

The Shifting Relationship Between Investment, Productivity and Growth in Asia

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What causes private investment to remain relatively low
in Asia?

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Outline

1. Introduction
- 2 Empirical analysis of growth drivers: pattern of growth in the recent past → relative importance of capital versus TFP
- 3 Empirical analysis of growth drivers: estimation of per worker GDP growth and TFP growth models
4. Priority areas for sustaining growth
5. Concluding observations

growth?

- Developing Asia was recently preoccupied with using fiscal and monetary policy to offset the negative impact of global financial crisis.
 - Theme of ADO 2010
- As the crisis recedes, short-run macroeconomic stabilization will give way to long-run growth as the top priority of Asian policymakers.
- The region has recovered much faster and stronger than expected.
 - Fiscal and monetary stimulus seem to have contributed to the recovery.

growth?

- The key question now becomes – can high growth be sustained beyond the current V-shaped recovery?
- More importantly, what must the region do to sustain growth in the long run?
 - What are the key obstacles to long-run growth and what are the key policy options for overcoming those obstacles?
 - E.g. weak investment \Rightarrow policy measures to improve investment climate
- High and sustainable long-run growth is indispensable for substantial and sustained poverty reduction.
 - Developing Asia has made substantial progress in reducing poverty but a lot of poverty still remains.

growth?

- The external environment may be less benign in the post-crisis period.
 - Weaker demand from traditional G3
 - Caveat \Rightarrow Robust demand from developing countries will partly offset
 - There may be greater volatility.
 - Industrialized countries are no longer the bedrock of stability that they were before the global crisis.
- Related to this, is it time to re-think the outward-looking export-led growth model?
 - There is no need for a fundamental re-think \Rightarrow openness will continue to yield enormous benefits for the region.
 - But, rebalancing is feasible and desirable (ADO 2009), as is strengthening intra-regional trade (ADO 2009 Update).
 - But long-run growth is determined by supply-side factors rather than demand-side factors.
- More fundamentally, precisely because of Asia's spectacular past success and transformation, some policies which worked well in the past will be less effective.
 - Policies that are effective at lower stage of economic development become less effective at a higher stage of economic development.
 - In particular, Asia has been transformed from a capital-scarce region to a capital-abundant region.

growth?

- Another big challenge for the region's long-run growth is the end of the demographic dividend.
 - Adverse implications for labor supply
 - Adverse implications for savings
- Productivity growth is likely to play a bigger role in the region's economic growth.
 - In the past, capital accumulation contributed substantially to the region's growth.
 - Especially in East Asia \Rightarrow high-savings, high-investment paradigm
 - Many economies are maturing and set to experience diminishing marginal returns to capital.
 - Even for poorer, capital-deficient countries, productivity growth magnifies the positive impact of investment on output.

growth?

- Developing Asia has been a high performance, high growth region.
 - The region has outperformed the rest of the world.
 - Many of the region's strong fundamentals – e.g. openness, macroeconomic discipline – will continue to serve the region well in the post-crisis period.
- Mapping out the region's future growth requires an understanding of the region's past growth.
 - In particular, what have been the drivers of the region's growth in the past?
 - Has the relative importance of the different drivers changed over time?
 - What does this evolution tell us about what will be the key growth drivers of the future?

2 Empirical analysis of growth drivers: pattern of growth in the recent past

- We perform two types of empirical analysis to explain the region's growth.
 - In this section, we look at the recent pattern of growth.
 - In the next section, we estimate per worker GDP growth models and TFP growth models.
- Our examination of the pattern of growth between 1992 and 2007 focuses on 2 key indicators.
 - Total factor productivity (TFP) growth
 - Growth accounting estimates which indicate the relative importance of different growth drivers

(2.1) Calculations of TFP growth

- TFP growth without labor quality adjustment
 - Actual labor shares: compensation of employees/GDP, National Account
 - Labor shares = 0.6

$$Y = AF(K, L)$$

$$\Delta \ln(TFP) = \Delta \ln(Y) - (1 - a_L)\Delta \ln(K) - a_L\Delta \ln(L)$$

- TFP growth with labor quality adjustment
 - Exponential labor quality adjustment

$$Y = AK^{1-\alpha_L}(hL)^{\alpha_L}$$

$$\Delta \ln(TFP) = \Delta \ln(Y) - (1 - \alpha_L)\Delta \ln(K) - \alpha_L[\Delta \ln(L) + 0.08\Delta h]$$

(2.2) Growth Accounting

- Growth accounting for the economic growth
 - of 12 Asian economies and of G-5 economies
 - Growth accounting for 5-year intervals
 - for the period of 1992 – 1997, 1997 – 2002, and 2002 – 2007.
 -
- Three different versions of TFP growth estimates are given:
 - Two without labor quality adjustment
 - One with labor quality adjustment (human capital consideration)
- The estimates are averaged into five groups:
 - non-Asian G5, Japan,
 - 4 NIEs (Newly Industrialized Economies: Hong Kong, Korea, Singapore, Taiwan),
 - China,
 - 7 ADEs (Asian Developing Economies: India, Indonesia, Malaysia, Pakistan, Philippines, Thailand, Vietnam).

Contributions of inputs

- In each table,
 - 5-year average growth rates of output, capital, and labor are shown for each interval
 - Contribution of capital is the percentage point of the output growth that is explained by the growth in capital
 - Contribution of labor is the percentage point of the output growth that is explained by the growth in labor
 - Contribution of TFP is the percentage point of the output growth that is explained by the TFP growth
 - Relative contribution of TFP is the relative portion of output growth that is explained by the TFP growth

Table 2-1a. Growth Accounting without labor quality adjustments: labor share = actual, 1992-1997

Period (1992-1997)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in :					
Output	2.35%	1.26%	6.99%	9.79%	5.64%
Capital	2.50%	3.29%	8.72%	11.45%	8.04%
Labor	0.50%	0.61%	2.14%	1.17%	2.33%
C1. labor share = actual					
Contribution of :					
Capital	1.03%	1.63%	4.42%	5.39%	5.57%
Labor	0.29%	0.31%	1.03%	0.62%	0.70%
TFP	1.04%	-0.68%	1.55%	3.78%	-0.63%
(Relative contribution of TFP)	44.00%	-53.52%	22.18%	38.63%	-11.24%
Ish1992	60.00%	60.00%	60.00%	60.00%	60.00%
labsh1992	60.06%	49.12%	49.71%	52.33%	30.06%

Table 2-1b. Growth Accounting without labor quality adjustments: labor share = actual, 1997-2002

Period (1997-2002)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in					
Output	2.58%	-0.19%	2.57%	7.69%	3.16%
Capital	3.23%	1.59%	4.95%	8.74%	3.92%
Labor	0.66%	-0.30%	1.49%	0.96%	2.46%
C1. labor share = actual					
Contribution of					
Capital	1.33%	0.78%	2.43%	4.10%	2.75%
Labor	0.38%	-0.15%	0.75%	0.51%	0.76%
TFP	0.86%	-0.81%	-0.61%	3.08%	-0.34%
(Relative contribution of TFP)	33.38%	431.85%	-23.75%	40.10%	-10.71%
Lsh1997	60.00%	60.00%	60.00%	60.00%	60.00%
labsh1997	57.89%	50.77%	50.20%	53.11%	30.68%

Table 2-1c. Growth Accounting without labor quality adjustments: labor share = actual, 2002-2007

Period (2002-2007)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in					
Output	2.32%	1.73%	5.48%	12.20%	6.58%
Capital	2.78%	1.10%	3.74%	10.63%	4.92%
Labor	0.77%	-0.07%	1.46%	0.85%	2.25%
C1. labor share = actual					
Contribution of					
Capital	1.16%	0.55%	1.84%	4.98%	3.44%
Labor	0.44%	-0.04%	0.72%	0.45%	0.69%
TFP	0.72%	1.22%	2.91%	6.76%	2.45%
(Relative contribution of TFP)	31.06%	70.46%	53.11%	55.44%	37.25%
Lsh2002	60.00%	60.00%	60.00%	60.00%	60.00%
labsh2002	59.05%	50.97%	51.46%	53.11%	30.55%

Table 2-2a. Growth Accounting without labor quality adjustments: labor share = 0.6, 1992-1997

Period (1992-1997)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in :					
Output	2.35%	1.26%	6.99%	9.79%	5.64%
Capital	2.50%	3.29%	8.72%	11.45%	8.04%
Labor	0.50%	0.61%	2.14%	1.17%	2.33%
C2. labor share=0.6					
Contribution of:					
Capital	1.00%	1.32%	3.49%	4.58%	3.21%
Labor	0.30%	0.37%	1.28%	0.70%	1.40%
TFP	1.06%	-0.42%	2.22%	4.51%	1.03%
(Relative contribution of TFP)	44.90%	-33.20%	31.77%	46.10%	18.26%
Ish1992	60.00%	60.00%	60.00%	60.00%	60.00%
labsh1992	60.06%	49.12%	49.71%	52.33%	30.06%

Table 2-2b. Growth Accounting without labor quality adjustments: labor share = 0.6, 1997-2002

Period (1997-2002)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in					
Output	2.58%	-0.19%	2.57%	7.69%	3.16%
Capital	3.23%	1.59%	4.95%	8.74%	3.92%
Labor	0.66%	-0.30%	1.49%	0.96%	2.46%
C2. labor share=0.6					
Contribution of:					
Capital	1.29%	0.64%	1.98%	3.50%	1.57%
Labor	0.39%	-0.18%	0.89%	0.58%	1.47%
TFP	0.90%	-0.65%	-0.30%	3.62%	0.12%
(Relative contribution of TFP)	34.73%	344.17%	-11.74%	47.07%	3.77%
Lsh1997	60.00%	60.00%	60.00%	60.00%	60.00%
labsh1997	57.89%	50.77%	50.20%	53.11%	30.68%

Table 2-2c. Growth Accounting without labor quality adjustments: labor share = 0.6, 2002-2007

Period (2002-2007)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in					
Output	2.32%	1.73%	5.48%	12.20%	6.58%
Capital	2.78%	1.10%	3.74%	10.63%	4.92%
Labor	0.77%	-0.07%	1.46%	0.85%	2.25%
C2. labor share=0.6					
Contribution of:					
Capital	1.11%	0.44%	1.49%	4.25%	1.97%
Labor	0.46%	-0.04%	0.87%	0.51%	1.35%
TFP	0.74%	1.33%	3.11%	7.44%	3.26%
(Relative contribution of TFP)	32.10%	77.12%	56.74%	60.96%	49.53%
Lsh2002	60.00%	60.00%	60.00%	60.00%	60.00%
labsh2002	59.05%	50.97%	51.46%	53.11%	30.55%

Findings: Tables 2-1 and 2-2

- **Main source of growth**
 - The main source of growth was capital stock until 2002.
 - **After 2002, the main source of growth has shifted to TFP growth.**
 - Throughout whole period, the contribution of labor was minimal for all Asian economies
- **Role of TFP growth**
 - The contribution of TFP growth for the Asian economies are lower when actual labor shares are used (since higher weights are applied to capital stock growth which was very high)
 - The relative contribution of TFP was lower than those of the non-Asian G5 till 2002. However, **estimates and contributions of TFP growth seem to have increased significantly in the period of 2002 – 2007 for the 4 NIEs and 7 ADEs.**
 - The TFP growth estimates for the 11 Asian economies for this sub-period are even higher than those of the non-Asian G5.

Findings: Tables 2-1 and 2-2 (cont'd)

- **China**

- The estimates and contribution of China's TFP growth are strongly positive throughout the whole period, exhibiting a very different pattern compared to those of the Asian economies in a similar developmental stage.

Contributions of inputs

- In each table,
 - 5-year average growth rates of output, capital, and labor are shown for each interval
 - Contribution of capital is the percentage point of the output growth that is explained by the growth in capital
 - Contribution of labor is the percentage point of the output growth that is explained by the growth in labor
 - Contribution of labor is the percentage point of the output growth that is explained by the growth in human capital
 - Contribution of TFP is the percentage point of the output growth that is explained by the TFP growth
 - Relative contribution of TFP is the relative portion of output growth that is explained by the TFP growth

Table 2-3a. Growth Accounting with labor quality adjustments: labor share = 0.6, 1992-1997

Period (1992-1997)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in :					
Output	2.35%	1.26%	6.99%	9.79%	5.64%
Capital	2.50%	3.29%	8.72%	11.45%	8.04%
Labor	0.50%	0.61%	2.14%	1.17%	2.33%
Human2	0.88%	0.68%	0.49%	1.00%	0.64%
C4. exponential labor- quality adjustment					
Contribution of:					
Capital	1.00%	1.32%	3.49%	4.58%	3.21%
Labor	0.30%	0.37%	1.28%	0.70%	1.40%
Human2	0.53%	0.41%	0.29%	0.60%	0.38%
TFP	0.53%	-0.83%	1.93%	3.91%	0.65%
(Relative contribution of TFP)	22.38%	-65.37%	27.60%	39.96%	11.46%
lsh1992	60.00%	60.00%	60.00%	60.00%	60.00%
labsh1992	60.06%	49.12%	49.71%	52.33%	30.06%

Table 2-3b. Growth Accounting with labor quality adjustments: labor share = 0.6, 1997-2002

Period (1997-2002)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in					
Output	2.58%	-0.19%	2.57%	7.69%	3.16%
Capital	3.23%	1.59%	4.95%	8.74%	3.92%
Labor	0.66%	-0.30%	1.49%	0.96%	2.46%
Human2	0.80%	0.48%	0.67%	0.88%	0.71%
C4. exponential labor- quality adjustment					
Contribution of:					
Capital	1.29%	0.64%	1.98%	3.50%	1.57%
Labor	0.39%	-0.18%	0.89%	0.58%	1.47%
Human2	0.48%	0.29%	0.40%	0.53%	0.43%
TFP	0.41%	-0.94%	-0.71%	3.09%	-0.31%
(Relative contribution of TFP)	16.06%	496.47%	-27.41%	40.19%	-9.78%
Lsh1997	60.00%	60.00%	60.00%	60.00%	60.00%
labsh1997	57.89%	50.77%	50.20%	53.11%	30.68%

Table 2-3c. Growth Accounting with labor quality adjustments: labor share = 0.6, 2002-2007

Period (2002-2007)	non-Asian G5	Japan	4 NIEs	China	7 ADEs
Growth in					
Output	2.32%	1.73%	5.48%	12.20%	6.58%
Capital	2.78%	1.10%	3.74%	10.63%	4.92%
Labor	0.77%	-0.07%	1.46%	0.85%	2.25%
Human2	0.47%	0.45%	0.82%	0.72%	0.84%
C4. exponential labor- quality adjustment					
Contribution of:					
Capital	1.11%	0.44%	1.49%	4.25%	1.97%
Labor	0.46%	-0.04%	0.87%	0.51%	1.35%
Human2	0.28%	0.27%	0.49%	0.43%	0.51%
TFP	0.45%	1.06%	2.60%	7.01%	2.74%
(Relative contribution of TFP)	19.53%	61.55%	47.47%	57.45%	41.62%
Lsh2002	60.00%	60.00%	60.00%	60.00%	60.00%
labsh2002	59.05%	50.97%	51.46%	53.11%	30.55%

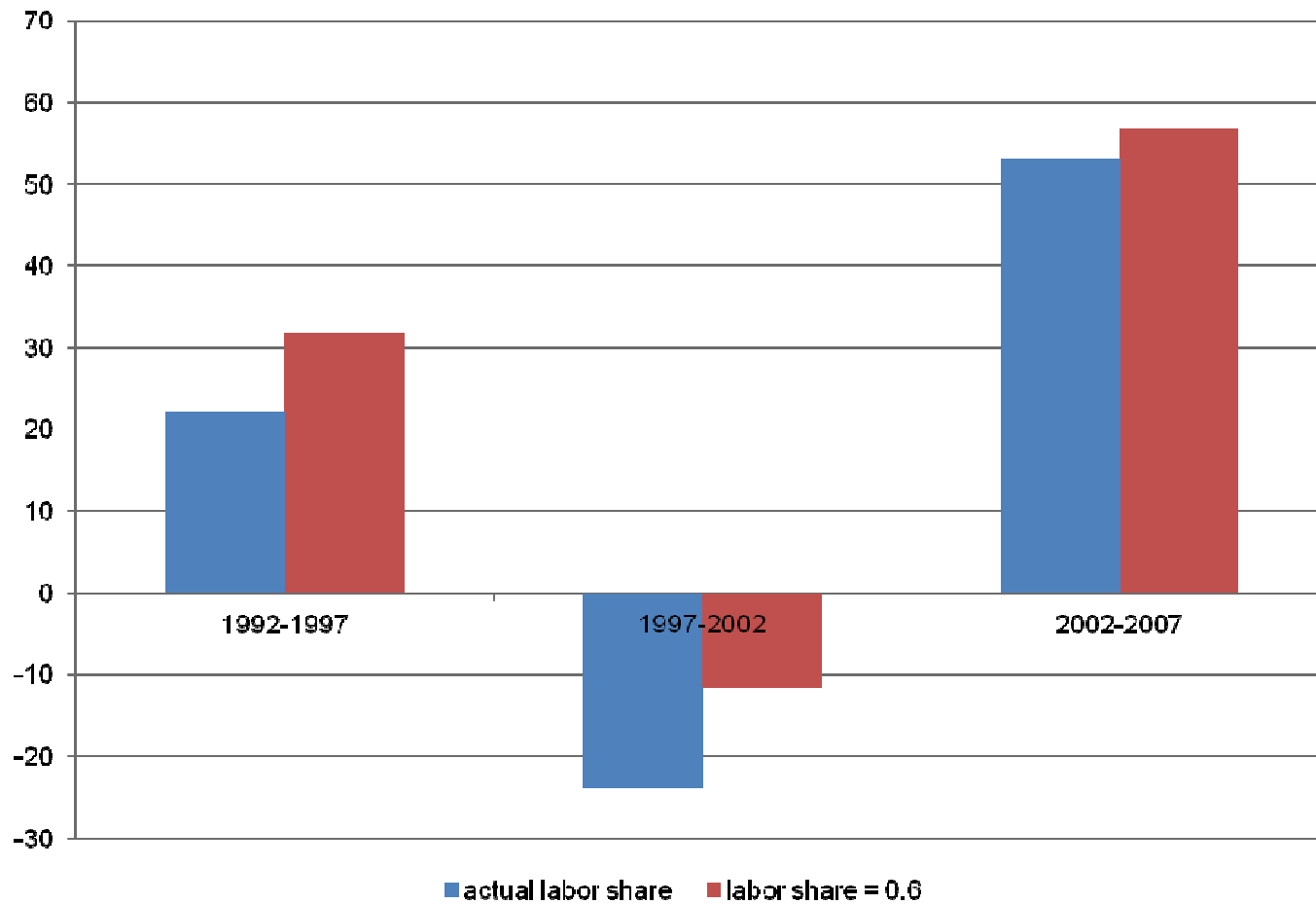
Findings: Table 2-3

- Main source of growth
 - The main source of growth was capital stock until 2002.
 - After 2002, **the main source of growth has shifted to TFP growth.**
 - Throughout whole period, the contribution of labor was minimal for all Asian economies
 - **Growths in human capital for 4 NIEs were lower than the G5 until 2002, but turned higher afterwards. As for the 7 ADEs, the growth in human capital was higher than all other groups(except for China) for all periods. (see human2)**

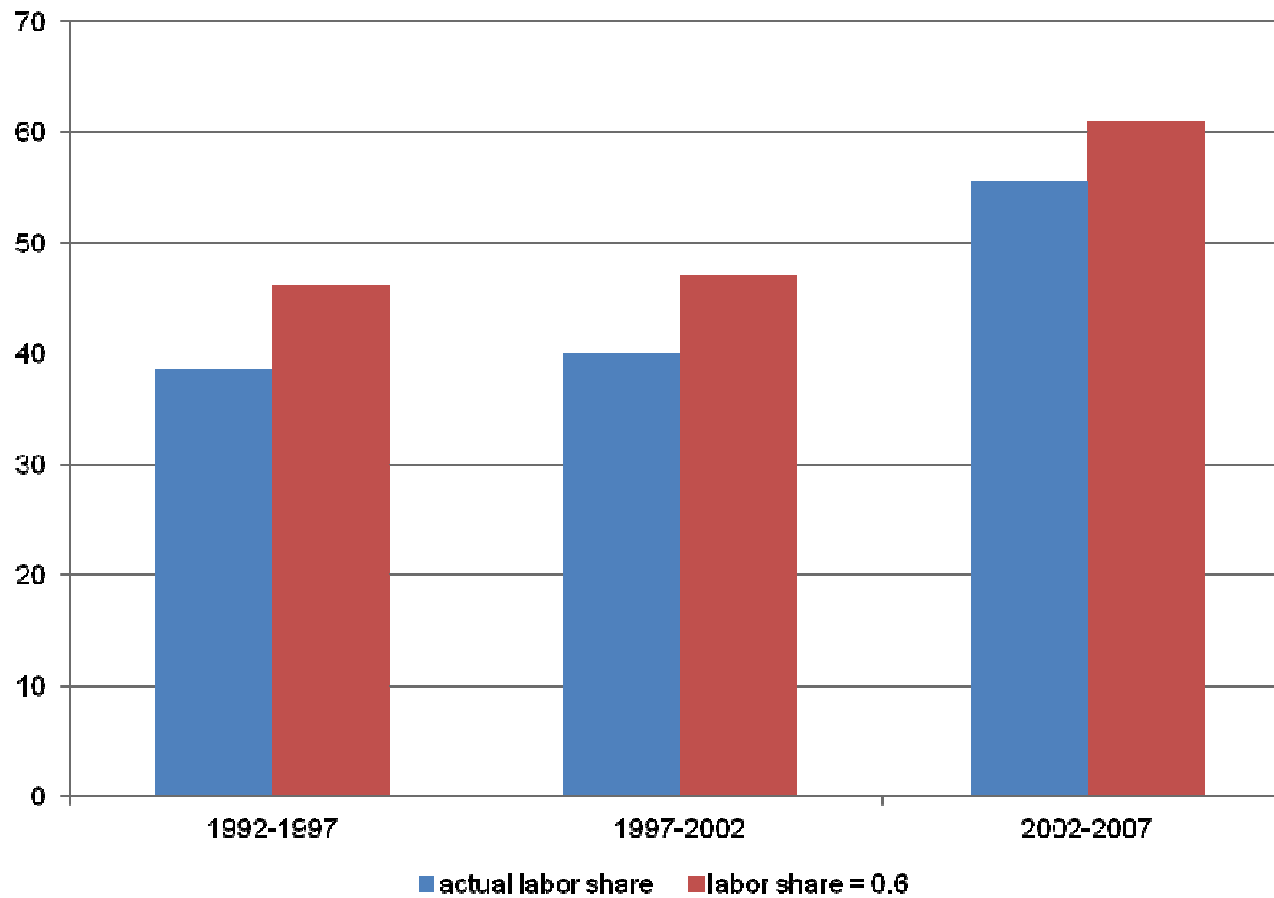
Findings: Table 2-3 (cont'd)

- Role of TFP growth
 - As for the 4 NIEs, the relative contribution of TFP growth was sizeable in the 1992 – 1997 period, but dropped during the post-crisis period of 1997 – 2002. However, the absolute size and relative contribution of TFP became dominant after 2002.
 - As for the 7 ADEs, the TFP growth either negative or minimal till 2002. Just as in 4 NIEs, the growth in TFP became a dominant factor in growth after 2002.
 - The estimates and contributions of TFP growth seem to have increased significantly in the period of 2002 – 2007 for the 4 NIEs and 7 ADEs.
 - The TFP growth estimates for the 11 Asian economies for this sub-period are even higher than those of the non-Asian G5.
- China
 - The estimates and contribution of China's TFP growth are strongly positive throughout the whole period, exhibiting a very different pattern compared to those of the Asian economies in a similar developmental stage.

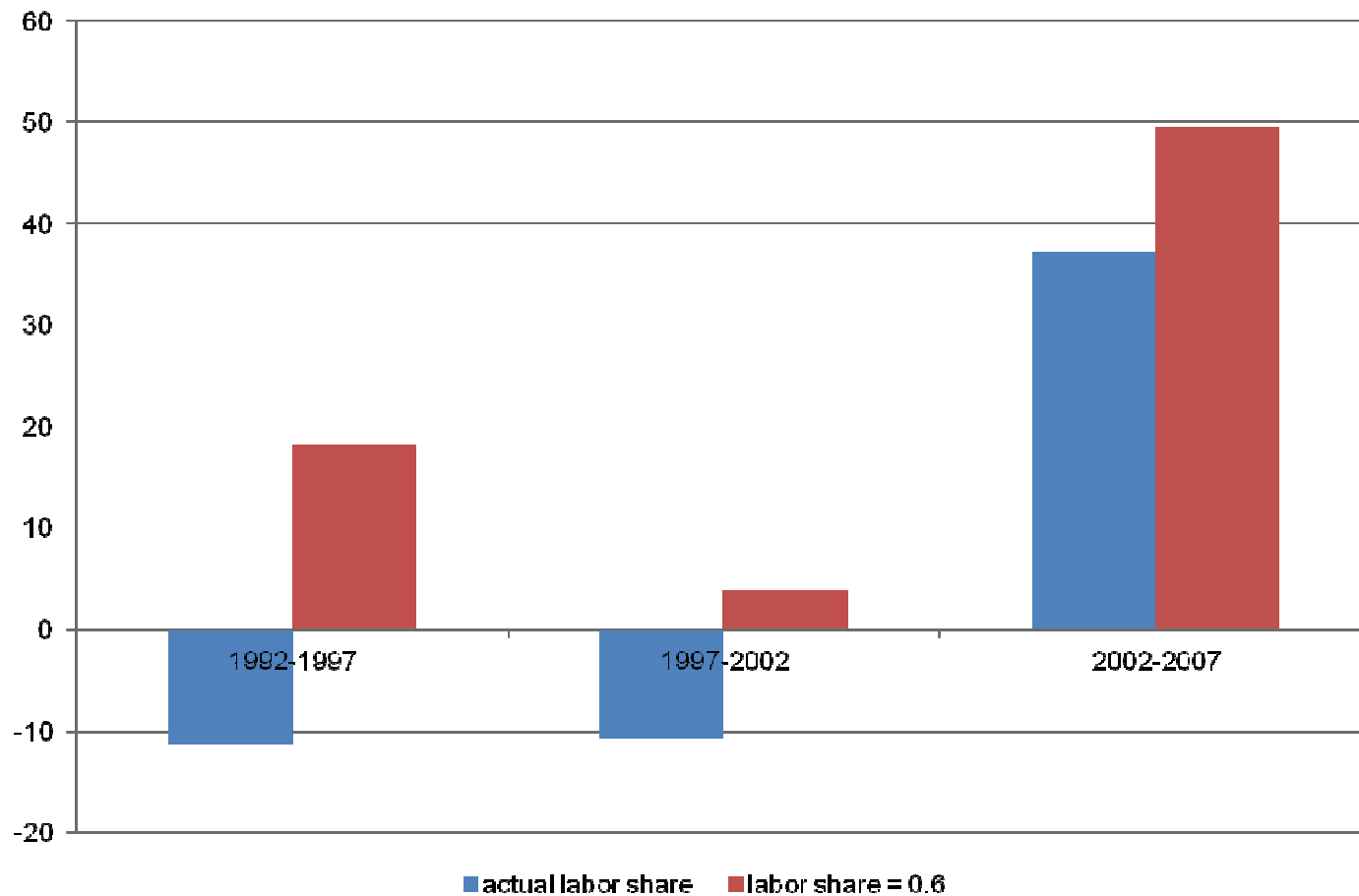
Relative contribution of TFP growth to output growth, NIEs, labor not adjusted for human capital



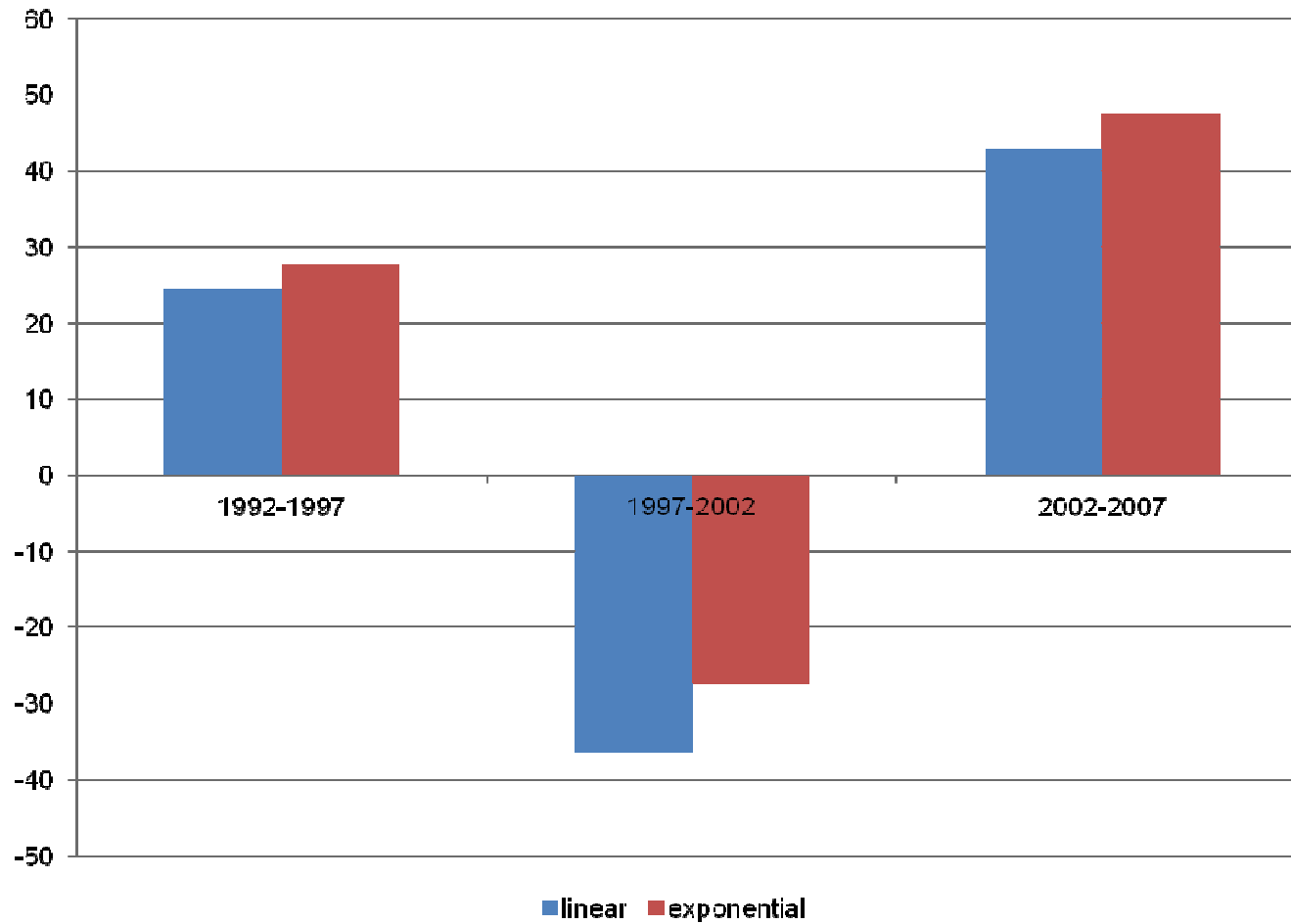
Relative contribution of TFP growth to output growth, PRC, labor not adjusted for human capital



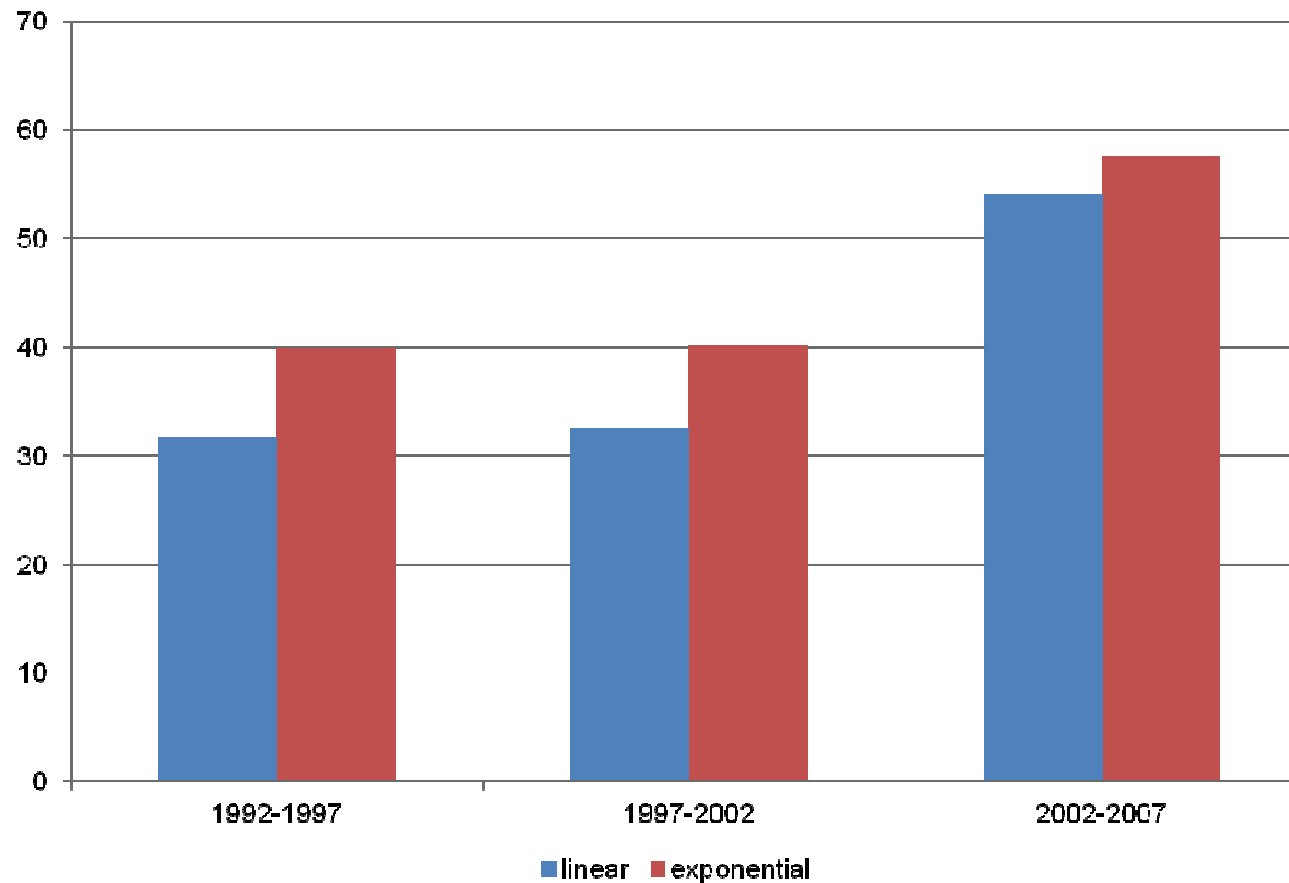
Relative contribution of TFP growth to output growth, 7 developing Asian economies, labor not adjusted for human capital



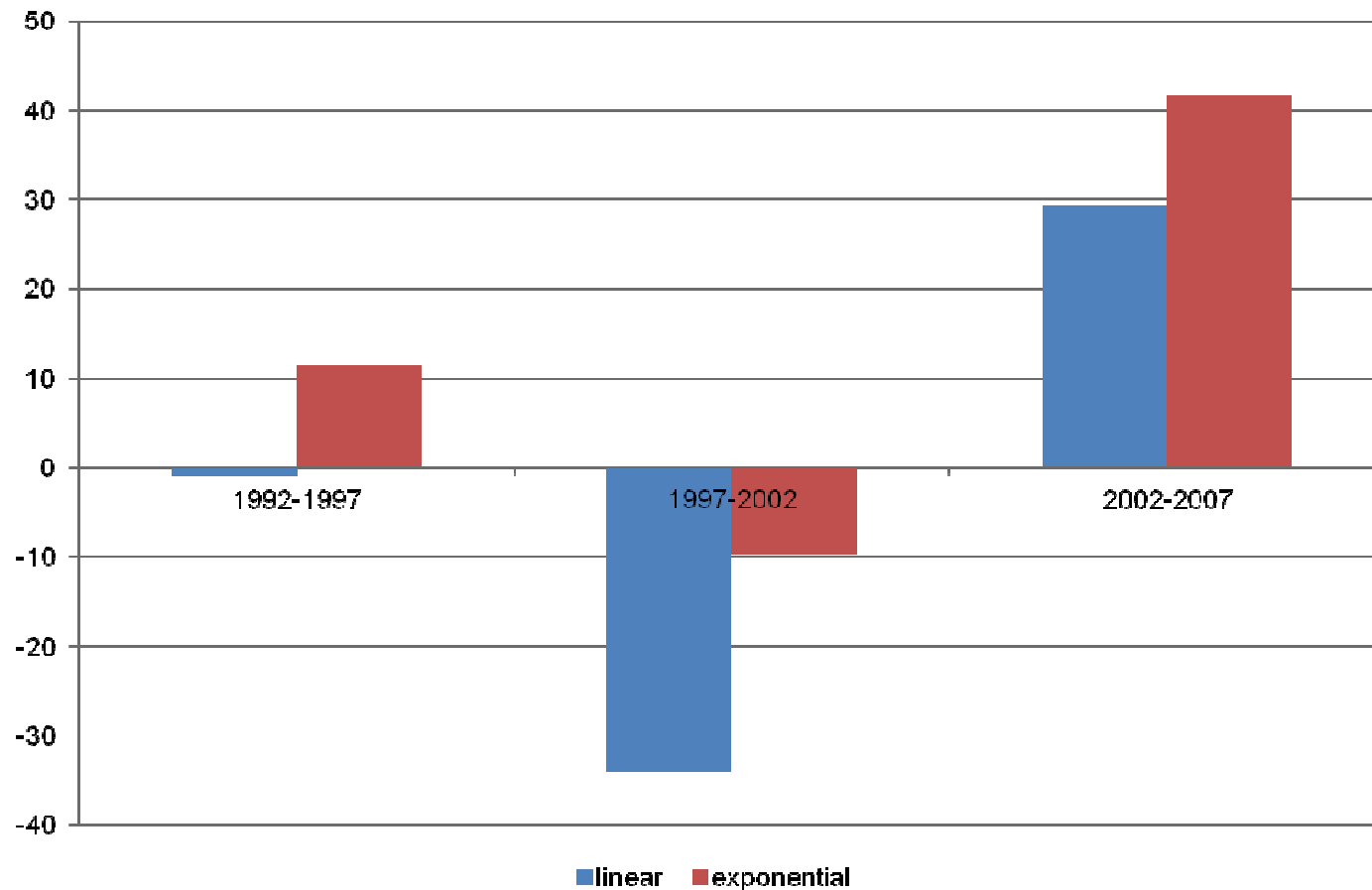
Relative contribution of TFP growth to output growth, NIEs, labor adjusted for human capital



Relative contribution of TFP growth to output growth, PRC, labor adjusted for human capital



Relative contribution of TFP growth to output growth, 7 developing Asian economies, labor adjusted for human capital



of per worker GDP growth and TFP growth models

- In the previous section, we analyzed drivers of growth by estimating per worker GDP growth and TFP growth models
- In this section, we explain per worker GDP growth and TFP growth through various fundamental determinants of growth.
- The fundamental determinants include capital, human capital, initial per capita GDP relative to US, openness, government effectiveness, geography, population, life expectancy, inflation rate, current account balance.
- The regression results can inform us about the relative importance of different determinants in driving Asia's growth in the past.

(3.1) Literature on the determinants of GDP and TFP growth

- Bosworth and Collins (2003)
 - empirical results in identifying sources of labor productivity growth and TFP growth based on international country-level panel data set.
 - Catch-up effect, openness, geographical factors, and institutional quality are shown to be influential in the empirical results on TFP growth equation estimations.
- Human capital
 - As a factor of growth: Benhabib and Spiegel (1994) or Pritchett (2001).
 - ‘Level of human capital’ influencing productivity growth: endogenous growth literature. Benhabib and Spiegel (1994), Dinopoulos and Thompson (2000), and Bils and Klenow (2000)

(3.2) Baseline model and Estimation methods

- Two-input production function with Cobb-Douglas technology and with constant returns to scale. ($h = \exp(0.08 \cdot \text{edu})$)

$$Y = AK^{1-\alpha_1}(hL)^{\alpha_1}$$

- Technology dynamics, Bosworth and Collins (2003)

$$\dot{A}/A = F(\text{catch-up effect}, \text{human capital}, \text{other determinants})$$

- **Human capital is therefore affecting the output through two channels.**

- It enters as a factor of input on one hand and also enters as an additional factor that contributes to the growth in the technological level on the other.

- Empirical equation with human capital consideration as a baseline model equation.

$$\Delta \ln(Y/L)_{it} = \beta_0 + \beta_1 \Delta \ln(K/L)_{it} + \beta_2 \ln\left(\frac{Y_{i0}}{Y_{US,0}}\right) + \beta_3 \text{human} + \gamma' Z + \text{dum_yr}_t + \varepsilon_{it}$$

(3.2) Baseline model and Estimation methods (cont'd)

- A 'five-year interval' data set
 - which consists of average values or initial values of variables from each non-overlapping five-year intervals within the full sample
- Initial values of each respective interval
 - are considered for the variables representing initial conditions such as initial income per capita relative to the U.S. level, initial life expectancy relative to the U.S., and initial population.
- Panel regression with time-fixed effect
 - is performed on the five-year interval panel data set.

(3.3) Data Description and Construction of Variables

- **Unbalanced panel of 125 developed and developing countries**
- **Data Sources**
 - GDP, workers: Penn World Tables (PWT version 6.3)
 - Capital stock series
 - are estimated from investment series from PWT based on a perpetual inventory method.
 - Human capital series are education attainment data from Barro and Lee (2010).
 - Since the data set only provides values for every 5 years, the data are interpolated to fill in the intervening missing values.
 - Labor shares are assumed to be 0.6
 - WDI, WGI (World Bank)

(3.4) Empirical results

- In this section, we report and discuss the key findings from our per worker GDP growth and TFP growth regressions.
- Furthermore, we include interaction dummies to compare the effect of some variables in Asian countries versus other countries.
- Above all, the results can inform us about the relative importance of the different determinants – e.g. physical capital and human capital – in driving developing Asia's growth.

<Table 3-1> Per worker GDP growth regressions: five-year average growth (dependent variable = $\ln(Y/L)$): baseline models

VARIABLES	(1) a1	(2) a2	(3) a3	(4) a4	(5) a5	(6) a6
mdkkl	0.448*** (12.23)	0.428*** (11.26)	0.428*** (11.23)	0.429*** (11.08)	0.403*** (10.06)	0.404*** (10.14)
lny_us	-0.010*** (-5.186)	-0.010*** (-5.396)	-0.010*** (-4.749)	-0.010*** (-4.231)	-0.014*** (-4.748)	-0.013*** (-5.040)
lnlifes			-0.000 (-0.00995)	-0.001 (-0.0634)	0.005 (0.440)	
mhuman	0.004*** (5.030)	0.004*** (5.158)	0.004*** (5.028)	0.004*** (4.811)	0.004*** (4.498)	0.004*** (4.764)
lnpop		0.002* (1.855)	0.002* (1.813)	0.002* (1.788)	0.002 (1.590)	0.002* (1.787)
mtropic	-0.010*** (-2.910)	-0.009*** (-2.836)	-0.009*** (-2.808)	-0.009*** (-2.850)	-0.008** (-2.385)	-0.008** (-2.449)
mopenc	0.005** (2.134)	0.009*** (2.817)	0.009*** (2.754)	0.009*** (2.834)	0.008** (2.453)	0.008** (2.533)
minflat_cpi				0.000 (1.007)	0.000 (1.228)	
mca_gdp				-0.000 (-0.158)	-0.000 (-0.00117)	-0.000 (-0.0113)
mgoveff					0.006** (2.271)	0.005** (2.109)
Observations	315	315	315	315	315	315
Adjusted R-squared	0.450	0.455	0.453	0.451	0.459	0.459

Findings: Per worker GDP growth regressions (baseline model)

- **Table 3-1**

- **In full sample regressions, following results were robust.**

- Growth in capital stock per worker, population size, human capital, openness, government effectiveness positively contributed to the growth in GDP per worker
- Lower the initial per capita GDP relative to the US, the less the tropical area, the growth in GDP per worker were higher
- There is evidence of convergence (catch-up effect)

- **Variables that were not significant were**

- Life expectancy, inflation rate, current account balance relative to GDP

(3.3) TFP Growth Regression

- Empirical equation with human capital consideration as a baseline model equation.

$$\Delta \ln(TFP)_{it} = \beta_0 + \beta_1 \ln\left(\frac{Y_{i0}}{Y_{US,0}}\right) + \beta_2 human + \gamma' Z + dum_{yr_t} + \varepsilon_{it}$$

<Table 3-3> TFP growth regressions: five-year average growth
(dependent variable = $d\ln(\text{TFP})$): baseline models

VARIABLES	(1) a1	(2) a2	(3) a3	(4) a4	(5) a5
lny_us	-0.010*** (-5.536)	-0.014*** (-5.895)	-0.015*** (-5.373)	-0.014*** (-4.882)	-0.012*** (-4.282)
lnlifes			0.005 (0.429)	0.005 (0.396)	-0.009 (-0.693)
mhuman	0.004*** (5.291)	0.004*** (5.045)	0.004*** (4.860)	0.004*** (4.645)	0.004*** (4.975)
lnpop			0.001 (1.163)	0.001 (1.142)	0.002 (1.603)
mtropic	-0.011*** (-3.325)	-0.009*** (-2.849)	-0.009*** (-2.676)	-0.009*** (-2.703)	-0.009*** (-2.662)
mopenc	0.006** (2.346)	0.005** (2.048)	0.007** (2.248)	0.007** (2.338)	0.008** (2.537)
minflat_cpi				0.000 (1.011)	0.000 (0.829)
mca_gdp				-0.000 (-0.207)	-0.000 (-0.237)
mgoveff		0.006** (2.414)	0.006** (2.288)	0.006** (2.342)	
mcontrolcorr					0.004** (1.994)
Observations	315	315	315	315	309
Adjusted R-squared	0.186	0.199	0.198	0.196	0.183

Findings: TFP growth regressions (baseline model)

- **Table 3-3**
 - **In full sample regressions, following results were robust.**
 - Human capital, openness, government effectiveness positively contributed to the TFP growth
 - Lower the initial per capita GDP relative to the US, the less the tropical area, the TFP growth
 - **Variables that were not significant were**
 - Life expectancy, population size, inflation rate, current account balance relative to GDP

<Table 3-4> TFP growth regressions: five-year average growth
(dependent variable = $d\ln(\text{TFP})$): differential effects

VARIABLES	(1) a1	(2) a2	(3) a3	(4) a4	(5) a5
lny_us	-0.014*** (-5.895)	-0.014*** (-6.036)	-0.014*** (-6.071)	-0.015*** (-6.198)	-0.015*** (-6.432)
mhuman	0.004*** (5.045)	0.004*** (5.141)	0.004*** (5.267)	0.004*** (5.219)	0.005*** (5.217)
mhuman_a		0.001* (1.822)			-0.003 (-1.205)
mhuman_o		-0.000 (-0.592)			-0.001 (-0.743)
mtropic	-0.009*** (-2.849)	-0.011*** (-3.235)	-0.011*** (-3.281)	-0.011*** (-3.120)	-0.011*** (-2.992)
mopenc	0.005** (2.048)	0.004 (1.400)	0.004 (1.444)	0.003 (0.979)	0.001 (0.295)
mopenc_a			0.002** (2.299)		0.006 (1.640)
mopenc_o			-0.000 (-0.152)		0.004 (1.193)
mgoveff	0.006** (2.414)	0.006** (2.249)	0.005** (1.986)	0.009*** (2.716)	0.008** (2.284)
mgoveff_a				0.004 (0.816)	0.005 (0.833)
mgoveff_o				-0.006* (-1.817)	-0.007 (-1.415)

Findings: TFP growth regressions (differential region effects)

- **Table 3-4**
 - **Differential impact in three different groups of countries (OECD, 12 Asian, the rest of the world)**
 - **The model (2) includes interaction dummies :**
 - $mhuman_a = mhuman * dummy_asia12$
 - $mhuman_o = mhuman * dummy_oecd$
 - **The model (3) includes interaction dummies :**
 - $mopenc_a = mopenc * dummy_asia12$
 - $mopenc_o = mopenc * dummy_oecd$
 - **The model (4) includes interaction dummies :**
 - $mgoveff_a = mgoveff * dummy_asia12$
 - $mgoveff_o = mgoveff * dummy_oecd$

Findings: TFP growth regressions (differential region effects, cont'd)

- **Table 3-4**
 - **Differential impact in three different groups of countries (OECD, 12 Asian, the rest of the world)**
 - **The model (2) includes interaction dummies :**
 - The role of human capital is greater in the 12 Asian economies than other countries.
 - **The model (3) includes interaction dummies :**
 - The role of openness is greater in the 12 Asian economies than other countries.
 - **The model (4) includes interaction dummies :**
 - The role of government effective is greater for the non-OECD economies compared to the OECD economies.

4 Priority areas for sustaining growth

- The empirical analysis of the previous two sections confirms the importance of supply-side factors in sustaining growth.
- In particular, given the growing importance of TFP growth in the region's recent economic growth, the key to sustain growth lies in fostering productivity.
- In the context of developing Asia, four areas – infrastructure, human capital, financial development and trade – will be pivotal to promoting TFP growth.

4 Priority areas: Human capital

- The region's rapid demographic transition means the end of the demographic dividend in the near future.
 - Caveat – different countries are at different stages of the demographic transition.
- Therefore, the region's growth will have to be based on better rather than more workers.
 - The empirical analysis of this paper supports this point – i.e. **small contribution of labor to growth and significance of human capital in TFP growth.**
- The region's education systems have to do a much better job of producing workers with the "right" skills
 - It is true that the region has invested heavily in education.
 - However, much of this investment is wasted and misallocated.

4 Priority areas: Trade

- Trade and more generally, openness, will continue to be a key growth driver for the region, but intra-regional trade may grow in significance.
 - This reflects the rising income levels and purchasing power of the region, and the relative decline of G3.
- Trade delivers substantial dynamic efficiency and productivity benefits by forcing firms and industries to raise their game to survive foreign competition.
 - The empirical analysis of this paper supports this point – the significance of openness for TFP growth.
- Regional integration which moves countries toward a single market will further expand such dynamic gains.

4 Priority areas: Infrastructure

- Infrastructure such as better transportation and communication networks improves the productivity of all firms and industries.
 - Therefore, good infrastructure also raises the returns to private-sector investment.
- A large part of developing Asia still suffers from serious infrastructure deficit.
 - A long-standing barrier to India's growth is its inadequate infrastructure.
 - Even in PRC, the interior provinces need more and better infrastructure.
- There is a lot of scope for regional cooperation and integration in infrastructure in the provision of infrastructure.

4 Priority areas: Financial development

- Investment will continue to be a key growth driver for the region but efficiency of investment will matter more.
- Therefore, the region's sound and efficient financial systems that allocate capital to its most productive uses.
- The region has made great strides in financial development since the Asian crisis but there is still a lot of scope for improvement.
 - The need for deeper bond markets and greater SME access to credit.
 - Regional financial integration, especially for bond markets, can create bigger, deeper and broader financial market

5 Concluding observations

- Developing Asia has an enviable record of rapid growth in the past.
 - Fastest-growing region in the world
 - Got many of the fundamentals “right”
 - Rapid growth has contributed to massive poverty reduction
- The region has recovered well from global financial crisis but faces the challenge of sustaining long-run growth in the post-crisis period.
 - Faces a less benign external environment as well as aging and other big shifts
 - Region is still home to two-thirds of the world’s poor
- This growth has been the consequence of a sustained increase in productive capacity.
 - Capital accumulation and TFP growth have both played a role

5 Concluding observations

- Policies which delivered rapid sustained growth in yesteryear's low-income, capital-scarce Asia will be less effective in today's middle-income, capital abundant Asia.
- In particular, growth will increasingly have to come from improving TFP growth rather than factor accumulation.
 - Evidence of this study shows that TFP growth is growing in relative importance as the driver of economic growth.
 - Therefore, policies that promote TFP growth will hold the key to sustaining growth in the post-crisis period.
- In the context of promoting TFP growth, some key areas that merit the attention of policymakers include:
 - Infrastructure
 - Human capital