (2011), UNDESA (2011), UNDP (2011), and WB (2012). Table 1 provides a brief description, summary statistics, and sources of the variables used in the analyses that follow.

- Table 1 here -

We use the UNDP (2011) methodology to construct a time-varying HD index (HDI) as an indicator of human development. This index has been designed to emphasize the role of human welfare as a development policy goal (and outcome) rather than focussing only on economic growth (Klugman et al., 2011). The HDI aims to measure human development and capabilities in three dimensions: (i) long and healthy life; (ii) knowledge and human capital; and (iii) a decent standard of living. The HDI is based on the human capital measure used by Cohen and Soto (2007), for which we obtained data from Barro and Lee (2010).[2]

To measure trade openness, we use a globalization sub-index from the KOF Globalization Index (Dreher, 2006) as a broad measure of trade openness (OP1) which is our preferred OT measure. The KOF Globalisation Index is a composite index comprising an economic globalization index, a social globalization index, and a political globalization index. To check the robustness of our results we also use a trade volume measure of openness (OP2), from the Penn World Tables and a final measure (OP3) from the World Bank (2012).

2.2 Analytical framework and estimation methodology

[2] Human capital stock (H) is constructed using Cohen and Soto (2007) methodology and employing Barro and Lee (2010) data. We use a depreciation rate of 5% following Wang and Yao (2003). Details on the calculation methods for H and for HDI are available on request.

The starting point of our analytical framework is the standard Cobb-Douglass country-level production function with constant returns to scale as used in Cooray et al. (2014):

$$Y_{it} = A_{i0} K_{it}^{\alpha} L_{it}^{(1-\alpha)} e^{\varphi Z_{it}}, \quad (1)$$

where Y_{it} is aggregate output of country i in period t, A_{io} is total factor productivity, K_{it} *is* the stock of physical capital, and L_{it} is the labour force. The vector Z_{it} contains control variables that affect growth such as human capital, policies, and institutions identified in the literature. Notably, in the Z_{it} vector we include our human development and openness indicators. The standard production function is a natural theoretical framework for our analysis given that it is the foundation of the neoclassical (Solow) growth model, where economic growth is determined by investments in physical and human capital and employment growth which, taken together, ultimately influence human development.

Following our discussion of the bi-directional causality between economic growth (EG) and human development (HD) and the moderating effects of openness to trade (OT), we opt for a system of simultaneous equations as our empirical specification. We believe this estimation strategy, in essence an instrumental variables approach, is a reasonable way of dealing with the severe endogeneity and reverse causality problems that characterise single equation specifications containing EG, HD, and OT. Opting for a structural, multi-equation empirical framework allows us to study the determinants of each of the three variables of interest rather than trying to control for and limit their impacts on each other.

We set up a three simultaneous equations empirical model based on the production function (1) to study the interrelationships between EG, HD, and OT in a panel of twelve major Asian countries.[3] Our empirical *EG equation* (2) closely resembles a neoclassical growth

[3] In our robustness analysis we also estimate single equation specifications using GMM SYS which is a popular alternative instrumental variables approach for dealing with endogeneity problems.

equation, derived from equation (1) but augmented with indicators of trade openness and human development:

$$\Delta Y_{it} = \alpha_1 \Delta L_{it} + \alpha_2 \Delta K_{it} + \alpha_3 \Delta H_{it} + \alpha_4 OP_{it} + \alpha_5 HDI_{it} + \mu_i + T + \varepsilon_{it}, \tag{2}$$

where ΔY is the growth rate of output, ΔL is the growth rate of employment, ΔK is the growth rate of physical capital stock, ΔH is the growth rate of human capital stock, OP is the level of trade openness (the OP1 measure), and HDI is the level of human development. The term μ_i is the individual country effect, T is a time trend, and ε_{it} is the zero mean error term which varies across countries and time.

Human capital plays an important role in stimulating economic growth in both the augmented neoclassical growth model (Mankiw et al., 1992) and the endogenous growth model (Lucas 1988; Romer, 1990). Empirical growth studies have often found it difficult to show the strong positive impact of human capital on economic growth predicted by theoretical models.[4] The difficulties encountered in linking H variables to EG growth may stem from methodological issues, such as the inclusion of skills in the measurement of human capital, and the identification of channels through which it affects EG (Sianesi and Van Reenen, 2003; Cooray et al., 2014; Qadri and Waheed, 2014). We follow Mankiw et al. (1992) and include human capital as an additional input, as it is expected to produce long-run growth even in the absence of technological advancements (Lucas, 1988). Our *a priori* expectations are that α_1, α_2, α_3, α_4, and α_5 are all positive.

In setting up our empirical HD equation, we draw from the *capabilities approach* (Anand and Sen, 1994; 2000). This postulates that the accumulation of human capital and health facilities are important for both economic growth and human development. Openness to

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[4] In a survey of macroeconomic literature on the link between education and growth Sianesi and van Reenen (2003) conclude that there is compelling evidence on the positive impact of human capital on productivity growth; the evidence is also consistent with findings by Cameron et al. (2005) and Bournakis (2012). However, the empirical evidence on both OECD and developing countries in favour of new growth theories is weak. Moreover, there is still no consensus on whether the stock of human capital influences the level of income in long run (augmented neoclassical models) or the long run growth rate suggested by endogenous growth theories.

trade may also affect human development by directly or indirectly facilitating access to goods and services, through income growth. Although trade liberalisation can raise growth in exports and imports, the balance of payments consequences depend upon its relative impact and on any relative shifts in the prices of traded commodities (e.g., Thirwall, 2012).

We specify the *HD equation* (3) based on development theory and evidence from recent empirical research (Anand and Sen, 2000; Binder and Georgiadis, 2011).

$$HDI_{it} = \beta_1 \Delta Y_{it} + \beta_2 OP_{it} + \beta_3 lnH_{it} + \beta_4 IMR_{it} + \mu_i + T + \varepsilon_{it}, \quad (3)$$

where *HDI* is the human development index, *IMR* stands for infant mortality rate and other variables are previously defined. Wagstaff (2002) suggests that there is two-way causation between poverty and ill health. *IMR* is an important indicator linked closely to individuals' health conditions, levels of poverty and human development. Generally, developing countries with low levels of income are expected to have high *IMR* rates while lower *IMR* rates would reflect improvements in economic development in more than one dimension. There is also recent evidence that, on balance, more open countries have higher levels of human development and that returns to schooling are positive (Human Development Report, 2015). To allow for the possibility of reverse causality and multicollinearity in our empirical analysis we experiment with lagged *IMR* and step-wise introduce the explanatory variables. Our a priori expectations are that β_1, β_2, and β_3 are positive, while $\beta_4<0$.

The specification of our empirical *OT equation* (4) is based on a version of gravity model modified by Guttmann and Richards (2006) and our preceding discussion on the interrelationships between EG, HD, and OT. The equation links openness with economic growth, human development, foreign direct investment and market size for the sample of Asian countries. Thus,

$$OP_{it} = \gamma_1 \Delta Y_{it} + \gamma_2 HDI_{it} + \gamma_3 FDI_{it} + \gamma_4 MS_{it} + \mu_i + T + \varepsilon_{it}, \quad (4)$$

where *OP* is our preferred trade openness measure, OP1, *FDI* stands for foreign direct investment, *MS* represents the market size, measured by population, and other variables are previously defined. Rigobon and Rodrik (2005) among others demonstrate that income has a positive impact on openness and that variables related to geography such as market size are the most important determinant of openness. Tsen (2006) found that during the liberalisation period 1978-1999 in China, economic growth and openness Granger cause each other in both directions. In the light of the above discussion we expect that γ_1, γ_2, and γ_3 are positive, and $\gamma_4<0$.

In all equations institutional factors that evolve slowly or remain fixed over the period of analysis are accounted for by country fixed effects. In addition, a time trend is included in all specifications to control for technological progress and business cycles.

We estimate the system of three simultaneous equations specified above using a three-stage least squares estimator (3SLS). The 3SLS is superior to the two-stage instrumental variables estimator (2SLS) as it is a combination of 2SLS and seemingly unrelated regression estimator (SURE) and is consistent and more efficient than the 2SLS (Kennedy, 2009). We include only the most important and theoretically motivated variables in each equation, to reduce problems of misspecification. To identify potential endogeneity issues we step-wise introduce explanatory variables in all equations. To investigate potential problems of omitted variable bias we conduct robustness checks, where we augment the base specifications outlined above with additional relevant variables according to theory.

3 Results

Table 2 provides comparisons of the estimates of our system of equations using pooled OLS, 2SLS, and 3SLS. The three sets of results are comparable; less comparable but still qualitatively similar are the results from fixed effects estimations which are available from the authors. The estimates produced by 3SLS are the closest to the *a priori* (theoretical) expectations. Furthermore, 3SLS provides relatively more precise estimates.

Given that 3SLS is effectively an instrumental variables (IV) estimator we formally test if HD and OP equations accurately identify the EG equation; the significance threshold p-value is set at 0.05. The Hansen J-statistic of the Sargan-Hansen overidentification test is 5.53 ($\chi^2(2)$) with a p-value of 0.07, while the Kleibergen-Paap Lagrange Multiplier (LM) statistic of the underidentification test is 9.84 ($\chi^2(3)$) with a p-value of 0.02. Thus, we cannot reject the null hypothesis of validity of instruments, while we do reject the null hypothesis of underidentification. We also run Breusch-Pagan LM diagonal covariance matrix test of 3SLS validity; the LM test statistic is 384.26 ($\chi^2(3)$) with a p-value of 0.001. Therefore, we reject the null hypothesis of diagonal disturbance covariance matrix – a result in support of the choice of 3SLS.

- Table 2 here -

For all three simultaneous equations we consider specifications with the three alternative measures of trade openness (OP1, OP2 and OP3) discussed earlier but report only results from the specification with our preferred measure, OP1 while results from specifications with the two alternative (partial) measures are available from the authors.

3.1 EG equation

Table 3, column (1) reports 3SLS estimates of the EG equation (2) within our three-equation system. The estimated coefficients of employment and physical capital growth rates are positive and statistically significant in all specifications, as predicted by neoclassical growth theory. The estimated coefficient of growth in human capital (H) is positive and also significant at conventional levels. Thus, we find strong evidence that the growth in human capital stimulates economic growth in Asian economies. A one percent growth in human capital stock is associated with about a 0.2 percent increase in income growth. Thus far, our results provide support for the human capital theory and endogenous growth models of Lucas (1988) and Romer (1990) and are consistent with empirical findings at both industry and country level (Mason et al., 2012 and Sunde and Vischer 2015 respectively).

Our results also provide evidence that openness fosters growth in Asian countries, consistent with studies by Wacizarg and Welch (2008) and Shahbaz (2012). The estimated coefficient of openness is positive and significant at the 1 percent level. This indicates that a one standard deviation increase in openness is associated with a four percentage points (about 75 percent of the mean) increase in the growth rate.

Interestingly, our results also provide evidence that improvements in the level of human development (HDI) enhance growth in the region. The estimated coefficient of HDI is positive and highly statistically significant. This suggests that improvements in HDI, reflecting socio-economic factors, institutions, and freedom have increased economic growth in the Asian economies. A one standard deviation improvement in the level of human development is associated with a 0.02, or a two percentage points (which is almost 40 percent of the mean) increase in the growth rate.

The country dummies capture fixed and unobservable effects such as institutional factors, relative to China, not captured by other explanatory variables. The dummy variables for India and Bangladesh have positive and significant coefficients suggesting that our model predicts higher growth in these countries relative to China, had the unobserved country conditions been more favourable. Given that the coefficients on the dummies change with the choice of openness measure (results available from the authors) they are likely to also capture the imprecision in the openness measure.[5]

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[5] Besides this point, while pre-1978 China experienced an annual real GDP growth of 3.8 percent per year, post-1978 China saw real GDP growth of 8.7 percent per year. This shift in regime could also partially explain the varied performance of the dummy variable set.

- Table 3 here -

3.2 HD equation

Table 3, column (2) reports the regression estimates from the human development equation (3). As per *a priori* expectations, a higher infant mortality rate (IMR) leads to lower levels of human development as the IMR coefficient is negative and statistically significant. A one standard deviation increase in IMR is associated with a 0.01 (which is about 2 percent of the mean) fall in the level of the human development index. This result shows that the poor health environment indicated by high IMR hampers human development in Asian countries even though the magnitude of the effect is small.

Our findings in Table 3, column (2) show that an increase in the level of human capital (H) has a statistically significant positive impact on the level of human development. A one percent increase in the level of human capital is associated with a 0.0006 improvement in the level of human development, which represents a more than one percent increase in the HDI's mean for a ten percent increase in H. The result provides support for the proposition that human capital stock accumulation is an important factor in enhancing human development. Sianesi and Van Reenen (2003) call such positive effects 'positive educational externalities', as the educated labour force is associated with increases in technological progress, improvements in productivity, and further investments in human capital which in turn further raise productivity.

Importantly, our results also suggest that economic growth and human development may be substitutes, at least in the case of the developing Asian countries from our sample. Results in Table 3, column (2) suggest that economic growth may have hampered human development in the Asian economies studied. However, the economic significance of the effect is quite small: a one percentage point increase in income growth is associated with a 0.005 (about 1 percent of the mean) fall in the level of HDI. By focusing on faster growth, Asian economies may have lost some ground in human development. In prioritising growth, in the presence of unfavourable institutional quality, an unfair distribution of assets and income may prevent the transformation of EG into better HD performance. Potential political and economic instability may ensue (Ranis et al., 2000), in turn hampering, economic performance given our results from the EG equation.

Openness to trade is often associated with implications for income generation and distribution in developing countries. Our results suggest a one S.D. increase in openness is associated with about a 0.1 improvement in the level of the human development index - almost 20 percent of the mean. The explanation here is that trade reforms in Asian economies have created new markets with diversified commodities and better access to products, and thus improved consumer welfare (Winters et al., 2004).

Overall, the coefficients on the country dummies are negative and significant suggesting that the large majority of Asian countries in the sample are not better off in terms of human development as compared to China.

3.3 OT equation

Table 3, column (3) presents regression estimates of the trade openness equation (4). Market size (MS) has a negative and significant impact on openness, consistent with the argument that large economies are less open than small ones. FDI has a positive and statistically significant effect on the openness of Asian economies. This is in line with trade theories which suggest that FDI and openness are complementary in nature as higher levels of FDI make economies more open and internationally competitive.

We find that economic growth promotes greater openness to international trade. This result reflects the growth experience of many Asian countries where trade liberalisation policies have been adopted after achieving higher economic growth (notably, India and China).

Human development seems to have a positive effect on openness although the coefficient on HDI in our base specification is not statistically significant.

The coefficients on the country dummies are negative and statistically significant suggesting that China has a more open economy than other Asian countries once its size is taken into account.

3.4 Robustness analyses

System equation specifications

Existing empirical studies provide some support for the argument that the net impact of globalisation has been positive. However, these studies use trade flows or other partial openness measures to proxy globalisation and thus cannot capture the overall impact of globalisation on growth.

To identify the net effect of globalisation, we further investigate the empirical link between an aggregate measure of globalisation, economic growth and human development in our sample of Asian economies. In Table 4, we replace the openness (OP) variable with a globalisation index (GLOB) and observe that the results remain stable and in line with results reported in Table 3. The main finding is that globalisation has had a positive impact on human development. A one standard deviation increase in GLOB is associated with an improvement in the level of human development of about 0.1, which is almost 20 percent of the mean. However, globalisation has no effect on economic growth as the coefficient of GLOB in the growth equation is not statistically significant. One explanation could be that although the Asian economies have started integrating in more recent years, historically they have not been well integrated into the world economy. The findings taken together also suggest that the globalisation process involves much more than improving economic growth alone.

- Table 4 here -

Next we replace HDI with its knowledge and education sub-index (EDU). This helps us test for the robustness of our results as well as in directly examining the links between openness, economic growth and education. The results in Table 5 suggest that our conclusions from Table 3 remain unchanged. A major finding here is a bi-directional association between education and economic growth. However, while greater openness to trade provides incentives and opportunities for more education, education seems to have no impact on trade openness. In sum, openness contributes to education which further helps boost economic growth in the Asian countries – a finding consistent with Cooray et al. (2014).

- Table 5 here -

Similarly, we replace HDI with its life expectancy sub-index (LEI) to directly test for the interaction between economic growth, health, and openness. The results in Table 6 provide evidence of bi-directional association between health and economic growth. This suggests that a healthy society contributes positively to economic progress and that in turn more resources need to be allocated to the health sector as incomes increase in Asian economies.

- Table 6 here -

Kohpaiboon (2003) suggests that FDI affects economic growth through the diffusion of advanced technology into less developed economies, and Agosin and Machado (2007) argue that FDI and openness are positively associated. Therefore, as a further robustness check, we include an FDI variable as a complement to openness, which also helps address concerns of omitted variable bias. In Table 7, first we include FDI in the EG equation and then also add it into the HD equation. This provides evidence that FDI has a strong positive impact on both economic growth and human development in Asian countries independent of trade openness effects. The results established with previous specifications remain valid.

- Table 7 here –

Single equation specifications

In our system equation model, many explanatory variables are not strictly exogenous therefore as a final robustness check we use the Arellano and Bover (1995) and Blundell and Bond (1998) GMM SYS estimator. This single equation approach allows us to control for the endogeneity of explanatory variables in each individual equation by the use of internal instruments. The approach uses both lagged level observations as instruments for differenced variables and lagged differenced observations as instruments for level variables, making them exogenous to fixed effects.

- Table 8 here –

The results of the single equation analysis are comparable to those from the system equation analysis, but also prompt us to interpret some of our empirical findings more cautiously. In Table 8 we report the signs and level of significance of the estimated coefficients for the three main variables of interest EG, HD, and OT from the two approaches (system and single equation) next to each other, for each of the three equations. In Table A1 in the Appendix the full GMM SYS estimation results are reported. The key message from Table 8 is that the relationships between EG, HD, and OT in the growth and openness equations are consistent across the two estimation approaches. In the human development (HD) equation our original finding regarding the negative impact of economic growth on human development is not fully supported, as the GMM SYS estimate is positive but not statistically significant at any conventional level. This result leads us to conclude only cautiously that economic growth may not have a positive impact on human development, in the context of our sample.

4 Summary and conclusions

We set out to investigate the links between economic growth (EG), human development (HD), and openness to trade (OT) for twelve Asian economies between 1970 and 2011. An empirical strategy based on theoretically motivated simultaneous equations framework, allowed us to test the interrelationships between the three variables of interest. Our results confirmed that economic growth, human development, and openness are interrelated. While openness to trade can have a positive impact on both economic growth and human development, we also find that economic growth alone does not have a positive impact on human development in our sample countries. However, human development can positively contribute to furthering economic growth. Thus, we find evidence of only a unidirectional positive link between human development and economic growth.

Given the literature, reviewed above, the lack of support for a positive link between EG and HD warrants further discussion. One explanation could be that growth is not immediately helping human capital formation, and may be why we observe no positive effect on HD. This style of argument follows from both Tabellini's (2010) discussion of the importance of imbedded cultural factors in good governance and from work by Acemoglu et al. (2005), who focus on the development of institutional quality. Such deep, long-run affects may not previously have been picked up given the previous scarcity of long-run economic data and adequate econometric techniques. Although our data set does not allow us to control explicitly for institutional quality, our inclusion of the infant mortality variable suggests a link to how good institutions (in this case adequate public health planning) may mitigate the negative effects of EG on human capital formation and HD. In support of such an argument, we find that the negative human development effects of growth tend to disappear in our robustness checks, where we use system GMM estimation, and when the HD equation is correctly identified by the inclusion of infant mortality.

Although infant mortality has generally declined in many Asian countries, Mallick (2014) has shown how higher mortality rates may reduce HD during periods of uneven economic growth. Displaced rural populations move into towns, as agricultural employment declines, but such migration takes place before the adequate urban socio-economic infrastructure (schools, healthcare, etc. required in successful development) can be put in place, and rural infrastructure remains underdeveloped.

Some insights into the subtle three-way linkages that exist between EG and HD, and between EG and OT are also provided. While trade openness considered in isolation is not an economic panacea, when the subtle interactions between the three variables are considered together trade can contribute positively to both growth and human development. Such findings in our sample of Asian countries, confirm the view that trade liberalisation is a viable development strategy when applied with due consideration for local institutional depth and quality. Hence future research may need to take the implications of the varying degrees of institutional quality found in Asian countries into account in a more structured way.

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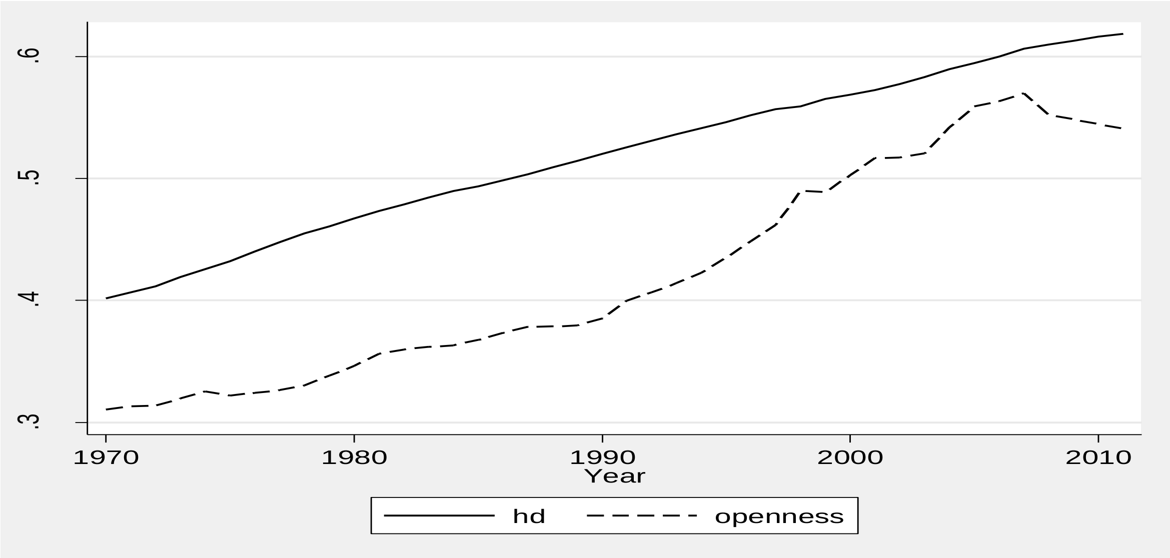
Figure 1: Openness and human development in Asia



Notes: Openness is measured by economic globalization calculated as in Dreher (2006) and human development (hd) is authors own calculations.

Table 1: Description and source of regression variables

Variable	Definition	Source	Mean	S.D.
ΔY (real GDP)	Growth rate in GDP in 1990 US$ (Geary Khamis PPPs)	Conference Board (2011), World Bank (2012)	0.054	0.036
ΔL (labour force)	Growth rate in employment	Conference Board (2011)	0.024	0.025
ΔK (physical capital stock)	Growth rate in capital, constructed series using PIM method	World Bank (2012)	0.092	0.059
H (human capital index)	Index constructed using Cohen and Soto (2007) methodology	Authors own calculations using Barro and Lee (2010) data	4.00	1.357
OP1 (openness)	Economic globalization Index	Dreher (2006)	0.422	0.225
OP2 (openness)	Ratio of exports plus imports to GDP	Penn World Tables 7.0	0.807	0.907
OP3 (openness)	Ratio of exports plus imports to GDP	World Bank (2012)	0.816	0.897
GLOB	Globalisation index	Dreher (2006)	0.431	0.179
HDI (human development index)	Composite index of income, health and education indices	Authors own calculations using UNDP (2011), UNDESA (2011), Barro and Lee (2010)	0.519	0.134
EDU	Education index	A sub index of HDI, based on Cohen and Soto methodology	0.403	0.125
LEI	Life expectancy index	A sub index of HDI	0.713	0.124
IMR (infant mortality rate): per thousand	Mortality rate, under-5 (per 1000)	World Bank (2012)	0.700	0.586
FDI (foreign direct investment)	Ratio of annual net inflows of FDI to GDP	World Bank (2012)	0.020	0.035
MS (market size)	Log total population	World Bank (2012)	17.977	1.611

Notes: Number of observations is 492.

Table 2: Base Specification using OLS, 2SLS and 3SLS

Variable	OLS	2SLS	3SLS
	EG (ΔY)	EG (ΔY)	EG (ΔY)
ΔL	0.202***	0.204***	0.176***
	(0.062)	(0.064)	(0.056)
ΔH	0.138	0.209*	0.188*
	(0.102)	(0.111)	(0.097)
ΔK	0.253***	0.290***	0.225***
	(0.040)	(0.043)	(0.040)
OP	-0.063*	0.075	0.195***
	(0.034)	(0.061)	(0.058)
HDI	0.101	0.477***	0.260**
	(0.080)	(0.138)	(0.131)
	HD (HDI)	HD (HDI)	HD (HDI)
IMR	-0.008	-0.027**	-0.020**
	(0.007)	(0.013)	(0.010)
lnH	0.038***	0.100***	0.057***
	(0.007)	(0.015)	(0.012)
ΔY	-0.040	-0.324***	-0.514***
	(0.024)	(0.107)	(0.101)
OP	-0.032	0.396***	0.422***
	(0.020)	(0.069)	(0.065)
	OT (OP)	OT (OP)	OT (OP)
MS	-0.333***	-0.322***	-0.277***
	(0.023)	(0.027)	(0.026)
FDI	0.010	0.130	0.212***
	(0.094)	(0.110)	(0.078)
ΔY	-0.115**	0.423***	0.455***
	(0.049)	(0.140)	(0.131)
HDI	-0.557***	-0.327**	0.006
	(0.086)	(0.156)	(0.143)

Notes: ***, **, and * denote statistical significant at 1%, 5%, and10 % level respectively; figures in parentheses are the standard errors. Number of observations is 492. Country fixed effects and time trend are included in each equation.

Table 3: 3SLS estimates of the base specification

Variable	EG (ΔY)	Variable	HD (HDI)	Variable	OT (OP)
	(1)		(2)		(3)
ΔL	0.176***	IMR	-0.020**	MS	-0.277***
	(0.056)		(0.010)		(0.026)
ΔH	0.188*	lnH	0.057***	FDI	0.212***
	(0.097)		(0.012)		(0.078)
ΔK	0.225***	ΔY	-0.514***	ΔY	0.455***
	(0.040)		(0.101)		(0.131)
OP	0.195***	OP	0.422***	HDI	0.006
	(0.058)		(0.065)		(0.143)
HDI	0.260**				
	(0.131)				
Trend	-0.002***	Trend	0.001**	Trend	0.012***
	(0.001)		(0.001)		(0.001)
Bangladesh	0.070*	Bangladesh	-0.173***	Bangladesh	-0.813***
	(0.038)		(0.014)		(0.081)
India	0.059*	India	-0.160***	India	-0.143***
	(0.031)		(0.009)		(0.036)
Nepal	0.044	Nepal	-0.178***	Nepal	-1.250***
	(0.038)		(0.016)		(0.122)
Pakistan	0.054	Pakistan	-0.181***	Pakistan	-0.665***
	(0.033)		(0.010)		(0.077)
Sri Lanka	0.003	Sri Lanka	-0.089***	Sri Lanka	-1.163***
	(0.013)		(0.007)		(0.110)
Indonesia	-0.012	Indonesia	-0.185***	Indonesia	-0.392***
	(0.022)		(0.010)		(0.056)
Malaysia	-0.065***	Malaysia	-0.190***	Malaysia	-0.795***
	(0.022)		(0.022)		(0.106)
Philippines	-0.024	Philippines	-0.168***	Philippines	-0.659***
	(0.018)		(0.013)		(0.079)
Singapore	-0.132***	Singapore	-0.213***	Singapore	-1.059***
	(0.034)		(0.036)		(0.148)
Korea	-0.038***	Korea	-0.039***	Korea	-0.773***
	(0.011)		(0.009)		(0.083)
Thailand	-0.013	Thailand	-0.134***	Thailand	-0.708***
	(0.015)		(0.010)		(0.080)

Notes: ***, **, and * denote statistical significant at 1%, 5%, and 10% level respectively; figures in parentheses are the standard errors. Number of observations is 492. China is the reference country. The test statistic for Breusch-Pagan LM test is 384.26 with a p-value of 0.001 in favour of 3SLS.

Table 4: Globalisation, economic growth, and human development

Variable	EG (ΔY)	Variable	HD (HDI)	Variable	OT (GLOB)
	(1)		(2)		(3)
ΔL	0.159***	IMR	-0.014	MS	-0.247***
	(0.061)		(0.009)		(0.020)
ΔH	0.317***	lnH	0.076***	FDI	0.318***
	(0.104)		(0.009)		(0.074)
ΔK	0.318***	ΔY	-0.354***	ΔY	-0.105
	(0.042)		(0.101)		(0.106)
GLOB	-0.129	GLOB	0.525***	HDI	-0.293**
	(0.089)		(0.089)		(0.115)
HDI	0.474***				
	(0.132)				

Notes: ***, **, and * denote statistical significant at 1%, 5%, and 10% level respectively; figures in parentheses are the standard errors. Number of observations is 492. Country fixed effects and time trend are included in each equation. The test statistic for Breusch-Pagan LM test is 183.17 with a p-value of 0.001 in favour of 3SLS.

Table 5: Openness, economic growth, and education

Variable	EG (ΔY)	Variable	HD (EDU)	Variable	OT (OP)
	(1)		(2)		(3)
ΔL	0.147***	IMR	-0.013	MS	-0.257***
	(0.053)		(0.009)		(0.025)
ΔH	0.210**	lnH	0.112***	FDI	0.156*
	(0.090)		(0.012)		(0.087)
ΔK	0.215***	ΔY	-0.518***	ΔY	0.547***
	(0.039)		(0.089)		(0.134)
OP	0.273***	OP	0.354***	EDU	-0.144
	(0.060)		(0.058)		(0.111)
EDU	0.235**				
	(0.102)				

Notes: ***, **, and * denote statistical significant at 1%, 5%, and 10% level respectively; figures in parentheses are the standard errors. Number of observations is 492. Country fixed effects and time trend are included in each equation. The test statistic for Breusch-Pagan LM test is 382.52 with a p-value of 0.001 in favour of 3SLS.

Table 6: Openness, economic growth, and life expectancy

Variable	EG (ΔY)	Variable	HD (LEI)	Variable	OT (OP)
	(1)		(2)		(3)
ΔL	0.167***	IMR	-0.145***	MS	-0.289***
	(0.056)		(0.012)		(0.025)
ΔH	0.206**	lnH	0.016	FDI	-0.018
	(0.093)		(0.014)		(0.081)
ΔK	0.229***	ΔY	-0.552***	ΔY	0.444***
	(0.038)		(0.128)		(0.148)
OP	0.181***	OP	0.289***	LEI	0.032
	(0.057)		(0.080)		(0.082)
LEI	0.246***				
	(0.059)				

Notes: ***, **, and * denote statistical significant at 1%, 5%, and10% level respectively; figures in parentheses are the standard errors. Number of observations is 492. Country fixed effects and time trend are included in each equation. The test statistic for Breusch-Pagan LM test is 411.73 with a p-value of 0.001 in favour of 3SLS.

Table 7: Base specification with FDI

Variable	EG (ΔY)	Variable	HD (HDI)	Variable	OT (OP)
	(1)		(2)		(3)
ΔL	0.134**	IMR	-0.0268***	MS	-0.282***
	(0.054)		(0.010)		(0.026)
ΔH	0.212**	lnH	0.0662***	FDI	-0.189*
	(0.093)		(0.014)		(0.108)
ΔK	0.208***	ΔY	-0.881***	ΔY	0.623***
	(0.040)		(0.132)		(0.134)
OP	0.185***	OP	0.524***	HDI	-0.171
	(0.058)		(0.076)		(0.147)
HDI	0.291**	FDI	0.462***		
	(0.133)		(0.092)		
FDI	0.176**				
	(0.086)				

Notes: ***, **, and * denote statistical significant at 1%, 5%, and 10% level respectively; figures in parentheses are the standard errors. Number of observations is 492. Country fixed effects and time trend are included in each equation. The test statistic for Breusch-Pagan LM test is 514.62 with a p-value of 0.001 in favour of 3SLS.

Table 8: Comparison of system and single equation estimates for EG, HD, and OT

Dependent variable	Specification	EG (ΔY)	HD (HDI)	OT (OP)
		(1)	(2)	(3)
ΔY	System		–***	+***
	Single		+	+
HDI	System	+**		+
	Single	+***		+***
OP	System	+***	+***	
	Single	+	+**	

Notes: The statistical significance and the sign of the coefficients are reported; ***, **, and * denote statistical significant at 1%, 5% and 10% level respectively. Number of observations is 492 in all regressions. System equation specifications are estimated by 3SLS. Single equation specifications are estimated by GMM SYS.

Appendix

Table A1: GMM SYS single equation estimates of the base specification

Variable	EG (ΔY)	Variable	HD (HDI)	Variable	OT (OP)
	(1)		(2)		(3)
ΔL	0.214***	IMR	-0.145***	MS	-0.051***
	(0.083)		(0.038)		(0.020)
ΔH	0.051	lnH	0.050*	FDI	1.471**
	(0.070)		(0.028)		(0.759)
ΔK	0.133**	ΔY	0.100	ΔY	0.010
	(0.066)		(0.137)		(0.020)
OP	0.015	OP	0.113**	HDI	1.027***
	(0.012)		(0.058)		(0.195)
HDI	0.103***				
	(0.030)				
Trend	-0.000	Trend	0.001	Trend	0.002
	(0.000)		(0.001)		(0.002)
AR(2)	0.080	AR(2)	0.073	AR(2)	0.120
Hansen J-test	0.999	Hansen J-test	0.999	Hansen J-test	0.999

Notes: ***, **, and * denote statistical significant at 1%, 5%, and 10% level respectively; figures in parentheses are the standard errors. FDI is share in capital investment. Number of observations is 492. For AR(2) and Hansen J-test *p*-values are reported.