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How can Korea Boost Potential Output to Ensure Continued Income Convergence?

Sonali Jain-Chandra and Longmei Zhang

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Asia and Pacific Department

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Prepared by Sonali Jain-Chandra and Longmei Zhang[1]

Authorized for distribution by Ms. Mateos y Lago

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Abstract

Korea's rapid growth has slowed in recent years, suggesting lower potential growth. This paper uses an array of techniques, including statistical filters, a multivariate model and the production function, to estimate Korea's potential growth. The main finding is that trend growth has fallen from around 4¾ percent during 2000−07 to around 3¼ −3½ percent by 2011−12. Absent reforms, it is projected to fall further to around 2 percent by 2025, primarily due to declining working-age population. However, Korea's potential growth can be maintained at a higher level by putting in place a comprehensive structural reform agenda, including increased female and youth labor force participation, liberalization of product and labor market regulation. Staff simulations suggest that such reforms could lift potential growth by around 1¼ percentage point over the next decade, maintaining potential growth at around 3¼ percent, counteracting the effect of population aging, and enabling Korea to continue to converge to income levels of the United States.

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I. INTRODUCTION

Korea grew rapidly for a sustained period of time, leading to impressive gains in living standards. It is one of the few countries that went from being a recipient of financial aid to a donor country and a member of the OECD in a relatively short span of time. It is also one of the few economies that escaped the so-called "middle-income trap" and is often noted as a model for developing countries. Korea's per capita income rose from around 11 percent of the United States level in 1970 to 65 percent by 2012—one of the most rapid and sustained convergences achieved.

GDP per capita (Korea as a proportion of US)
(In Percent)

Sources: World Economic Outlook, IMF Staff Estimates.
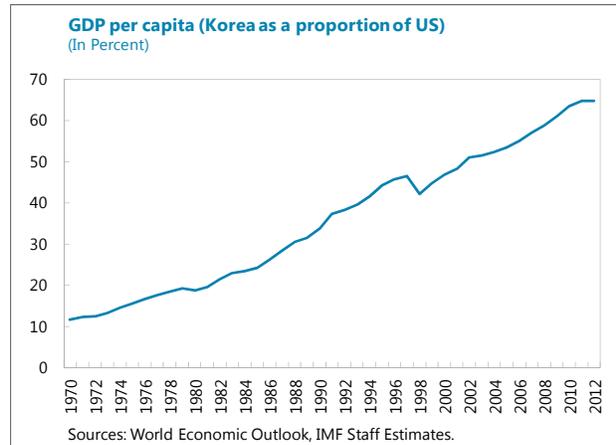
However, growth has slowed down in recent years, suggesting that potential output has also trended down. Real GDP growth has slowed from almost 10 percent during 1981−1990 to around 3 percent during 2011–12. Some of this moderation is to be expected given that developing countries often grow faster as their income levels have to catch up to those of advanced country levels, and progressive gains in living standards become more elusive as countries become richer. However, notwithstanding this natural progression and demographic headwinds to Korean growth, this paper argues that there is considerable room in Korea to prevent potential growth from falling via sustained structural reform. Such a boost to economic potential is necessary for per capita incomes and living standards to continue to converge to that of the most advanced economies.

Real GDP Growth in Korea
Percent

Sources: CEIC.
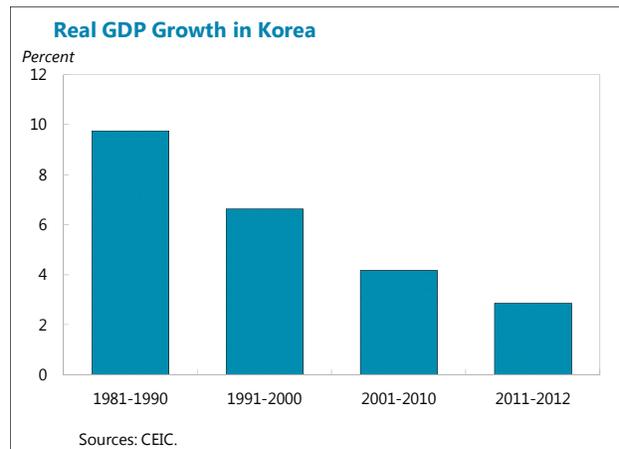
This paper is organized as follows. First, potential growth is estimated using a number of well-known techniques, including univariate statistical filters, multivariate models and the production function approach. It also analyzes whether potential output was affected by the 2008 crisis. Next, looking ahead, the paper provides illustrative scenarios of the impact of various structural reforms, including those relating to labor (in particular the gains from increasing female labor force participation and reducing employment protection legislation) and product market deregulation, which could lift potential growth in Korea. The paper also examines the drag on growth potential from low service sector productivity and measures to boost it.

II. ESTIMATING POTENTIAL OUTPUT

Since potential output is an unobservable variable, it is estimated using an array of techniques rather than relying on any single approach. Each technique has its well-known drawbacks, therefore it is important to rely on multiple approaches to arrive at an estimate of potential output. The commonly-used methodologies fall into three categories: first, the univariate statistical filters aim to extract the trend of the time series in question and filter out the cyclical components; the second methodology utilized is a multivariate model that is grounded in economic theory which postulates a relationship between potential output and its key determinants; third, we also use the production function approach, which will enable us to estimate Korea's potential output and decompose the change in potential output into the contributions of physical capital, labor, human capital and the efficiency with which various factors are combined.

Filters

We use a number of statistical filters to estimate potential growth, being mindful of their well-known limitations. The paper uses both purely statistical filters as well as univariate and bivariate state-space models with the Kalman filter. The statistical filters include Hodrick-Prescott (HP) filter, Baxter-King (BK) filter, and Christiano-Fitzgerald (CF) filter. The HP filter remains the most commonly used filter to use to estimate potential output[2], which, however, is a purely statistical technique and does not take into account economic theory and also suffers from the well-known endpoint problem. We also supplement it by using band-pass filters, namely the CF and BK filter. The band-pass filter is a linear filter that takes a two-sided weighted moving average of the data where cycles in a "band," given by a specified lower and upper bound, are passed through, and the remaining cycles are filtered out. Standard practice using these filters assumes a cycle lasts from 1.5 to 8 years. In particular, BK is a fixed length symmetric filter, where the weights for lags and leads (of same distance) are the same and time-invariant. CF filter is a full sample asymmetric filter, where the weights on the leads and lags are allowed to differ and is time-varying.

Korea's Potential Growth--- Kalman Filters

Sources: IMF, *World Economic Outlook*; CEIC data Company Ltd.; IMF staff calculations.
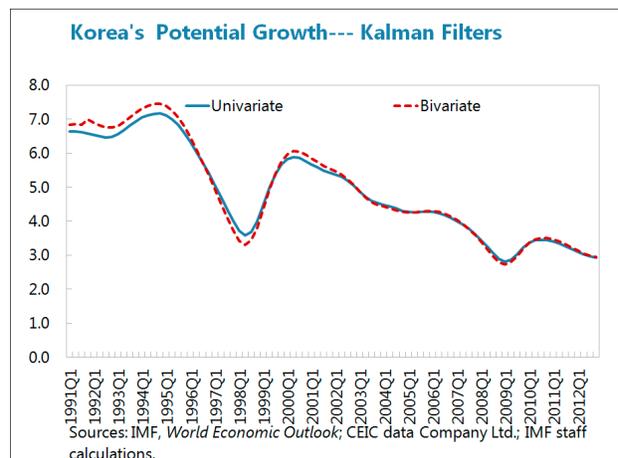
Also, univariate and bivariate state-space models with the Kalman filter are used to estimate potential growth. In the univariate case, output is decomposed into a permanent and a transitory component. The trend output is assumed to follow a local linear trend[3]. The output gap is assumed

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[2] We apply the filters to quarterly GDP data from 1990 to end-2012, using the standard 1600 smoothing parameter for quarterly data.
[3] Trend growth rate follows a random walk.

to follow an AR (1) process. For the bivariate case, a backward looking Phillips curve has been added to the above state-space model, where inflation depends on past inflation and current output gap.

The results from the filters show that Korea's potential growth has fallen from an average of around 4¾ percent during the pre global financial crisis period. The HP filter shows that the potential growth rate had fallen to around 3.1 percent by 2011−12, and the CF filter and state space models also confirm that it fell to around 3¼ percent.

Multivariate Filter

The multivariate filter based on Benes et al (2010) has considerable advantages over the univariate filters described above. The univariate filters do not consider the information contained in the structural relationship between different economic variables. Benes et al (2010) postulates a small macroeconomic model to measure potential output by incorporating the relationships between actual and potential GDP, unemployment, inflation and capacity utilization. The macro model consists of four structural equations: the IS curve, Philips curve, Okun's law and capacity utilization. The output gap is estimated as the common/latent factor that drives the observable variables that respond to the business cycle such as inflation, unemployment and capacity utilization. The parameters are estimated using Bayesian techniques. The multivariate filter confirms that potential growth has declined and currently the output gap is negative. The MV filter yields an estimate of around 4 percent for potential growth in 2012, and implies a smaller drop in potential growth than the univariate filters.

Korea Potential Growth - Multi-Variate Filters

Sources: IMF, *World Economic Outlook*; CEIC data Company Ltd.; IMF staff calculations.

Production Function Approach

The production function approach is another popular method that has a number of advantages. This approach allows for a breakdown of the potential growth into contributions from different factors of production, as opposed to the statistical filters which explain the drivers of growth. It allows decomposition of Korea's potential growth rate into the contributions of capital, labor, human capital and the efficiency with which various factors are combined. In addition, the production function approach allows for projections of potential growth, in contrast to the filters. The production function approach is employed in two stages. First, using the standard Cobb-Douglas production function, total factor productivity (TFP) is calculated as the residual after accounting for labor input, human capital, and the physical capital stock. Following standard practice, we assume capital share to be 1/3. Capital stock is constructed using perpetual inventory method with 5 percent depreciation rate. Human capital is calculated as a weighted average of primary, secondary and tertiary years of schooling, with the weights comprising

Mincerian coefficients obtained by Psacharopuolos (1994). We use annual data from 1990 to 2014[4] . Next, potential growth is calculated by summing the trend growth in the components of the production function and the trend growth in TFP. The HP filter is used to estimate the trend growth of the various factors of production.

The results show that Korea's potential growth rate has been on a declining trend. The results, presented in Table 1, suggest that potential growth declined sharply after the Asian financial crisis, as there was a rapid decline in the growth rate of physical capital and a moderate decline in labor inputs. Since the Asian crisis, however, the decline in potential growth has continued, albeit much more moderately, and has been driven by the reduction in the contribution from labor input and physical capital stock. While capacity utilization has held up, the growth in physical capital stock has continued to decline to correct the overinvestment in the pre-Asian crisis period and also due to outward FDI as large Korean companies have moved production overseas. Interestingly, the contribution of TFP growth has continued to increase over the last decade and shore up potential growth. These estimates are based on labor input as measured by the working age population using labor force participation rates. Alternatively labor input can be measured by using total working hours, which have been on a downward trend. In this case, the overall level of potential growth is largely unchanged though the growth decomposition reveals that the contribution of labor is much lower while the TFP contribution makes up the shortfall. This can be interpreted as lower working hours having led to an increase in overall efficiency which has supported growth potential.

Korea-- Contribution to Potential Growth

Sources: IMF staff calculation.
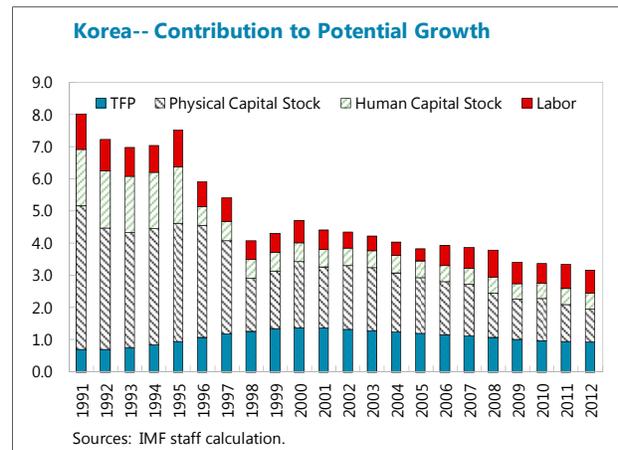
	Table 1. Decomposition of the Drivers of Potential Growth				
	Potential growth rate	Total Factor Productivity	Physical Capital Stock	Human Capital Stock	Labor
1991-1996	7.1	0.8	3.8	1.6	1.0
1997-2001	4.6	1.3	2.1	0.6	0.6
2002-2007	4.0	1.2	1.8	0.5	0.5
2008-2009	3.6	1.0	1.3	0.5	0.7
2010-2012	3.3	0.9	1.2	0.5	0.7

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[4] For 2013 and 2014, the data is based on projections in the World Economic Outlook.

Table 2. Summary of Potential Growth Estimates					
	1991-1997	1997-2001	2002-2007	2008-2009	2010-2012
Statistical Filters	7.0	5.1	4.5	3.2	3.3
Hodrick Prescott Filter	7.1	5.2	4.5	3.4	3.2
Baxter King Filter	6.8	5.1	4.5	3.5	3.2
CF Filter	7.3	4.9	4.6	3.4	3.3
Univariate Filter	6.8	5.1	4.5	3.1	3.3
Bivariate Filter	7.1	5.1	4.5	3.1	3.3
Multivariate Filter	7.1	5.0	4.3	3.1	3.5
Production Function	7.1	4.6	4.0	3.6	3.3
Average	7.1	4.8	4.3	3.4	3.3
Actual Growth	7.8	4.7	4.8	1.3	4.0

Since the global financial crisis, potential growth has dipped, though by not as much as in some other advanced countries. This is due to the fact that the crisis did not seriously damage major sectors of the economy. In the aftermath of financial crises, sectors such as finance, insurance and real estate sectors suffered large losses and lead to a permanent and sharp declines in potential output in many other advanced economies. Barrera et al (2009) estimate that the average potential growth rate for 2009–14 is 1½ percent for the United States, around ½ percentage point below their estimates for potential growth in the counterfactual scenario of no financial crisis.

In the absence of sustained and broad-based reforms, Korea's potential growth is likely going to continue to decline, in the face of demographic headwinds[5]. Using the production function approach, projections based on the current demographics trends (drawn from the UN population projections) and assuming constant participation rates (while maintaining the contributions of physical capital stock and human capital at the 2012 level) suggest that potential output will fall to around 2.4 percent by 2020 and further to 2 percent by 2025. In this scenario, GDP per capita will remain stagnant at the current level of around 64−65 percent of United States GDP per capita.

Korea: Projected Potential Growth

Sources: IMF Staff Calculation.

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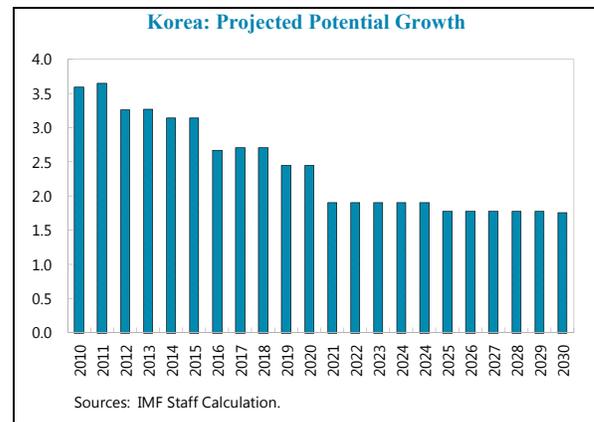
[5] There is considerable agreement regarding the forthcoming declining potential growth due to population aging. The Korea Development Institute estimates that Korea's potential growth will drop below 2 percent in the 2030s. The Bank of Korea has also recently estimated that potential growth had fallen to around 3.3−3.8 percent (based on 4 different methods) by 2010−12 from around 6¾ percent during the 1990s.

III. How Can Potential Growth Be Sustained? Quantification of the Gains from Structural Reforms to Bolster Growth

This section quantitatively illustrates the benefits from the implementation of key structural reforms using scenario analysis. These include increasing labor inputs (boosting female and youth labor force participation) and boosting total factor productivity (including by reducing employment protection to promote labor market flexibility and deregulation and strengthened competition to narrow the productivity gap between services and manufacturing).

A. Increasing Female and Youth Labor Force Participation

In the face of declining labor inputs, there is a need for reforms to boost labor force participation, in particular of women and the youth. Working age population is projected to start declining by as soon as 2016 and working hours have already been on declining trend. At the same time, certain segments of the population remain significantly underrepresented in the workforce.
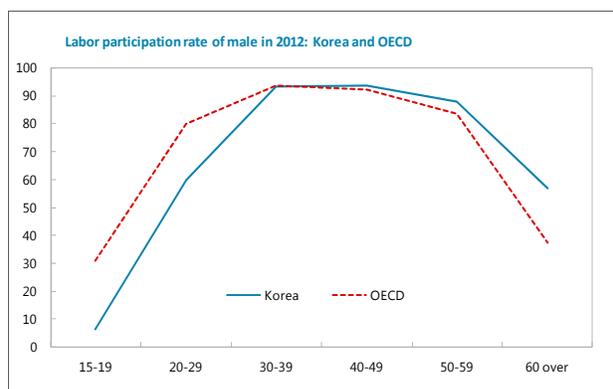
- The labor force participation rate for women was around 59.6 percent in 2012 compared to the OECD average of around 65 percent, and 70−80 percent in the most advanced countries, indicating considerable scope for increasing the number of women in the workforce. The pattern for female labor force participation rates across various age cohorts in Korea is different than in OECD peers. The gap is the largest for the 30−39 age group, when women tend to leave the workforce. In a 2010 government survey, women have cited family and child related responsibilities, including child care and children's schooling, as precluding labor force participation in this age cohort.

Source: OECD Employment Outlook Database.
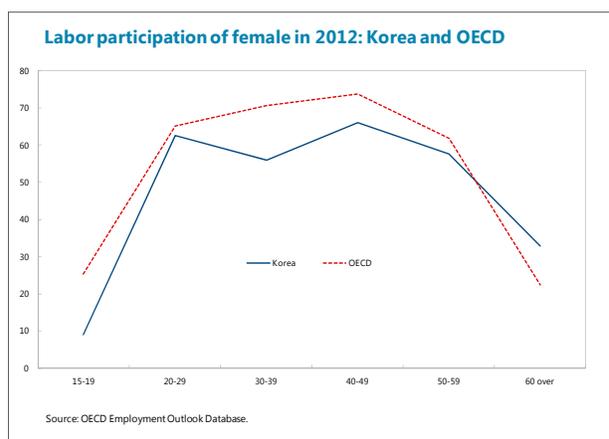
- In addition, the participation rate gaps for young males is very large compared with OECD peers, due to the high enrolment in tertiary education, mandatory military service and a widening skills mismatch. Given the lack of adequate pension coverage and early retirement of regular workers, older cohorts tend to be over-represented in the workforce, often trapped in low-productivity jobs.

Simulations suggest that measures to raise participation rates in the underrepresented segments of the population will result in a significant boost to potential growth. The baseline growth accounting scenario is augmented to quantify the impact of enhanced female and youth labor force inputs. Simulations assume rising participation rates until 2033 to narrow the gap between male and female participation rates (by 0.66 percentage point a year)[6]. Without reform, the labor force would fall from 25 million in 2013 to 23 million by 2025. A boost from increased female participation could lead to a slight rise in the labor force to around 25.6, more than counteracting the effect of aging. Such incremental but steady gains would lead to a rise in potential growth by around 0.3 percentage point per year over the projection period (relative to a baseline where female participation rates remain unchanged at the 2012 level). The government has made progress to this end as the target to boost female labor force participation to 60 percent by 2014 has almost been achieved. In addition, if more of the youth (age group 20−29) are brought into the workforce to close the gap over 20 years, potential output will rise by an additional 0.1 percentage point per year.

Total Labor Force

In Millions

Sources: UN population, CEIC and staff calculation.
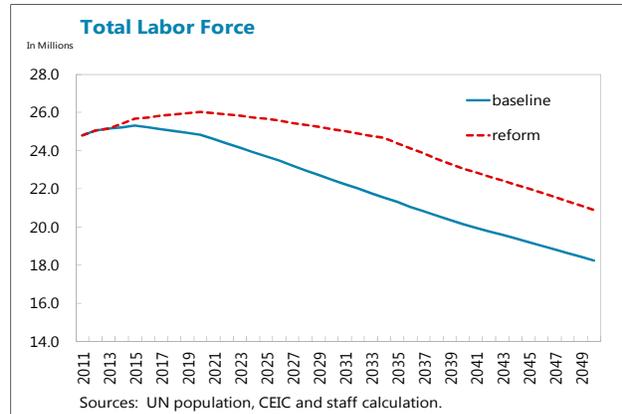
B. Reforming Employment Protection Legislation

Labor market reform related to the reform of employment protection legislation also has the potential to yield large gains for Korea. Korea has more stringent employment protection than the OECD average (this relates to rigid employment protection legislation for regular workers and not for non-regular workers, thereby covering a subset of workers) and there is considerable gap between Korea and the countries with the lowest level of employment protection. The OECD indicator of employment protection measures the procedures and costs involved in dismissing regular workers (in individual dismissals not collective).

Strictness of Employment Protection

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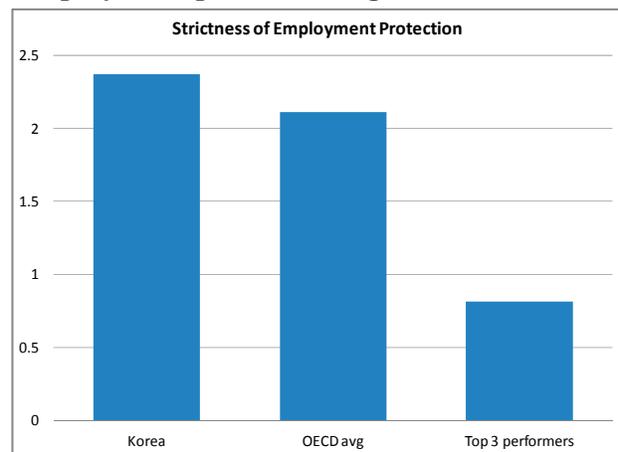
[6] The OECD estimates that if participation rates remain at their current levels the labor force would peak at 27.2 million in 2022 and then fell to 21.5 million in 2050. Raising female participation rates to the level of male participation rates would lead to working population falling to only 25.6 million.

The literature suggests that strict employment protection legislation could hamper productivity growth. Bassanini et al (2009) find that excessively stringent employment protection legislation depresses productivity growth in industries which naturally have high turnover rate or alternatively where such layoff restrictions are most binding. Such firms will find it more difficult to respond to changes in technology or demand and will not be able to reallocate labor accordingly, leading to inefficiencies. High degree of employment protection in Korea has also contributed to duality in the labor market, in which firms prefer to hire non-regular workers at lower cost. Non-regular workers are not provided adequate training leading to lower productivity.

To quantify the productivity gains from relaxing employment protection, we follow the model specification in Bassanini et al (2009). In this paper, the economy wide productivity level P depends on its own lag, the degree of employment protection EPLR, and the productivity level in the frontier economy P*. β captures the negative impact of EPLR on productivity, and is estimated to be -0.174. λ measures the extent to which employment protection constraints labor turnover in a particular economy. As shown in equation (2), λ is the weighted average of industry level layoff rate above 4 percent and the weight θ represents the value added share of each industry in the economy. $layoff_j^{U.S.}$ is the industrial level layoff rate in the United States. Given the very light labor market regulation in the U.S., this rate is used as a proxy for the natural layoff rate. An industry is considered as high "EPL-binding" if its natural layoff rate is above 4 percent.

The Degree of EPL-binding in OECD

Sources: OECD.
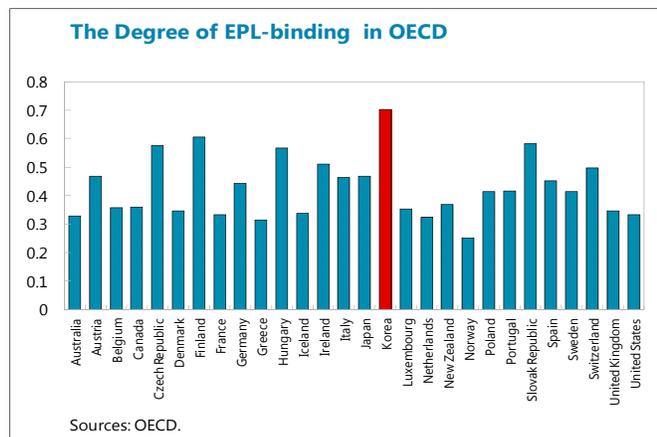
$$\log P_t = (1 - \varphi)\log P_{t-1} + \beta\lambda\text{EPLR}_{t-1} + \varphi\log P^* + C$$

$$\lambda = \sum_j \theta_j * (layoff_j^{U.S.} - 4)$$

The extent to which employment protection legislation in Korea is binding is the highest in OECD. This reflects its economic structure, notably the high share in value added of the "Electrical and optical equipment" sector in Korea (more than 6.5 percent of GDP in 2005 compared to less than 1.5 percent in the U.K. and the U.S.), a sector where the "natural" lay-off rate is very high.

Employment Protection Legislation Reform Scenarios
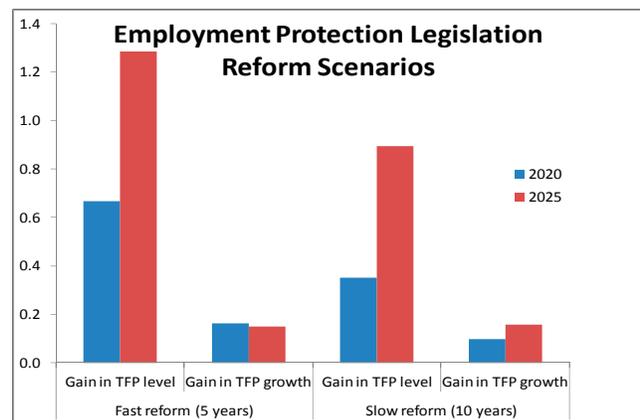
The simulations suggest that reducing the level of employment protection in Korea would yield significant productivity gains. If the level of employment protection in Korea converges to the average of the three lowest in the sample by 2020, the gains in TFP level will accrue to around 1.2 percent after 10 years or an annual increase in potential growth of around 0.2 percentage points after the phase-in of the first five years of reform.

C. Fostering Greater Competition in Network Service Sectors

This illustrative scenario assesses the quantitative impact on potential output over different horizons from reform in product markets. Bourles et al (2010) Bouis and Duval (2011) find that product market regulatory reform would lead to higher aggregate labor productivity. Specifically, alignment of product market regulation to the best practice (average of the top 3 most competitive countries in the OECD) in a wide range of upstream network service sectors such as energy, and transport, and in communication,

Product Market Regulation in Upstream Network Industries

More restrictive

retail trade, professional services and banking could significantly boost productivity in downstream sectors and lift growth potential of the economy. The importance of "network" industries stems from the fact that they produce key intermediate inputs for the rest of the economy. The distortion introduced by over regulation in network industries (such as stringent legal barriers to entry) is that the lack of competition leads to stronger market power which in turn results in higher prices of intermediate inputs, reducing productivity in downstream sectors by cutting their profits. Following their methodology, the scenario quantifies the gains from convergence of Korea's regulatory framework towards those in the top performing countries in the OECD.

 The regulatory environment for upstream service sectors in Korea is very stringent, compared with the OECD frontier. This holds true across the range of network sectors such as telecom, air, electricity rail, road, retails, and banking, suggesting ample room for reforms to boost productivity. The regulation is also more stringent compared to OECD average, although the gap is smaller there. Indicators of regulatory

Product Market Regulation in Upstream Sectors

Frontier   Korea

Sources: OECD.
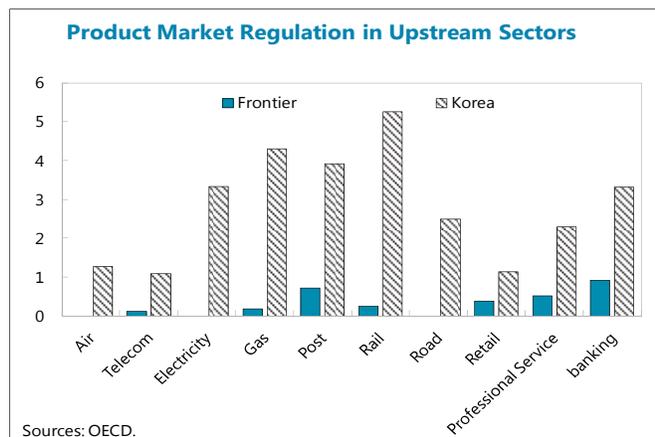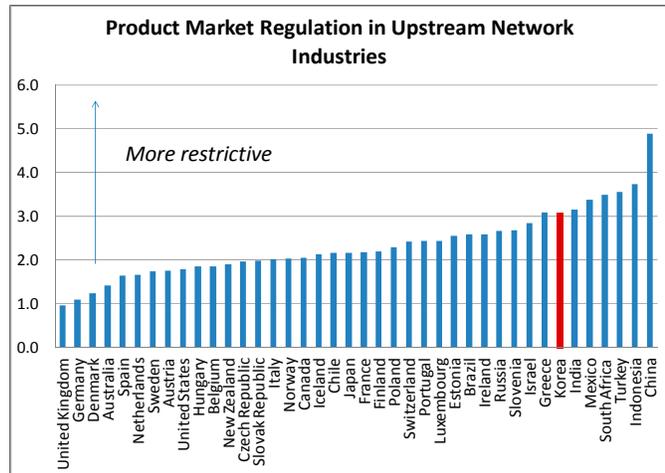
conditions in the 7 key non- manufacturing sectors are from the OECD international product market regulation database. The indicator for each sector relates the following 4 issues: entry regulation, public ownership, market structure and, where relevant, vertical integration (e.g., pertinent in the case of the electricity sector as to whether there is vertical separation between the transmission and generation segments of the electricity industry).

The gains to reducing product market regulation are simulated based on the framework in Bourles et al (2010). The impact of regulation in various upstream sectors on each downstream sector depends on the intensity of downstream use of that intermediate product (given by the weight in the input-output table). As shown in equation (3), NMR is the OECD indicator of regulation in the upstream sector k, and the weight ω is the required input from sector k to sector j,

$$REG_{j,t} = \sum_k NMR_{k,t} * \omega_{k,j}$$

The change in factor productivity MFP in sector j then depends on the productivity growth in the frontier economy, the distance to the frontier (gap), lagged upstream regulatory burden REG and its interaction with the distance to frontier, as well as sector and country fixed effects

$$\Delta lnMFP_{i,j,t} = a_0 lnMFP_{F,j,t} + a_1 gap_{t-1} + a_2 REG_{i,j,t-1} + a_3 REG_{i,j,t-1} * gap_{i,j,t-1} + f_i + f_{j,t}$$

The coefficients used in the simulation are based on panel estimates for OECD countries in Bourles et al (2010). The productivity growth in the frontier economy has a positive impact on MFP growth in less productive countries, reflecting technology pass-through ($a_0 = 0.122$). The coefficient on the gap variable a_1 is also positive as countries that are further away from the frontier tend to catch-up faster($a_1 = 0.032$). The coefficient on the regulatory burden a_2 is estimated to be -0.124. Also this effect is even more negative for country − sector pairs closer to the technological frontier as suggested by the positive coefficient ($a_3 = 0.132$) related to the interaction term. (See Bourles et al (2010) for more details)

The simulations for network service sector regulatory reform in Korea suggest the possibility of large productivity gains. If the regulatory burden in upstream sectors in Korea converges to the average of the three best performing (most competitive) economies in OECD by 2020, the gains in TFP level will accrue to around 3½ percent after 10 years or annual increase in potential growth of around ½ percentage point after the phase-in of the first five years of

reform. More front-loaded reform will yield higher benefits. It is also important to note that the estimated TFP gain here is the lower bound, as it only takes into account the indirect effect of the
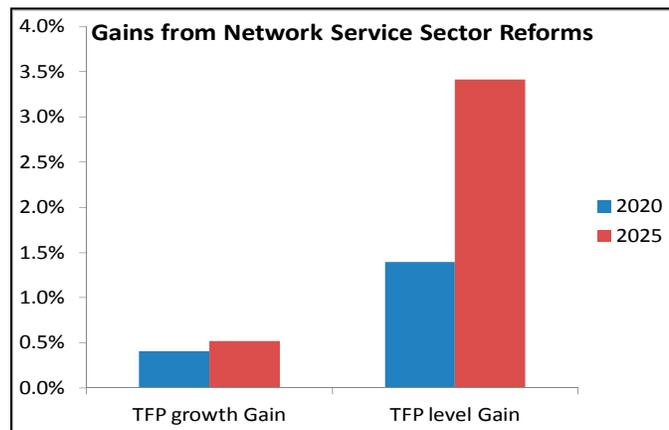
reforms on downstream sectors, while ignores possible direct productivity gains in the upstream sectors.

In addition to the reforms of the network service sectors, overall productivity in services lags considerably behind that of the manufacturing sector. Productivity in services is only around 53 percent of manufacturing in Korea. The corresponding gap in the OECD (average) is around 87 percent. Closing this gap is crucial for boosting potential growth and relying on domestic sources of growth. This entails a multi-pronged strategy including leveling the playing field between manufacturing and services along many dimensions, including taxation, deregulation to foster competition, and higher investment in services (at present investment in services lags behind investment in manufacturing).

IV. CONCLUDING REMARKS

Korea's rapid growth has slowed in recent years, suggesting lower potential growth. This paper used an array of techniques, including statistical filters, a multivariate model and the production function, to estimate Korea's potential growth. The main finding is that trend growth has fallen from around 4¾ percent during 2000−07 to around 3¼ −3½ percent by 2011−12. Absent reforms, it is projected to fall further to around 2 percent by 2025, primarily due to declining working-age population, with GDP per capita remaining at around the current level of 65 percent of the United States. In this scenario, convergence with the United States stalls.

Korea's potential growth can be maintained at a higher level by putting in place a comprehensive structural reform agenda. This includes policies to encourage increased female and youth labor force participation, easing of product market regulation, reduced employment protection and reforms to boost service sector productivity. The government has already put in place a number of structural reform measures in these areas. Staff simulations suggest that sustained and comprehensive structural reforms, including some that are already in train, could lift potential growth by around 1¼ percentage point over the next decade, essentially maintaining potential growth at around 3¼ percent, counteracting the effect of population aging. This would enable Korea to continue to converge to income levels of the United States (and attain 72 percent of U.S. income levels). Additional reforms could enable even greater convergence.

Income Convergence (Korea's GDP per capita as a percent of US GDP per capita)

Sources: World Economic Outlook, IMF Staff Estimates.

Gains from Structural Reforms

Baseline potential growth
Product Market Reform
Employment Protection Reform
Raise Female Labor Participation
Raise Male Youth Labor Participation

Source: IMF staff estimates.
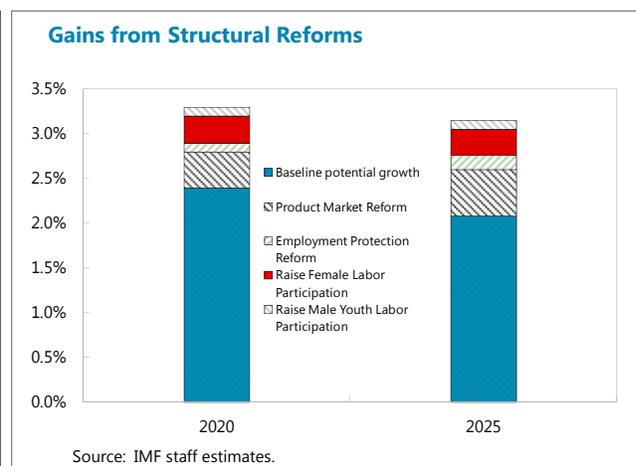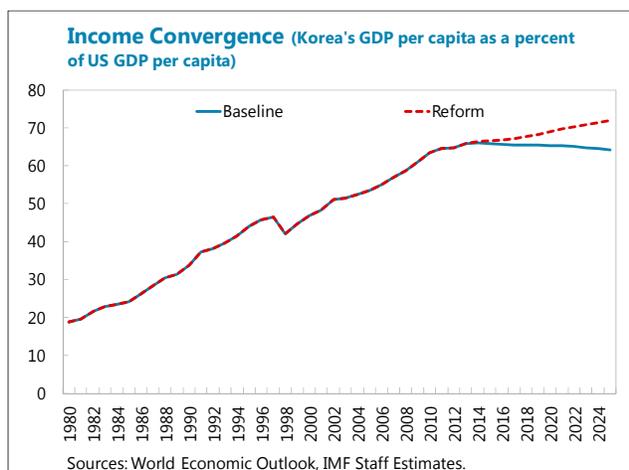
References

Barrera, Natalia, Oya Celasun, Marcello Estevão, Geoffrey Keim, Andrea Maechler, Paul Mills and Ashok Vir Bhatia, 2009, **"**United States: Article IV Selected Issues," IMF Country Report No. 09/229.

Bassanini, Andrea, Luca Nunziata, Danielle Venn, 2009, "Job protection legislation and productivity growth in OECD countries," Economic Policy, CEPR & CES & MSH, vol. 24, pages 349−402, 04.

Benes, Jaromir, Kevin Clinton, Roberto Garcia-Saltos, Marianne P. Johnson, Douglas Laxton, Peter Manchev and Troy Matheson, 2010, "Estimating Potential Output with a Multivariate Filter," IMF Working Paper 285.

Bouis, Romain and Romain Duval, 2011, "Raising Potential Growth After the Crisis: A Quantitative Assessment of the Potential Gains from Various Structural Reforms in the OECD Area and Beyond," OECD Economics Department Working Papers 835, OECD Publishing.

Bourlès, Renaud, Gilbert Cette, Jimmy Lopez, Jacques Mairesse and Giuseppe Nicoletti, 2010. "Do Product Market Regulations in Upstream Sectors Curb Productivity Growth?: Panel Data Evidence for OECD Countries," OECD Economics Department Working Papers 791, OECD Publishing.