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Abstract

This paper empirically analyzes the experience of East Asia's economic growth with data both at aggregate-economy and micro-firm levels, focusing on the role of international integration through trade and direct investment. The analysis within a framework of cross-country panel regression shows that trade openness and foreign direct investment (FDI) inflows have a positive effect on gross domestic product (GDP) growth—particularly in the 1970 and 1980s—while FDI outflows appear to have a negative effect on GDP growth. Micro-level evidence based on manufacturing data in the Republic of Korea (Korea) confirms the positive effect of trade and investment integration on plant-level productivity growth. It also suggests the relationship between FDI outflows and productivity growth depends on the characteristics of a recipient economy. We find that FDI to the People's Republic of China tends to reduce productivity growth of firms in Korea while FDI to the United States or Japan works in favor of productivity growth.

Keywords: integration; growth; trade; foreign direct investment; East Asia
JEL classification: F15, F43, O47, O53

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I. Introduction

During the past four decades East Asian economies showed impressive growth. Nine East Asian economies grew extremely rapidly, averaging over 4.6% in per capita terms between 1970 and 2005 (Table 1).[1] Economic performance in the People's Republic of China (PRC) has been most remarkable, with the average annual growth rate surpassing 7%, raising the level of real per capita gross domestic product (GDP) by almost 12 times.

The impressive performance was interrupted by the 1997/98 Asian financial crisis. The average per capita GDP growth rate for the nine East Asian economies dropped from 5.5% in 1990–1995 to 2.8% in 1995–2000. The five crisis-affected East Asian countries—Indonesia, Republic of Korea (Korea), Malaysia, Philippines, and Thailand—recorded less than 2.0% average growth rate. While they managed rapid recoveries, there seems to have been a permanent decline in potential growth rate. The average per capita GDP growth rate remained at 3.0% over 2000–2005.

The purpose of this paper is to empirically assess the East Asian growth performance over the last four decades, focusing on the role of international integration through trade and investment on East Asia's economic growth. Many

[1] Throughout this paper, "East Asia" refers to the nine emerging economies in the region for which we have complete data: People's Republic of China; Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; Taipei,China; and Thailand. "South Asia" refers to Bangladesh, India, Pakistan, and Sri Lanka.

researchers have paid attention to the potential causal link between trade openness and high growth in Asia. For example, Lucas (1993) explains the "East Asian miracle," focusing on the fact that those East Asian miracle economies have become "large scale exporters of manufactured goods of increasing sophistication." Viewing these as productivity miracles, he offered the following explanation: (i) the main engine of growth is the accumulation of human capital, especially in the form of on-the-job training; (ii) for this to persist, workers and managers should continue to take on new tasks; and (ii) for such learning to continue on a large scale, the economy must be a large-scale exporter. The role of foreign direct investment (FDI) in East Asian growth is also emphasized in the literature. It is a long-standing argument that FDI flows contribute to an economy's technology spillover and thereby to economic growth.[2]

The rapid integration into global markets has been one of the most salient features in Asian growth process. Figure 1 shows that both trade volumes and FDI flows have grown very fast in the region. The share of trade in GDP increased continuously from 21% in 1970 to 95% in 2005 for the nine East Asian economies. FDI inflows and outflows also increased rapidly, reaching peaks of 5% and 3% of GDP respectively in 2000. Figure 2 shows that the share of East Asian GDP in world GDP has almost doubled during the last 35 years, reaching 10% in 2005. The share of East Asian trade has grown more than four-fold,

[2] This paper focuses on the growth effect of FDI flows. The literature on the effects of financial integration shows that FDI produces more benefits than other types of financial flows since it has a positive effect on productivity growth through technology spillover. A recent paper by Kose et al. (2006) provides an extensive discussion of the benefits and costs of financial openness on developing economies.

currently exceeding over 20% of world trade volume. The share of East Asia's FDI inflows has also increased more than three-fold over the same period.

In view of this rapid international integration coupled with fast income growth, this paper conducts an analysis of the empirical relationships between international trade and direct investment integration and long-term income growth, utilizing both macro- and micro-level data.

First, we begin the analysis with a general framework of cross-country regression that allows us to assess East Asia's growth performance in a broad international context, by comparing it with other developing regions. This empirical framework helps identify the factors that have been critical to economic growth for the broad sample of countries over 1970–2005. We then extend the analysis to investigate the role of trade and FDI flows on economic growth.

Second, we examine the role of trade and FDI on firm-level productivity growth by using plant-, firm-, and industry-level micro data from the Korean manufacturing sector for the period of 1990–2003. Within the same country, the advance of international integration varies from industry to industry. The effect of trade and investment integration on productivity growth may occur through technology spillovers at firm-level or industry-level. A micro data analysis is needed to shed more light on empirical links between integration and productivity growth utilizing rich information.

The paper is organized as follows. In section 2, using cross-country regressions, we explain what have been the critical factors for East Asia's growth

performance, and analyze the role of international trade and direct investment on long-term income growth at the aggregate-economy level. In section 3, we investigate the links between global integration and productivity growth with plant- and industry-level micro data from the Korean manufacturing sector. Finally, section 4 concludes.

II. Cross-country Analyses of Economic Growth

The general approach in this section is to extend existing work on cross-country analyses of economic growth in order to assess the effects of international trade and investment integration in detail.

We use an empirical framework that has been widely used in previous studies such as Barro and Lee (1994), Sachs and Warner (1995), and Barro and Sala-i-Martin (2004, Chapter 12).

This model is based on an extended version of neoclassical growth model. The model predicts "conditional convergence" of income, implying that an economy with a lower initial income relative to its own long-run (or steady-state) potential level of income grows faster than a higher-income economy over time. In a cross-country context, convergence implies that poorer countries would grow faster than richer countries, when controlling for the variables influencing the steady-state level of per capita income.

The framework for determining the growth rate of real per capita GDP is indicated by the baseline regression, shown in column 1 of Table 2. As the general approach has been described elsewhere, we include here only a brief discussion.[3] Our regression applies to a panel data set of 85 countries over seven 5-year periods from 1970 to 2005. The panel is unbalanced with a total of 539 observations. Estimation is by three-stage least squares, using mostly lagged values of the independent variables as instruments—see the notes to Table 3.[4]

The dependent variables are the 5-year growth rates of real per capita GDP. We include in this analysis a representative set of the explanatory variables that have been used in previous work. We categorize these explanatory variables into seven broad dimensions: (i) initial per capita GDP; (ii) investment; (iii) initial human capital stock (schooling and initial life expectancy at birth); (iv) fertility rate; (v) external environment (terms-of-trade, and balance-of-payments crises)[5]; (vi) institutions and policy variables (government consumption, quality of

[3] Our framework adopts empirical methodology and a representative set of the explanatory variables that have been widely used in previous works. See Barro and Sala-i-Martin (2004, Chapter 12) and De Gregorio and Lee (2004).

[4] The framework does not include country fixed effects, because this procedure tends to eliminate the bulk of the information in the data, that is, the cross-sectional variations of the panel. De Gregorio and Lee (2004) show that many explanatory variables including initial income, fertility, inflation, and openness turn out to have much stronger effects on growth in the first-difference specification of this panel framework.

[5] A balance-of-payments crisis episode is defined from monthly data by combining two criteria: a nominal currency depreciation of at least 25% in any quarter of a specific year with the depreciation rate exceeding that of the previous quarter by a margin of at least 10%; and when an indicator of currency pressure—a weighted average of monthly nominal exchange depreciation and monthly foreign reserve loss—exceeds three standard deviations above the mean of the indicator over the sample period for each economy, provided that either the monthly nominal depreciation rate or percentage change of reserve loss is larger than 10%. A crisis that is not at least 3 years after the latest crisis is counted as a continuation of the initial crisis rather than an independent crisis.

institutions, inflation, and democracy), and (vii) openness (trade and direct investment). The definition and source of the variables are described in the notes to Table 2.

A summary of the variables for 1970–1975 and 2000–2005 is presented in Table 2, grouped by four developing regions including East Asia, Latin America, Sub-Saharan Africa, and South Asia. The data indicate by and large that East Asian economies had more favorable conditions for rapid growth than the other regions, based on relatively higher levels of investment, human capital, quality of institutions, and openness, with lower levels of fertility, government consumption, and inflation. But average per capita growth for the nine East Asian economies slowed from 5.2% in 1970–1975 to 3.1% in 2000–2005. This slowdown can be partly an outcome of the success during the earlier period. East Asian economies have continuously narrowed their income gap from their long-run potential levels over time. Thus, according to the prediction of the convergence process, the economies with higher initial income can expect slower growth. In fact, East Asian economies grew slower than South Asian economies in 2000–2005. The average per capita growth rate for the four South Asian economies jumped from 0.8% in 1970–1975 to 3.8% in 2000–2005, coinciding with a large improvement in the quality of institutions, control over inflation, and openness.

2.1. Basic Regression Results

Column 1 of Table 2 presents the regression results of basic specification. The first explanatory variable, the log of per capita GDP at the start of each period, reveals the "conditional convergence" effect. The log of the total fertility rate is also significantly negative. The measures of initial human capital stock—average years of schooling and life expectancy—turn out to have positive effects on growth. However, the estimated coefficients are statistically insignificant. Also, the ratio of real investment to real GDP has a positive but statistically insignificant effect on growth, as indicated by the coefficient 0.019 (s.e.=0.019). This reflects that many of the explanatory variables included affect an economy's investment rate as well.

The regression results show that government policies and institutions play a significant role in determining economic growth. A subjective measure of the extent of maintenance of the rule of law is significantly positive. Higher inflation, an indicator of macroeconomic instability, is significantly negative for growth. The estimated coefficient implies that a rise in average inflation rate by one percentage point reduces growth by 0.02 percentage points a year. The ratio of government consumption (measured exclusively by outlays on education and defense) to GDP enters negatively, but the estimated coefficient is only marginally significant.

The regression results confirm the nonlinear relationship between democracy and growth, as found by Barro (1997). The coefficients on the indicator of democracy and its square terms are positive and negative respectively

and both coefficients are jointly statistically significant. The pattern of coefficients indicates that the growth rate increases with political freedom at low levels of democracy but decreases with democracy once the society has attained a certain level of political freedom.

A higher growth rate of the terms of trade (export prices relative to import prices) has a positive effect on growth, but the estimated coefficient is not statistically significant. A balance-of-payments crisis has a strong, negative effect on economic growth. The estimated coefficient on the balance-of-payments crisis variable, -0.012 (0.005), indicates that a balance-of-payments crisis shock lowers the growth rate by 1.2 percentage points per year.

In sum, the regression results in column 1 shows that per capita GDP growth has strong relationships with initial per capita GDP level, investment, fertility, the quality of human resources, and economic policy and institutional factors, such as rule of law, government consumption, and macroeconomic stability.

Note that this "growth-regression" approach does not distinguish the role of factor accumulation from that of technological progress or total factor productivity (TFP) growth. Economic policy and institutional factors can affect both capital accumulation and technological progress. While East Asia's growth is largely attributed to factor accumulation rather than productivity growth (Young, 1995; and Botworth and Collins, 2003), the estimate of TFP, which is often called "index of our ignorance," is subject to many measurement errors. The

distinction between capital and technology (productivity) in a "growth accounting" approach is often ambiguous.

2.2 Integration and Economic Growth

Now, we turn to the role of trade openness, which is our main focus. Column 1 of Table 3 includes a measure of trade integration, which is the ratio of exports plus imports to GDP, filtered for the estimated effects on this measure from the logs of population and area, as described in Barro and Sala-i-Martin (2004, Chapter 12).

We recognize there are a large number of alternative measures of trade openness. For instance, Sachs and Warner (1995) construct a composite index on the basis of four policy dimensions: (i) average tariff rates, (ii) extent of imports governed by quotas and licensing, (iii) average export taxes, and (iv) the size of the black market premium on the exchange rate. While the measures have some valid points, they are also subject to many criticisms. Rodriguez and Rodrik (2000) claim that the indicators of openness frequently used in the literature are poor measures of trade policy and they are highly correlated with other sources of growth—such as macroeconomic policies. Frankel and Romer (1999) suggest trade volume as instrumented by an economy's geographical attributes. However, geographical features can also affect economic growth through different channels

such as institutional development and population growth (Acemoglu, Johnson, and Robinson, 2002).

In this paper, we do not delve into this controversy in detail, and will leave it to other recent papers—such as Wacziarg and Welch (2003) and Dollar and Kray (2004)—which provide comprehensive reviews of the facts and additional evidence on the effects of trade liberalization. In general, literature supports the positive effect of trade openness on growth through various channels such as larger markets, imports of capital and intermediate goods, and technological spill-over. Trade openness is also considered to provide competitive pressures necessary to increase efficiency and productivity.

Column 1 of Table 3 shows that increased openness to international trade has a significantly positive effect on growth. The estimated coefficient, 0.0075 (0.0037), indicates that an economy with a higher level of trade openness by 10 percentage points of GDP during the entire 1970–2005 period grew 0.08 percentage points faster annually.

Table 2 shows that the East Asian economies were among the most open of all developing economies between 1970 and 2005. Following an initial stage of modest import substitution, most of the fast-growing Asian economies reduced import tariffs and export taxes, and lowered quantity restrictions on trade. This export-orientation strategy made a significant contribution to the success of East Asian economies. For example, it accounted for faster growth of 0.6 percentage

points per year, compared with Latin America's inward-oriented trade strategy over 1970—2005.[6]

Now we turn to the role of FDI in economic growth. It is often argued that FDI inflows contribute to an economy's external financing and technology spillover and thereby to economic growth. At the economy-wide level, recent empirical work generally finds a positive role of FDI in generating economic growth. De Gregorio (1992) shows that FDI has a higher productivity than domestic investment in a cross-section of Latin American countries. For a boarder sample of economies, Blomstrom, Lipsey, and Zejan (1994) find FDI has a significant positive effect on growth. On the contrary, a recent study by Carkovic and Levine (2005) cast a skeptical view on the cross-country evidence for the positive effect of FDI on growth. Aggregate-level evidence on the relationship between FDI inflows and economic growth seems less conclusive.[7]

Column 2 of Table 2 shows the regression results from the cross-country regression with a measure of FDI inflow as an explanatory variable, a proxy for trade openness. The measure is the average ratio of FDI flows over the

[6] This figure is derived by combining the gap between Latin America and East Asia in terms of openness (0.78) over the sample period and the estimated coefficient on trade openness (0.0075).

[7] Another strand of literature shows that FDI inflows contribute to productivity growth in host economies that have an absorptive capacity for new technologies manifested in FDI. Borensztein, De Gregorio, and Lee (1998) and Xu (2000) find the importance of a minimum level of human capital stock as a means of domestic absorptive capacities for technology spillovers from FDI inflows. Durham (2002) and Alfaro, Chandra, Kalemli-Ozcan, and Sayek (2004) find that for a broader cross-section of economies, financial or institutional development in host economies also play an important role as an absorptive capacity for FDI technology spillovers. This paper does not investigate this interactive effect as we lack adequate measures of productivity growth or technology spillovers at the country-specific level.

contemporaneous 5-year period. FDI inflow has a positive effect on per capita GDP growth, but the coefficient, 0.094 (s.e.=0.066), is not statistically significant at the 10% level. Note that in this specification the FDI inflow variable is instrumented by the lagged value of FDI, considering that FDI inflow is also influenced by output growth over the contemporaneous 5-year period. In fact, if own variable is used for instrument, the FDI variable is statistically significant at 5%; the estimated coefficient is 0.131 (0.054).

In column 3, a measure of FDI outflow enters as an explanatory variable, replacing the FDI inflow variable. On one hand, FDI outflow is expected to lower domestic capital accumulation and thereby economic growth. Production links with low-productive firms in less developed economies can retard technology progress. On the other hand, FDI outflows can contribute to economic growth by enhancing both the static and dynamic efficiency of an economy, which comes mainly from competition, specialization, and economies of scale accompanying the progress of international fragmentation of production.

The regression shows that FDI outflow has a negative effect on per capita GDP growth, but the estimated coefficient, -0.085 (0.071), is not statistically significant at the 10% level. In this regression, considering that FDI outflows and GDP growth over the contemporaneous 5-year period are simultaneously correlated, the FDI outflow variable is instrumented by own lagged value.[8]

[8] When own variable is used for instrument, the FDI outflow variable is still statistically insignificant, -0.051 (0.065).

Column 4 includes both trade openness and FDI inflow as explanatory variables. While trade and FDI inflow variables are all positive, they are statistically insignificant at the 5% level. The statistical insignificance of the trade openness variable in this specification may reflect a high correlation between trade and direct investment inflows. While neither trade nor FDI inflow is individually statistically significant, they are jointly marginally significant at 10% level (p=0.103).

Column 5 adds FDI outflow as an explanatory variable, together with trade openness and FDI inflows. While both trade openness and FDI inflow variables remain statistically insignificant, FDI outflow has a significantly negative effect on per capita GDP growth, -0.199 (0.072). The estimated coefficient indicates that, given trade volume and FDI inflows, an increase in FDI outflows by one percentage-point of GDP is associated with a lower growth rate by 0.2 percentage point.

Columns 6 to 10 of Table 3 consider different slope coefficients for the integration variables for two subperiods—1970–1989 and 1990–2005.[9] Figure 2 shows that flows of foreign direct investments surged to a larger volume in the early 1990s. In the 1970s and 1980s, capital flows into emerging markets primarily took the form of debt financing. Considering this pattern of capital

[9] We have also adopted specifications by assuming different slope coefficients for the integration variables for each decade- 1970s, 1980s, 1990s and 2000-2005. The regressions results, which are qualitatively similar to those presented below, are available from the authors upon request. See footnote 9 too.

flows, we attempt to find any discerning effect of FDI flows as well as trade openness on economic growth for the different periods.

The results in column 6 of Table 3 show that the strong positive effect of trade openness on GDP growth occurred mostly in the 1970s and 1980s, rather than later periods. The estimated coefficients are 0.017 (0.005) for 1970–1989 period and 0.006 (0.004) for 1990–2005. Similarly, in column 7, FDI inflow has a significantly positive effect on GDP growth in the 1970s and 1980s, but not afterwards. The estimated coefficient on FDI inflows in 1970–1989, 0.281 (s.e.=0.107), implies, if viewed causally, that an increase of one percentage point in the FDI-to-GDP ratio per year lead to an increase in the per capita GDP growth rate of about 0.28 percentage points per year. Hence, the gap between South Asia and East Asia in terms of FDI inflows, amounting to 1.8% of GDP per year in the 1970s and 1980s, implies that a smaller volume of FDI inflows reduced South Asia's growth rate by 0.5 percentage points relative to its East Asian neighbors.

In column 9, where different slope coefficients for both trade and FDI inflows are allowed, all the coefficients are positive and individually statistically insignificant at the 5% level.[10] But, trade and FDI inflows for the 1970s and 1980s period are jointly significant at the 1% level (p=0.004), whereas trade and FDI inflows variables for the 1990–2005 period are jointly insignificant, (p=0.379).

[10] When slope coefficients are allowed to differ by decade, the estimated coefficients for trade openness in 1980s and FDI inflows in 1970s are both positive and individually statistically significant, while others are statistically insignificant.

The joint significance of trade and FDI inflows in the 1970s and 1980s period is also proved in column 10, where the FDI outflow variable is added. While trade and FDI inflow variables for the 1970s and 1980s period are individually statistically insignificant, they are still jointly significant at the 1% level (p=0.004). In this framework, trade and FDI inflows variables for the 1990–2005 period are jointly marginally significant at the 10% level (p=0.091).

These findings indicate that the positive effects of trade and investment integration on GDP were more significant during the 1970s and 1980s, but economies also benefited from deeper international integration during the 1990s and afterwards.

Column 9 shows that FDI outflows have negative effects on GDP growth, both in the 1970–1989 and 1990–2005 periods, but the estimated coefficients are individually and jointly statistically insignificant. But the strong negative effect of FDI outflows in the 1990–2005 periods appear in column 10, where trade and FDI inflow variables are included together. The estimated coefficient, -0.348 (0.218), implies that, given trade volume and FDI inflows, an increase in FDI outflows by one percentage-point of GDP is associated with a lower growth rate by 0.16 percentage point.

III. Micro-Data Analyses of Economic Growth

The findings from cross-country analyses in the previous section have confirmed the significantly positive contribution of trade and investment integration on economic growth in East Asia, particularly during the 1970s and the 1980s. With a focused use of plant-, firm-, and industry-level micro-data from Korea, this section aims to shed more light on links between integration and growth in the 1990s and afterwards.

3.1 Impact of Trade and FDI on Growth: Evidence from Micro-level Data

A growing number of empirical studies using longitudinal microdata confirm that firm dynamics (entry and exit, growth and decline of individual firms) is an important component of innovation and of aggregate productivity growth. However, empirical studies based on longitudinal micro-data in East Asia are still rare, mainly due to the lack of readily available data.

Aw, Chung, and Roberts (2000) examine and compare links between productivity and turnover in the exports market using the longitudinal firm-level data from Taipei,China and Korean manufacturing Censuses. They find that exporting producers tend to have higher productivity. Their analysis reveals that evidence from Korean firm data is consistent with "learning-by-exporting" hypothesis, whereas data from Taipei,China show that firms with high productivity self-select to enter export markets.

While Aw, Chung, and Roberts (2000) focused on the "five-yearly" census data, the Korea National Statistical Office compiles the plant-level data "annually" covering all plants with five or more employees. Taking advantage of this higher frequency data, and using the methods of Bernard and Jensen (1999a and 1999b), Hahn (2005) detects evidence of self-selection and (short-lived) "learning-by-exporting" effects in the relation between exporting and plant-level productivity in Korea.

The findings in Hahn (2005) from the Korean data are in fact qualitatively similar to those of Bernard and Jensen (1999a and 1999b) from United States data in the following aspects: (i) significant and positive contemporaneous correlations are observed between levels of exports and productivity; (ii) while exporting plants have substantially higher productivity levels and bigger size than non-exporting plants, evidence that exporting increases plant productivity growth rates is weak; and (iii) new exporters grow faster around the time when they enter the export market.

A number of studies also investigate the impact of trade liberalization on productivity growth. The best-known links between import and productivity are based on increased competition, allocative efficiency, and technology-spillovers. By and large, the literature supports the positive link between import and productivity growth at firm- or industry-level data, but the existing empirical evidence from micro-data is still limited for East Asian economies.

The extent and the channels that international trade can contribute to technology spillovers and to productivity growth vary from industry to industry, and also from economy to economy, depending on the economic and technological environment. For example, gain from trade of the US with China must have little productivity spillovers, while exporting cars from Korea to the US seems far more likely to generate technological learning.

FDI is of growing importance in the internationalization of East Asian firms. Intraregional trade in East Asia has been increasing with the main engine of this trend outsourcing and the international fragmentation of production (Ahn, Fukao, and Ito, 2007). The expansion of parts and components trade and processed intermediate goods trade accounts for 65% of the total increase of intraregional trade from 1990 to 2003.

More than half of the expansion of intraregional trade owes to the growth in trade in electrical and general machinery. The share of the electrical and general machinery industry in total intraregional trade increased from 28% in 1990 to 46% in 2003. Intraregional trade in parts and components increased about six-fold between 1990 and 2003. The growth of intraregional trade in parts and components is closely related with the expansion of intraregional trade in electrical and general machinery. In 2003, 90% of total intraregional trade in parts and components consisted of electrical and general machinery (Ahn, Fukao, and Ito, 2007).

Many Japanese and Korean firms—especially those in leading export industries such as electronics and transportation equipment—are rapidly relocating some segments of their production lines and establishing new export bases in the PRC and other East Asian economies. Compared with Japan, Korea experienced even more rapid progress in outsourcing to East Asian economies, especially the PRC. According to Table 4—based on PRC statistics on investment flows and cumulative inward investment amounts in all industries—Korea and Japan have been the top two investors in PRC in recent years in terms of investment amounts—if Hong Kong, China is excluded.

While FDI inflows are often argued to be closely related to technology spillovers from foreign advanced firms to domestic producers, existing theoretical models and empirical evidence of outbound FDI do not offer a clear answer on the impact of outbound FDI in terms of productivity growth of domestic producers. Helpman, Melitz and Yeaple (2004) build a multi-economy, multi-sector general equilibrium model in order to explain the decision of heterogeneous firms whether to serve overseas markets through exports or through "horizontal FDI." A basic idea of the model is that FDI involves higher sunk costs but lower per-unit costs than exporting does in serving the overseas market. The model predicts that only the more productive firms will choose to

serve foreign markets and that the most productive firms among them will further choose FDI to serve the overseas market.[11]

According to the model of "horizontal FDI," it is expected that high-productivity producers would self-select themselves overcoming the first hurdle of exporting and the second (more challenging) hurdle of "horizontal FDI." In this case, however, the direction of causation is not from FDI to productivity, but from productivity to FDI. Productivity implications of the "vertical FDI" are even more complicated. Taking advantage of international differences in factor prices by international fragmentation of production would probably help improve multinational firms' profitability. But, it is unclear whether such gains in profitability for multinational firms would necessarily mean productivity gains in the home economy. All in all, links between outbound FDI and domestic productivity growth remain a subject for empirical investigation.

3.2 Empirical Specification and Data

We investigate the impact of integration (trade and/or FDI) on productivity growth using regression equations for the growth in labor

[11] The model predicts that the greater the heterogeneity of firms' productivity, the greater will be FDI sales relative to export sales. These predictions are strongly supported by data on US exports and sales of overseas US affiliates. Head and Ries (2003) also find from Japanese firm data that firms using both FDI and exports to serve foreign markets are more productive than firms that only export.

productivity (value added per worker) and for the total factor productivity (TFP) growth:

$$\ln Y_{i,t+3} - \ln Y_{i,t} = \beta_0 + \beta_{Plant} \cdot X_{i,t} + \beta_{Industry} \cdot Z_{j,t} + \beta_{D_t} \cdot D_t + u_i + \varepsilon_{i,t}$$

where the left-hand-side variable is the subsequent 3-year growth rate of value added per worker (or total factor productivity) at plant (firm) i from year t to year (t +3) and the following right-hand-side variables:

● $X_{i,t}$: a vector of plant-specific variables for plant (firm) i in year t, which includes the initial levels of the dependent variable (either value added per worker or total factor productivity), the capital-labor ratio, research and development (R&D) intensity measured as R&D expenditure divided by sales, the export-sales ratio, and the number of workers.

● $Z_{j,t}$: a vector of industry-specific variables for industry j to which plant i belongs in year t, including the industry-level capital-labor ratio, R&D intensity, export intensity, and the growth rates of inbound/outbound FDI and trade (exports plus imports). Moreover, in order to examine the impact of FDI to—or trade with—major partners, we include the industry-level share of each destination or partner: the shares of FDI to PRC, US, Japan, and Korea, the shares of trade with PRC, the US, Japan, and Korea.

● D_t: a vector of year dummy variables.

● u_i: plant-specific fixed effects.

Plant-level total factor productivity (TFP) is estimated by the chained-multilateral index number approach. This uses a separate reference point for each cross-section of observations and then chain-links the reference points together over time, as in the Tornqvist-Theil index. The output, input, and productivity level of each plant in each year is measured relative to the hypothetical plant at the base-time period. This approach allows us to make transitive comparisons of productivity levels among observations in a panel dataset. The productivity index for plant *i* at time *t* is measured as follows:

$$\ln TFP_{it} = (\ln Y_{it} - \overline{\ln Y_t}) + \sum_{\tau=2}^{t} (\overline{\ln Y_\tau} - \overline{\ln Y_{\tau-1}})$$

$$- \left\{ \sum_{n=1}^{N} \frac{1}{2} (S_{nit} + \overline{S_{nt}})(\ln X_{nit} - \overline{\ln X_{nt}}) + \sum_{\tau=2}^{t} \sum_{n=1}^{N} \frac{1}{2} (\overline{S_{n\tau}} + \overline{S_{n\tau-1}})(\overline{\ln X_{n\tau}} - \overline{\ln X_{n\tau-1}}) \right\}$$

where Y, X, S, and TFP denote output, input, the input share, and the TFP level, respectively, and symbols with an upper bar are the corresponding measures for the hypothetical firms. The subscripts τ and n are indexes for time and inputs, respectively.

For the regression analyses, we constructed a plant- and industry-level dataset for the Korean manufacturing sector covering the period from 1990 to 2003. This dataset is based on four major sources of information: the *Annual Report on Mining and Manufacturing Survey* (Korean National Statistical Office), the *UN Commodity Trade Statistics Database* (United Nations [UN] Statistics Division), the *Overseas Direct Investment Statistics Yearbook* (The Export-Import

Bank of Korea) and the *Foreign Direct Investment Survey* (Ministry of Commerce, Industry, and Energy).

The *Mining and Manufacturing Survey* is conducted annually by the Korea National Statistical Office. The survey covers all plants with five or more employees in the mining and manufacturing industries and contains plant-level information on output, input, and a variety of additional items, including the 5-digit Korean Standard Industry Classification (KSIC) code assigned to each plant based on its major product. Variables such as plant-level employment growth, the capital-labor ratio, the ratio of nonproduction- to production-workers, labor productivity, and total factor productivity were calculated at the plant-level based on the information from this survey.

The *UN Commodity Trade Statistics Database* ("UN COMTRADE") is compiled by the UN Statistics Division and contains annual amounts of imports, exports, and re-exports in US dollars by commodity and by trading partner. Commodities are classified according to the International Trade Classification (SITC: Rev. 1 from 1962, Rev. 2 from 1976 and Rev. 3 from 1988) and the Harmonized System (HS) (from 1988 with revisions in 1996 and 2002). Imports from and exports to Korea's major trading partners by commodity based on the SITC Rev. 3 and on the HS system from 1990 to 2003 are downloaded from the UN COMTRADE website [http://unstats.un.org/unsd/COMTRADE/].

The *Overseas Direct Investment Statistics Yearbook* is published by the Export-Import Bank of Korea, an official export credit agency providing

comprehensive credit and guarantees for trade and overseas investment. The yearbook reports the flows and stock of outbound foreign direct investment by industry and by destination. The Export-Import Bank has its own code for industry classification ("EXIM code") which by and large is comparable to the 3-digit KSIC code. For example, the manufacturing sector as a whole consists of 71 industries according to the 3-digit KSIC code and of 70 industries according to the EXIM code. Information on annual FDI flows and stocks disaggregated by the EXIM code and by destination was downloaded from the Bank's website [http://www.koreaexim.go.kr/en/].

The Ministry of Commerce, Industry, and Energy reports quarterly and annual FDI inflows data by industry, by region, by investment type, and by investment size. In this dataset, which covers the period of 1991–2005, the manufacturing sector consists of 11 sub-sectors.

While the Manufacturing Survey contains plant-level information, the trade and FDI databases do not provide plant-level information. Therefore, to merge these four different sources, we can link the data only at a certain level of industry-wide aggregation. As the basic industry classification for our analysis, we use the 78 sector classification of the National Accounting, where the manufacturing sector consists of 34 sub-sectors. Summary statistics for key variables used in the regression analyses are in Table 5.

3.3 Regression Results

Applying a fixed-effect panel regression method, we estimate the regression equations for the plant-level labor productivity growth and for the TFP growth. Table 6 and Table 7 summarize the fixed-effect panel estimation results for labor productivity growth and for the TFP growth, respectively. They strongly suggest that economic integration such as inbound FDI, outbound FDI, and trade contributes to the productivity growth in one way or another. For both Table 6 and Table 7, columns 1 and 2 show regression results without including the growth rate of industry-level FDI inflows, while columns 3 and 4 are the results when the growth rate of industry-level FDI inflows is included as an explanatory variable.

We first look at the regression results for growth in labor productivity (value added per worker), which is conceptually similar to the per capita GDP growth in the previous section. The first explanatory variable in Table 6, the log of value added per worker at the start of each 3-year period captures the "conditional convergence" effect. The first explanatory variable (the ratio of nonproduction workers to production workers) can be interpreted as a proxy for skill-intensity or education-intensity of each plant, in the sense that nonproduction workers tend to be more skilled or more educated. The next four variables (capital-to-labor ratio, R&D expenditures to sales ratio, export to sales ratio, and the log of employment size) are all plant-level variables. Table 6 shows that a plant with (i) a higher share of nonproduction workers, (ii) higher capital-labor ratio, (iii) more export-oriented, and (iv) with a bigger size at the start of each 3-

year period, tends to have a faster labor productivity growth during the 3-year period. On the other hand, the coefficients for the plant-level R&D intensity were positive but insignificant.

Now we turn to the industry-level variables as determinants of plant-level productivity growth. Coefficients for the industry-level capital intensity and for the industry-level R&D intensity are almost always significantly positive, while coefficients for the industry-level nonproduction workers' ratio and export intensity tend to be significantly negative. At face value, these results suggest that investment in physical capital and in R&D activities tend to have industry-wide spillover effects. The fact that the industry-level skill-intensity or the industry-level export-intensity show negative effects on individual plants' productivity growth seems to reflect adversarial effects from intensified competition. The import-penetration ratio had insignificant effects of plant-level productivity growth.

As a comparison of Table 6 and Table 7 reveals, the basic conclusion on the industry-level determinants of plant-level productivity growth holds true both for the labor productivity growth and for the TFP growth. Similarly, the size of a plant or the export intensity of a plant tends to be positively correlated with productivity growth (both for labor productivity and TFP). In contrast, the positive effects of plant-level skill-intensity and of R&D intensity seem to be limited only to labor productivity growth.

We have now finally returned to the main issues of this section, that is, links between integration and productivity growth. First, both Table 6 and Table 7 confirm that plants in an industry that experienced a higher growth rate of FDI inflows over the previous 3 years tend to have significantly faster productivity growth over the following 3-year period. Both Table 6 and Table 7 also reveal that industry-level FDI outflows and industry-level trade also have positive spillover effects on individual plants' productivity growth in one way or another. According to the regression results, positive contribution of outbound FDI growth is clearly observed when inbound FDI growth is taken into account (columns 3 and 4). In contrast, the positive contribution of trade growth on productivity growth is more clearly shown when FDI inflow growth is not included as an explanatory variable (columns 1 and 2).

Regression results so far indicate that an increased degree of international integration at the industry level tends to be followed by faster productivity growth at the plant-level. Columns 2 and 4 of Table 6 and Table 7 reveal that not only the degree of international integration but also the composition of the integration matters. Regression results of columns 2 and 4 suggest that increased integration with more advanced economies could have even larger benefits in terms of domestic producers' productivity growth.

IV. Concluding Remarks

The successful performance of East Asian economies over the last four decades is broadly attributed to favorable conditions—such as relatively higher levels of investment, human capital, and quality of institutions, and lower levels of fertility, government consumption, and inflation. In addition, international openness is critical to East Asia's rapid economic growth. The process of fast income growth achieved in East Asian economies has occurred with rapid growth in trade and direct investment flows.

This paper shows there is a positive relationship between international integration and long-term growth both at aggregate-economy and micro-firm levels. The cross-country regression highlights that trade openness and FDI inflows have a significantly positive impact on income growth. Micro-level evidence also confirms the positive role of global integration through trade and direct investment in productivity growth. The estimation based on Korean manufacturing data strongly suggests that global integration through inbound FDI, outbound FDI, and trade contributes to the plant-level labor productivity growth and the TFP growth.

Our empirical findings suggest that the relationship between trade openness and foreign FDI inflows and GDP growth was not strong in the 1990s and afterwards, compared with 1970–1989. We also find FDI outflows have a negative effect on GDP growth at the aggregate economy level. Micro-data analysis reveals further evidence that the impact of outbound FDI depends on the destination of FDI.

While deeper trade and investment integration process continues to be beneficial to Asian economies, it seems a certain change has occurred in the mechanism by which international integration influences income growth. The impact of global integration on productivity growth depends on the nature of trade and production links between economies. Considering the economic emergence of China and India in the region, it is important for emerging Asian economies to expand linkages to these economies to maximize the benefits accrued from integration.

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Table 1: **Growth Performance in East Asia**

Economy	GDP per capita			Average Annual per capita GDP Growth (%)								
	1970	2005	2005/ 1970	1960–1970	1970–1975	1975–1980	1980–1985	1985–1990	1990–1995	1995–2000	2000–2005	1970–2005
China, People's Rep. of	500	5826	11.7	1.09	3.27	4.82	8.25	7.80	9.61	7.85	7.51	7.02
Hong Kong, China	6967	31537	4.5	7.41	4.32	8.77	3.58	6.29	4.07	0.23	2.93	4.31
Indonesia	1273	4237	3.3	1.73	6.16	3.69	1.25	5.49	4.77	0.36	2.33	3.44
Korea, Rep. of	2552	19072	7.5	5.60	5.64	5.69	6.22	8.94	6.53	3.32	3.89	5.75
Malaysia	2529	13215	5.2	3.40	7.63	5.80	2.61	4.00	6.13	3.95	2.94	4.72
Philippines	2431	4072	1.7	1.76	3.39	2.81	-2.57	1.96	0.38	3.11	1.25	1.48
Singapore	6838	30518	4.5	4.83	6.18	6.72	2.32	5.71	5.66	2.61	0.72	4.27
Taipei,China	2846	21626	7.6	6.79	6.72	8.07	4.90	7.80	5.98	4.70	2.40	5.80
Thailand	1734	7937	4.6	4.93	3.32	5.60	4.31	7.40	6.49	-0.77	4.08	4.35
East Asia 9 Avg.	*3074*	*15338*	*5.0*	*4.17*	*5.18*	*5.77*	*3.43*	*6.15*	*5.51*	*2.82*	*3.12*	*4.57*
Brazil	4026	7530	1.9	4.21	6.60	3.81	-0.74	0.90	0.18	0.85	0.91	1.79
Japan	11391	25290	2.2	9.27	2.91	3.28	2.27	4.43	1.05	0.93	1.07	2.28
India	1155	3432	3.0	2.59	0.42	2.68	3.18	3.67	2.08	4.54	5.22	3.11
United States	17321	37015	2.1	2.96	1.78	2.64	2.42	2.11	1.53	3.22	1.49	2.17

Notes: Per capita GDP levels and growth rates are based on 2000 international (purchasing power parity adjusted) prices, based on the Penn World Tables 6.2. The average is unweighted average for nine East Asian economies.

Table 2: **Summary of Key Variables by Region, 1970–1975 and 2000–2005 periods** (Unweighted average)

	East Asia (N=9)	Latin America (N=21)	Sub-Saharan Africa (N=18)	South Asia (N=4)
		1970–1975		
Per capita GDP growth	0.052	0.025	0.017	0.008
Per capita GDP in 1970	3074	4664	1554	1290
Investment/GDP	0.228	0.150	0.151	0.106
Fertility rate in 1970	4.8	5.5	6.7	6.0
Schooling in 1970	3.96	3.36	1.31	2.14
Life expectancy in 1970	64.8	65.1	51.3	58.6
Government consumption	0.050	0.102	0.139	0.085
Rule-of-law index	0.611	0.381	0.357	0.292
Inflation	0.105	0.202	0.105	0.151
Democracy index	0.346	0.479	0.222	0.736
Terms of trade	0.003	-0.009	-0.047	-0.085
Balance-of-payments crisis	0.22	0.29	0.06	0.25
Trade openness	0.324	-0.147	-0.011	-0.106
FDI inflows/GDP	0.0179	0.0212	0.0125	0.0003
FDI outflows/GDP	0.0011	0.0009	0.0005	-0.0003
		2000–2005		
Per capita GDP growth	0.031	0.013	0.015	0.038
Per capita GDP in 2000	13448	6524	1959	2755
Investment/GDP	0.218	0.128	0.085	0.111
Fertility rate in 2000	2.0	3.0	5.5	3.2
Schooling in 2000	7.62	5.78	3.32	3.94
Life expectancy in 2000	4.3	4.2	3.8	4.2
Government consumption	0.095	0.139	0.156	0.187
Rule-of-law index	0.643	0.450	0.453	0.483
Inflation	0.025	0.083	0.127	0.054
Democracy index	0.570	0.741	0.493	0.560
Terms of trade	-0.018	0.002	-0.011	-0.039
Balance-of-payments crisis	0.00	0.33	0.33	0.00
Trade openness	1.049	-0.155	-0.115	0.016
FDI inflows/GDP	0.0462	0.0361	0.0261	0.0094
FDI outflows/GDP	0.0340	0.0087	0.0021	0.0008

Notes: see next page.

Notes to Table 2

The sample consists of the 85 economies that are used in the regressions in Table 3. Per capita GDP levels and growth rates are based on 2000 international (purchasing power parity adjusted) prices, based on the Penn-World Tables 6.2, as described in Heston, A., R. Summers, and B. Aten (2006).

Schooling data is the average years of schooling for population aged 25 and above from Barro and Lee (2001). The investment ratio is the ratio of real investment (private plus public) to real GDP, based on the Penn-World Tables 6.2, averaged over the period. The government consumption measure is the ratio of real government consumption (exclusive of spending on education and defense) to GDP, based on the World Tables 6.2. The life expectancy at age one and fertility rate are from World Bank, *World Development Indicators*. The rule-of-law index, expressed on a zero-to-one scale, with one being the most favorable, is based on the *International Country Risk Guide's* maintenance of the rule of law index. The inflation rate is the growth rate over each period of a consumer price index. The democracy index, expressed on a zero-to-one scale, with one being the most favorable, is based on the indicator of political rights compiled by Freedom House. The growth rate of the terms of trade is the change of export over import prices over the period. The balance-of-payments-crisis variable is described in the footnote 4 to the text. The trade openness variable is the ratio of exports plus imports to GDP, filtered for the estimated effects on this measure from the logs of population and area. The measure of FDI inflows or outflows is the average ratio of FDI inflows or outflows over the contemporaneous 5-year period, sourced from UNCTAD, *World Investment Report*. The nine East Asian economies include PRC; Hong Kong, China; Indonesia; Korea; Malaysia; Philippines; Singapore, Taipei,China; and Thailand. South Asia includes Bangladesh, India, Pakistan, and Sri Lanka.

Table 3: **Cross-country Panel Regressions for Per Capita GDP Growth Rate**

	(1)	(2)	(3)	(4)	(5)
Log (per capita GDP)	-0.0205**	-0.0226**	-0.0204**	-0.0201**	-0.0178**
	(0.0031)	(0.0033)	(0.0033)	(0.0032)	(0.0031)
Investment/GDP	0.0192	0.0319	0.0424**	0.0193	0.0203
	(0.0198)	(0.0195)	(0.0196)	(0.0194)	(0.0192)
Log (total fertility rate)	-0.0211**	-0.0257**	-0.0238**	-0.0217**	-0.0199**
	(0.0055)	(0.0058)	(0.0058)	(0.0056)	(0.0056)
Average years of schooling	0.0013	0.0009	0.0008	0.0013	0.0014
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Log (life expectancy)	0.0221	0.0274*	0.0353**	0.0220	0.0265*
	(0.0143)	(0.0150)	(0.0160)	(0.0142)	(0.0151)
Government consumption/GDP	-0.0440*	-0.0495**	-0.0515**	-0.0442*	-0.0381
	(0.0236)	(0.0236)	(0.0249)	(0.0234)	(0.0243)
Rule-of-law index	0.0151**	0.0177**	0.0168**	0.0156**	0.0131*
	(0.0069)	(0.0071)	(0.0075)	(0.0069)	(0.0072)
Inflation rate	-0.0195**	-0.0151*	-0.0165*	-0.0206**	-0.0256**
	(0.0091)	(0.0088)	(0.0088)	(0.0089)	(0.0088)
Democracy index	0.0390**	0.0497**	0.0495**	0.0423**	0.0413**
	(0.0177)	(0.0177)	(0.0185)	(0.0175)	(0.0178)
Democracy index Squared	-0.0275	-0.0393**	-0.0410**	-0.0308*	-0.0320*
	(0.0167)	(0.0165)	(0.0172)	(0.0165)	(0.0169)
Growth rate of terms of trade	0.0307	0.0340	0.0380*	0.0295	0.0234
	(0.0205)	(0.0208)	(0.0224)	(0.0203)	(0.0217)
Balance-of-payments crisis	-0.0119**	-0.0144**	-0.0123**	-0.0111**	-0.0087*
	(0.0048)	(0.0051)	(0.0051)	(0.0047)	(0.0045)
Trade openness	0.0075**	--	--	0.0058	0.0071
	(0.0037)			(0.0046)	(0.0046)
FDI inflows/GDP	--	0.0940	--	0.0469	0.1250
		(0.0656)		(0.0729)	(0.0813)
FDI outflows/GDP	--	--	-0.0848	--	-0.1993**
			(0.0709)		(0.0717)
No. of economies	85	85	85	85	85
No. of observations	539	541	508	536	503

Table 3: **Continued**

	(6)	(7)	(8)	(9)	(10)
Log (per capita GDP)	-0.0201** (0.0032)0.0	-0.0227** (0.0032)	-0.0203** (0.0033)	-0.0206** (0.0031)	-0.0177** (0.0032)
Investment/GDP	0.0104 (0.6063)	0.0277 (0.0192)	0.0411** (0.0200)	0.0110 (0.0196)	0.0110 (0.0200)
Log (total fertility rate)	-0.0205** (0.0055)	-0.02525** (0.0057)	-0.0242** (0.0059)	-0.0212** (0.0056)	-0.0205** (0.0057)
Average years of schooling	0.0015 (0.0010)	0.0011 (0.0010)	0.0009 (0.0010)	0.0015 (0.0010)	0.0017* (0.0010)
Log (life expectancy)	0.0253* (0.0144)	0.0306** (0.0149)	0.0342** (0.0160)	0.0256* (0.0143)	0.0262* (0.0151)
Government consumption/GDP	-0.0474** (0.0235)	-0.0568** (0.0233)	-0.0489* (0.0252)	-0.0512** (0.0233)	-0.0352 (0.0246)
Rule-of-law index	0.0128* (0.0070)	0.0176** (0.0070)	0.0169** (0.0075)	0.0142** (0.0069)	0.0130* (0.0072)
Inflation rate	-0.0146 (0.0090)	-0.0121 (0.0088)	-0.0172* (0.0090)	-0.0156* (0.0090)	-0.0240** (0.0090)
Democracy index	0.0349** (0.0177)	0.0493** (0.0175)	0.0505** (0.0187)	0.0405** (0.0174)	0.0422** (0.0180)
Democracy index Squared	-0.0245 (0.0167)	-0.0397** (0.0163)	-0.0423** (0.0175)	-0.0303* (0.0164)	-0.0337** (0.0171)
Growth rate of terms of trade	0.0283 (0.0205)	0.0293 (0.0210)	0.0386* (0.0224)	0.0252 (0.0204)	0.0209 (0.0218)
Balance-of-payments crisis	-0.0111** (0.0049)	-0.0145** (0.0051)	-0.0128** (0.0051)	-0.0106** (0.0047)	-0.0088* (0.0046)
Trade openness *1970–1989	0.0165** (0.0054)	--	--	0.0106 (0.0065)	0.0115 (0.0072)
Trade openness *1990–2005	0.0055 (0.0038)	--	--	0.0040 (0.0050)	0.0060 (0.0050)
FDI inflow/GDP *1970–1989s	--	0.2805** (0.1072)	--	0.1805 (0.1254)	0.1731 (0.1351)
FDI inflows/GDP *1990–2005	--	0.0251 (0.0739)	--	0.0292 (0.0865)	0.0837 (0.0981)
FDI outflow/GDP *1970–1989	--	--	-0.1897 (0.2222)	--	-0.3484 (0.2183)
FDI outflows/GDP *1990–2005	--	--	-0.0868 (0.0709)	--	-0.1607** (0.0764)
No. of countries	85	85	85	85	85
No. of observations	539	541	508	536	503

Notes: see next page.

Notes to Table 3

The system has seven equations, corresponding to the periods 1970–1975, 1975–1980, 1980–1985, 1985–1990, 1990–1995, 1995–2000, and 2000–2005. The dependent variables are the growth rates of per capita GDP. Data on GDP are from Penn-World Tables version 6.2.

The log of per capita GDP, the average years of male secondary and higher schooling, and the log of life expectancy at age one are measured at the beginning of each period. The ratios of government consumption and investment to GDP, the inflation rate, the total fertility rate, the growth rate of the terms of trade, the democracy index, the trade openness, FDI inflows and FDI outflows are period averages. The rule-of-law index is the earliest value available (for 1982 or 1985) in the first equation and the period average for the other equations..

Estimation is by three-stage least squares. Instruments are the actual values of the variables for schooling, life expectancy, openness, and the terms of trade; dummy variables for Spanish or Portuguese colonies and other colonies (which have substantial explanatory power for inflation); lagged values of the log of per capita GDP, the government consumption ratio, and the investment ratio; and the initial values for each period of the rule-of-law index, democracy index, FDI inflows and FDI outflows. In the first two equations, the rule-of-law indicator is for 1982 or 1985. The initial values of foreign reserve-import ratio are used as an instrument for balance-of-payments crisis. Individual constants (not shown) are included for each period. ** and * indicates significant at 5% and 10% levels.

Table 4: **Inward FDI into The People's Republic of China, by source economy (in US$ 10,000's)**

(a) Number of inward FDI projects and amount of investment

	No. of projects				Amount of investments fulfilled			
	2003		2004		2003		2004	
World Total	41,081	(100.0)	43,664	(100.0)	5,350,467	(100.0)	6,062,998	(100.0)
Hong Kong, China	13,633	(33.2)	14,719	(33.7)	1,770,010	(33.1)	1,899,830	(31.3)
Japan	3,254	(7.9)	3,454	(7.9)	505,419	(9.4)	545,157	(9.0)
Taipei,China	4,495	(10.9)	4,002	(9.2)	337,724	(6.3)	311,749	(5.1)
Macau	580	(1.4)	715	(1.6)	41,660	(0.8)	54,639	(0.9)
Korea, Rep. of	4,920	(12.0)	5,625	(12.9)	448,854	(8.4)	624,786	(10.3)
US	4,060	(9.9)	3,925	(9.0)	419,851	(7.8)	394,095	(6.5)
Canada	901	(2.2)	995	(2.3)	56,351	(1.1)	61,387	(1.0)
Europe	2,074	(5.0)	2,423	(5.5)	393,031	(7.3)	423,904	(7.0)
Germany	451	(1.1)	608	(1.4)	85,697	(1.6)	105,848	(1.7)
France	269	(0.7)	289	(0.7)	60,431	(1.1)	65,674	(1.1)
Italy	297	(0.7)	358	(0.8)	31,670	(0.6)	28,082	(0.5)
Netherland	189	(0.5)	199	(0.5)	72,549	(1.4)	81,056	(1.3)
UK	438	(1.1)	488	(1.1)	74,247	(1.4)	79,282	(1.3)
ASEAN-5	2,128	(5.2)	2,156	(4.9)	285,309	(5.3)	290,962	(4.8)
Singapore	1,144	(2.8)	1,279	(2.9)	205,840	(3.8)	200,814	(3.3)
Indonesia	143	(0.3)	122	(0.3)	15,013	(0.3)	10,452	(0.2)
Malaysia	350	(0.9)	352	(0.8)	25,103	(0.5)	38,504	(0.6)
Philippines	297	(0.7)	241	(0.6)	22,001	(0.4)	23,324	(0.4)
Thailand	194	(0.5)	162	(0.4)	17,352	(0.3)	17,868	(0.3)
Others	5,036	(12.3)	5,650	(12.9)	1,092,258	(20.4)	1,456,489	(24.0)
Br. Virgin Iss.	2,218	(5.4)	2,641	(6.0)	577,696	(10.8)	673,030	(11.1)

(b) Cumulative number and amount of investment of inward FDI projects (in US$10,000's)

	No. of projects				Amount of investments fulfilled			
	up to 2003		up to 2004		up to 2003		up to 2004	
World Total	465,277	(100.0)	508,941	(100.0)	5,015	(100.0)	5,612	(100.0)
Hong Kong, China	224,509	(48.3)	239,228	(47.0)	2,226	(44.4)	2,416	(43.0)
Japan	28,401	(6.1)	31,855	(6.3)	414	(8.3)	468	(8.3)
Taipei,China	60,186	(12.9)	64,188	(12.6)	365	(7.3)	396	(7.1)
Macau	8,407	(1.8)	9,122	(1.8)	52	(1.0)	57	(1.0)
Korea, Rep. of	27,128	(5.8)	32,753	(6.4)	197	(3.9)	259	(4.6)
US	41,340	(8.9)	45,265	(8.9)	441	(8.8)	480	(8.6)
Canada	6,941	(1.5)	7,936	(1.6)	39	(0.8)	45	(0.8)
Europe	16,158	(3.5)	18,581	(3.7)	379	(7.6)	421	(7.5)
Germany	3,504	(0.8)	4,112	(0.8)	89	(1.8)	99	(1.8)
France	2,302	(0.5)	2,591	(0.5)	61	(1.2)	68	(1.2)
Italy	2,137	(0.5)	2,495	(0.5)	25	(0.5)	28	(0.5)
Netherland	1,254	(0.3)	1,453	(0.3)	51	(1.0)	59	(1.0)
UK	3,856	(0.8)	4,344	(0.9)	114	(2.3)	122	(2.2)
ASEAN-5	21,158	(4.5)	23,314	(4.6)	321	(6.4)	350	(6.2)
Singapore	11,871	(2.6)	13,150	(2.6)	235	(4.7)	255	(4.6)
Indonesia	1,079	(0.2)	1,201	(0.2)	13	(0.3)	14	(0.2)
Malaysia	2,888	(0.6)	3,240	(0.6)	31	(0.6)	35	(0.6)
Philippines	1,945	(0.4)	2,186	(0.4)	16	(0.3)	19	(0.3)
Thailand	3,375	(0.7)	3,537	(0.7)	25	(0.5)	27	(0.5)
Others	31,049	(6.7)	36,699	(7.2)	582	(11.6)	718	(12.8)
Br. Virgin Iss.	8,877	(1.9)	11,518	(2.3)	302	(6.0)	369	(6.6)

Note: Figures in parentheses indicate shares in World Total in percent.
Source: Ministry of Commerce, People's Republic of China (2004, 2005).

Table 5: **Summary of Key Variables for the Plant-Level Data Analyses**

Variable	Mean	Std. Dev.	Min	Max
$\ln(LP)_{i,t}$	3.30390	0.73301	-0.97433	8.78669
$\ln(TFP)_{i,t}$	0.00618	0.67907	-3.19537	4.10403
(Non-production worker share)$_{i,t}$	0.38733	0.80939	0	193.40000
(Capital-labor ratio)$_{i,t}$	30.46873	85.28126	0.00358	22995.80000
(R&D intensity)$_{i,t}$	0.00702	0.22608	0	131.22330
(Export-sales ratio)$_{i,t}$	0.06603	0.24527	0	88.23529
$\ln$(Number of workers)$_{i,t}$	2.88361	1.02232	0.69315	10.42088
(Non-production worker share)$_{j,t}$	0.38250	0.15375	0.12528	1.04929
(Capital-labor ratio)$_{j,t}$	50.91503	51.65717	4.89101	831.67880
(R&D intensity)$_{j,t}$	0.00966	0.01038	0	0.08460
(Export intensity)$_{j,t}$	0.19718	0.15654	0	0.77480
(Import penetration ratio)$_{j,t}$	0.22329	0.26044	0.00023	6.39863
(Preceding inbound FDI growth r	0.94408	0.60230	0.08200	2.68300
(Preceding outbound FDI growth	0.65006	7.48124	-1.60808	227.14290
(FDI to PRC share)$_{j,t}$	0.27726	0.26148	0	3.22876
(FDI to Japan share)$_{j,t}$	0.00394	0.02706	0	0.46643
(FDI to US share)$_{j,t}$	0.16696	0.22482	0	1.09776
(Preceding trade growth rate)$_{j,t}$	0.09816	0.80948	-0.96803	112.18260
(Trade with PRC share)$_{j,t}$	0.07030	0.06342	0	0.67365
(Trade with Japan share)$_{j,t}$	0.20699	0.13059	0	0.73918
(Trade with US share)$_{j,t}$	0.19870	0.12160	0	0.82800

i: plant-level, *j* : industry-level, *t* : 1994-2003

Table 6: **Plant-Level Fixed Effect Panel Regressions** (Labor Productivity Growth)

	(1)		(2)		(3)		(4)	
ln(LP)$_{i,t}$	**-0.34226**	***	**-0.34223**	***	**-0.34611**	***	**-0.34597**	***
	(0.00068)		(0.00068)		(0.00072)		(0.00073)	
(Non-production worker share)$_{i,t}$	**0.00123**	**	**0.00124**	**	**0.00094**	*	**0.00095**	*
	(0.00054)		(0.00054)		(0.00053)		(0.00054)	
(Capital-labor ratio)$_{i,t}$	**0.00002**	**	**0.00002**	**	**0.00001**	**	**0.00001**	**
	(0.00001)		(0.00001)		(0.00001)		(0.00001)	
(R&D intensity)$_{i,t}$	**0.00044**		**0.00047**		**0.00039**		**0.00043**	
	(0.00052)		(0.00052)		(0.00049)		(0.00049)	
(Export intensity)$_{i,t}$	**0.00300**	**	**0.00298**	**	**0.00192**	*	**0.00189**	
	(0.00126)		(0.00126)		(0.00115)		(0.00115)	
ln(Number of workers)$_{i,t}$	**0.02272**	***	**0.02247**	***	**0.02135**	***	**0.02105**	***
	(0.00096)		(0.00096)		(0.00103)		(0.00103)	
(Non-production worker share)$_{j,t}$	**-0.02888**	***	**-0.03426**	***	**-0.05689**	***	**-0.05819**	***
	(0.00548)		(0.00561)		(0.00572)		(0.00585)	
(Capital-labor ratio)$_{j,t}$	**0.00014**	***	**0.00014**	***	**0.00012**	***	**0.00012**	***
	(0.00001)		(0.00001)		(0.00001)		(0.00001)	
(R&D intensity)$_{j,t}$	**0.35607**	***	**0.23745**	***	**0.44618**	***	**0.33289**	***
	(0.04735)		(0.04799)		(0.04973)		(0.05063)	
(Export intensity)$_{j,t}$	**-0.00175**		**0.00503**		**-0.02556**	***	**-0.01598**	***
	(0.00417)		(0.00435)		(0.00452)		(0.00470)	
(Import penetration ratio)$_{j,t}$	**-0.00006**		**0.00046**		**0.00075**		**0.00115**	
	(0.00203)		(0.00203)		(0.00213)		(0.00213)	
(Preceding inbound FDI growth rate)$_{j,t}$					**0.01067**	***	**0.01045**	***
					(0.00074)		(0.00075)	
(Preceding outbound FDI growth rate)$_{j,t}$	**0.00001**		**-0.00014**		**0.00082**	***	**0.00086**	***
	(0.00016)		(0.00016)		(0.00018)		(0.00018)	
(FDI to China share)$_{j,t}$			**-0.01342**	***			**-0.00537**	***
			(0.00187)				(0.00198)	
(FDI to Japan share)$_{j,t}$			**0.43269**	***			**0.41530**	***
			(0.03965)				(0.04264)	
(FDI to USA share)$_{j,t}$			**0.00691**	***			**0.01335**	***
			(0.00196)				(0.00212)	
(Preceding trade growth rate)$_{j,t}$	**0.00108**	**	**0.00112**	**	**0.00066**		**0.00100**	*
	(0.00044)		(0.00044)		(0.00051)		(0.00052)	
(Trade with China share)$_{j,t}$			**-0.01862**	**			**0.01377**	
			(0.00823)				(0.00945)	
(Trade with Japan share)$_{j,t}$			**0.01721**	***			**0.02380**	***
			(0.00460)				(0.00491)	
(Trade with USA share)$_{j,t}$			**0.01432**	***			**0.00071**	
			(0.00544)				(0.00595)	
Intercept	**1.06119**	***	**1.05428**	***	**1.10687**	***	**1.09825**	***
	(0.00449)		(0.00512)		(0.00486)		(0.00552)	
Number of observations	**422343**		**422343**		**365264**		**365264**	
F value	**12460.8**		**9821.8**		**11080.4**		**8734.7**	
R-squared	**0.5662**		**0.5667**		**0.5747**		**0.5751**	

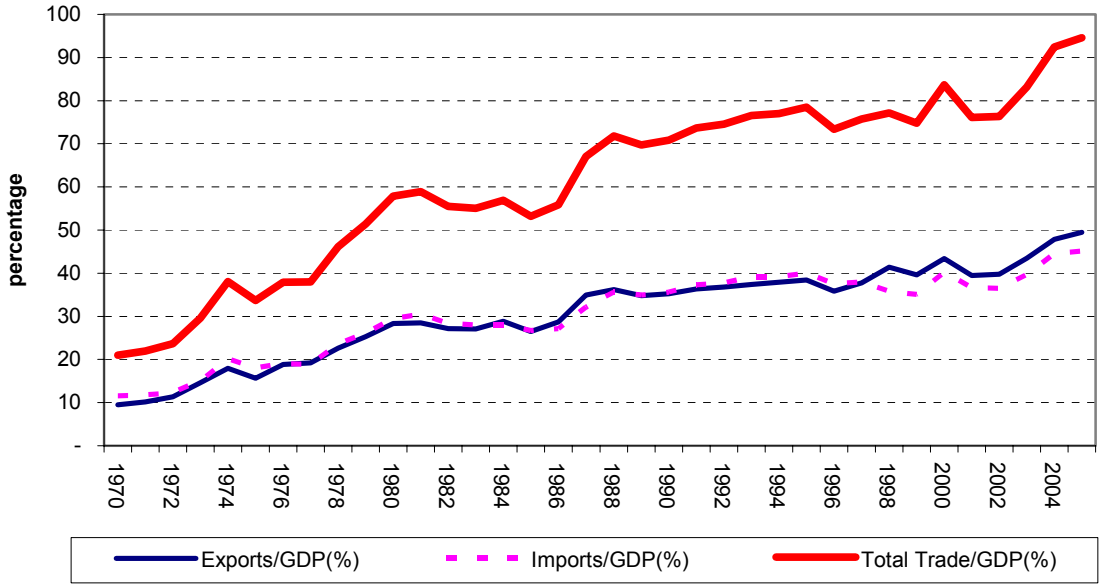
Note: Heteroskedasticity-robust standard errors are in parentheses. ***, **, and *: significant at 1%, 5% and 10% levels.

Table 7: **Plant-Level Fixed Effect Panel Regressions (**TFP Growth)

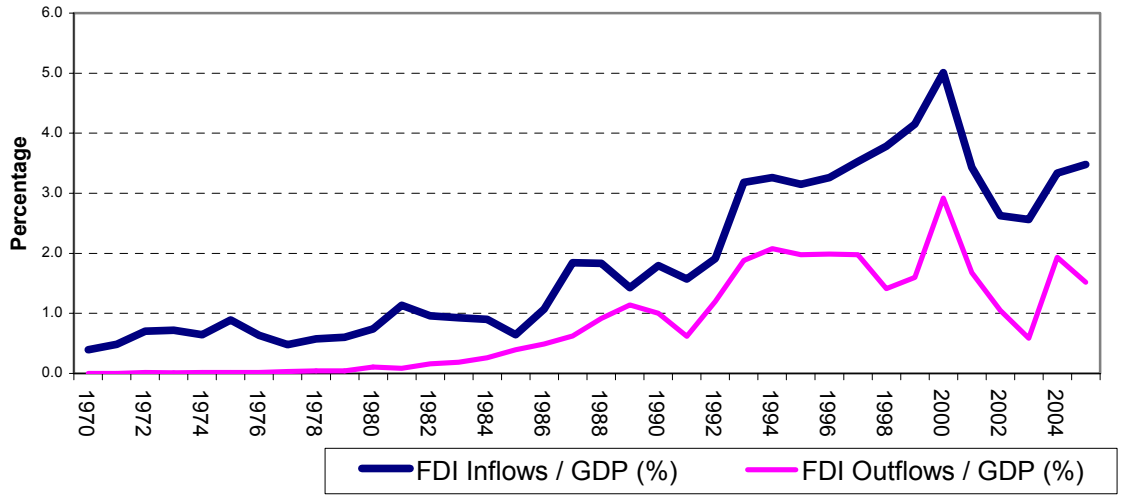
	(1)		(2)		(3)		(4)	
ln(TFP)$_{i,t}$	**-0.35299**	***	**-0.35291**	***	**-0.35673**	***	**-0.35663**	***
	(0.00084)		(0.00084)		(0.00090)		(0.00090)	
(Non-production worker share)$_{i,t}$	**0.00016**		**0.00018**		**0.00027**		**0.00028**	
	(0.00068)		(0.00068)		(0.00073)		(0.00073)	
(Capital-labor ratio)$_{i,t}$	**0.00000**		**0.00000**		**0.00000**		**0.00000**	
	(0.00001)		(0.00001)		(0.00001)		(0.00001)	
(R&D intensity)$_{i,t}$	**-0.00431**		**-0.00397**		**-0.00589**		**-0.00565**	
	(0.00652)		(0.00651)		(0.00673)		(0.00671)	
(Export intensity)$_{i,t}$	**0.00633**	***	**0.00618**	***	**0.00540**	***	**0.00528**	***
	(0.00164)		(0.00161)		(0.00147)		(0.00145)	
ln(Number of workers)$_{i,t}$	**0.00535**	***	**0.00508**	***	**0.00388**	***	**0.00354**	***
	(0.00121)		(0.00121)		(0.00130)		(0.00130)	
(Non-production worker share)$_{j,t}$	**-0.04259**	***	**-0.04267**	***	**-0.06878**	***	**-0.06652**	***
	(0.00750)		(0.00764)		(0.00786)		(0.00799)	
(Capital-labor ratio)$_{j,t}$	**0.00014**	***	**0.00015**	***	**0.00013**	***	**0.00014**	***
	(0.00002)		(0.00002)		(0.00002)		(0.00002)	
(R&D intensity)$_{j,t}$	**0.16421**	***	**0.09668**		**0.29959**	***	**0.23200**	***
	(0.06291)		(0.06360)		(0.06637)		(0.06737)	
(Export intensity)$_{j,t}$	**-0.00280**		**0.00432**		**-0.02594**	***	**-0.01644**	***
	(0.00568)		(0.00594)		(0.00617)		(0.00642)	
(Import penetration ratio)$_{j,t}$	**-0.00030**		**0.00030**		**-0.00051**		**-0.00020**	
	(0.00270)		(0.00270)		(0.00290)		(0.00291)	
(Preceding inbound FDI growth rate)$_{j,t}$					**0.00999**	***	**0.00951**	***
					(0.00094)		(0.00095)	
(Preceding outbound FDI growth rate)$_{j,t}$	**0.00003**		**-0.00009**		**0.00087**	***	**0.00087**	***
	(0.00019)		(0.00019)		(0.00023)		(0.00023)	
(FDI to China share)$_{j,t}$			**-0.00665**	***			**-0.00009**	
			(0.00218)				(0.00230)	
(FDI to Japan share)$_{j,t}$			**0.15543**	***			**0.14406**	**
			(0.05346)				(0.05739)	
(FDI to USA share)$_{j,t}$			**0.01282**	***			**0.01873**	***
			(0.00263)				(0.00285)	
(Preceding trade growth rate)$_{j,t}$	**0.00163**	***	**0.00172**	***	**0.00057**		**0.00086**	
	(0.00054)		(0.00054)		(0.00069)		(0.00071)	
(Trade with China share)$_{j,t}$			**-0.00622**				**0.01313**	
			(0.01058)				(0.01230)	
(Trade with Japan share)$_{j,t}$			**0.01947**	***			**0.02198**	***
			(0.00623)				(0.00672)	
(Trade with USA share)$_{j,t}$			**0.03667**	***			**0.02446**	***
			(0.00732)				(0.00805)	
Intercept	**-0.00523**		**-0.02127**	***	**0.07270**	***	**0.05665**	***
	(0.00507)		(0.00602)		(0.00535)		(0.00650)	
Number of observations	**331388**		**331388**		**286819**		**286819**	
F value	**8847.8**		**6964.1**		**7830.2**		**6164.5**	
R-squared	**0.5244**		**0.5246**		**0.5301**		**0.5303**	

Figure 1**: Trade and FDI Flows of East Asia***

A. Trade Volume, Exports and Imports (as share of GDP)

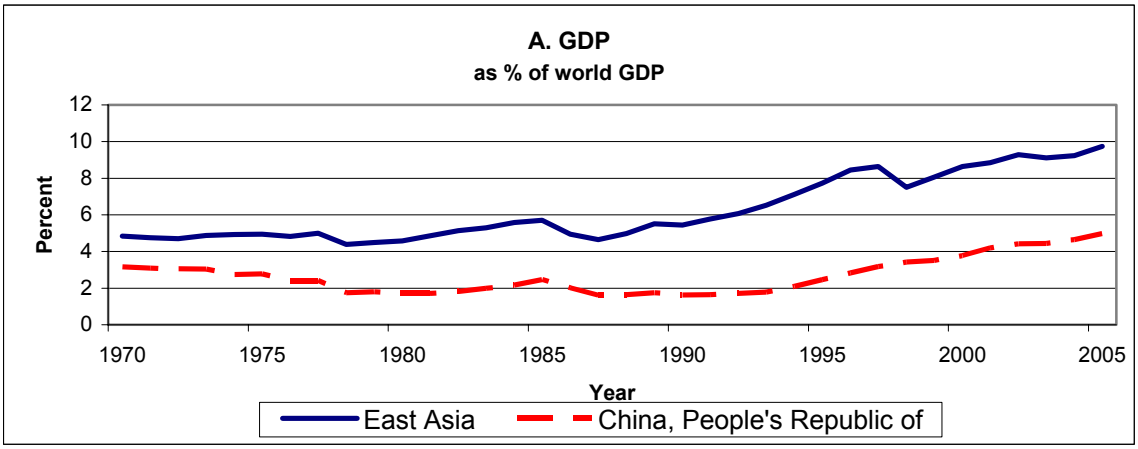


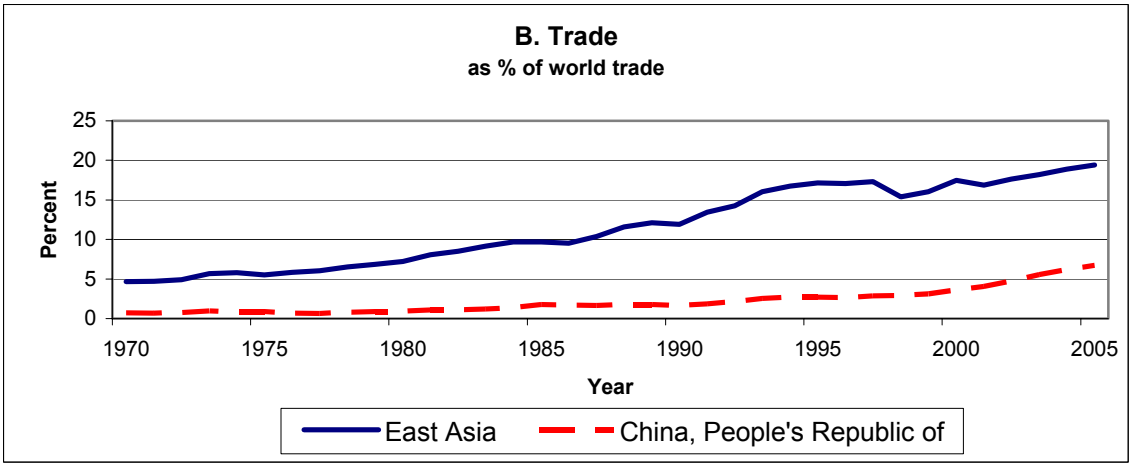
B. FDI flows (as share of GDP)

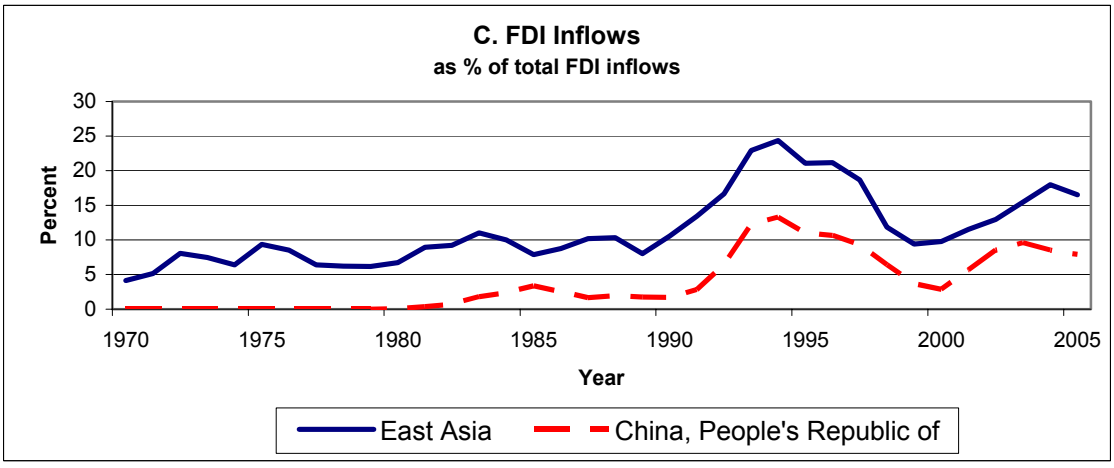


* East Asia comprises the People's Republic of China, Hong Kong, Taipei,China, Korea, Indonesia, Malaysia, Philippines, Singapore, and Thailand.
Source: World Bank, *World Development Indicators* 2006; UNCTAD, *World Investment Report* 2006; data for Taipei,China from ADB Statistical Database System.

Figure 2: **The Emergence of East Asia**







Source: World Bank, *World Development Indicators* 2006; UNCTAD, *World Investment Report* 2006; data for Taipei,China from ADB Statistical Database System.