

Projecting Economic Growth with Growth Accounting Techniques
The Conference Board Global Economic Outlook 2012
Sources and Methods

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1. Introduction and Summary

This note describes the methodology and sources underlying the projections of growth of Gross Domestic Product in the 2012 edition of *The Conference Board Global Economic Outlook*. The outlook covers the period 2012-2025, with separate projections for the medium term (2012-2016) and the long term (2017-2025). The Outlook covers 12 regions, divided in advanced economies (the United States, the EU-15, Japan and other advanced economies) and emerging and developing economies (China, India, other developing Asia, Latin America, Middle East, Africa, Central & Eastern Europe, and the Commonwealth of Independent States, including Russia).

Section 2 describes how the trend growth, which determines our base scenario for growth, is estimated on the basis of an extrapolated growth accounting model which projects the various growth components of the production function. For labor quantity (Section 2.1), the measures are primarily based on projections for the working age population (age of 15-64) from the [International Data Base of the U.S. Census Bureau](#). For labor composition (Section 2.2), estimates are based on projections of population by level of education attainment, age and sex by [KC et al. \(2010\)](#). For capital services and Total Factor Productivity (Section 2.3), we use regression models which are largely based on relevant past-period variables. The extrapolated

growth accounting estimates are provided for 30 advanced economies and 25 major emerging and developing economies.

The projected GDP growth rates based on the growth accounting framework are to be considered to represent the trend growth of each economy. In the long run, countries grow according to their trend. In the short run, however, countries deviate from their long-run path due to temporary deviations primarily due to business cycle dynamics. Occasionally, shocks can also occur which have a deep impact on the structure of the economy, which can permanently change the course of the trend. The 2008/09 recession represents a combination of business cycle dynamics and shock effects, which has led to such changes. Section 3 describes the medium-term adjustments to the trend growth estimates obtained from the extrapolated growth accounts.

The outlook suggests some effects of a modest recovery in advanced economies beginning in late 2012, which potentially brings these countries back to pre-recession growth of around 2 percent by 2013. Among the larger economies, the United States will be outperforming Europe in 2012-2016 by a small margin (2.3 and 1.5 percent annual GDP growth, respectively). However, there remain significant downside risks to even this modest recovery, which could slow growth to as little as 1.1 percent for advanced economies as a whole.

During the past two years emerging and developing economies have, on average, grown somewhat beyond their growth trend. Given the current sober conditions in the global economy, there is little reason to expect emerging economies to continue to grow above trend for much longer. For example, the economies of China and India begin to show signs of maturing beyond 2012, as their trend growth will begin to slow from 2012-2016 to 2017-2025 (from from 6.9 to 3.5 percent in China and 6.2 to 4.6 percent in India.) Overall, emerging economies' growth will slow to 3.3 percent on average from 5.1 percent.

In the period from 2017-2025, the global economy faces much larger challenges as the base scenario brings global GDP growth down to 2.7 percent. Advanced economies will continue to grow at 1.9 percent while emerging economies are likely to experience a greater slowdown in

their trend growth to 3.3 percent. Overall, the slowdown in emerging economies will more than offset the modest recovery in advanced economies.

In sum, global growth of GDP is projected to grow at 3.5 percent in 2012, then accelerate somewhat to 3.6 percent from 2013-2016, and then show a further slowdown to 2.7 percent from 2017-2025. At 3 percent, on average, global growth will still be somewhat higher than the period 1980-1995 but between half and a full percentage point below the growth rate from 1995-2008.

2. Medium- and long term projections for 2013-2016 and 2017-2025.

The medium- and long-term projections which form the basis of The Conference Board Global Economic Outlook are based on the growth accounting framework as developed in Jorgenson, Gollop and Fraumeni (1987) and more recently in Jorgenson, Ho and Stiroh (2005). The growth accounting methodology is based on a production function, which decomposes output growth into components associated with changes in factor inputs including capital and labor inputs, and a residual that reflects technological progress and production efficiency, known as the Total Factor Productivity (TFP):

$$Y = Af(LQ, K) \quad (1)$$

Where Y is gross output, L is labor quantity, Q is the composition of the labor force based on different education attainment, K is capital services, A is total factor productivity. Under the assumption of perfect competitive factor markets where the marginal product of each input equals its price and constant returns to scale, the above general production function can be transformed into the following growth accounting framework:

$$\Delta \ln Y = \Delta \ln A + \bar{v}_L \Delta \ln L + \bar{v}_Q \Delta \ln Q + \bar{v}_K \Delta \ln K \quad (2)$$

where $\Delta \ln X$ denotes the growth rate of variable X over two studying time periods,¹ \bar{v} 's stand for the two period average input shares in total factor income. Under the assumption of constant returns to scale, $\bar{v}_L + \bar{v}_K = 1$.

Equation (2) illustrates that output growth is driven by share weighted input growth and TFP growth, a residual that captures all sources of growth which are left unexplained by labor and capital inputs. Thus, projection of output growth requires projection of each individual input component on the right hand side of equation (2). Our projection covers the medium term period (2012-2016) and a longer term period (2017-2025) for 30 advanced economies and 25 major emerging economies.

2.1 Growth in Labor Quantity

The projection of the growth of labor quantity is approximated by the working age population (age of 15-64) from the [International Data Base of the U.S. Census Bureau](#). The actual growth in employment that enters the production process can of course differ from the working age population due to changes in the employment participation in the labor force. However, predictions on labor force participation and employment are subject to high degree of uncertainty as they are affected by unpredictable factors such as institutional and cultural changes as well as cyclical fluctuations. Therefore, we only use the more stable measure of working age population..

At an annual rate of 0.5 percent, the United States has one of the fastest growth rates in working age population among advanced economies. Working age population growth in many European countries, as well as in Japan and Russia, is already negative between 2008 and 2016, putting downward pressure on output growth. In emerging economies, working age population growth is still an engine underpinning their economic growth during 2008 – 2016. Looking beyond, growth of working age population in our sample will further slow between 2017 and 2025, except for Ireland, Spain, Nigeria and South Africa. China, where economic growth has thus far been fueled by cheap and abundant labor, will see its working age population growth decline by

¹ In this paper, all growth rates are calculated as the difference in the log of the levels of each variable

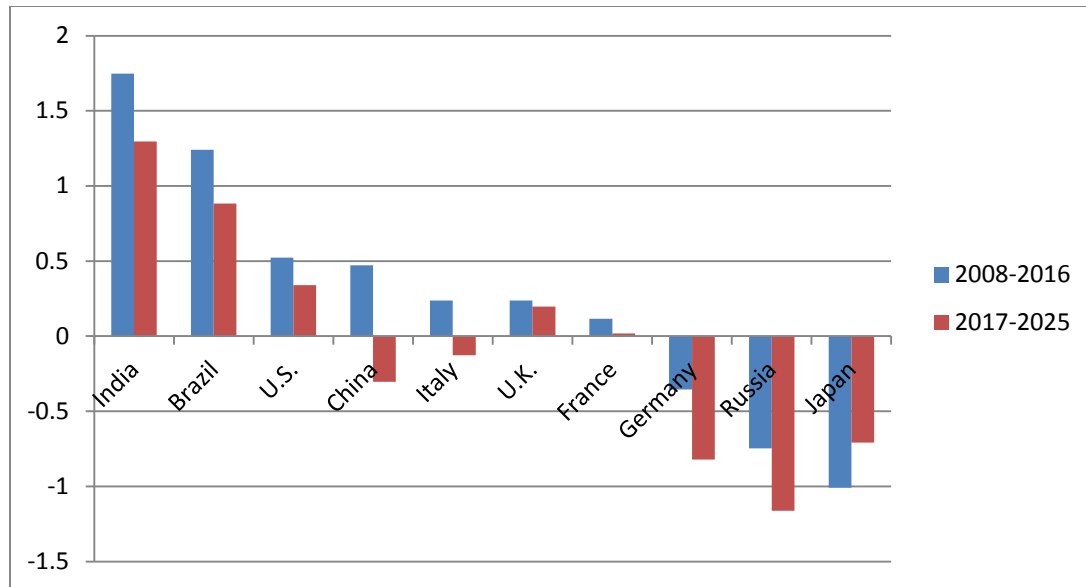
0.3 percent on average between 2017 and 2025. India, on the other hand, will continue to enjoy a robust working age population growth at above one percent. In the U.S., the working age population growth will slightly abate to 0.3 percent.

Table 1: Growth of working age population, growth of labor composition, and labor share for 2008-2016, 2017-2025

Country	Region	Growth of working age population (%)		Growth of labor composition (%)		Labor share (%)
		2008-2016	2017-2025	2008-2016	2017-2025	2008-2025
Advanced Economies						
United States	United States	0.52	0.34	0.24	0.23	0.65
Austria	EU-15	-0.07	-0.60	0.10	0.12	0.63
Belgium	EU-15	-0.12	-0.50	0.33	0.32	0.67
Denmark	EU-15	-0.02	-0.11	0.09	0.13	0.68
Finland	EU-15	-0.50	-0.67	0.30	0.30	0.64
France	EU-15	0.12	0.02	0.25	0.25	0.65
Germany	EU-15	-0.35	-0.82	0.16	0.17	0.66
Greece	EU-15	-0.14	-0.35	0.56	0.47	0.56
Ireland	EU-15	0.75	0.91	0.25	0.20	0.54
Italy	EU-15	0.24	-0.13	0.08	0.10	0.64
Luxembourg	EU-15	1.14	0.75	0.29	0.28	0.55
Netherlands	EU-15	0.06	-0.13	0.11	0.14	0.66
Portugal	EU-15	0.04	-0.18	0.85	0.92	0.67
Spain	EU-15	0.44	0.53	0.48	0.45	0.62
Sweden	EU-15	-0.29	-0.20	0.15	0.12	0.67
United Kingdom	EU-15	0.24	0.20	0.20	0.17	0.72
Japan	Japan	-1.01	-0.71	0.25	0.28	0.56
Australia	Other Advanced	0.88	0.58	0.29	0.25	0.60
Canada	Other Advanced	0.39	-0.08	0.21	0.14	0.63
Cyprus	Other Advanced	1.57	0.62	0.45	0.26	0.59
Hong Kong	Other Advanced	0.19	-1.15	0.23	0.19	0.70
Iceland	Other Advanced	0.65	0.07	0.43	0.43	0.83
Israel	Other Advanced	1.58	1.35	0.27	0.27	0.70

Country	Region	Growth of working age population (%)		Growth of labor composition (%)		Labor share (%)
		2008-	2017-	2008-	2017-	2008-
		2016	2025	2016	2025	2025
Malta	Other Advanced	-0.22	-0.55	0.39	0.35	0.57
New Zealand	Other Advanced	0.69	0.35	0.41	0.29	0.67
Norway	Other Advanced	0.20	-0.11	0.20	0.17	0.53
Singapore	Other Advanced	2.18	1.08	0.58	0.37	0.70
Switzerland	Other Advanced	0.02	-0.43	0.09	0.12	0.78
Taiwan	Other Advanced	0.44	-0.84	0.44	0.44	0.70
Emerging and Developing Economies						
China	China	0.47	-0.30	0.27	0.22	0.45
India	India	1.75	1.30	0.31	0.30	0.50
Indonesia	Other Developing Asia	1.46	0.93	0.32	0.30	0.50
Malaysia	Other Developing Asia	1.77	1.33	0.33	0.30	0.50
Pakistan	Other Developing Asia	2.64	1.96	0.33	0.31	0.50
Thailand	Other Developing Asia	0.61	-0.09	0.68	0.51	0.50
Argentina	Latin America	1.06	0.91	0.29	0.35	0.50
Brazil	Latin America	1.24	0.88	0.38	0.35	0.40
Chile	Latin America	0.96	0.34	0.44	0.25	0.50
Colombia	Latin America	1.59	0.82	0.39	0.33	0.50
Mexico	Latin America	1.48	0.96	0.34	0.37	0.47
Venezuela	Latin America	1.95	1.26	0.64	0.64	0.50
Iran	Middle East	1.59	0.90	0.34	0.25	0.50
Saudi Arabia	Middle East	2.40	1.57	0.36	0.33	0.50
United Arab Emirates	Middle East	3.13	1.88	0.00	0.00	0.50
Algeria	Africa	1.70	0.84	0.39	0.39	0.50
Egypt	Africa	2.03	1.82	0.37	0.34	0.50
Morocco	Africa	1.52	0.88	0.34	0.36	0.50
Nigeria	Africa	2.70	2.89	0.24	0.29	0.50
South Africa	Africa	0.07	0.14	0.45	0.26	0.50
Czech Republic	Central and East Europe	-0.75	-0.75	0.22	0.16	0.60
Hungary	Central and East Europe	-0.51	-0.78	0.39	0.32	0.61
Poland	Central and East Europe	-0.36	-1.06	0.22	0.19	0.67
Turkey	Central and East Europe	1.52	1.02	0.32	0.35	0.45
Russian Federation	Russia	-0.75	-1.16	0.31	0.18	0.45

Chart 1: Growth of working age population (%)



2.2 Growth in Labor Composition

In addition to the change in labor quantity, an adjustment for changes in the composition of the labor force in terms of different skill-levels is needed to measure labor's effective contribution to output growth. The change of labor composition is constructed on the basis of weighted measures of different skill-level groups (low, medium and high skilled workers based on educational attainment) in the labor force:

$$\Delta \ln Q_t = 1/2 \sum_i (v_{i,t} + v_{i,t-1})(\ln h_{i,t} - \ln h_{i,t-1}) \quad (3)$$

in which v_i is the share in labor compensation by labor type i and h_i is the share of total hours worked by labor type i . For a detailed methodology describing the construction of the labor composition data, please refer to Bonthuis (2011).

The projection data used in equation (3) are mainly based on the projection of population by level of education attainment, age and sex by [KC et al. \(2010\)](#). In general, labor composition is relatively stable over the time. The average growth rate across all 55 countries in our projection

sample is around 0.3 percent for two projection periods. Consequently, the direct contribution from the growth of labor composition to total output growth is quite small. However, a well educated labor force can improve productivity by enabling better utilization of equipment, adoption of advanced technology, and improvement of production process, thereby contributing to output growth.

In order to establish the contribution of labor quantity and composition to GDP, and in accordance with the growth accounting model, we need to assign weights relative to the contribution of capital, discussed in the next section. According to Gollin (2002), labor shares are approximately constant across time and countries within a range of 0.65-0.80. We therefore use the average labor share in 2000-2007 for the projection years. On average labor shares are lower in emerging economies because capital is scarcer while labor is cheaper compared to advanced economies. Our data (see Table 1) confirm this pattern: Brazil, Russia, Turkey, China and Mexico have the lowest labor share (between 0.4-0.47) among our projection countries while labor shares in U.K., Korea, Switzerland and Iceland are more than 0.7.²

2.3 Growth in Capital Services and Total Factor Productivity

Compared to the projections for labor inputs, the development of capital services and Total Factor Productivity (TFP) is subject to a higher degree of uncertainty. We use the following regression models to forecast the growth of capital services and TFP.

$$\Delta \ln KSvc_t = \alpha_0 + \alpha_1 \ln I_{t-1} + \alpha_2 \Delta \ln N_t + \alpha_3 \delta_t + \alpha_4 \Delta \ln TFP_{t-1} + \alpha_5 \ln KD_{t-1} + \varepsilon_t \quad (4)$$

$$\Delta \ln TFP_t = \beta_0 + \beta_1 \Delta \ln TFP_{t-1} + \beta_2 \ln LP_{t-1} + \mu_t \quad (5)$$

where $\Delta \ln X$ denotes the log growth rate of variable X over period t and $t-1$, $\ln X$ indicates the log level of the variable X . The definition of the variables and the data sources are listed in Table 2 below.

² For countries that we do not have labor share data for, we use 0.7 for advanced countries and 0.5 for emerging economies.

Table 2: Definition of variables and data sources:

Variable name	Definition	Data source
Capital Services Equation (4)		
$\Delta \ln KSvc_t$	log growth of capital services in period t	<i>Total Economy Database</i>TM
$\ln I_{t-1}$	log level of investment over GDP ratio in period t-1	Penn World Table 7.0
$\Delta \ln N_t$	log growth of working age population in period t	International Data Base of the U.S. Census Bureau
δ_t	weighted depreciation rate across 6 asset types in period t	Authors' own calculation
$\Delta \ln TFP_{t-1}$	log growth of TFP in period t-1	<i>Total Economy Database</i>TM
$\ln KD_{t-1}$	log level of the average capital deepening (capital stock /employment ratio) in last two years of the previous period	<i>Total Economy Database</i>TM
TFP Equation (5)		
$\Delta \ln TFP_t$	log growth of TFP in period t	<i>Total Economy Database</i>TM
$\Delta \ln TFP_{t-1}$	log growth of TFP in period t-1	<i>Total Economy Database</i>TM
$\ln LP_{t-1}$	log level of labor productivity (output and employment ratio) in period t-1	<i>Total Economy Database</i>TM

Data used in estimation are from The Conference Board [*Total Economy Database*TM](#), [Penn World Table 7.0](#), and [International Database of U.S. Census Bureau](#). All three databases cover 100+ countries with annual data starting from 1950. To implement our regressions, we restrict our sample to 30 advanced economies and 25 major emerging economies from 1972 to 2007 to ensure the high quality of the data. We also divide the 36 years into six time periods: 1972-1978, 1979-1983, 1984-1989, 1990-1994, 1995-1999, and 2000-2007. These divisions are designed to distribute the number of years to each period as equally as possible. More importantly, we choose divisions so that the initial and end years do not fall on recession years. All annual variables from the data sources are averaged for each defined period. Using data from these six time periods, we project the average annual growth of capital services and TFP for the seventh period (2008-2016).

We estimate both capital services growth and TFP growth regressions using simple OLS, fixed effect panel regression, robust OLS, OLS with regional dummies and robust OLS with regional dummies. Table 3 and 4 report the results for capital services and TFP respectively. In both regressions, almost all independent variables are significant with expected signs.

To determine which estimation method is preferred for our projection, we carry out out-of-sample tests on capital services growth, TFP growth and GDP growth to measure the deviation of the forecast value from the actual value. Specifically, we use the first four or five periods' data in the capital services and TFP growth regressions to predict capital services and TFP growth in periods 5 or 6. We can then compare the average deviation between projection and actual across different estimation methods.³ The predicted capital services and TFP growth in period 5 and 6 are used to calculate the projected GDP growth, which is compared with the actual GDP growth. Table 5 summarizes the average deviation for capital services growth and TFP growth regressions as well as for GDP growth based on the five different estimation methods. Based on these results, the robust OLS estimation produced the most accurate projections for GDP and TFP growth and the second most accurate projection of capital services growth. We therefore chose the robust OLS estimation as our preferred estimation method.

The third column in Table 3 and 4 lists the results based on robust OLS estimation. In the capital services growth regression, higher investment ratio, employment growth, depreciation rate and TFP growth all lead to higher growth in capital services. The negative coefficient of the capital deepening level indicates a convergence effect - if the capital stock per person employed in a country is high in a certain time period, the growth of capital services will be slower in the next period, *ceteris paribus*. In the TFP growth regression, lagged TFP growth has a positive effect on the TFP growth in the current period. The negative effect from the lagged labor productivity level suggests convergence - TFP will grow slower in countries with higher labor productivity levels, *ceteris paribus*.

³ The average deviation of the projection from the actual is calculated as the average of the squared deviations between projected and actual values over all countries in each time period.

Table 3: Estimation results of capital services growth equation

Dependent variable = capital services growth					
	OLS	Fixed effect panel	Robust OLS	OLS w/ regional dummies	Robust OLS w/ regional dummies
$\ln I_{t-1}$	0.0162*** (4.17)	0.000861 (0.13)	0.0161*** (4.06)	0.0103* (2.36)	0.00954* (2.13)
$\Delta \ln N_t$	0.00349** (2.80)	0.00964*** (3.43)	0.00361** (2.83)	0.00748*** (4.31)	0.00805*** (4.53)
δ_t	0.00550*** (4.07)	0.00631** (2.83)	0.00544*** (3.93)	0.00405** (2.93)	0.00436** (3.08)
$\Delta \ln TFP_{t-1}$	0.00259*** (4.00)	0.00197** (3.11)	0.00252*** (3.81)	0.00180** (2.77)	0.00195** (2.93)
$\ln KD_{t-1}$	0.00908*** (-6.37)	-0.0105* (-2.22)	0.00793*** (-5.43)	-0.0121*** (-5.36)	0.00998*** (-4.31)
Constant	0.0503** (2.87)	0.101 (1.96)	0.0372* (2.08)	0.106*** (3.98)	0.0815** (2.98)
Regional dummies	No	No	No	Yes	Yes
Observations	263	263	263	263	263
R-sq	0.296	0.174	0.266	0.434	0.416
adj. R-sq	0.283	-0.066	0.251	0.397	0.378

Note: t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 4: Estimation results of TFP growth equation

Dependent variable = TFP growth					
	OLS	Fixed effect panel	Robust OLS	OLS w/ regional dummies	Robust OLS w/ regional dummies
$\Delta \ln TFP_{t-1}$	0.265*** (5.41)	-0.0614 (-0.95)	0.111** (2.63)	0.116* (2.11)	0.0436 (0.93)
$\ln LP_{t-1}$	-0.274* (-2.33)	-2.382*** (-4.59)	-0.236* (-2.34)	-1.001*** (-4.10)	-1.327*** (-6.40)
Constant	3.268** (2.74)	24.79*** (4.71)	3.129** (3.05)	11.46*** (4.13)	15.07*** (6.40)
Regional dummies	No	No	No	Yes	Yes
Observations	267	267	267	267	267
R-sq	0.121	0.092	0.048	0.274	0.274
adj. R-sq	0.114	-0.150	0.040	0.236	0.237

Note: t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 5: Average Deviations of Out-of-Sample Forecast

	OLS	Fixed Effect	Robust OLS	OLS with regional dummy	Robust OLS with regional dummy
Capital Services	16.6	20.3	15.9	16.0	15.7
TFP	2.9	3.6	2.5	2.8	3.0
GDP	3.8	4.8	3.4	4.3	4.5

In addition to the medium term projection for 2008-2016, we also project growth in the longer term, for 2017-2025 (period 8). In order to project capital services and TFP growth for 2017-2025 (period 8), we need estimates of investment ratio, capital deepening, and labor productivity in 2008-2016 (period 7). The labor productivity level in period 7 is calculated through labor productivity growth, which is obtained from the difference between GDP growth and employment growth. GDP growth in period 7 is obtained using projected capital services and

TFP growth as explained above. Employment growth is approximated by the growth of working age population available from the [International Database of the U.S. Census Bureau](#). As capital deepening is defined as the ratio of capital stock over employment, the latter is again approximated by the working age population, while the former is estimated using equation (6). Meanwhile, another auxiliary regression is employed to obtain the estimate of investment ratios, as shown in equation (7),

$$\Delta \ln KStk_t = \alpha_0 + \alpha_1 \ln I_{t-1} + \alpha_2 \Delta \ln N_t + \alpha_3 \delta_t + \alpha_4 \Delta \ln TFP_{t-1} + \alpha_5 \ln KD_{t-1} + \varepsilon_t \quad (6)$$

$$\ln I_t = \alpha_0 + \alpha_1 \ln I_{t-1} + \alpha_2 \Delta \ln N_t + \alpha_3 \delta_t + \alpha_5 \ln KD_{t-1} + \varepsilon_t \quad (7)$$

where $\Delta \ln KStk_t$ is log growth of capital stock in period t, other variables are defined the same way as specified in Table 2.

The specification of the regression equations for capital stock growth and the investment ratio are similar to that of capital services growth, assuming they are subject to similar determining factors. We apply robust OLS on both regressions and present the results in Table 6, and find the results to be similar to the results from the capital services regression.

Table 6: Estimation results of capital stock growth and investment ratio equation

	capital stock growth	log(investment ratio)
$\ln I_{t-1}$	0.0231*** (6.76)	0.810*** (31.44)
$\Delta \ln N_t$	0.00446*** (4.06)	0.0125 (1.54)
δ_t	0.00372** (3.12)	0.0234* (2.59)
$\Delta \ln TFP_{t-1}$	0.00281*** (4.92)	
$\ln KD_{t-1}$	-0.00741*** (-5.88)	-0.0196* (-2.10)
Constant	0.0131 (0.85)	0.655*** (5.59)
Observations	263	263
R-sq	0.378	0.812
adj. R-sq	0.366	0.809

Note: t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Equations estimated using robust OLS

Having the projected capital services growth and TFP growth in place, we can then calculate GDP growth using the growth accounting equation (2). Table 7 lists GDP projections for periods 7 (2008-2016) and 8 (2017-2025) for all 55 economies as well as the growth contributions of labor, capital, and TFP. The actual GDP growth between 1996 and 2007 is also reported to compare with forecast values.

Table 7: Projection on GDP growth and its components (%)

Country	Average growth 1996-2007	Average annual growth 2008 - 2016 (projection)					Average annual growth 2017 - 2025 (projection)				
		GDP	Labor Quantity	Labor Composition	Capital Services	TFP	GDP	Labor Quantity	Labor Composition	Capital Services	TFP
Advanced Economies											
United States	3.0	2.5	0.3	0.2	1.5	0.5	2.3	0.2	0.1	1.4	0.5
Austria	2.5	1.9	0.0	0.1	1.3	0.6	1.4	-0.4	0.1	1.1	0.6
Belgium	2.3	1.5	-0.1	0.2	0.8	0.5	1.2	-0.3	0.2	0.7	0.5
Denmark	2.2	1.8	0.0	0.1	1.3	0.5	1.8	-0.1	0.1	1.2	0.6
Finland	3.8	1.7	-0.3	0.2	1.2	0.7	1.3	-0.4	0.2	1.0	0.6
France	2.2	1.4	0.1	0.2	0.6	0.5	1.4	0.0	0.2	0.6	0.5
Germany	1.6	1.6	-0.2	0.1	1.1	0.6	1.1	-0.5	0.1	1.0	0.6
Greece	3.7	2.3	-0.1	0.3	1.5	0.6	2.0	-0.2	0.3	1.3	0.6
Ireland	7.1	3.2	0.4	0.1	2.1	0.6	3.1	0.5	0.1	2.0	0.5
Italy	1.5	2.0	0.2	0.1	1.3	0.5	1.8	-0.1	0.1	1.3	0.6
Luxembourg	4.6	2.8	0.6	0.2	1.5	0.5	2.4	0.4	0.2	1.4	0.5
Netherlands	2.8	1.9	0.0	0.1	1.1	0.6	1.7	-0.1	0.1	1.1	0.6
Portugal	2.5	2.2	0.0	0.6	1.1	0.4	2.4	-0.1	0.6	1.2	0.7
Spain	3.7	2.4	0.3	0.3	1.4	0.5	2.6	0.3	0.3	1.4	0.6
Sweden	3.2	1.8	-0.2	0.1	1.3	0.7	1.7	-0.1	0.1	1.2	0.6
United Kingdom	2.9	2.0	0.2	0.1	1.1	0.6	1.8	0.1	0.1	1.0	0.5
Japan	1.4	1.5	-0.6	0.1	1.2	0.7	1.5	-0.4	0.2	1.1	0.6
Australia	3.6	2.3	0.5	0.2	1.1	0.5	2.1	0.4	0.2	1.1	0.5
Canada	3.1	2.1	0.2	0.1	1.2	0.5	1.8	0.0	0.1	1.2	0.6
Cyprus	3.4	3.1	0.9	0.3	1.1	0.7	2.1	0.4	0.2	0.9	0.7
Hong Kong	3.8	2.4	0.1	0.2	1.2	0.9	0.7	-0.8	0.1	0.8	0.6
Iceland	4.3	2.3	0.5	0.4	0.6	0.8	1.5	0.1	0.4	0.5	0.6
Israel	4.0	3.6	1.1	0.2	1.6	0.7	3.3	0.9	0.2	1.5	0.6
Malta	2.6	1.9	-0.1	0.2	1.2	0.6	1.6	-0.3	0.2	1.1	0.6
New Zealand	3.3	2.7	0.5	0.3	1.4	0.6	2.4	0.2	0.2	1.3	0.6
Norway	2.9	1.6	0.1	0.1	0.9	0.5	1.4	-0.1	0.1	0.9	0.5

Country	Average growth 1996-2007	Average annual growth 2008 - 2016 (projection)					Average annual growth 2017 - 2025 (projection)				
		GDP	Labor Quantity	Labor Composition	Capital Services	TFP	GDP	Labor Quantity	Labor Composition	Capital Services	TFP
Singapore	5.8	4.2	1.5	0.4	1.4	0.8	2.7	0.8	0.3	1.1	0.5
South Korea	5.1	2.8	0.3	0.3	1.3	0.9	1.3	-0.6	0.3	1.0	0.7
Switzerland	1.9	1.8	0.0	0.1	1.1	0.6	1.4	-0.3	0.1	1.0	0.6
Taiwan	4.6	2.6	0.3	0.3	1.2	0.8	1.2	-0.6	0.3	0.9	0.6

Emerging and Developing Economies

China	9.1	5.3	0.2	0.1	3.4	1.6	3.5	-0.1	0.1	2.4	1.1
India	6.8	5.3	0.9	0.2	2.9	1.3	4.5	0.6	0.2	2.5	1.2
Indonesia	3.6	4.8	0.7	0.2	2.6	1.3	3.9	0.5	0.2	2.1	1.1
Malaysia	5.2	4.5	0.9	0.2	2.5	1.0	3.7	0.7	0.2	2.1	0.8
Pakistan	4.8	5.1	1.3	0.2	2.4	1.2	4.5	1.0	0.2	2.2	1.1
Thailand	3.6	4.0	0.3	0.3	2.2	1.2	3.0	0.0	0.3	1.8	1.0
Argentina	2.8	3.2	0.5	0.1	1.7	0.9	3.0	0.5	0.2	1.5	0.8
Brazil	2.9	3.5	0.5	0.2	2.0	0.9	3.4	0.4	0.1	2.0	0.9
Chile	4.6	2.6	0.5	0.2	1.3	0.7	2.3	0.2	0.1	1.2	0.8
Colombia	3.2	3.9	0.8	0.2	1.9	0.9	3.2	0.4	0.2	1.7	0.9
Mexico	2.9	3.2	0.7	0.2	1.6	0.7	3.0	0.5	0.2	1.5	0.8
Venezuela	3.0	3.9	1.0	0.3	1.7	1.0	3.2	0.6	0.3	1.4	0.8
Iran	4.9	3.9	0.8	0.2	1.9	1.0	2.9	0.4	0.1	1.5	0.8
Saudi Arabia	2.9	4.1	1.2	0.2	2.1	0.6	3.4	0.8	0.2	1.8	0.6
United Arab Emirates	6.6	4.5	1.6	0.0	2.2	0.7	3.2	0.9	0.0	1.7	0.5
Algeria	3.7	4.1	0.9	0.2	2.1	1.0	3.3	0.4	0.2	1.7	1.0
Egypt	5.0	4.8	1.0	0.2	2.5	1.1	4.4	0.9	0.2	2.3	1.0
Morocco	3.6	5.0	0.8	0.2	2.9	1.1	4.3	0.4	0.2	2.5	1.1
Nigeria	6.3	5.0	1.4	0.1	1.8	1.7	4.6	1.4	0.1	1.7	1.3
South Africa	3.6	3.4	0.0	0.2	2.3	0.8	3.4	0.1	0.1	2.3	0.9
Czech Republic	3.4	1.9	-0.4	0.1	1.4	0.9	1.5	-0.4	0.1	1.1	0.7

Country	Average growth 1996-2007	Average annual growth 2008 - 2016 (projection)					Average annual growth 2017 - 2025 (projection)				
		GDP	Labor Quantity	Labor Composition	Capital Services	TFP	GDP	Labor Quantity	Labor Composition	Capital Services	TFP
Hungary	3.3	1.9	-0.3	0.2	1.3	0.8	1.5	-0.5	0.2	1.1	0.7
Poland	4.6	1.7	-0.2	0.1	1.0	0.8	1.0	-0.7	0.1	0.8	0.7
Turkey	4.7	3.1	0.7	0.1	1.5	0.8	2.8	0.5	0.2	1.4	0.7
Russian Federation	4.0	2.8	-0.3	0.1	1.6	1.5	1.1	-0.5	0.1	0.7	0.8

Among the advanced countries projected GDP growth between 2008 and 2016 is lower than the actual GDP growth between 1996 and 2007, except for Germany, Italy and Japan. The projected trend GDP growth will further slow down during the 2017-2025 period for most advanced countries, except for Portugal, Spain and Japan. More than half of emerging economies in our sample experienced higher average GDP growth during 1996 – 2007 than the projected trend growth in the following period. Mostly notable are the performances of China, Chile, Czech Republic, Hungary and Poland, whose 1996-2007 actual GDP growth exceeded projected trend GDP growth in 2008-2016 by more than 70 percent. The high speed economic growth in emerging countries will abate across the board after 2016 with the projected trend growth of 2017-2025 ubiquitously lower than that of 2008-2016.

3. Adjustments to Trend and Growth Scenarios

The projected GDP growth rates based on the growth accounting framework are to be considered as the trend growth rates of an economy. Trends are important for projecting future growth, because they depict how an economy grows on the basis of its potential which is determined by the available labor force, capacity in capital and technology base. As such, the projected GDP growth in period 7 and 8 constitutes our base scenario forecast for 2012-2016 and 2017-2025. In the long run, countries grow according to their trend. In the short run, however, countries deviate from their long-run path due to temporary deviations primarily due to business cycle dynamics. Occasionally, shocks can also occur which have a deep impact on the structure of the economy, which can permanently change the course of its long-run trend.

As a prime example, the 2008/09 recession created a large gap between the actual output level and what could have been produced if the economy had stayed on the trend in most advanced countries. We call these countries “underperformers” relative to trend. In contrast, some major emerging economies have grown beyond their growth trend in the past few years. We call these countries “outperformers” relative to trend. According to our base projection, both underperforming and outperforming countries will not adjust for the output gap or surplus, but will instead stay on the projected trend growth from 2012 and onwards.

In order to come up with realistic annual estimates between 2012 and 2016, we therefore assumed that economies whose average growth rates in 2008-2011 deviated from their trend growth rates (2008-2016) by more than 1 percentage point only begin to approach their trend growth rates in 2012. We thus assume such countries to gradually approach its trend growth by 2016, and subsequently derive the annual growth for 2012 through linear interpolation of the 2012-2016 period.⁴

We also developed a range of optimistic and pessimistic scenarios relative to the base scenario. In the optimistic scenario for underperformers, we assume that the average GDP growth of 2012-2016 is the rate needed to recover half of the current output gap by 2016, and the average GDP growth of 2017-2025 is the rate needed to fully close up the output gap by 2025. Our assumptions concerning a pessimistic scenario for outperformers are the mirror image of the underperformers in optimistic scenario. That is, the average GDP growth of 2012-2016 is the rate for outperformed countries to fall half way back to the trend output level and the GDP growth of 2017-2025 will allow those countries to meet the output level should the economy have stayed on the trend and would continue to until 2025. Table 8 describes the forecast methodology in three scenarios and Table 9 and 10 presents the results for individual countries and regions.

A few exceptions to the procedures are worth noting:

- Base case for 2012-2016

In the past few years, some countries deviated from the trend growth by a big margin, that is, the average growth rate of 2008-2011 is either faster or slower than the estimated trend growth rate of 2008-2016 by more than 1 percentage point. For those countries, we assume that their growth rate will gradually approach the trend growth rate by 2016.⁵ Individual years between 2012 and 2016 are linearly interpolated and allow us to estimate the average growth rate of 2012-2016.

⁴ In order to capture the latest developments in the global economy, our 2012 projections are further adjusted based on the analysis of The Conference Board.

⁵ Such adjustments apply to the following countries: Algeria, Austria, Canada, China, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, India, Iran, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Poland, Portugal, Russia, South Africa, Spain, Thailand, United Arab Emirates, United Kingdom, and Venezuela.

- Underperformers base case in 2012-2016:

An issue arises when an underperforming country (based on its 2008-2011 growth) experiences markedly fast growth in 2011. When the base scenario growth rate is calculated as the average of the linearly interpolated growth rates between 2012 and 2016, it is possible that this method results in a growth projection that is higher than the growth estimated in our optimistic scenario, as it is in the cases of Austria and Germany. For these countries, we alternatively take the trend growth rate of 2008-2016 as the base scenario growth rate.

- Outperformers pessimistic case in 2017-2025

In the pessimistic scenario, we estimate the projected growth in 2017-2025 to be the growth rate needed to reach the projected 2025 level based on the 2008-2025 trend growth. However, there are countries that outperformed its trend in 2008-2011 by only a small margin. For these countries, the growth rate needed to reach the projected 2025 level may in fact be faster than the base trend between 2017 and 2025. In these cases, we alternatively use the same deviation between base and optimistic scenarios for the pessimistic scenario.⁶

⁶ Such adjustments apply to the following countries: Argentina, Hong Kong, Indonesia, Singapore, Korea and Taiwan. Our pessimistic scenario for the U.S. is based on a separate scenario calculation, based on The Conference Board analysis.

Table 8: Methodology of projecting GDP growth in three scenarios

Base	2012-2016		Trend growth rate of 2008-2016. For countries whose average growth rate of 2008-2011 is greater or less than the trend growth rate of 2012-2025 by more than 1 percentage point, assume their growth rate will gradually approach the trend growth rate by 2016. Years between 2012 and 2016 are linearly extrapolated
	2017-2025		Trend growth rate of 2017-2025
Optimistic	2012-2016	Outperformer*	Same growth rate as the average of 2008-2011
	2012-2016	Underperformer	Growth rate needed to catch up halfway to the projected GDP level by 2016 based on the 2008-2016 trend growth
Pessimistic	2017-2025	Outperformer	Apply the same ratio of the optimistic and base case in 2012-2016
	2017-2025	Underperformer	Growth rate needed to catch up to the projected GDP level by 2025 based on the 2008-2025 trend growth
Pessimistic	2012-2016	Outperformer	Growth rate needed to reach halfway to the projected GDP level by 2016 based on the 2008-2016 trend growth
	2012-2016	Underperformer	Apply the same deviation between the base and positive case
Pessimistic	2017-2025	Outperformer	Growth rate needed to reach the projected GDP level by 2025 based on the 2008-2025 trend growth
	2017-2025	Underperformer	Apply the same deviation between the base and positive case

*Outperformer: average output growth between 2008-2011 is higher than the trend growth rate of 2008-2016

Table 9: Projected GDP growth in three scenarios by country (%)

	<u>2012-2016</u>			<u>2017-2025</u>		
	GDP Growth in Pessimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Optimistic Scenario	GDP Growth in Pessimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Optimistic Scenario
Advanced Economies						
United States	1.5	2.3	3.6	2.7	3.4	4.1
Austria	2.2	2.3	2.4	2.9	3.0	3.2
Belgium	1.1	1.5	1.9	2.0	2.1	2.3
Denmark	0.2	1.6	3.0	0.8	1.4	1.9
Finland	2.0	2.3	2.6	0.8	1.2	1.5
France	1.0	1.5	2.0	3.4	3.5	3.8
Germany	1.2	1.6	2.1	1.3	1.8	2.3
Greece	-6.2	-0.9	4.7	2.3	2.3	3.0
Ireland	-0.8	2.4	5.7	3.1	3.5	4.9
Italy	-0.5	1.4	3.3	2.8	3.2	3.7
Luxembourg	0.6	2.4	4.1	1.1	2.1	3.1
Netherlands	1.2	1.8	2.5	1.0	1.5	2.0
Portugal	-2.3	0.6	3.5	1.0	1.8	2.6
Spain	-0.2	1.8	3.7	4.3	4.5	4.8
Sweden	1.5	1.9	2.3	0.6	1.3	2.1
United Kingdom	-0.2	1.5	3.1	1.0	1.4	1.8
Japan	-0.1	1.1	2.3	0.6	1.1	1.6
Australia	2.3	2.4	2.5	0.3	2.0	3.8
Canada	1.7	2.2	2.7	0.5	0.7	0.9
Cyprus	-0.1	2.0	4.1	0.6	1.6	2.5
Hong Kong	2.1	2.4	3.1	0.0	1.5	3.0
Iceland	0.3	2.2	4.1	4.2	4.6	5.6
Israel	3.6	3.7	3.7	3.3	3.9	4.6
Malta	1.8	1.9	2.0	2.2	3.0	3.8

	<u>2012-2016</u>			<u>2017-2025</u>		
	GDP Growth in Pessimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Optimistic Scenario	GDP Growth in Pessimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Optimistic Scenario
New Zealand	0.9	2.2	3.5	1.5	3.2	4.8
Norway	1.8	1.9	2.0	3.2	3.3	3.5
Singapore	4.0	4.3	5.0	0.8	1.8	2.8
South Korea	2.7	2.8	3.1	0.9	1.5	2.0
Switzerland	1.6	1.8	2.1	1.4	2.5	3.5
Taiwan	2.4	2.7	3.4	3.3	3.8	4.3

Emerging and Developing Economies

China	3.9	6.9	9.6	1.5	1.7	1.8
India	4.6	6.2	7.7	2.3	3.0	3.7
Indonesia	4.6	4.9	5.8	4.0	4.3	4.7
Malaysia	4.3	4.7	5.0	1.2	1.7	2.2
Pakistan	2.2	4.2	6.2	1.8	2.4	3.1
Thailand	3.1	3.9	4.6	4.3	4.7	5.8
Argentina	3.2	3.3	3.4	1.0	1.4	1.8
Brazil	3.5	3.6	3.9	3.7	4.6	5.5
Chile	2.4	2.7	3.4	0.7	1.0	1.4
Colombia	3.6	3.9	4.3	1.6	2.4	3.2
Mexico	2.9	3.5	4.2	0.0	1.1	2.2
Venezuela	1.7	3.5	5.4	3.0	3.4	3.9
Iran	2.2	3.4	4.6	2.3	2.7	3.1
Saudi Arabia	4.0	4.2	4.4	3.0	3.4	3.9
United Arab Emirates	2.6	4.0	5.6	1.2	1.3	1.5
Algeria	2.5	3.7	4.8	1.8	2.6	3.4
Egypt	4.7	4.9	5.0	1.4	1.7	2.0

	<u>2012-2016</u>			<u>2017-2025</u>		
	GDP Growth in Pessimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Optimistic Scenario	GDP Growth in Pessimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Optimistic Scenario
Morocco	4.9	5.1	5.2	1.0	1.4	1.7
Nigeria	4.3	5.8	7.1	0.9	1.2	1.6
South Africa	2.7	3.4	4.1	2.3	3.0	3.8
Czech Republic	1.3	1.9	2.5	2.7	2.8	3.0
Hungary	0.3	1.7	3.2	2.0	3.2	4.4
Poland	1.0	2.6	3.7	1.0	1.9	2.7
Turkey	3.0	3.1	3.2	1.5	2.3	3.1
Russian Federation	3.1	3.3	3.5	2.0	3.2	4.5

Table 10: Projected GDP growth in three scenarios by region (%)

	<u>2012-2016</u>			<u>2017-2025</u>			<u>2012-2025</u>		
	GDP Growth in Optimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Pessimistic Scenario	GDP Growth in Optimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Pessimistic Scenario	GDP Growth in Optimistic Scenario	GDP Growth in Base Scenario	GDP Growth in Pessimistic Scenario
US	3.6	2.3	1.5	3.1	2.3	1.5	3.2	2.3	1.5
EU-15	2.8	1.5	0.4	2.4	1.7	1.0	2.5	1.6	0.8
Japan	2.3	1.1	-0.1	2.0	1.5	0.9	2.1	1.3	0.6
Other*	3.0	2.6	2.3	2.0	1.7	1.4	2.3	2.0	1.7
Advanced Economies	3.0	1.9	1.1	2.6	1.9	1.3	2.7	1.9	1.2
China	9.6	6.9	3.9	4.9	3.5	3.1	6.5	4.7	3.4
India	7.7	6.2	4.6	5.6	4.6	4.2	6.4	5.2	4.4
Other developing Asia	5.5	4.6	3.9	4.5	3.8	3.1	4.9	4.1	3.4
Latin America	4.1	3.6	3.2	3.7	3.2	2.8	3.8	3.3	3.0
Middle East	4.8	3.9	3.0	3.9	3.2	2.5	4.2	3.4	2.7
Africa	5.4	4.6	3.9	4.7	4.1	3.7	4.9	4.3	3.8
Central & Eastern Europe	3.2	2.7	1.9	2.3	2.0	1.7	2.6	2.2	1.8
Other, incl. Russia**	3.6	3.4	3.2	2.2	1.1	0.0	2.7	1.9	1.1
Emerging Market and Developing Economies	6.5	5.1	3.6	4.3	3.3	2.8	5.1	4.0	3.1
World	4.8	3.6	2.3	3.6	2.7	2.1	4.0	3.0	2.2

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