Past and Future of the Labor Force in Emerging Asian Economies

Jinyoung Kim
No. 218 | September 2010

Asian Development Bank
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Abstract

This paper investigates the determinants of past changes in the labor force of 12 emerging Asian countries, and attempts to make projections of the labor force in those countries for the period 2010–2030. Results from the regression analysis indicate that the labor force has grown faster than the population, has an inverted U-shape relationship with per capita gross domestic product, and is smaller in more capital-intensive countries. Using extrapolation, the paper predicts that the labor force will increase in all 12 economies during the first 2 decades of the period 2010–2030, but will eventually decline in the People’s Republic of China; Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China. The paper also makes projections of the unemployment rate and the average working hours in those economies.


I. Introduction

Emerging Asian economies such as the People’s Republic of China (PRC); Hong Kong, China; India; Indonesia; Malaysia; Pakistan; the Philippines; Singapore; the Republic of Korea; Taipei, China; Thailand; and Viet Nam have been demonstrating extraordinary growth performances over the past few decades in defiance of the Asian financial crisis of the late 1990s. Moreover, the robust performances of these economies in the latest global economic crisis have been instrumental in providing impetus to the recovery of the world economy. Will these fast-growing economies be able to sustain fast economic growth in the coming decades? This question is of great significance not just to those people in these 12 economies (the size of which is itself a substantial portion of the world population) but also to the world economy.

As part of the growth projection project on these countries conducted by a team of economists (see Lee and Hong 2010, Athukorala 2010, Shioji and Khai 2010, Horioka and Terada-Hagiwara 2010, Park 2010), this paper attempts to make projections of changes in labor input over the period 2010–2030. Annual projections of labor input for each gender as well as for each age group are constructed to produce the aggregate labor input projections for a country over time.

To predict labor input changes over time, projections are made for the following four variables: (i) total population (age 15 and over); (ii) labor force participation rate (labor force divided by the total population); (iii) unemployment rate (number of unemployed divided by the labor force); and (4) average working hours. In general, the projections are based on the extrapolation method using historical data on these variables.

The paper is organized as follows. Section II documents the sources of data used for the projections. Before explaining how to make projections of labor input, determinants of the labor force are investigated using historical data in order to enhance understanding on the changes in the labor force. Results from the regression analysis of the labor force are presented in Section III. The projection methods for the labor force participation rate (LFPR), unemployment rate (UR), and average working hours are detailed in Sections IV, V, and VI, respectively. Section VII describes the definitions of variables in the data set.
II. Data Sources

For the population projections, projections constructed by the United Nations (UN) are utilized. Data on the projections of total population by sex and age group are from the World Population Prospects by the UN’s Population Division, Department of Economic and Social Affairs. These data include population projections every 5 years starting from 2010 up to 2050. The UN population database also includes historical population data from 1970 until 2005, also for every 5 years.

The UN population projections include four variants: medium fertility (which is the benchmark case), high fertility, low fertility, and constant fertility. The medium fertility case assumes that the total fertility rate in every country gradually converges to 1.85 children per woman from its historical level in 2005. Countries that show low fertility rates are projected to reach the level of 1.85 before 2050 while others that have high fertility levels still in 2005 may not reach that level before 2050. In the high-fertility variant, the total fertility rate is projected to remain at 0.5 children above the fertility in the medium variant over the projection period. By 2050, fertility in the high variant is therefore half a child higher (that is, 2.35) than that of the medium variant. Under the low-fertility variant, fertility is assumed to remain 0.5 children below the fertility in the medium variant. Countries therefore reach a total fertility of 1.35 children per woman at the end of the projection period in the low-fertility variant. In the constant-fertility case, fertility is assumed to remain constant at the level estimated for period 2005–2010 for each country. In these variants, mortality and international migration are projected to be normal. Normal mortality is calculated for each country using recent trends in life expectancy, and projected on the basis of models of life expectancy produced by the UN Population Division. Under the normal migration assumption, the future path of international migration is set constant based on past international migration estimates and the policy stance of each country with regard to future international migration flows.¹

Projections on the other three variables are produced using a methodology developed by this author (see Sections IV–VI for the description of the method), using historical data on these variables from International Labour Organization (ILO). The ILO data for the LFPR cover the period 1980–2008 and include annual observations by sex and age group. On the other hand, the annual ILO data for the UR and the average working hours cover the period 1969–2008, but are unbalanced across countries with missing years. The UR and working hour data from the ILO include observations by sex only (ILO 2010).²

Data for Taipei, China, however, are not available from the UN World Population Prospects. For Taipei, China’s population projection, US Census data are used, which provide population projections by sex and age group over 2010–2030 (U.S. Census

¹ For a detailed description of the UN population projections, see UN (2004, chapter VI).
² In the case of the PRC, ILO provides the UR for both sexes only. Data on working hours for Pakistan are not available from ILO.
Bureau 2010). Unlike the UN projections, the US Census projections are produced only in one variant: medium-fertility assumption. The US Census also provides the historical population data for Taipei, China since 1990.

For Taipei, China’s LFPR, we use the [Taipei, China] National Statistics database (DGBAS 2010) since the ILO database does not provide data. Unfortunately, the [Taipei, China] National Statistics database does not provide the LFPR separately for males and females, but rather the average rates for the population in a given age group. For the other two variables (UR and average working hours) for Taipei, China, the ILO database is used.

Variables used as regressors for the regression analysis of the labor force are obtained from the World Development Indicators database of the World Bank.

### III. Regression Analysis

In order to find out the determinants of past changes in labor input in the Asian countries, the following fixed-effects regression model is employed:

\[
\ln L_{igat} = \gamma_0 + \gamma_1 \ln POP_{igat} + \gamma_2 \ln PGDP_{it} + \sum_{j=2}^{11} \gamma_{3j} D_{ja} + \sum_{j=2}^{11} \gamma_{4j} D_{ja} \times \ln PGDP_{it} \\
+ \gamma_5 \ln (K/L)_{it} + \gamma_6 D^g + \gamma_7 T + \gamma_8 T \times D^g + \gamma_9 R&D_{it} + \epsilon_i + \mu_{igt} \tag{1}
\]

where \( \ln \) is the logarithm operator, and \( L_{igat} \) is the size of the labor force in country \( i \) for gender \( g \) (male or female) and age group \( a \) (see footnote 4) in year \( t \). \( POP_{igat} \) and \( PGDP_{it} \) are total population size and per capita real gross domestic product (GDP), respectively. The former variable is included as a regressor to control for the size of the economy, and the latter variable to control for the stage of economic development. \( D^a \) and \( D^g \) are dummy variables for age groups and males, respectively. The interaction terms of age group dummy variables are included with \( PGDP \) because it is expected that the effect of economic development on labor supply may vary across age groups. \( (K/L)_{it} \) is per capita capital stock and is included in the regression model to account for possible labor-capital substitutability. \( T \) is a time trend variable and its interaction term with the gender dummy is included in the specification because male labor supply tends to show a time trend different from that of female labor supply. \( R&D_{it} \) is the GDP share of research and development expenditure, which may pick up variations in the speed of technology progress across countries. \( \epsilon_i \) is fixed effects for country \( i \).
The results from the regression analysis are reported in Table 1. In the first column (Model 1), R&D is excluded because the number of observations is significantly reduced if R&D is included as a regressor. R&D is added as a regressor in the second column (Model 2). The size of the population has a significantly positive association with the labor force, and the magnitude of their association is somewhat smaller than unity. Per capita GDP shows a negative association with the labor force for age group 15–19 while it is positively related with the labor force for all other age groups. For example, the coefficient associated with \( \ln(PGDP) \) is 0.2894 (= –0.1739+0.4633) for age group 20–24. It is not surprising to see a decline in the labor force for age group 15–19 as the economy becomes more developed since young people in this age group stays longer in school. The coefficient associated with \( \ln(PGDP) \) shows an inverted U-shaped pattern with respect to age where it peaks at age group 25–29 in both models.

**Table 1: Determinants of Labor Force**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnPOP</td>
<td>0.9536 (33.39)</td>
<td>0.7965 (12.52)</td>
</tr>
<tr>
<td>lnPGDP</td>
<td>-0.1739 (-2.80)</td>
<td>-0.3139 (-1.39)</td>
</tr>
<tr>
<td>Age 20–24</td>
<td>-3.7059 (-16.65)</td>
<td>-4.5681 (-10.20)</td>
</tr>
<tr>
<td>Age 25–29</td>
<td>-3.8084 (-16.84)</td>
<td>-4.9077 (-10.84)</td>
</tr>
<tr>
<td>Age 30–34</td>
<td>-3.4048 (-14.63)</td>
<td>-4.6272 (-9.95)</td>
</tr>
<tr>
<td>Age 35–39</td>
<td>-3.2495 (-13.54)</td>
<td>-4.5824 (-9.33)</td>
</tr>
<tr>
<td>Age 40–44</td>
<td>-3.1852 (-13.03)</td>
<td>-4.6500 (-9.08)</td>
</tr>
<tr>
<td>Age 45–49</td>
<td>-3.1951 (-13.03)</td>
<td>-4.7065 (-9.10)</td>
</tr>
<tr>
<td>Age 50–54</td>
<td>-3.1008 (-12.67)</td>
<td>-4.7347 (-9.08)</td>
</tr>
<tr>
<td>Age 55–59</td>
<td>-2.7186 (-11.03)</td>
<td>-4.3275 (-8.41)</td>
</tr>
<tr>
<td>Age 60–64</td>
<td>-2.7632 (-11.04)</td>
<td>-4.3054 (-8.33)</td>
</tr>
<tr>
<td>Age 65+</td>
<td>-2.1621 (-8.58)</td>
<td>-3.4559 (-6.57)</td>
</tr>
<tr>
<td>lnPGDP*Age 20–24</td>
<td>0.4633 (20.02)</td>
<td>0.5593 (12.43)</td>
</tr>
<tr>
<td>lnPGDP*Age 25–29</td>
<td>0.4826 (20.56)</td>
<td>0.6085 (13.38)</td>
</tr>
<tr>
<td>lnPGDP*Age 30–34</td>
<td>0.4407 (18.33)</td>
<td>0.5805 (12.42)</td>
</tr>
<tr>
<td>lnPGDP*Age 35–39</td>
<td>0.4250 (17.26)</td>
<td>0.5764 (11.69)</td>
</tr>
<tr>
<td>lnPGDP*Age 40–44</td>
<td>0.4185 (16.84)</td>
<td>0.5814 (11.38)</td>
</tr>
<tr>
<td>lnPGDP*Age 45–49</td>
<td>0.4157 (16.80)</td>
<td>0.5806 (11.38)</td>
</tr>
<tr>
<td>lnPGDP*Age 50–54</td>
<td>0.3966 (16.19)</td>
<td>0.5696 (11.24)</td>
</tr>
<tr>
<td>lnPGDP*Age 55–59</td>
<td>0.3393 (13.89)</td>
<td>0.5050 (10.24)</td>
</tr>
<tr>
<td>lnPGDP*Age 60–64</td>
<td>0.3098 (12.65)</td>
<td>0.4607 (9.41)</td>
</tr>
<tr>
<td>lnPGDP*Age 65+</td>
<td>0.1758 (6.93)</td>
<td>0.3048 (5.88)</td>
</tr>
<tr>
<td>Log(K/L)</td>
<td>-0.2315 (-4.79)</td>
<td>-0.3067 (-1.57)</td>
</tr>
<tr>
<td>Male</td>
<td>0.8023 (44.71)</td>
<td>1.1131 (8.25)</td>
</tr>
<tr>
<td>T</td>
<td>0.0078 (5.22)</td>
<td>0.0154 (2.12)</td>
</tr>
<tr>
<td>T*Male</td>
<td>-0.0071 (-6.56)</td>
<td>-0.0222 (-3.60)</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>0.0891 (1.11)</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.9569</td>
<td>0.9588</td>
</tr>
<tr>
<td>Observations</td>
<td>6160</td>
<td>1606</td>
</tr>
</tbody>
</table>

Note: Dependent variable: labor force. Estimated using country fixed effects model. t-statistics are in parenthesis. Dummy for age group 15–19 is excluded due to collinearity. Coefficient estimates for country dummies are not reported to save space. Source: Author’s estimates.
More capital-intensive countries are shown to have less labor force: K/L is negatively associated with the labor force. The result shows that the male labor force is significantly larger than the female labor force. Table 1 shows that the female labor force exhibits an upward trend while the male labor force shows a flat or a downward trend over time. In Model 2, the GDP share of R&D expenditure is positively associated with the labor force, but the estimated coefficient is not significant.

IV. Projection Method for the Labor Force Participation Rate

The projection method used here is similar to what the ILO has proposed, which utilizes the shapes of the time trends in the male and female LFPRs for a given age group. In the first step, the time series of the LFPR of both sex groups for each age group are plotted. Next, the paper identifies where each type of pattern of the two time series for both sex groups belong to among the following four categories:

Category (A)—Both male and female LFPRs simultaneously rise (denoted as case A1), decline (case A2), or stay fairly constant over time (case A3) with the constant gap between the two time series. Examples of these cases are seen in Figures 1a–1c:

Figure 1: Examples for Category A of Male–Female LFPR Changes (percent)

<table>
<thead>
<tr>
<th>Viet Nam, Age 40–44</th>
<th>India, Age 15–19</th>
<th>Philippines, Age 30–34</th>
</tr>
</thead>
</table>

LFPR = labor force participation rate.
Source: See Section II for data sources.

---

3 There are 11 age groups in total: age 15–19 (group 1), 20–24 (group 2), 25–29 (group 3), 30–34 (group 4), 35–39 (group 5), 40–44 (group 6), 45–49 (group 7), 50–54 (group 8), 55–59 (group 9), 60–64 (group 10), 65 and over (group 11).

4 Economy codes are: 1 = PRC; 2 = Hong Kong, China; 3 = India; 4 = Indonesia; 5 = Viet Nam; 6 = Malaysia; 7 = Pakistan; 8 = Philippines; 9 = Singapore; 10 = Republic of Korea, 11 = Taipei, China; 12 = Thailand.
**Category (B)**—One LFPR stays constant or steadily declines over time while the other LFPR converges to the first time series. Examples are in Figures 2a–2c:

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**Figure 2: Examples for Category B of Male–Female LFPR Changes (percent)**

- Singapore, Age 30–34
- Hong Kong, China, Age 25–29
- Philippines, Age 65+

---

LFPR = labor force participation rate.
Source: See Section II for data sources.

The case illustrated in the first two figures is when the female LFPR catches up with the male LFPR that is fairly constant or declining over time. This is denoted as case B1. The case illustrated in the third figure is when the male LFPR appears to catch up with the female LFPR that is constant or declining over time. This is denoted as case B2.

**Category (C)**—The two time series diverge over time. In one case, the male LFPR declines over time but the female LFPR declines even faster (case C1 illustrated in Figure 3a below). In the other case, the male LFPR rises faster than the female LFPR (case C2 illustrated in Figure 3b below).

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**Figure 3: Examples for Category C of Male–Female LFPR Changes (percent)**

- Thailand, Age 20–24
- Viet Nam, Age 45–49

---

LFPR = labor force participation rate.
Source: See Section II for data sources.
Category (D)—Either one or both of the two time series for men and women take a nonmonotonic pattern, so that the pattern is U-shaped or inverted U-shaped. Examples are shown in Figures 4a and 4b:

Figure 4: Examples for Category D of Male–Female LFPR Changes (percent)

![Graphs showing LFPR changes from 1980 to 2008 for Hong Kong, China, Age 60–64 and Republic of Korea, Age 20–24.]

LFPR = labor force participation rate.
Source: See Section II for data sources.

These four categories are devised by carefully investigating and grouping all the LFPR time series for each age group in all 12 economies in the sample. The exact projection method applied to each of these four cases is as follows.

Category (A)—The projection in this case is carried out in three steps. The first step predicts the LFPR value for which each time series for males or females converges in year 2030. For this prediction of the convergence points, the average (m) and the difference (d) between the two series (one for males and the other for females) is calculated, and the growth rates of m and d for each year are computed. Mean growth rates of m and d are calculated over the sample period 1980–2008. Using the two estimated growth rates, the predicted vales of m and d in 2030 can be projected. The predicted values of male and female LFPR of convergence is calculated by m + d/2 for males and m - d/2 for females if the LFPR for males is higher than that for females, or the other way around otherwise. In the second step, a simple parametric model is estimated that fits the time series of the LFPR for males or females to the following logistic function:

\[
y_t = y_{\min} + \frac{(y_{\max} - y_{\min})}{1+\exp(a+b\cdot t)}
\]

where \(y_t\) is the LFPR in year \(t\) \((t=1980, 81,...,2008)\) for males or females, and a and b are parameters to estimate. \(y_{\max}\) and \(y_{\min}\) are the maximum and minimum constant values of \(y\) in a logistic function, which are taken from the larger and the smaller of the two values, respectively: the observed LFPR in 1980 and the convergence point estimated in the first step. In the third step, annual LFPR projections for 2009–2030 are produced, based on the out-of-sample predictions of \(y\) using the estimation results in the second step by varying \(t\).
**Category (B)—** In this case, the first step in case A is omitted in calculating the convergence point in year 2030, and two steps similar to the second and third steps in case A are conducted. Formally, in the first step a parametric model is estimated where the time series of the LFPR for males or females is fitted to the following logistic function:

\[
y_t = y_{min} + \frac{(y_{max} - y_{min})}{1+\exp(\alpha+\beta\cdot t)}
\]

where \(y_t\) is the LFPR in year \(t\) (\(t=1980, 81, ..., 2008\)) for males or females, and \(a\) and \(b\) are parameters to estimate. In case B1 where the female LFPR catches up with the male LFPR, the values of \(y_{max}\) and \(y_{min}\) for males are taken from the larger and the smaller of the two values, respectively: the observed LFPR in 1980 and the observed LFPR in 2008. The values of \(y_{max}\) and \(y_{min}\) for females are taken from the observed male LFPR in 2008 and the observed female LFPR in 1980, respectively. In case B2 where the male LFPR catches up with the female LFPR, the values of \(y_{max}\) and \(y_{min}\) for males are taken from the observed male LFPR in 1980 and the observed female LFPR in 2008, respectively. The values of \(y_{max}\) and \(y_{min}\) for females are taken from the larger and the smaller of the two values, respectively: the observed LFPR in 1980 and the observed LFPR in 2008.

In the second step, annual LFPR projections for 2009–2030 are produced, based on the out-of-sample predictions of \(y\) using the estimation results in the first step by varying \(t\).

**Category (C)—** This case essentially follows the same procedures in case A. In the first step, the LFPR value is predicted to which each time series for males or females converges in year 2030. For this prediction of the convergence points, the mean growth rate of the average of the male and female rates is calculated over the sample period 1980–2008. The mean growth rate of the difference between the male and female rates is also calculated. Using the two estimated growth rates, the average of and the difference between the male and female rates for year 2030 can be predicted, and then the predicted male and female LFPR values of convergence retrieved. In the second step, a parametric model is estimated where time series of the LFPR for males or females are fit to the following logistic function:

\[
y_t = y_{min} + \frac{(y_{max} - y_{min})}{1+\exp(\alpha+\beta\cdot t)}
\]

where \(y_t\) is the LFPR in year \(t\) (\(t=1980, 81, ..., 2008\)) for males or females, and \(a\) and \(b\) are parameters to estimate. In case C1 where both the male and the female LFPR decline but the latter declines faster, the values of \(y_{max}\) and \(y_{min}\) for males are taken from the observed LFPR in 1980 and the observed LFPR in 2008, respectively. The values of \(y_{max}\) and \(y_{min}\) for females are taken from the observed LFPR in 1980 and the convergence point estimated in the first step, respectively.
In case C2 where both the male and the female LFPR rise but the former rises faster, the values of \( y_{\text{max}} \) and \( y_{\text{min}} \) for males are taken from the convergence point estimated in the first step and the observed LFPR in 1980, respectively. The values of \( y_{\text{max}} \) and \( y_{\text{min}} \) for females are taken from the observed LFPR in 2008 and the observed LFPR in 1980, respectively. In the final step, annual LFPR projections for the period 2009–2030 are produced, based on the out-of-sample predictions of \( y \) using the estimation results in the second step by varying \( t \).

**Category (D)**—In this case, the general rule is to project on the basis of the longer section of the time series between the monotonically rising section and the monotonically declining section. For example, in the first figure of case D above (country 2, age group 10), only data between 1980 and 2001 are used, and data for 2002–2008 are discarded. The same method is applied for case A2 to make projections for 2009–2030. In case of the second figure (country 10, age group 2), the years 1991–2008 are used following the methodology for case A2.

Since only the average LFPR is available for Taipei, China, the aforementioned methods for cases A–D are not applicable. Therefore time series of the average LFPR are fitted to the logistic function where \( y_{\text{max}} \) and \( y_{\text{min}} \) are chosen from the larger and the smaller value of the two, respectively, i.e., the observed LFPR in 1980 and the observed LFPR in 2008. When the time series take a U-shape or inverted U-shape, the longer section between the monotonically rising section and the monotonically declining section is used and fitted to the logistic function.

The figures in Appendix 1 show annual projections for the aggregate labor force of each economy. According to these figures, the labor force in the PRC; Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China are projected to rise in the first 2 decades of the 2009–2030 period, but eventually decline in the last decade, which is mostly due to low levels of fertility rate in these economies. Countries like India, Indonesia, Malaysia, Pakistan, and the Philippines are projected to have a steady increase in the labor force in 2009–2030, while the labor force for Thailand and Viet Nam is predicted to grow at a decreasing rate and converge to some maximum level.

**V. Projection Method for the Unemployment Rate**

For most countries, the following methodology is used to project the UR. First to be used is the Kalman filter, which decomposes the UR time series in 1969–2008 into a trend component and a cyclical component, and which takes the trend component to predict the UR values in the sample period. The predicted UR values are then fitted to the following logistic function to estimate parameters \( a \) and \( b \), where the predicted values of 1970 and 2030 are set as the maximum or the minimum values in the logistic function.
\[ y_t = y_{\min} + (y_{\max} - y_{\min}) / (1 + \exp(\alpha + \beta \cdot t)) \]  

(5)

In the final step, annual UR projections are produced for 2009–2030, based on the out-of-sample predictions of \( y \) by varying \( t \).

In the case of India, Indonesia, and Viet Nam, the available data series are too short to apply the Kalman filter so it is assumed that the projected UR in 2009–2030 is constant at the average UR value over the sample period.

The figures in Appendix 2 present the annual projections of the UR for each sex. These figures show that most countries except Indonesia, Pakistan, and the Philippines are projected to have rather stable URs of around 5% in 2009–2030. Indonesia is expected to have a stable but higher rate over this period. The URs for Pakistan and the Philippines are predicted to rise and reach high levels at the end of this period.

### VI. Projection Method for Average Working Hours

In most countries the time series of the average working hours (AWH) are either flat over time or too short to apply any filtering method. The projected constant value of AWH over 2009–2030 is therefore assumed to equal the mean of AWH over the sample period.

A declining trend in the AWH time series is observed in the Republic of Korea; Singapore; and Taipei, China. For these economies, the first step for case A is followed in the labor force participation projections to estimate the convergence value of the AWH in 2030. The logistics function estimation method is then applied, where the value of the AWH in the first year of data availability is indicated as \( y_{\max} \) and the projected AWH value of convergence in 2030 as \( y_{\min} \).

The predicted values of AWH are presented in the figures of Appendix 3. Note that by construction most countries are projected to have constant levels in 2009–2030. The projected levels are about 45 hours per week. The exceptions are the Republic of Korea; Singapore; and Taipei, China where the AWH are shown to decrease over the period.
VII. Description of Variables in the Data

The variables included in the data set are presented in Table 2.

Table 2: Description of Variables

<table>
<thead>
<tr>
<th>Economy: Economy code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=PRC; 2=Hong Kong, China; 3=India; 4=Indonesia; 5=Viet Nam; 6=Malaysia; 7=Pakistan; 8=Philippines; 9=Singapore; 10=Republic of Korea; 11=Taipei, China; 12=Thailand</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male: 1 = men, 0 = women</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Age: Age group code</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–19 (group 1), 20–24 (group 2), 25–29 (group 3), 30–34 (group 4), 35–39 (group 5), 40–44 (group 6), 45–49 (group 7), 50–54 (group 8), 55–59 (group 9), 60–64 (group 10), 65 and over (group 11)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
</tr>
</thead>
</table>

| Pop1: Working-age population (age 15 and over, in thousands), constant fertility variant (see text) |
| Pop2: Working-age population (age 15 and over, in thousands), high fertility variant (see text) |
| Pop3: Working-age population (age 15 and over, in thousands), low fertility variant (see text) |
| Pop4: Working-age population (age 15 and over, in thousands), medium fertility variant (see text) |

| LFPR: Labor force participation rate (percent, age-group and sex-specific, available only for 1980 and after) |
| UR: Unemployment rate (percent) |

<table>
<thead>
<tr>
<th>Workh: Hours of work per week</th>
</tr>
</thead>
</table>

| Ifpr_prj: Equals 1 if projected labor force participation rate, and 0 if not |
| Ur_prj: Equals 1 if projected unemployment rate, and 0 if not |
| Workh_prj: Equals 1 if projected hours of work per week, and 0 if not |
| Pop_prj: Equals 1 if projected population, and 0 if not |
| If_prj: Equals 1 if projected labor force, and 0 if not |

| If1: Total labor force, constant fertility variant (aggregated over age groups and sexes, in thousands) |
| If2: Total labor force, high fertility variant (aggregated over age groups and sexes, in thousands) |
| If3: Total labor force, low fertility variant (aggregated over age groups and sexes, in thousands) |
| If4: Total labor force, medium fertility variant (aggregated over age groups and sexes, in thousands) |

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* The medium fertility variant is the benchmark case.
* If a country has only data on population average instead of separate data for men and women, the population average is entered for both male and female records.
* Data on working hours for Pakistan are not available.
* If1 through If4 is the total labor force of an economy in a given year, that is, the sum of the labor force over all age groups and sexes. To determine the size of the total labor force of an economy in a given year, these commands can be run in Stata:
  
  ```stata
sort country year age male
  by country year: gen obs=_n
  drop if obs==1
  keep country year If1-If4_if_prj
  ```

Source: See Section II for data sources.
Appendix 1: Labor Force Projections

People's Republic of China

Hong Kong, China

India

Indonesia

Viet Nam

Malaysia

continued.
Note: Values in thousands. Observed data are plotted for years 1980–2008. Those points after 2008 show projections. The projections are based on the medium fertility variant.

Source: See Section II for data sources.
Appendix 2: Unemployment Rate Projections

People's Republic of China

Hong Kong, China

India

Indonesia

Viet Nam

Malaysia

continued.
Appendix 2: continued.

Note: Observed data are plotted for years before 2008. The points after 2008 show projections. For the People's Republic of China, data are available for both sexes only.

Source: See Section II for data sources.
Appendix 3: Average Working Hours Projections

People’s Republic of China

Hong Kong, China

India

Indonesia

Viet Nam

Malaysia

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Male
Female
Appendix 3: continued.

 Philippine

 Singapore

 Republic of Korea

 Taipei, China

 Thailand

 Male – Female

 Note: Observed data are plotted for years before 2008. The points after 2008 show projections. Data from ILO are not available for Pakistan. Singapore has only data on the populationwide average working hours.

 Source: See Section II for data sources.
References


World Bank. 2010. World Development Indicators Database. Washington, DC.
About the Paper
Jinyoung Kim investigates the determinants of past changes in the labor force of 12 emerging Asian economies, and attempts to make projections of the labor force in those economies for the period 2010–2030. Results from the regression analysis indicate that the labor force has grown faster than the population, has an inverted U-shape relationship with per capita gross domestic product, and is smaller in more capital-intensive economies. Using extrapolation, the paper predicts that the labor force will increase in all 12 economies during the first 2 decades of the period 2010–2030, but will eventually decline in the People’s Republic of China; Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China.

About the Asian Development Bank
ADB’s vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries substantially reduce poverty and improve the quality of life of their people. Despite the region’s many successes, it remains home to two-thirds of the world’s poor: 1.8 billion people who live on less than $2 a day, with 903 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.