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Lucky Countries? Internal and External Sources of Southeast Asian Growth

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Lucky Countries? Internal and External Sources of Southeast Asian Growth[1]

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Abstract

For several decades, the economies of Southeast Asia have experienced average per capita GDP growth rates second only to China, and much higher than any other major world region. In this study we examine the sources of this growth. We ask whether countries of this region follow a common growth path relative to the rest of the developing world. We pay particular attention to two prominent features of virtually every Asian regional growth narrative – openness to international trade and factor flows, and spillovers from growth booms in large regional economies like Japan and China – which have not received adequate attention in previous quantitative growth analyses.

Our results show that rapid income growth in Northeast Asia had significant spillover effects on Southeast Asian growth, and that these effects were significantly larger than for other developing regions. But within the region, growth outcomes have been differentiated in part by the degree of openness to international trade and factor flows. Thus, while the good luck of geographic proximity to the booming economies of Northeast Asia has been important, good policies also matter.

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[1] This work has evolved from a thesis project by the first author (Phung 2012). The authors thank participants at seminars at the University of Wisconsin-Madison and the Asian Development Bank Institute, and at the Handbook of Southeast Asian Economics Conference (Bangkok, March 2013) for helpful comments on earlier drafts.

1. ECONOMIC GROWTH IN EAST AND SOUTHEAST ASIA

Among developing economies, East and Southeast Asia stand out as the most dynamically growing regions. With just a few exceptions, incomes in the region have risen sharply relative to world averages over the course of several decades (Table 1).

This remarkable performance has inspired many explanations.[2] Growth of labor and capital endowments has clearly played an important role (Young 1994, 1995; Krugman 1994; Collins and Bosworth 1996), as has human capital accumulation. Macroeconomic stability has attracted much attention, and so has the degree to which the region's economies have been open to international trade and factor flows. Other studies (including the World Bank's influential 1993 study *East Asian Miracle*, hereafter *EAM*) assert that governments in the region have intervened systematically and through multiple channels to foster development. Finally, there is widespread, though informal, recognition that the exceptional performance of Asia's "miracle" economies has been exported to other regional countries through trade, factor market linkages, and less tangible influences such as the demonstration effects of apparently successful development policies.

A number of prominent studies have used growth accounting or regression techniques to infer sources of Asian growth. *EAM* regressed growth from 1965-90 on primary factor and human capital endowments and found that for the eight "high-performing Asian economies" (HPAEs),[3] physical capital accumulation and primary education contributed the most to explained growth rates. Collins and Bosworth (1996) found that most growth in developing Asia was accounted for by factor accumulation and policies, with virtually no role for productivity growth. Radelet et al. (2001) found that a combination of initial conditions, economic policies and demographic changes account for East Asia's rapid growth, with an especially important role played by success in export growth, especially of labor-intensive manufactured products. In a significant

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[2] "Economic miracles are a public good: each economist sees in them a vindication of his pet theories" (Bhagwati 2000:98).

[3] Japan, South Korea, Taiwan, Hong Kong, Singapore, Malaysia, Thailand and Indonesia.

advance for the quality of inference, Lee and Hong (2010) accounted for endogeneity in key explanatory variables of the standard growth model (their paper also supplies a good survey of earlier work). They found that capital accumulation has been the key driver of regional growth, with much more modest contributions from labor force, human capital and TFP growth. In simulations based on their econometric results they also found that policy reforms relating to property rights, R&D and education have the potential to raise growth rates significantly among currently lagging economies.

These studies, along with many others, are built upon modifications to the standard Solow aggregate growth model with human capital (Mankiw et al. 1992). They also share some common features. First, in regression analyses from cross-country data they typically find an "East Asia" (i.e., Northeast and Southeast Asia) dummy variable to be positive and significant. This indicates a higher *ceteris paribus* rate of growth in developing Asia, but does not explain it.[4] Second, none of them explore more deeply the possibility that growth in Asian economies might differ in more structural fashion—that is, they do not test the assumption of homogeneity in slope parameters. Third, although narratives of East Asian growth invariably focus on international trade and factor flows as perhaps the most distinctive features of the region's experience, empirical treatment of openness remains quite cursory. Most studies that do address openness measure it by the Sachs-Warner index (Sachs and Warner 1995).[5] An earlier literature, and a minority of contemporary studies, rely on the ratio of trade to GDP, an obviously endogenous variable.[6] Although strongly associated with growth, this index has been criticized as a weak measure of underlying trade policies (Rodriguez and Rodrik 2001). Fourth, to our knowledge no existing study takes account of potential growth spillovers among countries, in

[4] Radelet *et al.* 2001 is the only such study in which regional dummy variables are not statistically significant.

[5] This index classifies an economy as closed when any of the following criteria holds: (i) its average tariff rate exceeds 40%, (ii) its non-tariff barriers cover more than 40% of imports, (iii) it has a socialist economic system (iv) it has a state monopoly of major exports, or (v) its black-market premium exceeds 20% during either the decade of the 1970s or the decade of the 1980s. Otherwise, the economy is considered "open".

[6] Among papers that we cite here, only Lee and Hong (2010) uses this definition of openness.

spite of the prominent role these play in regional growth narratives.[7] All in all, these limitations suggest that despite much prior empirical work, there is still scope to learn more about the Asian growth experience.

The value of another empirical growth exercise lies in the lessons it might convey. Although they are often treated as a single region in global growth studies, Northeast and Southeast Asian economies have followed quite distinct growth trajectories. Growth rates in Northeast Asia have slowed in the last two decades, while in Southeast Asia – and notably in the poorest transitional economies of Vietnam, Laos and Cambodia – growth has accelerated. Does the same model that explained Northeast Asian growth also account for that of the later-emerging economies? The rapid growth of the Southeast Asian economies is all the more surprising when considered in light of predictions from globally prominent cross-country studies of growth. Tropical locations and natural resource wealth, both features of Southeast Asian economies, were identified as having a strong negative association with growth in a series of studies by Sachs and Warner (1995; 2001). Weaknesses in the institutions of political and economic governance have likewise received notable attention as restraints on growth (Acemoglu et al. 2001; Acemoglu and Robinson 2012), and the Southeast Asian economies other than Singapore receive only fair to poor scores in international rankings of institutional quality. What factors helped the region's economies to overcome these impediments?

To answer questions of this kind, we estimate a growth model on international data and then test for differences in parameters for countries within and outside Southeast Asia. Rather than conduct a completely open-ended search, we consider determinants of Southeast Asian growth that have received the greatest attention in past debates. These are capital and human capital accumulation, macroeconomic stability, openness to trade and investment, and the spillover effects of growth, both in the global economy and during booms in two large regional economies Japan in the 1980s, and China since the 1990s.

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[7] The most enduring "spillover" narrative in Asia is of course the "flying geese hypothesis," which characterizes spillovers in the form of an international product cycle linked to trade and the cross-border relocation of industries (Akamatsu 1962; Lin 2011).

We use data from 1971-2010 covering a sample of 139 countries. Eight of out of eleven Southeast Asian countries are included: Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam. The other three, Brunei Darussalam, East Timor and Myanmar are excluded for lack of reliable data. In a departure from existing studies, we use an index of openness that is explicitly based on trade and other closely-related policies, we incorporate measures of growth spillovers as described above, and we test the interaction of openness and spillovers. Finally, we evaluate the robustness of our results in different model specifications and subsets of the data. Based on these estimates, we draw implications and policy lessons for the region's future development, especially the contributions to growth of openness to international trade and investment.

The remainder of the paper is organized as follows. Section 2 provides a very brief review the role of openness in growth theory and empirical applications. Section 3 surveys the Asian economic growth experience and discusses possible determinants of Southeast Asia's rapid growth. Section 4 presents data, growth models, and estimation results, and interprets the findings. The study concludes in Section 5 with a summary of the analysis and implications of our findings.

2. OPENNESS AND ECONOMIC GROWTH

2.1 Openness

The measurement of openness, and of the links between openness and growth has always been controversial. This is partially due to the variation in the ways economists define and measure openness (Baldwin 2003). Of many measures, the Sachs-Warner index referred to above has proved most popular in empirical work. As a measure of trade policy interventions, however, it is both very blunt and also demonstrably flawed. Rodriguez and Rodrik (2001) have shown that just two of the index's five components -- the existence of a state monopoly on the country's main exports, and a black market premium of more than 20% -- are responsible for nearly all of its explanatory power in cross-country regressions. These two variables do not cover variation in tariff and non-tariff barriers, let alone in a way that connects to growth theory.

Another problem for empirical growth studies is that the Solow growth model has no explicit role for trade and other international interactions. There were substantial theoretical advances on this front in the early 1990s (e.g., Rebelo 1992; Lee 1993), but while these models identified *ex ante* mechanisms, they were not linked to empirical tests. More recently, Estevadeordal and Taylor (2008) have integrated openness into the Solow model in a manner that is both consistent with neoclassical growth theory and also rich in empirically testable propositions. The main features of their model can be summarized as follows. Assume that the aggregate production function is of Cobb-Douglass form and includes intermediate inputs, which are combined with a primary factor composite such that $Y = A(K^{\alpha}L^{1-\alpha})^{1-\sigma}X^{\sigma}$, where Y is output and K, L and X are capital, labor and intermediate inputs respectively. An open developing economy is a net exporter of its output and a net importer of intermediate goods. It is also a net importer of capital (investment) goods, so that the equation of growth of net capital stocks, $\Delta K = I - \delta K$ (where I is investment, Δ a change operator, and δ the depreciation rate) is augmented to allow for imported capital. Demand for each type of import is a declining function of its price, which depends both on world prices and also on trade policies such as tariffs. Hence lowering tariffs (or equivalent barriers to imports) on intermediates increases their demand, and similarly, lowering the domestic cost of capital goods increases the stock of savings available for domestic investment.[8]

This model yields two interesting implications. First, a lower cost of intermediate imports is analogous to higher TFP growth, and second, since savings (the inputs to production of capital goods) can come from either domestic or foreign sources, any policy that lowers the cost of imported capital is isomorphic to a higher domestic savings rate. It follows that lowering tariffs on capital goods and intermediates can generate faster growth both along the transitional path and in the steady state.[9]

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[8] Take as an example the case of imported intermediates. By the Cobb-Douglas assumption, $\sigma Y = P_X X$, where $P_X = (1+t_X)$ when the world price of intermediates is normalized to unity. Then $X = \sigma Y/P_X$ and thus $\partial X/\partial t_X < 0$. Substituting for X in the Solow production function and solving, we have $\partial Y/\partial t_X$ isomorphic to $-\partial Y/A$. The solution for a lower tariff on capital goods imports is obtained form the dynamic equation for capital growth in equivalent fashion (Estevadeordal and Taylor 2008).

[9] These gains do not depend on endogenous growth mechanisms (e.g. Rivera-Batiz and Romer 1991; Grossman and Helpmann 1991), empirical support for which remains mixed (Kehoe and Ruhl 2010). The formal derivation of

Empirically, the Estevadeordal and Taylor model also implies a focus not on tariffs in general, but specifically on those applied to intermediates and capital goods. As such it overcomes an important limitation in previous studies in which combined all forms of tariff data were combined, thereby imposing the (unreasonable) assumption that protection on all types of goods has equivalent growth effects. Using disaggregated tariff data in a difference-in-difference model, the authors find robust evidence that lower tariffs on imported capital and intermediate goods are associated with significantly faster income growth in a large panel of countries. The effects are weaker for the case of average tariffs, which reinforces their case.[10]

By incorporating openness into the Solow model, this study has advanced our theoretical and empirical understanding of the openness-growth nexus. It provides a theoretically defensible mechanism through which openness can be related to growth. This in turn motivates hypotheses not only about the direct impact of openness on growth, but also about its role in transmitting growth booms (or busts) among economies.

3. SOUTHEAST ASIAN GROWTH IN GLOBAL CONTEXT

3.1. Regional growth rate comparisons

From 1965 to the 1990s, the eight HPAEs identified in *EAM* were able to maintain income per capita growth rates averaging more than 5%.[11] More recently, China has joined this group, having emerged in the early 1990s as the world's most rapidly-growing economy.

Since the 1970s these economies have grown faster than any other developing region. As seen in Table 1, developing countries in East Asia and Pacific achieved the highest average growth rates of per capita GDP (6.5%) in the last four decades. The Southeast Asian economies are now growing faster than all their counterparts in Northeast Asia except China. While the former

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growth gains from lower tariffs on inputs provides a theoretical foundation for many prior assertions of the same phenomenon, e.g. by Radelet *et al.* 2001: 32-34; Levine and Renelt 1992.

[10] The finding that lower tariffs on intermediates raises productivity finds support in a study using firm-level industrial data from Indonesia by Amiti and Konings (2007).

[11] Source: World Development Indicators Online.

region has enjoyed per capita income growth at approximately 4% since the 1970s, growth rates in the latter region have decelerated. In 1990-2010, Northeast Asian economies other than China grew at less than half the rate they had achieved in the 1970s and 1980s.

As a result, after China, Southeast Asia stands out among regions in the developing world. Its economies achieved on average 3.89% per capita income growth in the last four decades, significantly higher than Sub-Saharan Africa (0.55%), Latin America & Caribbean (1.57%), Middle East & North Africa (1.85%) and South Asia (3.08%). If we had invested $100 in each region in 1970, then by 2010 this would have returned $124 from Sub-Saharan Africa, $187 from Latin America & Caribbean, $209 from Middle East & North Africa, $336 from South Asia, and $468 from Southeast Asia.

While the inter-regional comparison is illuminating, there is also variation in within-region growth rates. Table 2 shows income per capita growth rates of eight major Southeast Asian economies (Myanmar, Brunei and East Timor are again excluded). From 1970 to 2010 all countries except the Philippines grew faster than the averages for Sub-Saharan Africa, Latin America & Caribbean, Middle East & North Africa and South Asia. In 1991-2010, Southeast Asian high-performing countries including Indonesia, Malaysia, Singapore and Thailand continued to grow rapidly, though at a slightly lower pace, down from 4.7%-6.6% in 1971-90 to 3.6%-3.9%.[12] In contrast, poorer economies in Southeast Asia including Cambodia, Laos and Vietnam accelerated to growth rates ranging from 4% to 6%. Significant differences in real income between the region's earlier and later developers remain, but the gap is closing.

3.2. Determinants of growth

East Asian Miracle showed that factor accumulation matters in the East Asian growth experience. For the HPAEs, primary education and investment were found to make the largest contributions to growth. However, different rates of factor accumulation explain only part of the variation in income growth rates between HPAEs and other regions, and overall, the *EAM*

[12] This period includes the major regional recession of 1997-99, but growth rates excluding this episode are also somewhat lower than for the pre-crisis decade.

regression model predicted only about two-thirds of observed HPAE growth. Moreover, there is reason to suspect that the most important factors explaining growth in 1965-90 are not necessarily those that dominate in later years and/or for later-developing economies.

In studies of Southeast Asian growth success, four main factors are usually identified.[13] First, saving and investment rates rose early and have been maintained at high levels by global standards (Horioka and Terada-Hagiwara 2011). Second, countries in the region are said to have allocated significant resources to education and human capital, and this, it is claimed, has facilitated the shift from labor-intensive exports to products of higher value. Third, after early experiments with import substitution most regional governments moved to liberalize trade and capital flows, for example by lowering tariff rates, creating export processing zones and imposing duty exemption schemes. Last but not least, Southeast Asian policymakers have played an important role in maintaining macroeconomic stability, something that is clearly of great importance when the bulk of new capital investment occurs in industries, such as assembly and other light manufacturing, that are internationally footloose. Of course no regional country other than Singapore comes close to an ideal on these criteria, and in particular, the poorer Southeast Asian countries are especially weak. However, Cambodia, Laos and Vietnam have also made great progress in liberalization since the 1990s, there are now signs that even Myanmar, the region's perennial laggard, may be catching up.

Another significant factor facilitating Southeast Asian development is its geographic proximity to the large booming economies of Northeast Asia. The gravity model literature asserts that proximity enhances trade (Bergstrand 1985; Deardorff 1998; Mátyás 1997; Frankel, Romer and Cyrus 1996), and a subset of contributions to the empirical growth literature have examined growth spillovers from neighboring countries.[14] The proximity of Southeast Asia to the large and dynamic economies of Northeast Asia has presumably brought critical opportunities for development through this channel. Trade connections between the two sub-regions have deep

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[13] See, for example, World Bank 1993, Radelet *et al*. 2001, Dowling 1997, Kong 2007.

[14] For a good recent review of empirical growth analyses with spillovers see Roberts and Deichmann 2011.

historical roots, but the modern history begins at the start of the 1970s with three-way trade in which electronic components were shipped from Japan to Malaysia and Singapore for assembly into radios and other appliances to be sold in the US market. These trade linkages were accompanied by FDI inflows from Japanese, US and European firms, and those in turn paved the way for a massive surge in inward FDI to Southeast Asia from Japan and its Northeast Asian neighbors following the 1985 Plaza Accord, under which the Japanese yen (and the Korean won and New Taiwanese dollar, two currencies closely linked to the yen) appreciated sharply against the US dollar. Currency appreciation accelerated the outsourcing of Northeast Asia's most labor-intensive industries, and producers of textiles, apparel, footwear, simple electronics and other light manufacturing found Southeast Asia to be an attractive host for offshore production due to its geographical proximity, abundant low-wage labor, relatively stable political systems, and macroeconomic stability.[15]

In the decade after the Plaza Accord, trade and FDI flows between Northeast Asia and Malaysia, Singapore, Indonesia and Thailand increased dramatically. By this means the Southeast Asian economies became established as producers of manufactures for the global market– and this provides a clue to their continued high GDP growth. Southeast Asian economies were able to turn trade and FDI into productivity growth through technology transfers, licensing or joint ventures with foreign companies. Rapid investment growth together with improvements in labor skills and technology caused rises in both output and productivity. Export industries were promoted by creating export-processing zones, lowering input tariffs, and removing other barriers to international trade and payments. Allocative efficiency improved as a result, and gradually, with improvements in both skills and wages, investment shifted to high-skill and capital-intensive products such the manufacture of parts and components for electronics and machinery (Dowling 1997; Athukorala and Yamashita 2006).

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[15] With the exception of the Philippines, Southeast Asia's middle-income economies (as well as Singapore, now classed as high-income) have a record of good macroeconomic management associated with a strong aversion to inflation. In the five-year period prior to the Plaza Accord these economies were able to maintain the lowest average inflation rate among developing economies. With the exception of South Asia, all other regions recorded two- or three- digit average inflation rates.

More recently, China's rapid emergence as the "the world's factory" has significantly affected the global economy and the structure of international trade. China's growth has presented challenges as well as opportunities to Southeast Asian development—the former through competition in sales to third markets, the latter through complementarities in production (Ianchovichina and Walmsley 2003, Ianchovichina *et al*. 2004, Ravenhill 2006; Eichengreen and Tong 2005; Coxhead 2007). All these phenomena operate directly and indirectly through trade and international factor flows. Intraregional exports of raw materials and electronic parts and components to China have boomed, while Southeast Asian producers of labor-intensive goods such as textiles, clothing and footwear have suffered due to direct competition from Chinese exporters. In a study limited to trade in manufactures, Eichengreen and Tong (2005) estimated that the impact of China's growth is positive on exports from high and middle-income Southeast Asian economies (Singapore, Malaysia, Indonesia, Philippines, and Thailand) and negative for low-income countries such as Cambodia that depend heavily on labor-intensive assembly. For resource-rich lower-income countries like Indonesia, Vietnam, Laos, Cambodia and Myanmar, short-term gains from exports of primary and agricultural products have been accompanied by concerns over their long-term welfare due to diminished profitability in labor-intensive manufactures and the negative consequences of natural resource export booms (Coxhead 2007; Thee 2012).

This account of the growth of Northeast Asian influences on developing Asian economies motivates tests of spillover effects on growth. In the 1980s, the Japanese economy accounted for an average 16% of world GDP and its GDP growth rate, which averaged 4.4%, was 1.75 times greater than in the rest of the world and 1.9 times greater than in the rest of the OECD (which accounted for 83% of world GDP at the time).[16] Japan's share in global trade was about 10% in the 1980s—second only to the USA, which grew much less quickly during this decade. China's shares in global GDP and trade in the 1990s and 2000s were both smaller than Japan's in the 1980s, but its GDP growth rate in the 1990s was on average 3.7 times greater than the world

[16] Compared with weighted average GDP growth in the group of 24 "early entrant" OECD countries plus China, Japan's growth rate lay above the 95% confidence interval in nine of the 13 years from 1979-91. Growth rates and shares computed from World Development Indicators Online.

average in the 1990s, and over 4 times greater in the 2000s. By the end of the decade China had become the world's second-largest economy with 8% of world trade. Therefore, it is reasonable to expect that these booms in the Japanese and Chinese economies influenced growth among their neighbors, and for that matter in the global economy as a whole.

Figure 1 provides one (admittedly informal) way to see the magnitudes of these booms. It shows annual GDP growth rates of the world's four largest economies multiplied by each economy's share in global merchandise exports. The Japanese boom of the late 1970s through 1991 is clearly evident, as is the United States' "long expansion" from the mid-1980s to 2000. China's growth rate is high almost throughout this period; however, what brings it to global prominence is the huge increase in its global export share after the early 1990s.

If geographic proximity is correlated with trade and other international linkages, then these booms in large economies appear quite different in different parts of the world. Figure 2 illustrates this by dividing the data in Figure 1 by distance from Singapore, which is located near the geographic center of Southeast Asia. In the "view from Singapore", the Japanese and Chinese booms acquire far greater prominence, while export-weighted growth in the USA and Germany is diminished, despite those countries' size and global trade shares.

4. MODEL, ESTIMATION AND DISCUSSION

4.1. Model Specification

The literature on East Asian and Southeast Asian growth experience provides very limited empirical evidence to distinguish those countries from other developing regions due to either restricted data or methodologies. As noted, a common approach is to introduce an "Asia" dummy variable to test for any deviation from a common intercept (Collins and Bosworth 1996; Radelet *et al.* 2001). This approach assumes that the underlying growth model is identical everywhere. Radelet *et al.* (2001) go one step further to point out Southeast Asian distinctiveness by examining controlled averages of various variables for Southeast Asia and other regions. They estimate a cross-country gravity model controlling for a number of structural and geographic variables where dependent variables are the variables under consideration like trade ratios,

government spending, etc. They include a dummy variable to represent high-performing countries in East Asia and Southeast Asia. Higher shares of imports, total exports and manufactured exports, higher savings and investment, and slightly larger central government budget shares are aspects in which Southeast Asia differed from other countries in 1990 as the Southeast Asian dummy is positive and significant in those regressions. Despite being more informative than the comparison of simple averages, this approach does not reveal the mechanisms by which Southeast Asian distinctiveness contributes to its growth. To the best of our knowledge, no empirical study has employed a method that is well suited to address this.

We augment the Solow growth specification made popular by Mankiw, Romer and Weil (1992), which includes initial income, physical and human capital and labor force as contributors to GDP growth. Our modifications to this basic model take three forms. First, we introduce variables intended to capture macroeconomic stability and openness. Second, we introduce a measure of economic growth in the world economy, and additional measures of the East Asian growth booms discussed in the previous section. As described below, these measures are based on geographic distance but take account also of economic "distance" via the relative sizes and growth rates of economies, taking account of openness as discussed in section 2. Third, we test whether the parameters of this model are equal for Southeast Asian economies relative to the rest of the world.

The basic growth model makes use of the standard Mankiw *et al*. variables augmented by policy indicators as described above. Its elements are:

- The logarithm of per capita GDP in the initial year of the period
- Capital investment (Investment/GDP)
- Human capital (Secondary school enrolment)
- Demographic development (Working-age population)
- Macroeconomic stability (Average annual inflation rate)
- Openness (Freedom to Trade Internationally index).[17]

[17] See below for additional discussion.

An important modification is to allow for growth spillovers among countries. Early tests of external effects in growth models took the form of spillovers from growth shocks in adjacent countries (e.g. Easterly and Levine 1998). This approach is conceptually limited in that a country's international interactions may extend far more broadly than to its immediate neighbors. It is also methodologically difficult since growth among immediate neighbors raises issues of endogeneity and simultaneity. Our approach is closer in spirit to studies that examine spillovers according to data-rich measures of "economic distance" (Moreno and Trehan 1997; Conley and Ligon, 2002; Roberts and Deichmann 2011). These measures take account not only of geographic proximity, but also of the relative size and/or growth rates of other economies.

Our estimation framework of the spatial spillover model follows Moreno and Trehan (1997) and Erter and Koch (2007). We extend their work in two important ways; we take account of a country's openness as a factor conditioning its receptiveness to growth spillovers, and we examine spillovers not only from the world economy as a whole, but also from a specific subset, the Northeast Asian economies.

The model to be estimated is given by:

$$g_i = \rho \sum_{j=1}^{n} w_{ij} g_j + X_i \beta + e_i, \;\; i = 1 \ldots . n \qquad (1)$$

or in matrix form,

$$G = \rho W G + X\beta + e, \qquad (2)$$

where g_i is the per worker income growth rate in country i over some period. Following Ertur and Koch (2007), it is computed as:

$$g_i = \frac{\ln y(ending\ period) - \ln\ y\ (starting\ period)}{T};$$

Income within starting/ending period is simply an average of per worker GDP of its first and last year. T is the number of years between the beginning years of starting and ending periods. w_{ij} is the (i, j) element of weighting matrix W which essentially characterizes the "influence" of country j on country i (construction of the weight matrix will be explained later). Regressor X_i

includes the commonly used cross-country growth regression variables such as logged investment rate, logged effective depreciation rate, logged secondary school enrollment rate, and inflation; In order to explore how a country's trade liberalization policy directly affects its own growth, we also include an index of logged openness (between 0 and 1) in X_i. The error term, e_i, is assumed to be distributed N (0, σ^2). Following Ertur and Koch (2007) and papers cited therein, the effective depreciation rate is defined as the population growth rate plus 0.05 (the latter number is assumed to be the sum of capital depreciation rate and steady state capital growth rate).

It can be shown that in Eq. (2), the spatially lagged variable WG is correlated with the error term. Therefore, the OLS estimator will be biased and inconsistent. Following Moreno and Trehan (1997) and Ertur and Koch (2007), such a spatial autoregressive model (SAR) can be estimated in a maximum likelihood framework. We provide details in an appendix.

The spatial weight matrix

We use four types of weight matrices.

Type 1: inverse of distance

$$w_{ij} = \frac{1/d_{ij}}{\sum_k d_{ik}} \quad (i \neq j) \qquad w_{ii} = 0,$$

where d_{ij} is the Great Circle distance between country i's capital and country j's capital. This method is used in Moreno and Trehan (1997) and Ertur and Koch (2007). Diagonal elements are all 0.

Type 2: inverse of distance squared

$$w_{ij} = \frac{1/(d_{ij})^2}{\sum_k (d_{ik})^2} \quad (i \neq j) \qquad w_{ii} = 0,$$

This method is used in Ertur and Koch (2007).

Type 3: Type 1 weighted by GDP_j

$$w_{ij} = \frac{GDP_j/d_{ij}}{\sum_k GDP_j \cdot d_{ik}} \quad (i \neq j) \qquad w_{ii} = 0,$$

This matrix not only takes geographical distance into account, but also the size of the foreign economy relative to the total sample of countries. Within period GDP is a simple average of annual aggregate GDP from the five years involved. A variant on this weighting scheme uses growth rates instead of GDP levels (Moreno and Trehan 1997). Note that for the first three types of weight matrix, the sum of each row is equal to 1.[18]

Finally, we have hypothesized that the influence of growth elsewhere in the world will be greater for more open economies.

Type 4: Type 3 weighted by openness

$$w_{ij} = Open_i * \frac{GDP_j/d_{ij}}{\sum_k GDP_j \cdot d_{ik}} \quad (i \neq j) \qquad w_{ii} = 0,$$

This weight matrix further weaves a country's own openness into the spillover effect. Singapore and Indonesia for example are roughly the same distance from the U.S., but since the former country is more open than the latter, it is expected that U.S. will have a greater influence on Singapore than on Indonesia. Note that in this type of weight matrix, row sums do not add to 1.

4.2 Estimation

Do Southeast Asian economies grow differently?

Even though OLS estimates are likely to be biased, it is still feasible to use an OLS or fixed effects model to test for the significance of individual regressors. This is valuable in the first tests that we conduct, which are aimed at discovering whether the Southeast Asian economies as a group grow "differently" We test for structural breaks between the Southeast Asian economies and others in the data set. We do this by interacting a Southeast Asia dummy variable with all

[18] In the actual regression analysis the weight matrix may be reduced to smaller dimension due to variable availability of some countries. In this case, the row sum of this actual weight matrix may not add up to 1.

explanatory variables (other than regional fixed effects). This approach draws from Block (2001), who used an equivalent method and found some significantly different slope parameters for Sub-Saharan Africa relative to the rest of the world. The regressors include measures of the size and/or growth of the big Northeast Asian economies, China and Japan.

A fixed-effects approach allows us to exploit the panel data dimensions of the dataset. Panel data methods endow regression analysis with both spatial and temporal dimensions. This approach also eliminates any short-run business cycle effects by using five or ten year averages instead of annual data. In addition, fixed-effects methods control for unobserved heterogeneity across countries and provide unbiased and efficient estimates compared to simple OLS regressions. Empirically, the fixed effects estimator is justified by a Hausman test, which rejects the null hypothesis that the error terms are uncorrelated with other regressors. A disadvantage of the fixed-effects model is that it does not allow consideration of time-invariant variables such as natural resource endowments. However, its advantages are sufficient to prefer it despite this constraint. In a final OLS exercise we restrict the dataset to the Southeast Asian countries only, and once again test hypotheses on existence of spillovers controlling for openness.

How influential are inter-country spillovers?

In the second part of the analysis we seek to quantify the spillover effects. As discussed above, this is infeasible with OLS. In moving to a maximum likelihood model with spatial spillovers, we are unable to retain the nested tests of separate parameter values for Southeast Asia. Therefore we pool all country data. To obtain more detail on the effects of spillovers we divide the data into two periods. The first spans 1981-2000, the years prior to and up until the onset of the Asian financial crisis (AFC), which market a sharp break in the development of the Southeast Asian economies. The second is the decade 2001-2010. This division allows for the possibility of a structural break around 2000, though in the estimates we see relatively little evidence for this. For pre- and post-AFC periods analysis, GDP weights used to construct the matrix of distance measures are the average of 1996~2000 in the first period, and of 2006~2010 in the second. In

constructing the Type 4 weight matrix, the openness index of country i is the average of 1981-1985 in the early period, and of 2001-2005 in the later period.[19]

4.3. Data

The sample includes all economies with available data, a total of 139 economies. The data set covers 1971 to 2010 in five-year sub-periods. Most data are from the World Bank's World Development Indicators, except for GDP and investment data (Penn World Tables) and the openness measure, which is from the Economic Freedom of the World project (Gwartney *et al.* 2011). Table 3 presents a summary of regional and country averages.

Income in this table is measured as real GDP per capita in constant 2000 PPP dollars. The dependent variable for the OLS model is the GDP per capita growth rate measured by the geometric average of each sub-period. The use of geometric rather than simple averages eliminates any bias caused by outliers in GDP data. Thus, the regional and country's GDP per capita growth rates presented in Table 3 differ slightly from those in Tables 1 and 2. Southeast Asian growth still remains higher than that of other developing economies except China (8.17%) and Europe and Central Asia (3.6%). Most economies in Europe and Central Asia were in recession during the first half of the 1990s, hence the simple average growth rate of 1.34% presented in Table 1 underestimates their real growth.

All other explanatory variables are the five-year averages of each sub-period. Southeast Asia's average investment share of GDP is similar to other regions, but investment rates have been consistently high (ranging from 28%-42% of GDP) in the high-performing regional subgroup of Indonesia, Malaysia, Singapore and Thailand. Differences in labor force size reflect population differences. Secondary school enrollment is highest in Eastern Europe and Central Asia and high-income economies, and lowest in South Asia and Sub-Saharan Africa. Southeast Asia as a region is by no means exceptional on this measure of human capital. The Philippines and Singapore have very high enrollment rates, consistent perhaps with high expectations of

[19] The estimation results are not sensitive to use of weights from adjacent subperiods.

employment outside of agriculture.[20] But enrollments in Malaysia, Thailand and Indonesia are quite low relative to per capita incomes.

We proxy for macroeconomic stability using annual inflation rates. Inflation in Southeast Asia has been very moderate by world standards. In Singapore, Malaysia and Thailand, average inflation rates in the last forty years have been below 6%. Most other regions, especially Eastern Europe and Central Asia, Latin America and Caribbean, and Middle East and North Africa, have recorded average inflation at two or three digit rates.

As noted earlier, there is dissatisfaction with most openness measures used in prior empirical studies. Rather than rely on Sachs-Warner, we instead use the Freedom to Trade Internationally index, a component of the annual survey Economic Freedom of the World. This index is continuous from 0 to 10 and is based on five main variables: taxes on international trade, regulatory trade barriers, actual size of the trade sector relative to expected, black-market exchange rates, and international capital controls. Besides taxes on trade, policies in the other four areas also play a crucial role in promoting international trade. Hence, this is a relatively comprehensive index of openness, and arguably less vulnerable to the criticisms leveled at Sachs-Warner.[21]

It should be noted that the data panel is unbalanced. Some data, especially on the trade openness measure, are missing in early periods for many poor countries. Thus the results using this variable might overstate the actual values of this index in many developing countries. In general, South Asian economies have the lowest openness scores. Southeast Asia has been relatively open, with an average index of 6.38 compared with the highest value of 7.11 in high-income

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[20] Secondary school enrollment data for Singapore are scaled from enrollment data available at UNICEF's website, http://www.childinfo.org/files/IND_Singapore.pdf

[21] Data on disaggregated tariffs by consumption, intermediate and capital goods, as used by Estevadeordal and Taylor, are unavailable for several Southeast Asian economies. Our use of the EFW index is a second-best choice, but superior to the Sachs-Warner index.

economies. Within Southeast Asia, Laos and Cambodia are the least open.[22] Singapore are Malaysia are most open; in fact Singapore ranked first worldwide in 2009, with a score close to 10. All economies other than Singapore and Malaysia have greatly increased their openness by this measure since the late 1990s (Figure 3).

4.3. Estimation Results and Discussion

Table 4 shows estimates of unconditional spillover effects from global growth and East Asian booms. Models I-III in this table use spatially-weighted GDP values to measure spillovers, and models IV-VI use spatially-weighted GDP growth rates. In each case the first model accounts only for initial GDP and spillovers. The second models bring in measures of Japanese and Chinese growth booms. The third models add in the openness measure. All are estimated with country fixed effects. With the exception of the Japan effect in model II, all estimates are significant at conventional levels and of expected sign.

The growth effects of global growth spillovers are highly significant. In model III, the openness measure also has a powerful effect on growth. Growth booms in East Asian countries have significant impacts on average GDP growth rates.

Table 5 reports conditional results, when we control for the standard inputs to the aggregate production function plus inflation. Once again, all estimates are of expected sign, and significance levels are high: p-values are 0.05 or lower except for the working age population variable. We estimate four models, varying both the definition of the spillover effect as before, and also the specification of the growth boom effects, by interacting the growth measures for Japan and China with country openness. The test is that more open economies experience a greater impact from the East Asian booms than do less open ones, and that this effect is transmitted through more than one channel. Once again, all openness and the spillover measures

[22] Values of the EFW openness index data for Cambodia, Laos and Vietnam are missing for many early years. We reconstruct them based on the Penn World Tables openness measure, which is computed as (exports +imports)/GDP.

are all highly significant. The variables for Japan's growth in the early period and for China's growth in the later period are significant even after controlling for world GDP or growth.

We next ask whether Southeast Asian growth parameters differ from the rest of the world. As already noted, the global growth literature typically finds distinct intercept shift effects for world regions, but rarely tests for different slope effects. If growth experiences differ, then those differences should appear as significantly different slope coefficients associated with inputs, policies, or the spillover effects from growth or growth booms elsewhere. Table 6 shows estimates of the same model as in Table 5, only now with separate Southeast Asia interaction terms for each right hand side variable. Southeast Asia, as a group, differs from the rest of the world in just two respects: schooling has a smaller effects and the East Asian booms a larger one. Of course, since these estimates use OLS we cannot place much weight on the magnitudes of estimates, only on their statistical significance.[23]

To summarize, Southeast Asian economies have grown faster than most other developing regions, but we find that that their growth mechanisms do not differ from the rest of the world except in in two respects. First, it seems that the influence of schooling on growth is lower in the region than in the world as a whole. Second, East Asian growth booms had a significantly greater impact on growth in Southeast Asia than in other world regions.

Next, in search of quantifiable estimates of spillover effects, we turn to a maximum likelihood estimator. We use the same data set, only now divided into two subsets, the 1980s-90s and the

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[23] To test for robustness, we run fixed-effects regressions on the same baseline specification but for 10-year sub-periods. Results are in Table 7. All independent variables remain significant with expected signs and magnitudes. It could also be that growth spillovers occur through indirect channels rather than through trade. To check for robustness with respect to this possibility, we replicated all the regressions presented in Tables 7 and 9 using a measure of growth spillovers that excludes openness. All major findings remain robust. Similarly, we investigate effects of growth booms in countries other than Japan and China. From Figures 1 and 2, the obvious (and perhaps only) alternative candidate is the United States, which experienced a sustained growth episode from the second Reagan administration to the end of the Clinton era in 2000. Using the same techniques as for China and Japan, we re-run the growth models already discussed. The US effect is never significant; other coefficient estimates are broadly similar to those already reported.

2000s.[24] To save space we report here only the most relevant results, those using the openness-adjusted spatial weights (Type 4 weights). These are shown in Table 7, which reports three models. In Model XI we regress the dependent variable, the annual average growth of output per worker only on weighted growth of other countries. The estimate of *rho* (highlighted in bold) is significant and positive, indicating a significant spillover of world growth to the average country in the data set. In Model XII we fit the standard Mankiw et al. model, including (in logarithmic form) initial income, investment, and the secondary school enrollment rate (a proxy for education) as well as a measure of effective depreciation. All have expected signs and are significant at conventional levels. Following Ertur and Koch, we also include the spatially weighted log of initial world income. In this model, *rho*, the spillover measure, is again positive and significant. In Model XII we further augment the model with the two policy variables, for inflation and openness. Most variables remain of expected sign and significance. The estimate of spillover effects is significant as usual in the early period but marginally outside the 10% significance level in the later period.[25]

Focusing on Model XII, we see that openness (here scaled to be between zero and one) is very influential on growth. The estimate, 0.0252, indicates that a doubling of the openness index would directly add 2.5 percentage points to growth. Referring to Figure 3 we see that if Laos (openness=0.35 in 1991-95) were to double its openness index, that would make it almost equal on that measure to Malaysia in the same period. Similarly if the Philippines had been as open as Malaysia, it would have grown at a rate much closer to that enjoyed by Malaysia. In the later period, the estimated effect of openness is twice as large again. Moreover these impacts do not include the gains of greater openness in terms of larger spillover benefits from world economic growth, which are captured separately by the estimate of *rho* multiplied by the openness-adjusted Type 4 spatial weights. Countries that are geographically close to large, fast-growing

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[24] The dependent variable in the ML estimation is output per worker in each subperiod.

[25] These estimates are robust to a wide range of alternative model specifications. Though we report only the models using Type 4 weights, we also fit the same series of models using weights of Types 1-3. There are 32 models in all. The estimate of rho is positive and significant in all but two. The results are also robust with respect to inclusion of "new" countries in the later period of the data. We re-estimated the later data, restricting the sample to only those countries included in the 1980s-90s period. The main results were unchanged.

economies, and which are themselves relatively open to trade and investment flows, benefit disproportionately from growth in the world economy. As the OLS estimates in Table 6 already hinted, it is here that Southeast Asian economies can be seen to differ from the vast majority of countries in the world economy.

For each country, *rho* times the sum of its openness-adjusted spatial weights tells us the elasticity of its own growth rate with respect to that in the world economy (as can be seen from equation (2)). Likewise, *rho* multiplied by a country's weights for a subset of other countries—such as those in Northeast Asia only—provides a measure of that country's elasticity of growth with respect to an increase in growth in that regional subset. Table 8 shows the countries for which this elasticity is significantly larger than for others, as determined by a z-score at 90% or higher. Singapore, by virtue of its openness, derives a significantly higher growth "kick" from world growth in both periods. Growth in North America delivers a similar boost only to small economies in Central America and the Caribbean. Growth in Northeast Asia, which was fastest in the world in both periods, and which also gained greater weight over time due to the rapidly increasing GDPs of Japan and then China, also confers the greatest benefits to a small set of countries. The ASEAN-5 countries are among them, and so is Vietnam in the later period.

With this information in hand we can now evaluate the contributions of world and Northeast Asian growth to the overall growth of economies worldwide.[26] Multiplying each country's growth elasticity of spillovers by growth rates in the sources gives us the percentage points of GDP growth attributable to spillovers. These are plotted on the horizontal axes of Figures 4-7, while observed average growth rates are plotted on the vertical axes. In Figure 4, for example, we can see that Malaysia, with average annual growth of output per worker of 3.8%, owed 1.75 percentage points (or almost half) of that growth to the effects of growth in the world economy, with the rest coming from growth of domestic resource endowments, investment and openness. Comparing Figure 5 (which shows the same data on the vertical axis) we see that just 0.3% of that growth, or 16% of the total spillover, was directly attributable to growth in Northeast Asia.

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[26] In the early period, "Northeast Asia" consists only of Japan and Korea, due to data limitations. In the later period this group also includes China.

Moving to the later period, we see that output per worker in Malaysia grew by 2.8% per year, with 1.25% due to spillovers from world growth (Figure 6), of which almost half was due to growth in Northeast Asia alone.

Similarly, in the 1980s and 1990s Indonesia's output per worker grew at 3.8% annually; 1.3 percentage points, almost one third of total growth, came from global growth spillovers, of which one-fifth (0.3 percentage points) came directly from Northeast Asian growth. By the 2000s, when Indonesia's economy expanded at 5.8% per year, it owed almost 1% of that to world growth, fully half of which was due to Northeast Asian growth alone. For most other countries, as the figures make clear, spillovers contributed much less to total growth, and those from Northeast Asia less still, in spite of the rapid increase in that region's share of the global economy. Part of the difference is attributable to trade costs (as proxied by distance), but individual country openness also matters greatly, as demonstrated by the extreme case of Singapore, the world's most open economy.

Finally, it should be noted that these spillover estimates are lower bounds in three senses. First, we have separately accounted for the growth effects of openness as one of the explicit regressors; second, we have not accounted for endogenous changes in domestic investment or education driven by trade linkages; and third, for the regional spillovers we have measured only direct effects, excluding third-party influences. Thus the impact on, say, Indonesian growth due to Northeast Asia-driven expansion in Singapore's economy is not counted.

5. CONCLUSIONS

Southeast Asia's consistently high economic growth in the last four decades has set this region apart from most of the developing world. Nonetheless most empirical explanations for growth assume the same underlying economic growth dynamics in Southeast Asia as elsewhere. This study advances the discussion by testing for differences in the determinants of growth between Southeast Asia and other countries.

Our estimates reveal that growth spillovers from Northeast Asian booms have significantly larger effects in Southeast Asia than in other world regions. This conforms to historical facts: the post-

Plaza Accord East Asian FDI boom continues to benefit the region's development in the long run. These benefits originated from having export-oriented industries with improved labor skills and transferred technology, productivity growth and economic efficiency followed the massive investment inflows from Northeast Asian economies.

Clearly the Southeast Asian countries are fortunate to be located close to Northeast Asia.[27] Still, distance is not the only important variable. Our estimates show that within Southeast Asia, countries that are more receptive to international trade and capital flows benefit even more from growth spillovers. An example is the transition from protecting import-substituting industries to export orientation in Malaysia, Indonesia and Thailand following the Plaza Accord, which resulted in rapid investment inflows and high rates of long-run income growth in these countries. In contrast, the later entrants to the global economy - Philippines, Laos, Vietnam and Cambodia - are still behind their neighbors in the income ladder.

Our research raises some additional unresolved questions.

First, how and when will Southeast Asian economies' growth decelerate, as theory and experience indicate it must? This situation may not necessarily happen again as the regional and global contexts have since changed. Unlike many economists who are concerned about the adverse effects of the giant China on Southeast Asia, we provide evidence that China's growth is creating a favorable growth impact on the world economy in general, and to a greater extent than average on its neighbors' development. Southeast Asian economies benefit from being exporters of intermediate goods, raw materials and agricultural products to "the world's factory." In the long run, however, there are different implications and policy lessons within Southeast Asia. The higher-wage economies with greater complementarity with China – Singapore, Malaysia and Thailand -- will be better off by promoting freer trade. In contrast, for the less-developed yet resource-rich countries like Indonesia, Laos, Cambodia and Vietnam, the increasing demand for natural resources may reduce incentives for investments in the manufacturing sector and human development, thus diminishing their potential for long-run economic growth and increasing the

[27] Controlling for shipping distances in growth regressions is a possible direction for future research.

risk of a “middle-income trap.” First and foremost, these countries need better institutions and resource management policies to minimize the potential losses in long-term welfare caused by over-exploitation of the their natural resources. Second, given direct competition from a rapidly growing Chinese economy and other low-cost competitors in labor-intensive exports, there is a need to specialize in selected areas that are skill-intensive and highly differentiated (Coxhead and Li 2008). While the rise of fragmentation trade makes it easier to find these niche markets, building capacity in those areas requires intensive investments in human capital and technology transfer. Finally, globalization puts these developing countries at higher risk of growth slowdowns transmitted not only directly from the world economy, but also indirectly through the strength of their links with China.

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Table 1: Average GDP per Capita Growth Rates By Region (%)			
Region	1970-1989	1990-2010	1970-2010
East Asia & Pacific (developing only)	5.45	7.47	6.48
Europe & Central Asia (developing only)	n.a	1.34	n.a.
Latin America & Caribbean (developing only)	1.49	1.65	1.57
Middle East & North Africa (developing only)	1.46	2.25	1.85
Sub-Saharan Africa (developing only)	0.31	0.78	0.55
South Asia	1.84	4.25	3.08
Southeast Asia (exc. Brunei, East Timor and Myanmar)	4.01	3.77	3.89
Cambodia, Laos, Vietnam	*2.09*	*5.75*	*5.05*
Northeast Asia (China, Hong Kong, Japan, Korea)	6.39	8.32	7.38
Hong Kong, Japan, Korea	*4.09*	*2.02*	*3.03*
China	*6.76*	*9.22*	*8.02*

Source: World Development Indicators

Table 2: GDP per Capita Growth Rates in Southeast Asia (%)			
Country	1970-1989	1990-2010	1970-2010
Indonesia	4.71	3.63	4.15
Malaysia	4.12	3.72	3.92
Singapore	6.66	3.90	5.24
Thailand	5.01	3.80	4.39
Cambodia	n.a.	5.97	5.97
Lao PDR	1.31	4.58	3.95
Vietnam	2.14	5.82	5.11
Philippines	1.05	1.65	1.36
Southeast Asia	**4.01**	**3.77**	**3.89**

Source: World Development Indicators

Table 3: Summary of Regression Data, by Region and Country

Region and country	PC GDP growth (%)	Initial GDP per capita ($)	Investment (% GDP)	Labor force (m)	Enrollment rate (%)	Inflation (%)	Openness
Southeast Asia	3.74	3,055	29.9	57.2	51.4	8.2	6.6
Cambodia	1.21	924	11.8	5.6	24.0	4.3	2.3
Indonesia	3.95	2,269	28.5	112.1	44.1	12.2	6.5
Lao PDR	3.69	1,168	14.2	2.4	25.3	26.4	2.1
Malaysia	4.03	6,407	31.2	11.5	57.2	3.8	7.7
Philippines	1.31	2,110	20.7	35.9	69.5	10.7	6.1
Singapore	5.34	23,534	42.2	2.3	68.8	3.1	9.3
Thailand	3.91	4,242	35.1	35.8	42.8	5.4	6.7
Vietnam	4.09	1,165	22.9	39.4	56.9	6.4	3.1
China	8.17	1,827	37.5	732.3	53.7	6.2	6.0
NE Asia & Pacific*	1.70	2,220	24.2	1.8	43.0	17.2	6.8
Europe and Central Asia	1.69	8,097	22.0	62.2	83.6	139.4	6.1
L.Am.& Carib	1.29	5,544	21.3	11.6	57.7	75.6	5.9
MidEast & N. Africa	1.40	4,688	27.9	25.1	56.2	13.1	5.1
South Asia	3.38	1,370	22.1	426.1	38.0	8.2	4.7
Sub-Saharan Africa	0.97	2,045	18.7	21.3	42.9	45.2	5.8
High-Income Economies	1.82	25,181	21.3	87.6	95.8	5.4	7.4

Source: Penn World Table, World Development Indicators and Economic Freedom of the World Project

Panel data covers 8 five-year sub-periods from 1971 to 2010 for the 139 country sample. Regional averages are weighted averages where the weights are total GDP

GDP per capita growth for each period is calculated based on geometric average

Except for the initial GDP per capita which takes the value of the first year of each five-year period, all other explanatory variables are the five-year averages for the time period 1971-2010

**Includes countries in East Asia and Pacific other than China and Southeast Asia*

Table 4: Unconditional spillovers with convergence. Dependent variable: growth of per capita GDP

	I	**II**	**III**	**IV**	**V**	**VI**
ln(initial GDP)	-0.06*** (0.0069)	-0.062*** (0.007)	-0.065*** (0.007)	-0.049*** (0.006)	-0.052*** 0.006	-0.057*** (0.006)
W*GDP	0.169*** (0.021)	0.145*** (0.027)	0.082*** (0.026)			
W*growth				0.048*** (0.006)	0.048*** (0.008)	0.022*** (0.008)
JPN gr*1980s		0.154 (0.0012)	0.445*** (0.123)		0.370*** (0.133)	0.532*** (0.132)
CHN gr*90-00s		0.103** (0.00048)	0.181*** (0.046)		0.152*** (0.046)	0.213*** (0.044)
Openness			0.012*** (0.001)			0.015*** (0.001)
Constant	1.504*** (0.056)	1.492*** 0.0558	1.461*** (0.054)	1.308*** (0.046)	1.311*** (0.049)	1.357*** (0.047)
Obs/groups	771/137	771/137	706/137	771/137	771/137	706/137
R^2 within	0.124	0.131	0.229	0.123	0.139	0.225

Notes: W*GDP: Spatial weights times GDP of partner countries (Type 3)

W*growth: Spatial weights times GDP growth rate of partner countries.

Country fixed effects included.

Standard errors in parentheses.

Table 5: Growth model with spillovers (dependent variable: growth of per capita GDP)

	VII	**VIII**
ln(initial GDP)	-7.13*** *0.748*	-6.65*** *0.655*
Investmt/GDP	0.052* *0.027*	0.064** *0.027*
Wking age pop	0.011 *0.010*	0.011 *0.010*
HS enrollmt	0.030* *0.016*	0.030** *0.015*
Inflation	-0.0009** *0.00044*	-0.0009** *0.00043*
Openness	0.961*** *0.162*	0.892*** *0.165*
JPN gr*1980s	0.460*** *0.124*	0.551*** *0.132*
CHN gr*90-00s	0.198*** *0.048*	0.217*** *0.046*
W^0*GDP	5.73E-09** 2.79E-09	
W^0*growth		2.061** 0.872
Constant	50.39*** *6.012*	42.28*** *5.220*
Obs/groups	629/136	629/136
R^2 within	0.254	0.256

Note: country fixed effects included.

Table 6: Growth model with spillovers and SE Asia interactions (dependent variable: growth of per capita income)

	IX		
ln(initial GDP)	**-6.97*** ***0.705***	SEA*initialGDP	4.25 *3.24*
Investmt/GDP	**0.063** ***0.030***	SEA*Inv/GDP	0.081 *0.092*
Wking age pop	0.011 *0.010*	SEA*Wking age pop	0.032 *0.066*
HS enrollmt	**0.037** ***0.016***	SEA*HS enrollmt	**-0.197*** ***0.101***
Inflation	**-0.0009** ***0.0004***	SEA*inflation	-0.090 *0.063*
Openness	**0.879*** ***0.167***	SEA*openness	-0.316 *0.948*
JPN gr*1980s	**0.483*** ***0.137***	SEA*JPN gr	**1.521** ***0.597***
CHN gr*90-00s	**0.183*** ***0.047***	SEA*CHN gr	**0.420** ***0.200***
W^0*growth	**2.012** ***0.882***	SEA*W^0*growth	12.651 *7.999*
Constant		**40.897*** **5.387**	
Obs/groups		629/136	
R^2 within		0.281	

Note: Country fixed effects included.

Table 7: Maximum likelihood estimates (dependent variable: average annual growth rate of output per worker)

	Early period (1980s-90s)			Late period (2000s)		
	Estimate	S.E	estimate/se	Estimate	S.E	estimate/se
Model X						
Constant	-0.0057	0.003	2.164	0.0080	0.003	2.553
rho	**1.3895**	**0.075**	**18.539**	**0.9510**	**0.139**	**6.857**
sigma2	0.0004	0.000	6.964	0.0005	0.000	8.336
Obs.	97			139		
Model XI						
Constant	-0.2163	0.031	6.999	-0.1050	0.030	3.495
Log initial income	-0.0031	0.002	1.854	-0.0082	0.001	5.788
Log investment	0.0349	0.005	6.593	0.0255	0.006	4.126
Log eff. depctn	-0.0499	0.012	4.225	-0.0271	0.010	2.841
W*log initial inc.	0.0004	0.001	0.272	0.0053	0.002	2.649
rho	**1.1609**	**0.169**	**6.851**	**0.6866**	**0.207**	**3.312**
sigma2	0.0002	0.000	6.892	0.0003	0.000	8.124
Obs	95			132		
Model XII						
Constant	-0.1764	0.046	3.807	-0.1652	0.052	3.186
Log initial income	-0.0062	0.002	2.558	-0.0046	0.002	2.018
Log investment	0.0293	0.007	4.042	0.0124	0.008	1.477
Log eff. depctn	-0.0320	0.015	2.199	-0.0371	0.011	3.418
W*log initial inc.	-0.0011	0.002	0.591	-0.0020	0.004	0.580
Inflation rate	-0.0001	0.000	2.155	0.0012	0.001	2.429
Log openness	0.0252	0.013	1.934	0.0506	0.022	2.320
Log enrollment	0.0002	0.000	1.880	-0.0001	0.000	0.917
rho	**1.2065**	**0.331**	**3.643**	**0.4532**	**0.276**	**1.640**
sigma2	0.0002	0.000	6.041	0.0003	0.000	7.681
obs	73			118		

Note: Estimate/s.e. ratio greater than 2.00 is significant at 95% or better. Estimate/s.e. greater than 1.66 is significant at 90% or better.

Table 8: Countries with significantly high growth elasticity from spillovers

	Source of growth spillovers		
	Entire world	**North America**	**Northeast Asia**
1980s-90s	Canada, Panama, Singapore, Venezuela	Bahamas, Belize, Guatemala, Panama, Venezuela	Fiji, Indonesia, Malaysia, New Zealand, Philippines, Singapore, Thailand
2000s	Belgium, Estonia, Ireland, Luxembourg, Netherlands, Singapore	Bahamas, Belize, Costa Rica, Dom. Rep., El Salvador, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Trinidad & Tobago	Indonesia, Malaysia, Mongolia, Papua New Guinea, Philippines, Singapore, Thailand, Vietnam

Note: Significance is determined by right-tail z-score of country i's elasticity in a sample of all countries.

North America: USA, Canada, Mexico. Northeast Asia (early): Japan, South Korea; (late): Japan, South Korea, China. Countries in a region not included in calculations for spillovers from that region.

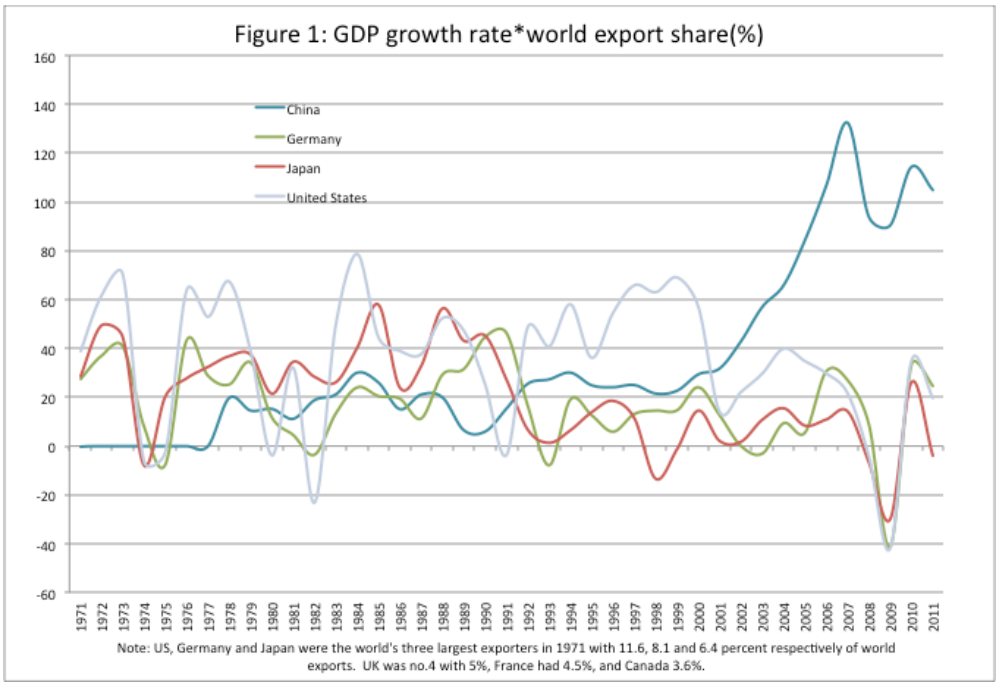

Figure 1: GDP growth rate weighted by share in world exports, four large economies (data source: WDI Online)

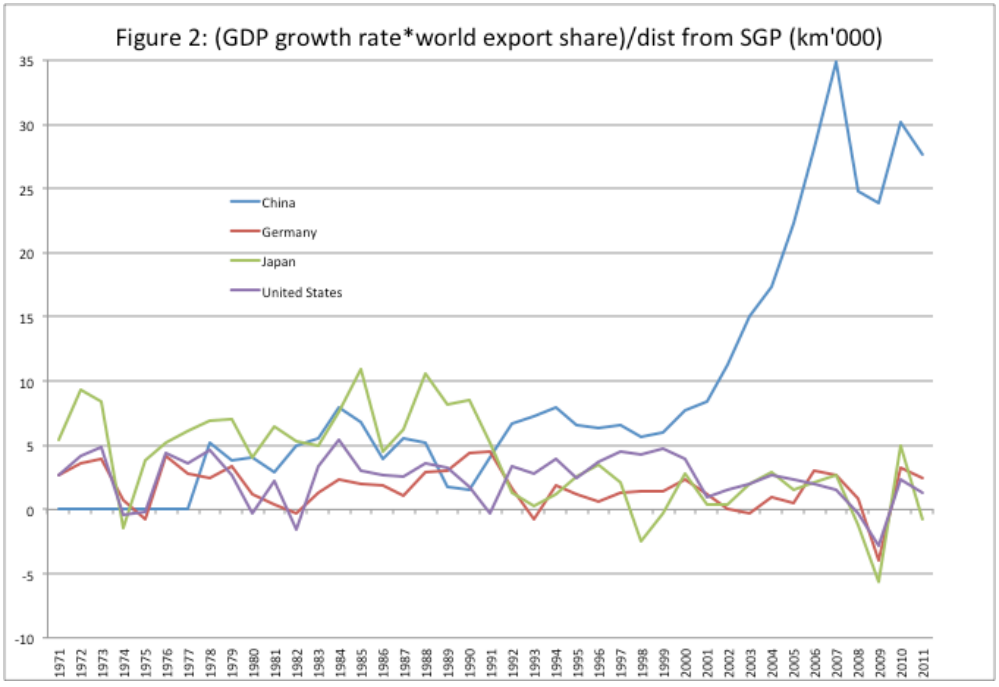

Figure 2: GDP growth rate weighted by share in world exports and distance from Singapore (data source: WDI online)

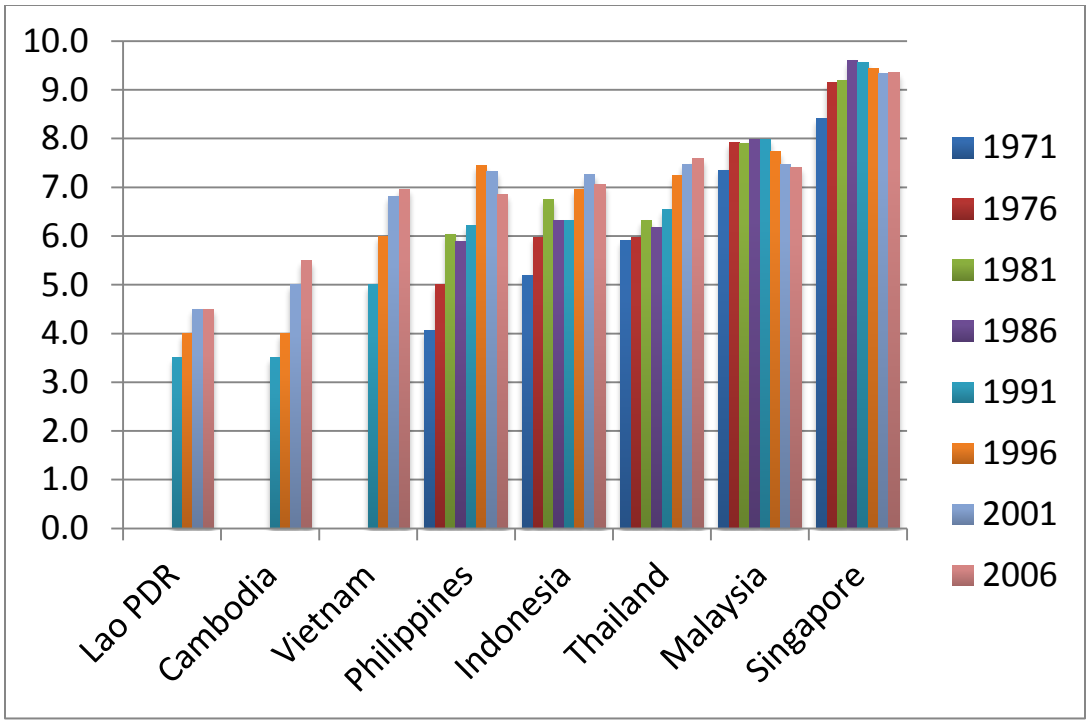

Figure 3: Openness indexes for Southeast Asia (averages for half-decade periods beginning with date shown). Source: see text.

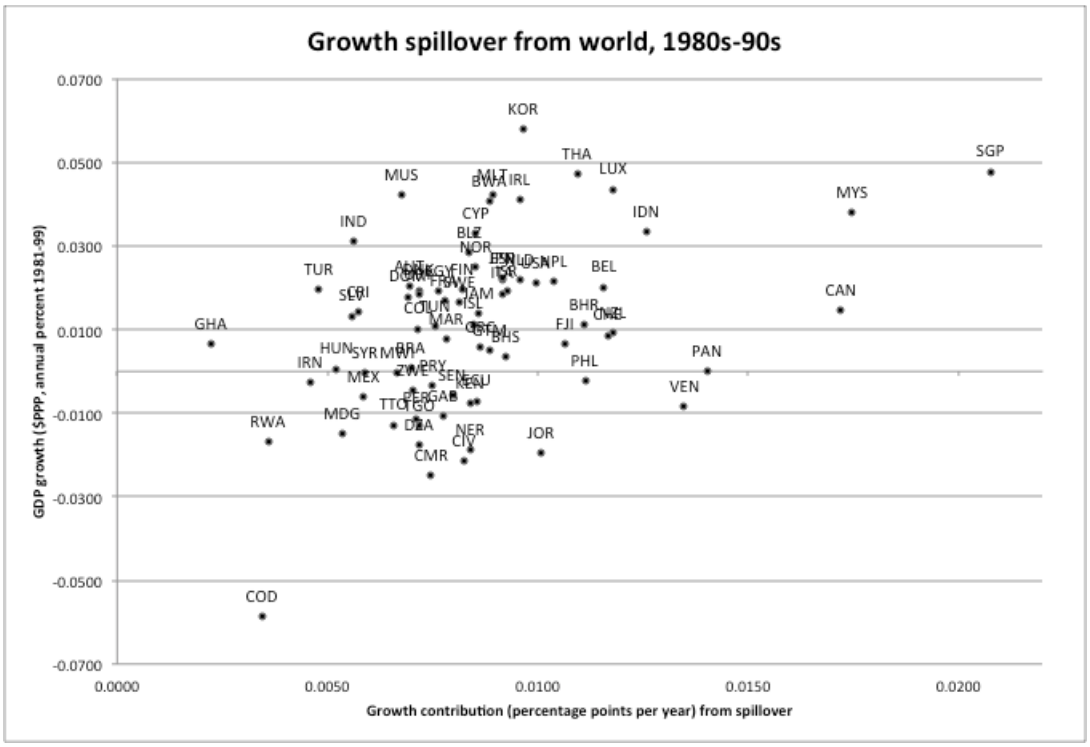

Figure 4: GDP growth spillovers from world economic growth, 1980s-1990s

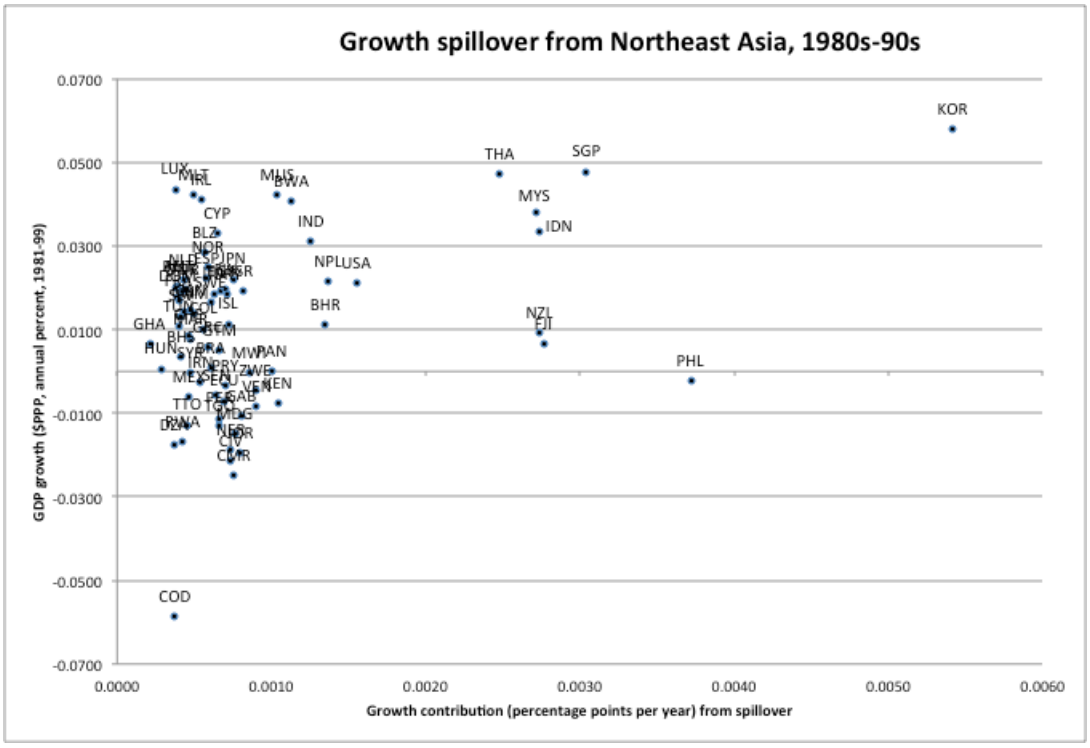

Figure 5: GDP growth spillovers from Northeast Asian economic growth, 1980s-1990s

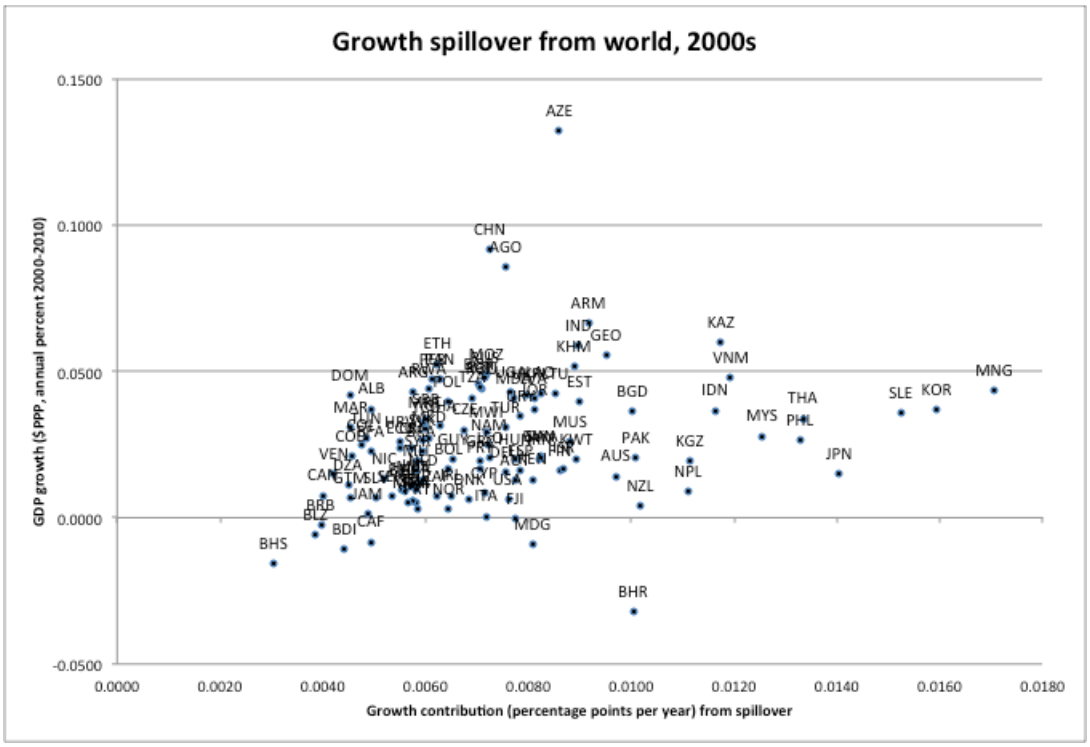

Figure 6: GDP growth spillovers from world economic growth, 2000s

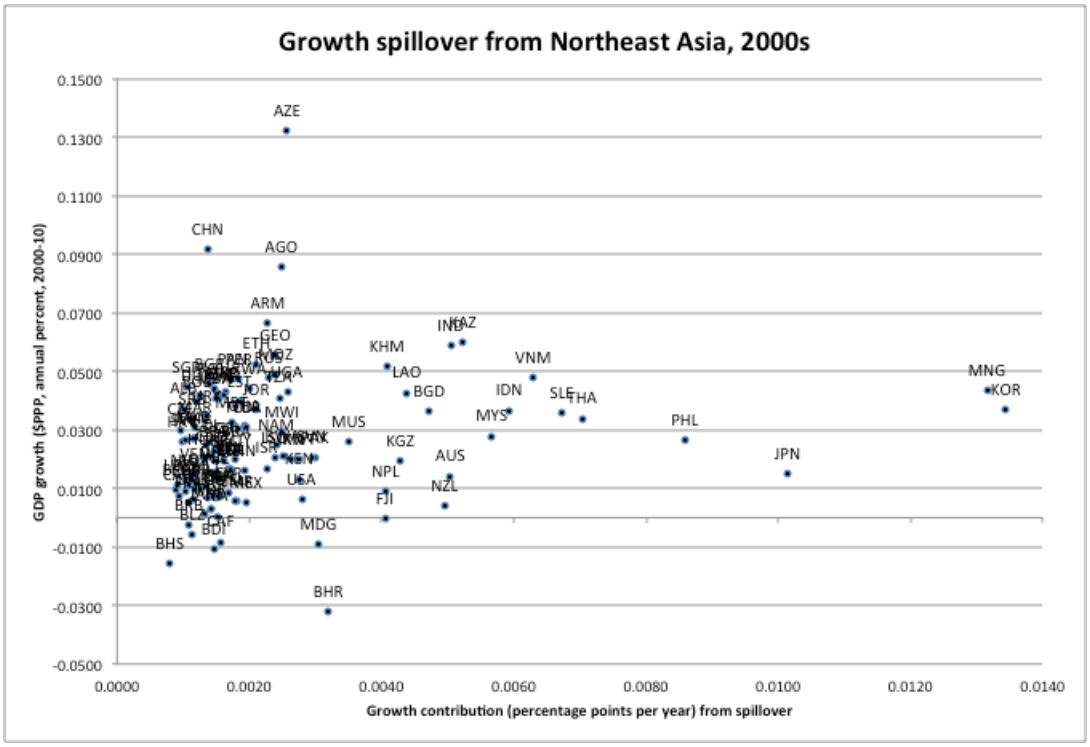

Figure 7: GDP growth spillovers from Northeast Asian economic growth, 2000s

Appendix A: the maximum likelihood model

It can be shown that in Eq. (2), the spatially lagged variable WG is correlated with the error term:

$$Cov\,(WGe') = \sigma^2 W(I - W)^{-1} \neq 0.$$

Therefore an OLS estimator will be biased and inconsistent. Following Moreno and Trehan (1997) and Ertur and Koch (2007), such spatial autoregressive model (SAR) can be estimated in a maximum likelihood framework. Given that the error term is normally distributed, the log likelihood function is given by:

$$\ln L\,(\beta', \rho, \sigma^2) = -\frac{N}{2}\ln(2\pi) - \frac{N}{2}\ln(\sigma^2) + \ln|I - \rho W|$$

$$-\frac{1}{2\sigma^2}[(I - \rho W)G - X\beta]'[(I - \rho W)G - X\beta]$$

The asymptotic covariance matrix of the estimator is:

Asy. Var (β', ρ, σ^2) =

$$\begin{bmatrix} \frac{1}{\sigma^2}X'X & \frac{1}{\sigma^2}(X'W_AX\beta) & 0 \\ \frac{1}{\sigma^2}(X'W_AX\beta)' & tr[(W_A + W'_A)W_A] + \frac{1}{\sigma^2}(W_AX\beta)'(W_AX\beta) & \frac{1}{\sigma^2}trW_A \\ 0 & \frac{1}{\sigma^2}trW_A & \frac{N}{2\sigma^4} \end{bmatrix}$$

Appendix B: Countries in the data set

China

Europe and Central Asia

Albania	Kazakhstan	Montenegro
Armenia	Kyrgyz Republic	Romania
Azerbaijan	Latvia	Russian Federation
Bosnia and Herzegovina	Lithuania	Serbia
Bulgaria	Macedonia, FYR	Turkey
Georgia	Moldova	Ukraine

Latin America and the Caribbean

Argentina	Ecuador	Mexico
Belize	El Salvador	Nicaragua
Bolivia	Guatemala	Panama
Brazil	Guyana	Paraguay
Chile	Haiti	Peru
Colombia	Honduras	Uruguay
Costa Rica	Jamaica	Venezuela, RB
Dominican Republic		

Middle East and North Africa

Algeria	Jordan	Syrian Arab Republic
Egypt, Arab Rep.	Morocco	Tunisia
Iran, Islamic Rep.		

Other Asia and Pacific

Fiji	Mongolia	Papua New Guinea

South Asia

Bangladesh	Nepal	Sri Lanka
India	Pakistan	

Southeast Asia

Cambodia	Malaysia	Thailand
Indonesia	Philippines	Vietnam
Lao PDR	Singapore	

Sub-Saharan Africa

Angola	Gabon	Niger

Benin
Botswana
Burkina Faso
Burundi
Cameroon
Central African Republic
Chad
Congo, Dem. Rep.
Congo, Rep.
Cote d'Ivoire
Ethiopia
Ghana
Guinea-Bissau
Kenya
Lesotho
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Namibia
Nigeria
Rwanda
Senegal
Sierra Leone
South Africa
Tanzania
Togo
Uganda
Zambia
Zimbabwe

High-Income Economies

Australia
Austria
Bahamas, The
Bahrain
Barbados
Belgium
Canada
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hong Kong SAR, China
Hungary
Iceland
Ireland
Israel
Italy
Japan
Korea, Rep.
Kuwait
Luxembourg
Malta
Netherlands
New Zealand
Norway
Oman
Poland
Portugal
Slovak Republic
Slovenia
Spain
Sweden
Switzerland
Trinidad and Tobago
United Kingdom
United States