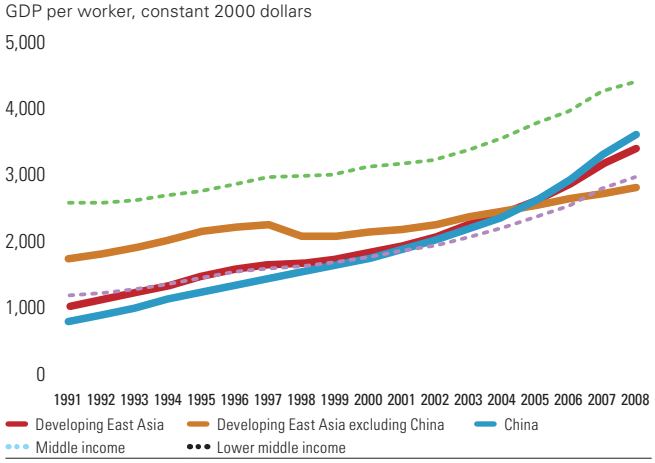
VII. INNOVATION FOR STRONGER PRODUCTIVITY GROWTH

Faster growth in productivity is the key driver of economic growth in East Asia, especially as demographics become less favorable and countries move through middle-income status. Innovation, that is the transmission, absorption and commercialization of new ideas, will be crucial for this productivity growth. To innovate, firms need adequately educated and skilled workers, who can absorb and use innovative knowledge and processes. And both workers and companies need to be together for ideas to be transmitted and implemented. Cities therefore will need to become the true crucibles of innovation by exploiting the proximity of companies and workers, acting as knowledge exchanges, and providing capital for innovative but risky projects.

Productivity growth is lagging in most countries in the region

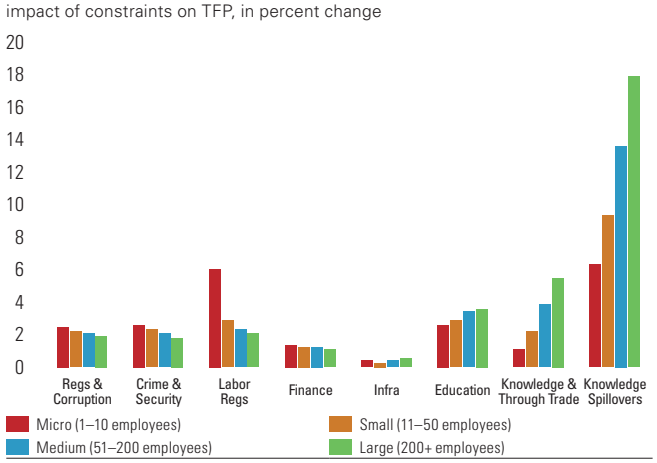
The middle-income countries of East Asia other than China have recorded slower productivity growth than countries with similar incomes in other regions. This slowdown appears to have accelerated since the 1997–98 Asian financial crisis (Figure 70). Boosting the pace of productivity growth will be crucial for the middle-income countries to move to high-income status.

Figure 70. Output per worker in East Asia's middle-income countries other than China grew more slowly than in other regions



Source: Bloom and Finlay (2009).

Figure 71. Innovation and education have the biggest impact on productivity in East Asia



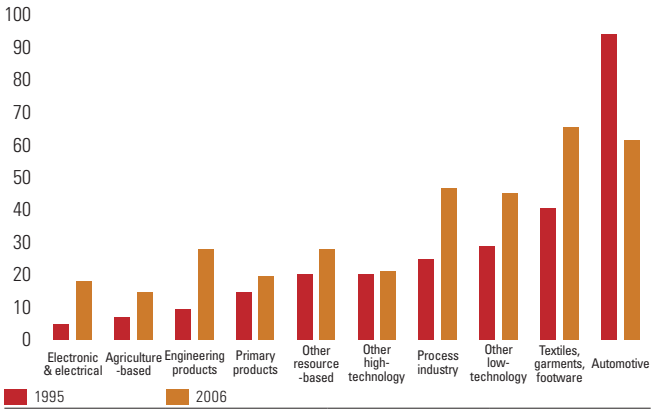
Sources: Enterprise Surveys and Dutz and O'Connell (2011).
Note: Knowledge spillovers denote a composite factor that combines different ways of innovation transmission: introduction of new products, use of internet, etc.

Behind the aggregate slowdown, there is a substantial diversity in productivity across countries. This diversity reflects a variety of factors. Of those that are firm-specific, the level of innovation efforts a firm undertakes is the most important determinant of total factor productivity. Empirical evidence confirms that firms that spend on research and development have approximately 18 percent higher TFP than firms that do not, and product innovation is associated with 6 percent higher TFP. Indicators of access to more advanced technology—such as having internationally-recognized quality certifications or using foreign-licensed technology—similarly show higher TFP for more advanced firms.

Without educated workers, ideas would not emerge, get transmitted, adopted or implemented. One of the two most important determinants of firm-level innovation in East Asia is the education of workers. Other factors, such as the general investment climate, the regulatory system, crime rates, and restrictiveness of labor laws are also

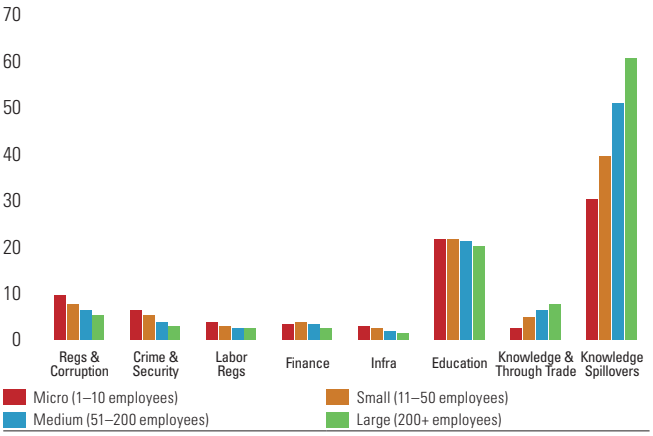
important but are less significant (Figure 73). Availability and accessibility of financing also plays a role, especially for smaller firms. These are followed by regulations creating a competitive environment, and availability of innovation financing. This chapter turns to these components of innovation framework in more detail, after discussing the role of cities in facilitating innovation.

Figure 72. Competition with South Asia has intensified in all goods categories, except automotive



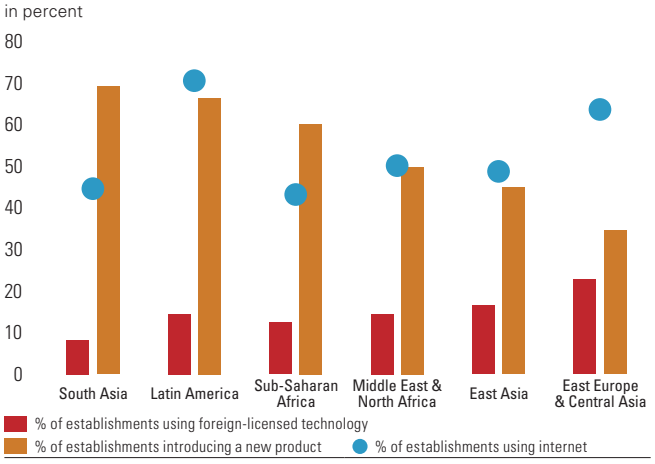
Source: Yusuf and Nabeshima (2010).
Note: Technology classification is based on Lall (2000).

Figure 73. Firm-level innovation is heavily dependent on knowledge spillovers and education…



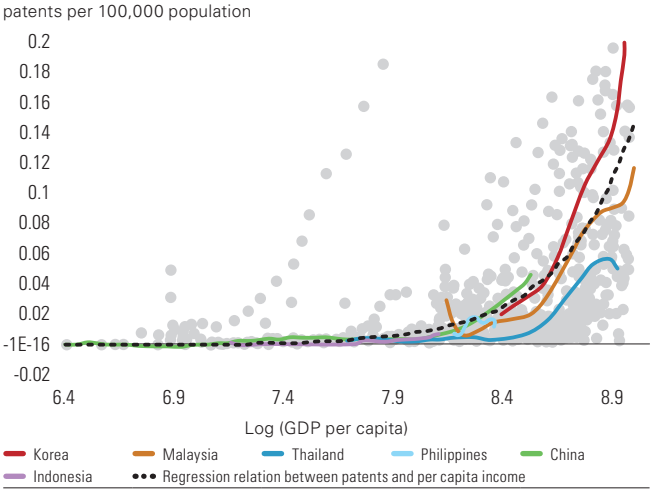
Sources: Enterprise Surveys and World Bank staff calculations.

Figure 74. Firms in East Asia innovate less on some measures



Source: Brahmbhatt and Hu, 2010.

Figure 75. Number of patents per capita in Thailand and Malaysia is lower than in Korea during its take-off



Source: Brahmbhatt and Hu, 2010.

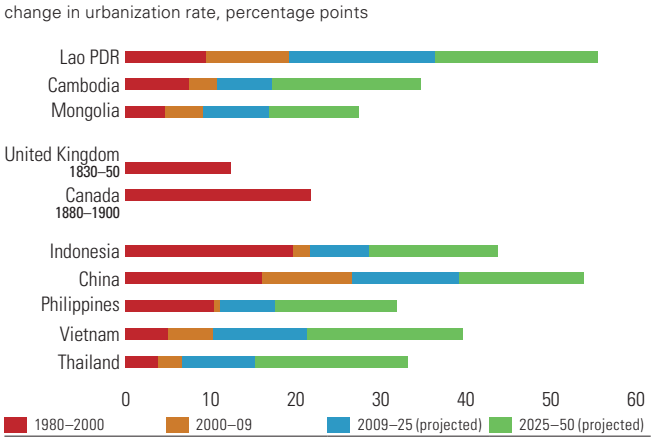
The middle-income countries other than China in the region are falling behind their peers on frontier innovation. Thailand and Malaysia, for example, have patens per capita that are below the average for their income group, and certainly are far below Korea during its take off. China, by contrast, is building up its technological capacity, as reflected in the fast growing number of patents issued by U.S. Patent Office (USPTO), and is now above its peers based on per-capita income (Figure 75).

Innovation happens in cities

Innovation cannot happen in isolation. Without knowledge spillovers, firm-level innovation by large firms would have been 40 percent lower, and in the absence of knowledge transfers through trade, it would have been 10 percent lower. Larger firms are better able to benefit from access to global knowledge, while smaller firms needed to locate close to large firms to catch up. For example, for small firms the use of information and telecommunications technology in their vicinity is more important than their own efforts.

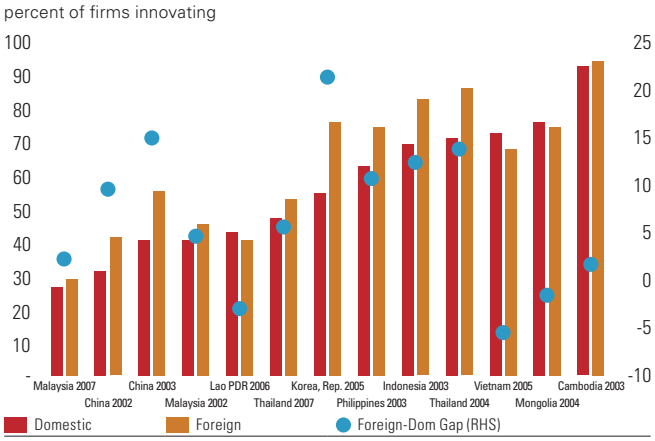
Strong economic growth in East Asia has been accompanied by rapid urbanization. Cities in East Asia absorb 2 million new residents every month and are projected to triple their built-up areas in the coming two decades. The pace of urbanization between 1980 and 2009 is comparable to that in today's advanced economies during their rise in the nineteenth century, when they were at similar levels of per-capita income, but that pace is four times that of the high-income countries right now (Figure 76). By 2050, the total urban population of developing East Asia is expected to more than triple to about 70 percent from 1980, with urban dwellers set to increase by 640 million from 2009.

Figure 76. In some countries, urbanization rates doubled since 1980



Sources: UN World Urbanization Prospects, 2009, and WDR 2009.

Figure 77. In the middle-income countries, foreign firms innovate more than domestic firms



Sources: Enterprise Surveys, Dutz and O'Connell (2011).

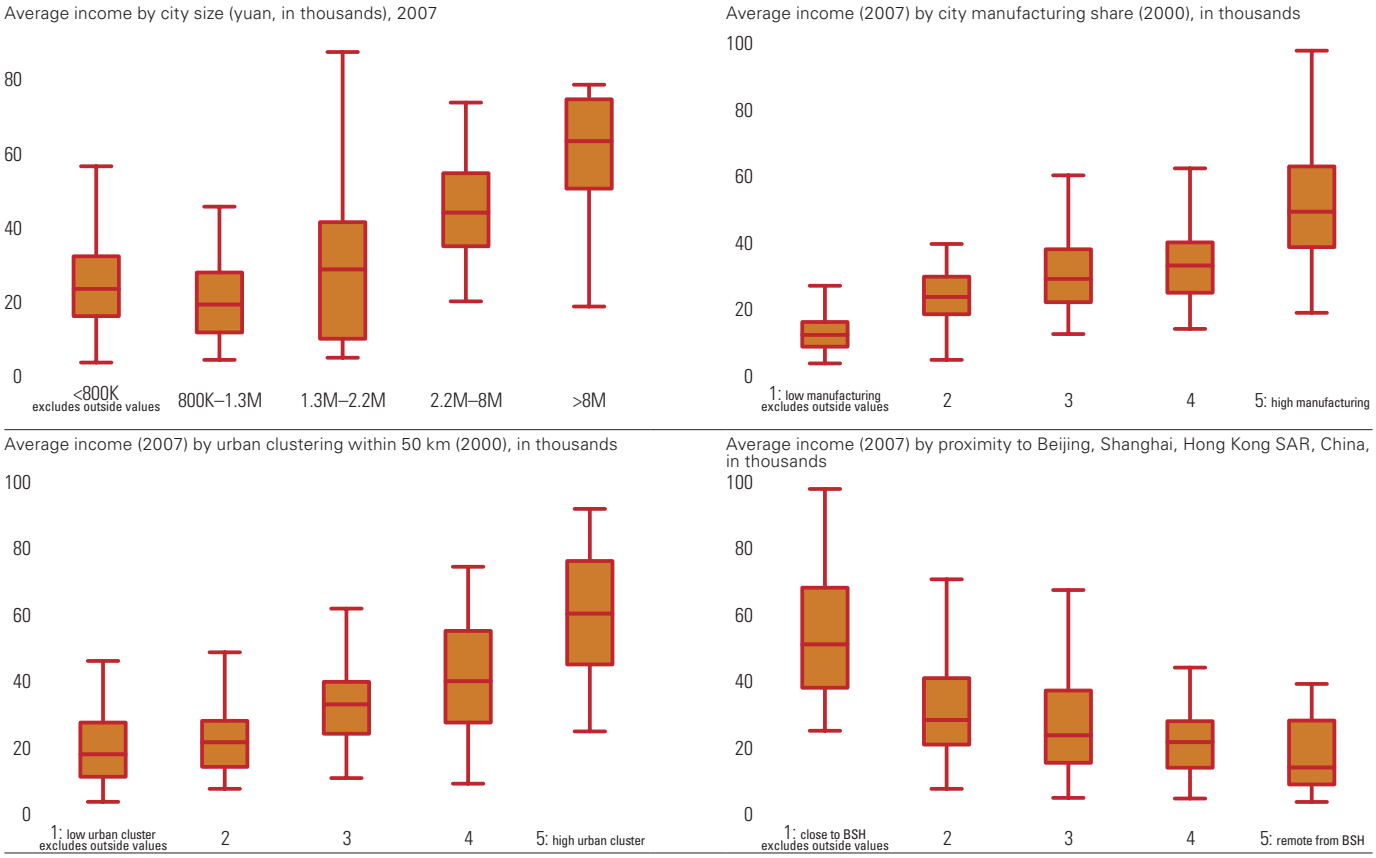
Industrial development that drove growth in East Asia during the last decades has been an exclusively urban phenomenon. In 1980, the urban population in China was 29 percent of the total living in 189 cities. This rose to 50 percent (counting migrants) in 2008 with 651 cities. Most of these cities are home to large manufacturers. For example, Tianjin (China) derives more than half of its growth from industry, facilitated by determined efforts to improve education at all levels. Enrollment rates in tertiary education, for example, grew from 9.9 percent in 2001 to 22.9 percent in 2007.[27]

In Chinese cities, the employment share in manufacturing, urban clustering, and access to international market are highly correlated with urban productivity. Proximity to Beijing, Shanghai or Hong Kong, China is as important to a city's success in terms of urban productivity (Figure 78). It is links to markets that explain success, not city size.[28] Indeed, 76 percent of urban exports of China are generated in cities with 2.5 million people or more.

27 Yusuf and Nabeshima 2010b, page 51.

28 Similar evidence is found in Brazil during 1970-2000 where city growth was primarily driven by market potential for goods, inter-city transport costs, and the population concentration in nearly towns and villages (Da Mata, et al., 2007).

Figure 78. In Chinese cities, urban productivity strongly correlates with presence of manufacturing, clustering, and connectedness to markets



Source: Lall and Wang (2011).
Note: Average city income is measured by GDP per capita.

A study of Chinese cities confirms that innovation and financial services tend to concentrate in the largest cities. International experience highlights that manufacturing initially concentrates in large cities of countries at early stages of economic development (India), then disperses evenly across the urban system, and finally becomes specialized in small cities and rural areas of mature countries. In China, large "coastal" cities have a disproportionate concentration of manufacturing employment, but not financial services. It suggests that Chinese economic structure is still in the early stage of industrialization and will undergo significant structural changes in the near future.[29] In addition, large cities either coastal or inland have strong concentration of scientific research activities—similar to the U.S.

Cities will adapt to the needs of their economies

East Asia combines megacities that produce more than half of the region's GDP with the some of the least urbanized economies in the world. The level of urbanization in the region is now at almost that of the industrialized countries in the 1950s, but with only one-fifth of their income per capita.

29 See also the monograph by Bruce Katz suggesting that manufacturing remains concentrated in the larger U.S. metro areas and the bulk of U.S. exports are manufactures.

In the next 20 years, continuing urbanization will raise several additional challenges in East Asia. Well-integrated economies have cities that spur growth in the rest of the economy through product and factor market connections. As urbanization continues, livability in the large cities tends to come under stress, and the trade-off between growth and congestion becomes more prominent. For smaller cities, integration with the world economy and with production networks becomes more important, especially through links already established by large clusters.

Livability and other factors make it likely that more than 60 percent of the projected increase in urban population in East Asia will settle in smaller cities with fewer than one million inhabitants. Some of the cities and clusters in the middle-income countries, such as Bangkok, Kuala-Lumpur, Zhangzhou and other interior cities of China, will also need to take advantage of the agglomeration economies and move up the value chain while competing with the large cities for educated workers and industrial locations. Connectivity to large cities will become a priority, given that growth is defined by linkages to international markets. Such improved connectivity will also reduce congestion in large cities and may mitigate inequality (see Chapter VI).

For all countries, but especially for the low-income ones, it is time to make irreversible decisions. Cities such as Manila, Hanoi, and HCMC will need to provide basic services and bring livability to a minimum level to set the trend for the century. Once each of these cities decides on a development path, whether it is low-carbon, high or low density, it will be hard to reverse. This reinforces the need for urban planning and investments in infrastructure for these cities.

In the future, two different trends might still emerge that depend on the developments of the East Asia's production networks. The emergence of these networks was driven by reductions in transportation and communication costs, as well as large inflows of FDI and the substantial presence of multinational corporations in the region.

Developing East Asia can continue to catch up with the region's advanced economies in terms of industrialization. However, even during the recent boom, no new clusters have emerged in South East Asia. Apart from deepening industrial agglomerations in China, Hanoi and Haiphong, HCMC and Danang clusters in Vietnam, most of the developments in manufacturing happened though the deepening of the exiting linkages, subsectors, and markets.

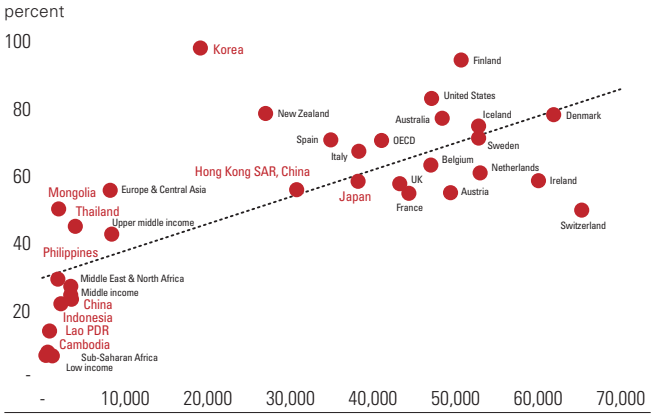
Education ensures absorption capacity

The importance of education for innovation lies in the ability of skilled workers to better absorb and retain knowledge and ideas.[30] As the technology becomes more skill biased and competitive pressures intensify, entrepreneurs and managers need more than secondary level education and they must employ larger numbers of skilled workers, some with higher degrees.[31] Indeed, more technologically advanced and innovating firms hire on

30 This section is based on World Bank (forthcoming) Flagship on Tertiary Education in East Asia and Pacific, and Yusuf and Nabeshima (2010c).

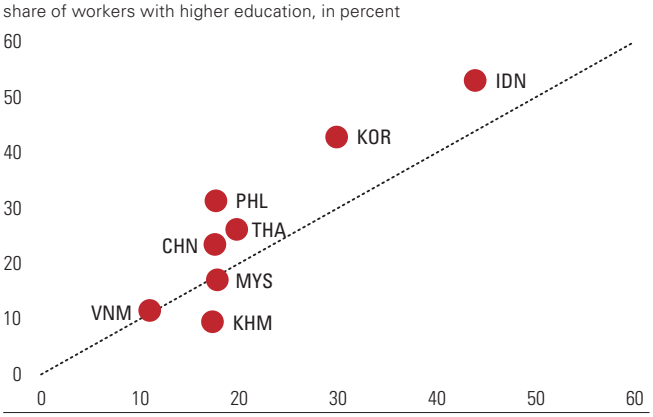
31 This has been noted by Glaeser (2007) and Berry and Glaeser (2005). More highly educated entrepreneurs hire workers with a higher level of skills because of the nature of the businesses they start.

Figure 79. No country transited to high income without higher education



Sources: Enterprise Surveys, World Bank (forthcoming), Almeida (2009b).

Figure 80. Innovators hire more tertiary educated workers

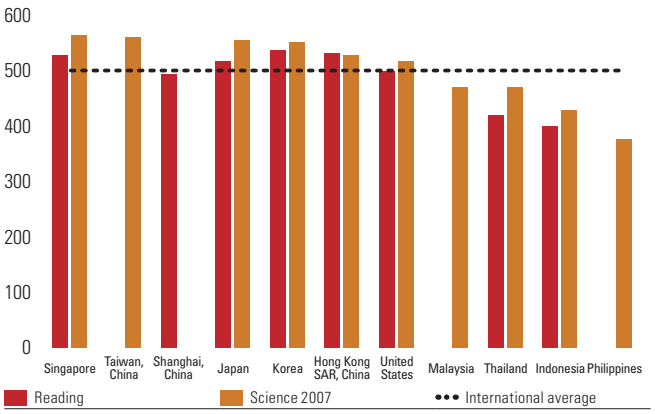


Sources: Enterprise Surveys, World Bank (forthcoming), Almeida (2009b).

average more skilled workers (Figure 79 and Figure 80). As economies move up the ladder of technology and the gap between them and the front runners' narrows, the need for education and skills at all levels grows.[32]

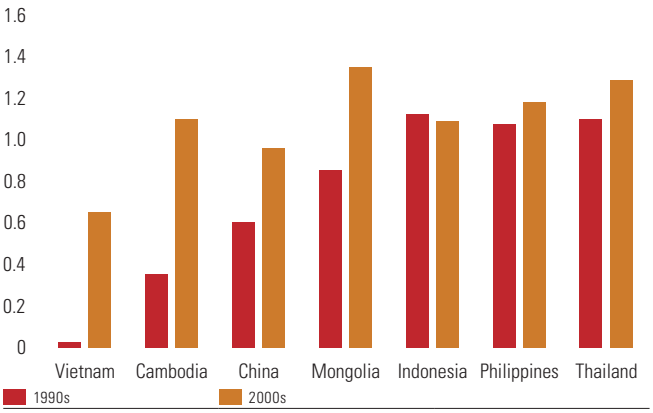
Demand for tertiary education graduates has been generally on the rise in the region. The steep increase in tertiary education premiums in Cambodia, Vietnam, and China, together with gradually rising tertiary education workers, indicates growing demand (Figure 82, Figure 83, and Figure 84).[33]

Figure 81. Science scores in the middle-income countries are lower than world average



Sources: WDI and World Bank Staff calculations.
Note: TIMSS denotes Trends in International Mathematics and Science Study.

Figure 82. Dynamics of wage premiums for tertiary educated workers show strong demand, especially in the low income countries



Source: Di Gropello and Sakellariou (2009).
Note: Different years are used.

Enrollment in tertiary education in the middle-income countries in the region is low compared to the OECD countries, but it is at par with the world average for similar income levels. More than enrollment rates, it is the quality of education and the level of practical skills that matter for the capacity to innovate (Figure 84). The importance

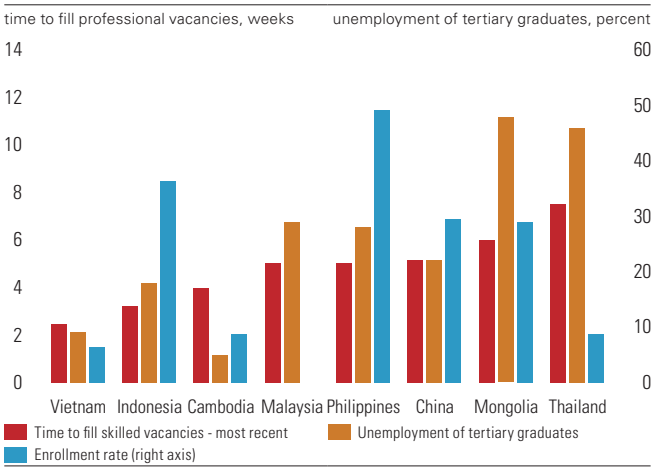
32 Vandenbussche, Aghion and Meghir (2006) draw attention to the greater returns from investment in skills and research as a country approaches the technological frontier.

33 World Bank (forthcoming).

Figure 83. It is increasingly harder to hire educated graduates that fit the job, except in Malaysia

Source: World Bank (forthcoming).

Figure 84. Even with high enrollment and substantial unemployment, it is hard to fill skilled vacancies



Source: World Bank (forthcoming).

of this is reconfirmed by the performance of East Asian students in mathematics: in the middle-income countries scores are lower than the international average (Figure 81). For example, Thailand does not innovate as its enrollment rates or income per capita suggest based on international evidence, indicating issues with the quality of education or its transfer to productive skills base.[34] And even with high enrollment in tertiary schools in Thailand and in the presence of unemployment, it still takes up to 7.5 weeks to fill a skilled vacancy.

Links to universities, entrepreneurship and competition are also transmission channels

The technology nexus supported by strong linkages between industry and universities is an essential part of a modern innovation framework. While large firms depend mostly on their own research and development for innovative activities, small- and medium-size firms exploit knowledge created in the industry and in universities.[35]

Improving university quality can increase the absorptive capacity of entrepreneurs and strengthen innovation framework, especially in middle-income countries. Only 9 out of the 50 best universities in the world are in East Asia.[36] Only Korea, Singapore and Japan have numbers of scientific articles per capita that are comparable to those of industrialized countries. The middle-income countries in the region, except China have substantially fewer published scientific articles per capita than comparable countries in other regions, such as Mexico, Brazil, or South Africa.

The geographic proximity of universities and corporate research is important, but once it is established the curricula need to also be tailored to the industry needs. There are several ways by which universities can influence innovative capacity of firms in addition to educating and encouraging entrepreneurship (Table 7).

Firms that face strong competition are much more likely to innovate than those reporting no such pressure. The innovative activity of small- and medium-sized firms tends to be greater where there is a strong presence of knowledge spillovers. Clusters are formed by entrepreneurs, and so positive economic returns must be linked to

34 See Thailand Economic Monitor, November 2010.

35 Audretsch and Feldman (1994).

36 According to the Times Higher Education Supplement.

Table 7. Channels to enhance knowledge spillovers

Licensing	Spin-offs	Technology transfer offices
Technology brokers	Science parks	Incubators
Support for graduate entrepreneurship	Research contracts and consultancy	Collaborative research
External training	Mobility programs for research staff	Student placement in enterprises
Technology centers	Technology networks	Venture capital funds
Cluster initiatives		

Source: Porter (2008), cited from Yusuf and Nabeshima (2010c).

entrepreneurial activity. Entrepreneurial activity is determined by the number of startup rates (especially for SMEs), population density, population growth, skill and human capital levels of the labor force (high share of skilled workers), low unemployment, and the average establishment size has negative impact on startup rates. Start-up rates and exit rates have been shown to contribute positively to productivity growth, controlling for imperfect competition and extent of scale economies. Reflected in the number of procedures required to start a business, firms in East Asian countries are facing better competition now than in 2004.