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Global Growth Projections for The Conference Board Global Economic Outlook 2016

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Abstract

This paper presents the methodology for The Conference Board Global Economic Outlook 2016, including projections for 11 major regions and individual estimates for 33 mature and 32 emerging market economies for 2016, 2016-2020, and 2021-2025. The projections are based on a supply-side growth accounting model that estimates the contributions of the use of factor inputs – labor and capital –, and total factor productivity growth to the growth of real Gross Domestic Product (GDP). While labor input growth rates are estimated using information on demographic changes and work force participation rates, capital input and total factor productivity growth are econometrically estimated using a wide range of related variables during past periods. Even though the model is predominantly supply side based, it also considers demand side elements such as savings, and socio-economic variables such as life expectancy and educational attainment. In order to account for the potential impact of trends in globalization on future economic growth, we also incorporate measures of globalization, where exports and imports – two other demand side indicators – enter as key elements. The trend growth rates that are obtained from this model are adjusted for possible deviations between actual and potential output in the short run.

1. Introduction

Since 2008, The Conference Board publishes an annual global economic outlook, projecting GDP growth for 55 countries – which is now extended to 65 countries in the current version – using growth accounting techniques. The basis of the framework is built upon the works of Dale Jorgenson and colleagues, including Jorgenson, Ho and Stiroh (2005) and Jorgenson and Vu (2009 a and b). Over the years The Conference Board has extended and improved the projection methods, using more information from the historical performance and adjusting for cyclical deviations from the trend in the short term.

This paper describes the methodology and sources underlying the projections of growth of Gross Domestic Product in the 2016 edition of *The Conference Board Global Economic Outlook* (GEO). The projection methodology used in the 2016 GEO is an expanded version of the methods implemented in the 2015 edition of the outlook.[1] The predictive model has been improved substantially by including more theoretically pertinent explanatory variables in the productivity and capital services equations and also by allowing for regional differences in the intercept. By including regional dummies in the model, we allow the model to capture any region specific factors, which are otherwise not captured by our global model. Moreover, this year we have explored the interaction between globalization and economic growth and as a result modified the model to include globalization variables. The model has also been extended to ensure a wider coverage of emerging economies by adding 10 new countries.

The projections in this paper cover the period 2016-2025, with separate projections for the medium term (2016-2020) and the long term (2021-2025). The outlook covers 65 major economies across 11 regions, including 33 mature economies (the United States, Europe, Japan and other mature economies) and 32 emerging and developing economies. In the later part of this introduction, we provide an overview of main results of the 2016 outlook. Section 2 describes how trend growth is estimated on the basis of an extrapolated growth accounting model which projects the various growth components of the production function. The model first estimates the factor inputs – labor quantity, labor composition (the effect of heterogeneity among workers in terms of educational qualification), and capital services –, and total factor productivity, a measure of overall production efficiency. Broadly speaking, the measures for labor quantity (Section 2.1) are based on projections of labor force participation rates from the International

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[1] See Erumban and de Vries (2014), which builds upon Chen, V., B. Cheng, G. Levanon, A. Ozyildirim and B. van Ark (2012).

Labor Organization (ILO, 2013), combined with working-age population projections from the United Nations (UN, 2015). The measures on labor composition (Section 2.2) are based on projections of educational attainment by the Wittgenstein Centre for Demography and Global Human Capital (2015) and Barro-Lee (2014). Capital services and total factor productivity (Section 2.3) are estimated using regression models which are largely based on relevant past-period variables. Projections of all input factors are combined to provide projections of GDP growth, which are presented in Section 2.4.

The projected GDP growth rates, which are based on the growth accounting framework, can be interpreted as a representation of the trend growth of each economy. In the long run, countries grow according to their trend.[2] In the short run, however, countries deviate from their long-run path due to temporary fluctuations primarily due to business cycle dynamics. Moreover, shocks can occasionally occur which can have a deep impact on the structure of the economy and can permanently change the course of the trend. The 2008/09 recession represents a combination of business cycle dynamics and structural factors, which has led to such a change in the trend growth. Section 3 describes the medium-term adjustments to the trend growth estimates obtained from the extrapolated growth accounts. Section 4 compares our GDP growth projections with those from other studies. Section 5 concludes.

1.1 Overview of the main results

The outlook for 2016 and beyond reflects some effects of an economic recovery in mature economies from the 2008/09 recession (and subsequent 2012/13 recession in the Euro Area), which brings this group of economies to an average growth of 2.1 percent between 2016 and 2020. Global growth is likely to be lower than what it was during last five years at a modest 3.1 percent average for the period of 2016–2020, with emerging markets growing at 4 percent, double the rate at which mature economies are projected to grow. In the longer run both mature and emerging markets are likely to see a decline in their trend growth rates, with mature economies growing at a modest 1.8 percent and emerging economies at 3.6 percent on average over the 2021-2025 period. Thus, overall the global economy is likely to see an average growth of 2.8 percent during 2021-2025. Among the larger economies, the United States is likely to see

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[2] Our trend growth rates may be seen as a proxy to the growth rate of potential output, but as our estimates do not explicitly account for a non-inflationary constraint on our growth measure, and our estimates are not accompanied by a measure of potential output, we prefer to use the term "trend growth", as our estimates are essentially derived from past growth trends.

a slightly slower growth at 2.4 percent in 2016 compared to 2.5 percent in 2015. The United States will see further decline in growth rates to 2 percent in the medium term (2016-2020) and to 1.6 percent during 2021-2025. The European growth environment remains fragile and the downward risks are still around. During the last five years, Euro Area average GDP growth was just above half a percentage. The region is expected to see a 1.6 percent growth rate in 2016, which is moderately higher than the 1.4 percent growth in 2015, and almost double the 2014 growth rate. While a modest recovery in the job market and the consequent improvement in consumer confidence will likely strengthen domestic consumption in the short run, European growth is constrained by decline in exports to emerging markets, domestic structural weaknesses and the ongoing geopolitical tensions. The long-run growth in Euro Area will decline from 1.9 percent during 2016-2020 to 1.5 percent during 2021-2025, as the declining work force and the increase in ageing of the population further add to long-run downside risks.[3] Nevertheless, the trend growth projections show the European economy growing slightly faster than the US economy, largely because of higher investment and productivity growth helped by cyclical dynamics of recovery finally gaining more traction in the next five years as well as supported by structural reforms such as the banking union.

An important feature of this year's outlook is a major adjustment made to China's overstated official growth rate. Based on Wu (2014), growth rates of Chinese industrial GDP are adjusted for misreporting bias and non-material services GDP are adjusted for biases in price deflators.[4] These adjustments suggest that, even though the Chinese economy has been growing less fast than the official numbers for a longer period of time, the gap between official and alternate series has widened in the recent years. China's economy grew much slower than the official estimates suggest in the recent years. During the last five years, our estimates suggest an average growth of 4.3 percent which is substantially lower than the official estimate of 7.8 percent. In 2015, we project China to see an average growth of 3.7 percent, which is indeed lower than the official target of 7 percent. In the medium term, 2016-2020, we foresee some recovery in the average growth rate to 4.5 percent, which however, is likely to decline to 3.6 percent in the longer run (2021-2025). The change in China's growth estimates has important implications for our assessment of the growth rate of the global economy in general and that of

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[3] For a comprehensive analysis of labor shortages in mature economies, see The Conference Board (2014). "What does the coming labor shortage from retiring baby boomers mean for your company?" https://www.conference-board.org/laborshortages/
[4] For a detailed discussion on this adjustment, see Wu (2014) and for frequently asked questions on the China adjustment see China GDP FAQ.

the emerging markets in particular (see Table 6). It reduces global growth of the last five years by nearly half a percentage point, and by 0.6 percentage point for 2015. The impact is even higher on emerging markets, where the growth rate is lower by nearly double the magnitude – by about 1 percent during the last five years.

Emerging markets are on a declining growth path, as their growth engines sputter because of declines in commodity and energy prices as the commodity super-cycle comes to an end, reversal of capital flows and the exhaustion of their catch-up potential. While growth in emerging and developing economies was quite strong immediately after the 2008/09 crisis with 5 to 8 per cent growth in 2010 and 2011, since then it has shown a declining trend in the range of 3 to 4 percent. The growth rate of emerging and developing economies declined to 4 percent in 2013 and further to 3.6 percent in 2014. Given the weak conditions in the global economy, and the time lag by which reforms pay off in terms of faster growth, there is little scope for emerging economies to accelerate their growth performance much in the next few years. This year is likely to end up at an even lower rate of 2.9 percent average growth rate compared to 3.6 percent in 2014.. Almost all major economies, except Mexico, witness a deceleration in GDP growth rate in 2015, including significant contractions in Russia and Brazil.

In sum, growth in both the mature and the emerging economies in 2016 is expected to recover marginally over 2015. Yet, the slower growth rate of emerging markets, compared to their performances in the recent past leaves the global growth at a slower rate of 2.8 percent in 2016. In the longer run, the trend growth rate remains 2.8 percent during 2021-2025, which is lower than the growth projection of 3.1 percent during 2016-2020. This is the case in almost all regions of the economy; while mature economies show a decline of about 0.3 percentage point, emerging economies show a decline of about 0.4 percentage point, primarily driven by a decline of nearly 1 percent in Chinese growth rate and half a percent decline in Indian growth rate[5]

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[5] For a broad analysis of the results, see The Conference Board Chief Economist's analysis in StraightTalk® "Escaping the global economy's holding pattern"

2. Medium- and Long Term Projections for 2016-2020 and 2021-2025

2.1 The Growth Accounting Framework

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) and Jorgenson and Vu (2009b). The growth accounting methodology is based on a production function, which decomposes output growth into components associated with changes in factor inputs – capital and labor – , and a residual that reflects technological progress and production efficiency, known as Total Factor Productivity (TFP). Assume a production function of the following form:

$$Y = Af(L, Q, K) \tag{1}$$

Where Y is gross domestic product, L is labor quantity, Q is the composition of the labor force based on educational attainment, K is capital services, A is total factor productivity. Under the assumption of perfectly competitive factor markets where inputs are paid according to their marginal product, and constant returns to scale, the above general production function can be transformed into the following growth accounting framework:

$$\Delta lnY_t = \Delta lnA_t + \bar{v}_{L,t}\Delta lnL_t + \bar{v}_{L,t}\Delta lnQ_t + \bar{v}_{K,t}\Delta lnK_t \tag{2}$$

In the above equation, growth of output in a given year t ($\Delta ln\text{Y}_t$) is decomposed into the contributions of total factor productivity growth (ΔlnA_t), labor ($\Delta ln\text{L}_t$), labor composition ($\Delta ln\text{Q}_t$) and capital services ($\Delta ln\text{K}_t$).[6] The contribution of factor inputs, L, Q and K are obtained as the product of their growth rates over the current and previous periods and their compensation share ($\bar{v}$) in total nominal Gross Domestic Product averaged over the last two years:

$$\bar{v}_{L,t} = 0.5 * (v_{L,t} + v_{L,t-1}) \tag{3}$$

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[6] In this paper, all growth rates are calculated as the difference in the log of the levels of each variable unless otherwise specified.

and

$$\bar{v}_{K,t} = 0.5 * (v_{K,t} + v_{K,t-1}) \qquad (4)$$

where $v_{K.t} = \frac{P_L.L}{P_Y.Y}$ and $v_{K.t} = \frac{P_K.K}{P_y.Y}$, with P_L being the price of labor (wage rate), P_K is the price of capital (rental price) and P_Y is the price of output. Under the assumption of constant returns to scale, the cost shares of labor and capital sums to unity, $\bar{v}_L + \bar{v}_K = 1$.

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 and TFP growth on the right hand side of equation (2). Our projection covers the medium term period (2016-2020) and a longer term period (2021-2025) for 33 mature economies and 32 major emerging economies.

2.2 Measuring the Growth of Labor input

2.2.1 Growth of Labor quantity

The growth in labor quantity for our projection periods are based on labor force participation rate projections from the ILO (2013) and the growth of the working-age population from the UN (2015).[7] While population growth can be projected with a certain degree of accuracy, predictions on labor force participation have a greater degree of uncertainty as they are affected by unpredictable factors such as policy changes like retirement plans, cultural changes, such as preferences for work vs. leisure, as well as cyclical fluctuations.

Mature economies in general are to expect to see tight labor markets in the coming decade, as looming labor shortage in these economies are likely to exert wage pressure.[8] While several of the mature economies will see a shrinking working age population, others are expected to see only negligible increase.[9] The United States will see a 0.4 percent annual average growth rate of its labor force[10] during the next five years, which is the fastest growth rate among the

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[7] The range of ages used in defining working-age population often differs from country to country. However, to be consistent across countries, we use the most common definition of population of age 15 to 64.
[8] See the The Conference Board (2014). "What does the coming labor shortage from retiring baby boomers mean for your company?" https://www.conference-board.org/laborshortages/
[9] See note 4.
[10] The term labor force growth here refers to the growth rate of the product of working age population and labor force participation rate.

larger mature economies. Labor force growth in many European economies, as well as in Japan, is already projected to become negative between 2016 and 2020, putting downward pressure on output growth.

Among the emerging economies, China and Russia are already part of the group of countries that witness a contraction in their labor force during 2016-2020. China, where economic growth has thus far been fueled by cheap and abundant labor, will see its labor force growth decline at a faster rate (-0.4) between 2021 and 2025. Thailand is also likely to join this group of countries with declining demographic dividend in the longer term. India, on the other hand, still enjoys a demographic dividend, registering 1.6 percent annual growth in its labor force during 2016-2020, with a marginal decline to 1.4 percent during 2021-2025. However, translating India's demographic dividend into economic growth is constrained by severe lack of skill and education of its workforce (Das et al, 2015). Most other emerging markets also still have demographic dividends as their labor force continues to grow though the pace of the growth will slow from 2016-2020 period to 2021-2025 period.

2.2.2 Growth of Labor Composition

To measure labor's effective contribution to output growth, an adjustment for changes in the composition of the labor force in terms of different skill-levels is needed in addition to the change in labor quantity (section 2.2.1). 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:

$$\Delta ln Q_t = 0.5 * \sum_i (v_{i,t} + v_{i,t-1})(ln h_{i,t} - ln h_{i,t-1}) \qquad \textbf{(5)}$$

where v_i is the compensation share of ith labor type (where i=low, medium and high skilled) in total labor compensation and h_i is the share of ith labor type in total hours worked. For a detailed methodology describing the construction of the labor composition data, please refer to Bonthuis (2011).

The projection data used in equation (5) are mainly based on the projection of population by level of educational attainment by the Wittgenstein Centre for Demography and Global Human Capital (2015) and Barro-Lee (2014). In general, labor composition is relatively stable

over time. The weighted average growth rate across all 65 countries in our projection sample is around 0.1 percent for the period 2016-2020. 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 via an additional channel. There is also a likely complementarity with investment in intangible capital, such as R&D and organizational changes, which will also enhance productivity (Corrado, Haskel and Jona-Lasinio, 2014).

2.2.3 The Share of Labor income in GDP

In order to measure the contribution of labor quantity, labor composition and capital services to GDP growth using the growth accounting model, relative weights of labor and capital are required. Under neoclassical assumptions, these weights can be approximated by compensation shares of labor and capital in total nominal GDP. Since capital incomes are unobservable, they can be obtained as a residual after subtracting labor incomes from GDP. This leaves the task of obtaining proper measures of labor income share in GDP, which is not always available directly for many countries. According to Gollin (2002), labor income shares in GDP are approximately constant across time and countries within a range of 0.65-0.80. Historical data on observed labor income shares are taken from The Conference Board Total Economy Database, which is inclusive of compensation to self-employed workers. Our data shows a decline in the labor share of many advanced economies over a long span of time, which is in contrast with Gollin (2002)'s observation. For instance the labor income share in the United States has declined from 0.65 in 1970 to 0.57 in 2015. On average, labor shares are lower in emerging economies because capital is scarcer and more expensive while labor is cheaper compared to mature economies. During the last period of our data, 2006-2015, the average labor share in emerging economies including Mexico, Thailand, China, India and Indonesia, varies from 0.3 to 0.5 while the labor shares in mature economies such as Switzerland, France, Germany, Denmark, United States, and the United Kingdom, are between 0.6 to 0.7. For the projection period, we assume a constant labor share based on the last year of data.

Table 1: Growth of Labor Force, Growth of Labor Composition, and Labor Share

MATURE ECONOMIES		Growth of labor quantity (%)		Growth of labor composition (%)	Labor income share (%)
Country	*Region*	*2016-2020*	*2021-2025*	*2016-2025*	*2016-2025*
United States	United States	0.4	0.3	0.2	0.6
Austria	Europe	-0.2	-0.6	0.1	0.6
Belgium	Europe	0.3	0.0	0.3	0.7
Cyprus	Europe	1.1	0.6	0.5	0.5
Czech Republic	Europe	-0.3	-0.4	0.2	0.7
Denmark	Europe	0.4	0.2	0.1	0.6
Finland	Europe	-0.2	-0.1	0.3	0.6
France	Europe	0.2	0.1	0.2	0.6
Germany	Europe	-0.4	-0.9	0.2	0.6
Greece	Europe	-0.3	-0.5	0.6	0.5
Hungary	Europe	-0.4	-0.4	0.4	0.5
Iceland	Europe	0.4	0.4	0.4	0.6
Ireland	Europe	0.6	0.9	0.3	0.5
Italy	Europe	-0.2	-0.4	0.1	0.6
Luxembourg	Europe	1.0	0.9	0.3	0.5
Malta	Europe	0.3	-0.1	0.4	0.5
Netherlands	Europe	-0.1	-0.3	0.1	0.6
Norway	Europe	0.9	0.5	0.2	0.5
Poland	Europe	-0.6	-0.7	0.2	0.5
Portugal	Europe	-0.6	-0.6	0.9	0.5
Spain	Europe	-0.3	-0.4	0.5	0.6
Sweden	Europe	0.3	0.4	0.1	0.5
Switzerland	Europe	0.5	0.0	0.1	0.7
United Kingdom	Europe	0.3	0.2	0.2	0.6
Japan	Japan	-0.6	-0.5	0.3	0.6
Australia	Other Mature	0.9	0.9	0.3	0.5
Canada	Other Mature	0.3	0.2	0.2	0.6
Hong Kong	Other Mature	-0.1	-0.7	0.2	0.5
Israel	Other Mature	0.8	1.0	0.3	0.3
New Zealand	Other Mature	0.6	0.5	0.5	0.5
Singapore	Other Mature	1.1	0.1	0.6	0.4
South Korea	Other Mature	0.3	-0.5	0.4	0.6
Taiwan	Other Mature	-0.3	-0.9	0.4	0.5

Table 1: continued….

EMERGING MARKETS		Growth of labor quantity (%)		Growth of labor composition (%)	Labor income share (%)
Country	*Region*	*2016-2020*	*2021-2025*	*2016-2025*	*2016-2025*
China	China	-0.1	-0.4	0.2	0.4
India	India	1.6	1.4	0.3	0.4
Indonesia	Other Developing Asia	1.3	0.9	0.3	0.5
Malaysia	Other Developing Asia	1.7	1.2	0.3	0.4
Pakistan	Other Developing Asia	2.5	2.3	0.3	0.5
Philippines	Other Developing Asia	1.7	1.7	0.5	0.4
Thailand	Other Developing Asia	-0.1	-0.4	0.7	0.4
Vietnam	Other Developing Asia	0.7	0.4	0.5	0.5
Argentina	Latin America	1.3	1.1	0.3	0.4
Brazil	Latin America	1.1	0.7	0.3	0.5
Chile	Latin America	1.2	0.7	0.4	0.5
Colombia	Latin America	1.2	0.8	0.3	0.4
Mexico	Latin America	1.7	1.4	0.4	0.5
Venezuela	Latin America	1.6	1.3	0.6	0.3
Algeria	Middle East & Northern Africa	1.4	1.0	0.4	0.5
Egypt	Middle East & Northern Africa	1.9	1.8	0.3	0.5
Iran	Middle East & Northern Africa	1.2	0.7	0.4	0.4
Morocco	Middle East & Northern Africa	1.4	1.0	0.4	0.5
Saudi Arabia	Middle East & Northern Africa	2.4	1.4	0.3	0.3
United Arab Emirates	Middle East & Northern Africa	1.1	0.4	0.0	0.3
Ethiopia	Sub-Saharan Africa	3.4	3.0	0.5	0.5
Ghana	Sub-Saharan Africa	2.6	2.4	0.5	0.4
Kenya	Sub-Saharan Africa	3.0	3.0	0.5	0.5
Nigeria	Sub-Saharan Africa	3.0	3.0	0.3	0.4
South Africa	Sub-Saharan Africa	1.3	1.1	0.7	0.4
Tanzania	Sub-Saharan Africa	3.3	3.3	0.5	0.5
Belarus	Russia, Central Asia and Southeast Europe	-0.9	-1.0	0.0	0.6
Kazakhstan	Russia, Central Asia and Southeast Europe	0.2	0.5	0.3	0.4
Russian Federation	Russia, Central Asia and Southeast Europe	-1.0	-0.9	0.3	0.5
Turkey	Russia, Central Asia and Southeast Europe	1.2	0.8	0.4	0.3
Turkmenistan	Russia, Central Asia and Southeast Europe	1.4	1.0	0.3	0.5
Uzbekistan	Russia, Central Asia and Southeast Europe	1.3	1.0	0.3	0.5

Source: The Conference Board Global Economic Outlook, 2016
Notes: The growth rates in labor quantity are based on labor force participation rate projections from the ILO and the growth of the working-age population from the United Nations ('2015 Revision of World Population Prospects'). The labor composition projections are mainly based on the projection of population by level of educational attainment by the Wittgenstein Centre for Demography and Global Human Capital (2015) and Barro-Lee (2014).

2.3 Measuring the Growth of Capital Services and Total Factor Productivity

Compared to the projections for labor inputs, the development of capital services and total factor productivity (TFP) are subject to a higher degree of uncertainty. The growth contributions are estimated by a system of equations in which we use explanatory variables – both economic and institutional – as suggested by the literature. We estimate three endogenous variables: TFP growth, the savings rate, and capital services growth. The savings rate is important to add in, because it is closely related to investment in capital that determines the growth of capital services. Moreover, savings, representing the other part of income, also related to elements of demand in our otherwise supply side model. All other variables are either exogenous or predetermined. This year, we expanded the capital services equation by including nominal interest rates and real exchange rates as explanatory variables, and both the TFPG and capital equations by including variables that capture the impact of globalization.

The three equations are specified as follows:

$$\Delta \ln TFP_t = \alpha_0 + \alpha_1 \Delta \ln TFP_{t-1} + \alpha_2 lnLP_{t-1}^{US} + \alpha_3 lnCORRUPT_t + \alpha_4 R\&D_t$$
$$+ \alpha_5 HDI_t + \alpha_6 RESTRICT_t + \sum_{i=1}^{n} \alpha_i R\_DUMMY_i + \varepsilon_{1t} \tag{6}$$

$$SAVING_t = \beta_0 + \beta_1 DEP_t + \beta_2 P\_GDP_{t-1} + \beta_3 \Delta lnGDP_{t-1} + \beta_7 SERVICE_t$$
$$+ \sum_{i=1}^{n} \alpha_i R\_DUMMY_i + \varepsilon_{2t} \tag{7}$$

$$\Delta lnKSERV_t = \gamma_0 + \gamma_1 SAVING_t + \gamma_2 \Delta lnGDP_{t-1} + \gamma_3 DPN\_RATE_t + \gamma_4 \Delta lnTFP_t$$
$$+ \gamma_5 lnKD_{t-1} + \gamma_6 WAGE_t + \gamma_7 ENERGY_t + \gamma_8 SD.INFL_t$$
$$+ \gamma_{10} ECO\_GLOB_t + \gamma_{11} REAL\_XR_t + \gamma_9 INTEREST_t$$
$$+ \sum_{i=1}^{n} \alpha_i R\_DUMMY_i + \varepsilon_{3t} \tag{8}$$

where ΔlnX denotes the log growth rate of variable X over period t and $t-1$, lnX indicates the log level of the variable X. The definition of the variables and the data sources are listed in Table 2 below and a discussion of the actual versus expected signs follows below.

Table 2: Definition of variables, expected signs, and data sources

Independent Variables	TFP	Saving	Capital Services	Description	Data sources
$\Delta \ln TFP_{t-1}$	+			Total factor productivity growth in the previous period	Total Economy Database and Projection from TFPG equation
$lnLP^{US}_{t-1}$	-			Log of level labor productivity relative to the United States in the previous period	Total Economy Database
$CORRUPT_t$	-			Corruption	World Bank, Worldwide Governance Indicators; Transparency International
$R\&D_t$	+			Growth rate of real R&D spending	OECD, UNESCO, Eurostat
HDI	+			Geometric average of average years of schooling and life expectancy at birth	Schooling: Wittgenstein (2015), Barro-Lee (2014); Life expectancy: UN Population Division (2015), except for Taiwan, which are from Taiwan National development council
$RESTRICT_t$	-			A component of globalization which measures intensity of various restrictions, including import barriers, tariff rates, taxes on trade and capital account restrictions.	KOF Swiss Economic Institute Globalization Index
DEP_t		-		Total (sum of old and young) dependency ratios	UN Population Division (2015)
$SERVICE_t$		-		Service share in GDP	UN National Account Statistics; World Bank World Development Indicators
lnP_GDP_t		+		Log of per capita GDP	Total Economy Database
$\Delta lnGDP_{t-1}$		+	+	GDP growth in the previous period	Total Economy Database
$\Delta lnTFP_t$			+/-	Total factor productivity growth	Total Economy Database and Projection from TFPG equation
$SAVING_t$			+	Saving rate	UN National Account Statistics; World Bank World Development Indicators and Projection from Saving equation
DPN_RATE_t			+	Depreciation rate	Total Economy Database*
$SD.INFL_t$			+	Standard deviation of inflation rate	IMF, World Economic Outlook;
$WAGE_t$			+	Growth rate of wages	Implicit Wage rates from Total Economy Database
$ENERGY_t$			+	Growth rate of energy use	International Energy Statistics
$lnKD_{t-1}$			-	Log of capital deepening in the previous period	Total Economy Database
$NTEREST_t$			-	Nominal interest rate	IMF, International Financial Statistics; OECD statistics

Table 2: continued…

Independent Variables	TFP	Saving	Capital Services	Description	Data sources
ECO_GLOB_t			+	Index of economic globalization which measures trends flows of trade, FDI, income payments and restrictions on international flows.	KOF Swiss Economic Institute Globalization Index data
$REAL\_XR_t$			+/-	Real exchange rates, obtained as market exchange rate (i.e. \$/national currency) × (national consumer price deflator / US consumer price deflator)	IMF, World Economic Outlook; UN National Account Statistics
R_DUMMY	+/-	+/-	+/-	Region dummies	1 if a country belongs to a given region, and 0 otherwise

Note: A + (-) sign indicates that the expected impact of the variable is positive (negative)

The above three equations constitute a simultaneous equation system which is estimated using three-stage least squares. We use this approach, firstly because the capital services growth equation contains endogenous variables (TFP growth) among the explanatory variables, thus instrumental variable estimation is needed to produce consistent estimates. Secondly, since some of the explanatory variables are the dependent variables of other equations in the system, the three error terms are expected to be correlated, thus generalized least squares should be used to account for the correlation among the error terms across equations.

We implement the regressions on our sample of 33 mature economies and 32 major emerging economies from 1972 to 2015. We divide the 43 years into six time periods: (1) 1972-1978; (2) 1979-1986; (3) 1987-1992; (4) 1993-1998; (5) 1999-2005, and (6) 2006-2015. The time periods are chosen so that the initial and end years do not coincide with recession years.[11] All annual variables from the data sources are averaged for each defined period.

Table 3 reports the results of the simultaneous equation system using the three-stage least squares estimation. The results are largely consistent with theoretical expectations. Specifically, the relative level of the labor productivity variable in the TFP growth equation and the lagged capital deepening variable in the capital services growth equation are specified to test the

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[11] Recession years vary across countries. However, we choose divisions based on U.S. recession years as determined by the National Bureau of Economics Business Cycle Dating Committee because the U.S. is the largest economy throughout the period under study.

convergence hypothesis.[12] Both variables are significantly negative, lending support to the convergence hypothesis that the country with higher labor productivity (or capital deepening) levels will show slower growth of total factor productivity (capital services) in the next period.

In the TFP growth equation, the coefficient of the geometric average of life expectancy and average years of schooling is significantly positive. This indicator represents a country's human development, which reflects both innovative and absorptive capacity. We combined these two indicators into one single variable, which is similar to the United Nation's Human Development Indicator (except that it does not include per capita GDP), in order to avoid serial correlation in the regression equation. Longer life expectancy is closely related to better health conditions, a foundation for faster productivity growth. A better educated labor force is equipped with the necessary knowledge and skills to enhance the productivity in the production process. While emerging economies benefit a lot from adopting technologies developed elsewhere, mature economies gain faster productivity growth by innovating. In both cases, R&D spending is crucial in fostering productivity growth; our results yield a significant positive effect of R&D growth rates on TFPG. Corrupt economies are prone to misallocation of resources, as investment decisions can be heavily influenced by wasteful rent seeking and a distorted bureaucracy.[13] Lack of transparency and accountability can not only lead to irresponsible investments resulting in misallocation of capital, but can also strangle innovation, and, therefore, corruption is expected to impact productivity negatively. Our results confirm this hypothesis, suggesting that higher corruption reduces productivity growth. [14]

The restrictions variable, which we introduced in the current year's model, measures the intensity of various restrictions, including import barriers, tariff rates, taxes on trade and capital account restrictions. It is an important component of the economic globalization measure, as provided by the KOF globalization index. Such restrictions are expected to hamper competition and thereby productivity. We see a negative and significant impact of restrictions on total factor productivity growth.

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[12] Ideally, we want to use the TFP and capital services level of the initial year to test convergence. Since we do not have the level data for TFP and capital services for all countries, labor productivity and capital deepening levels are used instead in the specification.

[13] Mauro (1995), among others, show a negative impact of corruption on investment/GDP ratio.

[14] Note that we transform the corruption variable obtained from the source data. In the source data, the corruption indicator ranges from -2.5 to +2.5, where -2.5 indicates weak governance (or high corruption) and +2.5 indicates strong government (or low corruption). This suggests that higher the value of corruption indicator, higher the productivity growth we expect to see. To make regression results read easy, we transform the variable to positive numbers, by taking 2.6 minus the source data.

Table 3: Estimation results of simultaneous equations

Independent Variables	TFP Growth		Saving Rate		Capital Service Growth	
$\Delta\ln TFP_{t-1}$	0.111	**				
	(2.31)					
$\ln LP_{t-1}^{US}$	-0.956	***				
	(-5.73)					
$CORRUPT_t$	0.0512					
	(0.35)					
$R\&D_t$	0.00946	*				
	(1.91)					
HDI	1.943	***				
	(3.62)					
$RESTRICT$	-0.0174	**				
	(-2.32)					
DEP_t			-0.257	***		
			(-6.63)			
$SERVICE_t$			-0.270	***		
			(-4.53)			
$\ln P\_GDP_t$			5.347	***		
			(5.78)			
$\Delta\ln GDP_{t-1}$			0.984	***	0.210	***
			(5.57)		(4.45)	
$\Delta\ln TFP_t$					-0.490	***
					(-4.93)	
$SAVING_t$					0.0739	***
					(3.49)	
DPN_RATE_t					0.315	***
					(3.37)	
$SD.INFL_t$					-0.285	*
					(-1.89)	
$WAGE_t$					0.277	***
					(5.81)	
$ENERGY_t$					0.191	***
					(5.18)	
$\ln KD_{t-1}$					-0.808	***
					(-6.94)	
$INTEREST$					-0.00458	
					(-0.98)	
ECO_GLOB					1.206	***
					(3.32)	
R_EXR					-0.157	***
					(-3.72)	
$Constant$	-4.901	**	47.22	***	-3.809	***
	(-2.65)		(7.92)		(-3.10)	
R-squared	0.221		0.481		0.667	
Regional Dummies	YES		YES		YES	

Notes: The system of equations is estimated by the 3SLS (three-stage least squares) method. Number of observations: 308.
* significant at 10%; ** significant at 5%; *** significant at 1%.

In the savings equation, the dependency ratio has a negative effect on the savings rate as population outside the working age group mostly does not earn an income and are major consumers of education and health care. The negative relationship between the share of the services sector in an economy and the savings rate probably results from the larger presence of government funded social services, education and health care, causing people to have less precautionary savings. The saving rate is positively influenced by the overall growth of real GDP and level of per capita income.

In the capital services growth equation, the savings rate, depreciation rate and GDP growth in the previous period all lead to higher growth in capital services. Intuitively, the growth accounting identity imposes a negative relationship between TFP and capital services growth because TFP growth is calculated as a residual in the equation. However, if TFPG is purely exogenous, it can affect capital services positively by pushing out the productivity frontier. Therefore, faster productivity growth can promote capital service growth via increased efficiency in the production process. The observed negative coefficient, however, defies this hypothesis, and suggests that productivity growth does not stimulate capital service growth. The standard deviation of inflation is used as a proxy for the stability of the macroeconomic environment. The significant negative effect indicates that unstable macroeconomic conditions may deter investment and consequently growth in capital services. Two other major indicators that affect capital service growth rates are the wage rate and the growth rate of energy use. As labor costs rise, demand for capital is likely to increase due to possible substitutions between the two. Energy use is a proxy for capacity utilization. If a large part of the current capital stock is underutilized, firms are unlikely to increase investment, hence a positive relationship between the two.

We introduced three new variables in the capital service equation in the current version of the model, which are nominal interest rates – a measure of the price of investment–, economic globalization, and real exchange rates. Nominal interest rates have a negative, but insignificant effect on the growth of capital services. Economic globalization has a positive and significant effect on capital services, as it facilitates cross-border investment and trade flows. The impact of exchange rates on investment, and thereby capital service growth, is less clear in theory. When the domestic currency appreciates, or become stronger (i.e. exchange rate expressed as domestic

currency per unit of foreign currency decreases)[15], the resulting decline in domestic demand and export could depress marginal return over capital. However, currency appreciation makes imports cheaper, allowing the increased use of imported intermediate and capital goods. The overall effect of exchange rates on investment depends upon which effect dominates, and thus remains an empirical question (see Harchaoui, Tarkhani, and Yuen, 2005). We measure real exchange rate as:

$$RealXR = \left(\frac{P_d}{P_f}\right)\left(\frac{1}{e}\right) \tag{9}$$

where P_d and P_f are relatively the price levels in domestic and foreign country, e is the exchange rate expressed as domestic currency per unit of foreign currency. Domestic and foreign prices are approximated using consumer price deflators. We find that the effective exchange rate has a negative and significant impact on capital service growth rates. This might suggest that currency appreciation (depreciation) would lead to decline (increase) in profits over any additional unit of capital and therefore result in declining (increasing) investment.

2.4 Trend Growth Projections

As explained above, equations (6) – (8) are estimated using the period averages in the actual data from periods 1 to 6. The estimated coefficients are then used to derive projections for TFP and capital services growth. To project TFP and capital services growth for both medium-term (2016-2020, period 7) and long-term (2021-2025, period 8), we also need to obtain all the exogenous variables in the system, which can be divided into three categories.

The first category includes variables whose values of medium- and long-term are available: old and youth dependency ratios, as well as growth of the labor force, sourced from the UN and ILO datasets.

The second category includes lagged variables whose long-term values need to be calculated based on medium-term projection: lagged TFP growth, lagged labor productivity and lagged capital deepening. The period 8 value of the first two lagged variables can be obtained by the projected value of period 7. The lagged labor productivity level in period 8 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

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[15] Throughout this paper, exchange rates are expressed as domestic currency per US$, for instance the exchange rate between the Euro and the $ is Euro per unit of US $ (€/$).

and TFP growth as explained above. Employment growth is approximated by the growth of the labor force. The lagged capital deepening in period 8 is calculated based on the projected growth of capital services in period 7 together with the growth of labor force.

The third category includes contemporary variables whose period 7 and 8 values are subject to judgment: inflation, standard deviation of inflation, services share in total value added, life expectancy, education attainment, corruption, R&D spending, wage rate, energy growth, globalization, interest rates and exchange rates. The share of the services sector reflects the structure of the economy; inflation rate and the standard deviation of inflation characterize the macro condition. For period 7, we use inflation rate projections from IMF, and for period 8, we assume they remain the same as in period 7. Life expectancy and education attainment are considered as policy oriented variables, whose values are subject to change depending on a country's economic condition and development strategy. For education attainment, we rely on schooling data from Wittgenstein Datacenter (2015) and Barro-Lee (2014). Projections of life expectancy at birth are obtained from United Nations. Corruption, an institutional variable, is assumed to remain constant, so that it captures mainly cross section effects while projecting forward. Growth rates of R&D spending, a major innovation influencing indicator, wage rates, energy use, globalization and interest rates are also assumed to remain the same as in period 6 for period 7 and 8. Projections on exchange rates are obtained from IMF for period 7 and for period 8 they are assumed to remain constant.

Table 4 lists GDP projections for periods 7 (2016-2020) and 8 (2021-2025) for all 65 economies as well as the growth contributions of labor, capital and TFP. The average actual GDP growth between 2008 and 2015 is also reported in the table for comparison purposes.[16] Among the mature economies, GDP growth in most European countries are projected to recover between 2016 and 2020 from the 2011–2015 period, the period that followed the global economic and financial crisis. The recovery will be most noticeable in those troubled European economies, such as those of Greece, Ireland, Portugal, Spain and Italy. United States is likely to see a 2 percent growth during 2015-2020, which is same as its growth rate during 2011-2015. Almost mature economies in Asia will experience a slowdown or stagnation in GDP growth during the 2016-2020 period compared to last five years, while other mature economies, such as

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[16] To evaluate the accuracy of our projection, we carried 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 for period 5 (1999-2005) and 6 (2006-2014). Please see the Appendix tables for details.

Australia, Canada, New Zealand and Israel, will see an increase. Among the Asian Tiger economies Hong Kong and Singapore are projected to see a decline in their growth rates during 2016-2020 compared to 2011-2015 by half a percentage to 1 full percentage point, whereas South Korea and Taiwan are likely to see some improvement. Japan, on the other hand, will double its growth rate in the next five years. Japan's stimulus efforts on the fiscal and policy fronts may translate into slightly better growth at 1.4 percent during 2016-2020 on average, compared to 0.7 percent during 2011-2015. The projected long-term trend growth of GDP will slowdown during the 2021-2025 period in almost all mature economies.

The majority of the emerging economies in our sample experienced higher average GDP growth during 2011-2015 than projected GDP growth in the following period (2015-2019). Both China and India are unlikely to see their extraordinary growth performance in the past decade repeated in the future. China's investment-driven growth in the past decade will not be sustainable in the longer run, because it will not be able to maintain its labor cost advantage, as its demographic dividend is dwindling, and more importantly as its productivity growth is weakening as it is reaching the point of diminishing returns. Even though India has more potential and demographic dividend, translating its potential to growth crucially depends upon its ability to strengthen its human capital, and continued commitment to structural reforms. Many of the expected reforms are not yet materialized thus hampering investor confidence. The rapid economic growth in emerging countries will abate across the board after 2020 with the projected trend growth of 2021-2025 ubiquitously lower than, if not equal to, that of 2016-2020. While the growth in the emerging economies will continue to be faster than that of mature economies, their relative contributions to global growth will start declining. This is not only a reflection of the 'long soft fall' of the Chinese economy[17] but other emerging market economies, with possible exception of Sub-Saharan African countries, are likely to witness a slowdown in their long-term growth. The translation of potential in Africa to growth, however, depends substantially on improved institutional performance and better governance. Overall, the share of emerging economies in the global economy increased by 9 percent during the last 10 years, which is likely to increase only by 4 percent in the next decade.

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[17] See The Conference Board (2014). "How will the long fall in China's growth impact risks and opportunities for business?" https://www.conference-board.org/china-growth/

Table 4: Projection of GDP trend growth and its components (%)

Country	Average growth 2011-2015	Average annual growth 2016 - 2020 (projected trend growth adjusted for output gaps*)					Average annual growth 2021 – 2025 (projected trend growth)				
		GDP	Labor Quantity	Labor Quality	Capital Services	TFP	GDP	Labor Quantity	Labor Quality	Capital Services	TFP
Mature Economies											
United States	2.0	2.0	0.3	0.2	0.9	0.7	1.6	0.2	0.1	0.6	0.6
Austria	1.0	1.9	-0.1	0.1	1.1	0.8	1.4	-0.3	0.1	0.9	0.8
Belgium	0.9	1.9	0.2	0.2	0.9	0.5	1.6	0.0	0.2	0.7	0.7
Cyprus	-1.8	2.5	0.8	0.3	0.2	1.2	1.9	0.3	0.2	0.2	1.1
Czech Republic	1.1	2.4	-0.3	0.2	1.1	1.4	2.1	-0.3	0.1	0.9	1.3
Denmark	0.6	2.4	0.3	0.1	1.5	0.6	2.2	0.1	0.1	1.3	0.7
Finland	0.2	2.0	-0.1	0.3	1.1	0.7	1.6	0.0	0.2	0.7	0.7
France	0.8	1.9	0.1	0.2	0.8	0.7	1.5	0.1	0.2	0.6	0.7
Germany	1.4	1.7	-0.3	0.1	0.9	1.0	1.5	-0.5	0.1	0.8	1.1
Greece	-3.3	3.4	-0.4	0.8	1.4	1.7	1.8	-0.3	0.3	0.8	1.0
Hungary	1.6	2.3	-0.2	0.2	1.5	0.9	2.7	-0.2	0.2	1.5	1.2
Iceland	2.3	3.1	0.3	0.3	1.2	1.3	3.2	0.2	0.3	1.3	1.3
Ireland	2.1	2.6	0.4	0.2	1.7	0.3	2.6	0.5	0.1	1.5	0.5
Italy	-0.7	1.9	-0.2	0.1	0.7	1.3	1.2	-0.2	0.1	0.5	0.9
Luxembourg	2.8	2.4	0.6	0.2	1.6	0.1	2.1	0.5	0.2	1.2	0.3
Malta	2.5	1.5	0.2	0.2	0.3	0.8	1.1	-0.1	0.2	0.1	0.9
Netherlands	0.6	1.9	0.0	0.1	1.2	0.7	1.5	-0.2	0.1	0.9	0.7
Norway	1.6	2.2	0.5	0.1	1.7	-0.1	2.0	0.3	0.1	1.5	0.1
Poland	3.0	3.0	-0.3	0.1	1.6	1.5	2.6	-0.3	0.1	1.3	1.5
Portugal	-0.9	1.8	-0.6	0.8	0.7	0.8	1.3	-0.3	0.5	0.4	0.7
Spain	-0.1	2.2	-0.3	0.4	1.1	0.9	1.5	-0.3	0.3	0.7	0.8
Sweden	1.8	3.0	0.2	0.1	2.1	0.6	2.9	0.2	0.1	1.9	0.8
Switzerland	1.6	2.7	0.4	0.1	0.9	1.2	2.1	0.0	0.1	0.8	1.2
United Kingdom	1.9	2.0	0.2	0.1	1.2	0.5	2.0	0.1	0.1	1.2	0.7
Japan	0.7	1.4	-0.4	0.1	0.3	1.2	1.6	-0.3	0.1	0.4	1.3
Australia	2.9	3.1	0.5	0.2	1.8	0.6	2.9	0.4	0.1	1.6	0.7
Canada	2.3	2.6	0.2	0.1	1.6	0.6	2.4	0.1	0.1	1.4	0.7
Hong Kong	2.9	1.9	-0.1	0.1	1.3	0.5	1.1	-0.4	0.1	0.8	0.5
Israel	3.4	4.9	0.2	0.1	3.5	1.1	5.1	0.3	0.1	3.6	1.2
New Zealand	2.6	2.9	0.3	0.2	1.5	0.8	3.0	0.2	0.2	1.5	1.0
Singapore	3.8	3.3	0.5	0.3	2.4	0.2	2.4	0.1	0.3	1.9	0.2
South Korea	3.0	3.8	0.2	0.2	1.7	1.7	3.2	-0.3	0.2	1.6	1.7
Taiwan	2.8	3.0	-0.2	0.3	2.2	0.8	2.2	-0.5	0.2	1.8	0.6

Table 4: Projection of GDP trend growth and its components (%), continued

Country	Average growth 2011-2015	Average annual growth 2016 - 2020 (projected trend growth adjusted for output gaps*)					Average annual growth 2021 - 2025 (projected trend growth)				
		GDP	Labor Quantity	Labor Quality	Capital Services	TFP	GDP	Labor Quantity	Labor Quality	Capital Services	TFP
Emerging Economies											
China	4.3	4.5	0.0	0.1	4.7	-0.3	3.6	-0.2	0.0	4.1	-0.4
India	6.6	6.0	0.7	0.1	4.1	1.0	5.5	0.6	0.1	3.9	0.8
Indonesia	5.7	5.1	0.6	0.2	4.2	0.1	4.5	0.4	0.2	3.9	0.0
Malaysia	5.2	3.3	0.7	0.1	3.2	-0.8	2.7	0.5	0.1	3.0	-0.9
Pakistan	4.2	3.7	1.3	0.2	2.3	-0.1	3.7	1.2	0.1	2.2	0.1
Philippines	6.0	5.5	0.7	0.2	3.7	0.9	5.3	0.6	0.2	3.6	0.8
Thailand	2.8	4.0	0.0	0.3	3.7	0.1	3.3	-0.2	0.2	3.3	0.0
Vietnam	5.7	5.8	0.4	0.2	4.3	0.9	5.5	0.2	0.2	4.1	0.9
Argentina	0.6	2.5	0.5	0.1	1.3	0.6	2.3	0.4	0.1	0.9	0.9
Brazil	0.8	2.2	0.5	0.2	1.2	0.3	2.3	0.3	0.2	1.1	0.6
Chile	3.9	3.8	0.7	0.2	3.1	-0.3	3.0	0.4	0.2	2.4	0.0
Colombia	4.6	4.4	0.5	0.1	3.3	0.4	4.2	0.4	0.1	3.3	0.4
Mexico	2.8	2.7	0.9	0.2	1.7	-0.1	2.5	0.7	0.2	1.5	0.1
Venezuela	-0.1	-1.0	0.5	0.2	0.4	-2.1	-0.5	0.4	0.2	-0.3	-0.8
Algeria	3.2	1.9	0.7	0.2	2.0	-1.0	1.6	0.5	0.2	1.7	-0.8
Egypt	2.6	3.5	1.0	0.2	2.3	0.0	3.5	0.9	0.2	2.1	0.2
Iran	-0.6	2.4	0.4	0.1	1.9	-0.1	2.3	0.3	0.1	1.9	0.0
Morocco	3.9	3.5	0.7	0.2	2.2	0.4	3.2	0.5	0.2	2.0	0.5
Saudi Arabia	5.2	1.7	0.7	0.1	2.2	-1.3	1.3	0.4	0.1	2.9	-2.0
United Arab Emirates	4.5	1.8	0.3	0.0	2.7	-1.2	1.9	0.1	0.0	3.4	-1.6
Ethiopia	9.7	8.8	1.6	0.2	3.8	2.9	8.4	1.5	0.2	3.7	2.8
Ghana	8.5	5.8	1.1	0.2	2.9	1.5	5.5	1.0	0.2	2.8	1.4
Kenya	5.5	6.3	1.5	0.2	2.3	2.1	6.7	1.5	0.2	2.4	2.4
Nigeria	4.8	4.8	1.3	0.1	3.7	-0.3	4.9	1.3	0.1	3.4	0.0
South Africa	2.2	3.4	0.6	0.3	2.9	-0.4	3.3	0.5	0.3	2.6	-0.1
Tanzania	7.4	9.4	1.6	0.2	4.7	2.7	9.8	1.6	0.2	5.0	2.7
Belarus	1.6	3.0	-0.6	0.0	1.9	1.6	2.7	-0.6	0.0	1.6	1.6
Kazakhstan	4.9	3.8	0.1	0.1	3.1	0.5	3.4	0.2	0.1	2.7	0.3
Russian Federation	1.2	1.4	-0.5	0.2	0.7	1.1	1.3	-0.5	0.2	0.5	1.1
Turkey	4.2	3.3	0.4	0.1	1.9	0.9	2.9	0.3	0.1	1.3	1.2
Turkmenistan	10.9	5.0	0.7	0.1	2.5	1.6	5.2	0.5	0.1	3.2	1.3
Uzbekistan	8.1	8.0	0.7	0.1	3.5	3.5	7.3	0.5	0.1	3.6	2.9

Source: The Conference Board Global Economic Outlook, 2016
* The projected medium-term growth rates for some countries in this table are adjusted for 2016-2020 taking into account the output gap in 2015. The model projected trend growth rates are given in Appendix Table 3.

The projected GDP growth rates based on the growth accounting framework are to be interpreted as the trend growth rates of an economy. Trends are important for projecting future growth because they depict how an economy develops on the basis of its growth potential which is determined by the available labor force, capacity in capital and technology base. In the long run, countries grow according to their trend. In the short run, however, countries may deviate from their long-run path due to temporary factors primarily, in particular their business cycle dynamics. Occasionally, shocks can also occur which have a deep impact on the structure of the economy beyond the business cycle permanently changing the course of its long-run trend.

As a prime example, the 2008-09 recession created a large gap in most mature economies between the actual output level and what could have been produced if the economy had stayed on the trend. In contrast, some major emerging economies have grown beyond their growth trend in the past few years. In order to come up with annual estimates between 2016 and 2020, we therefore made use of estimates of existing output gaps in individual economies. We make a distinction between average projected growth (trend growth) between 2016 and 2020 and the potential growth rate of the economy averaged over those years. In the long run these two measures converge. Assuming that the potential output in a country grows at the model projected trend growth rates, we estimate the required growth rate for a country to close its current (2015) output gap by a given year in the future. For instance, in the case of United States, we assume a 2 percent output gap in 2015, and we also assume that the U.S will close this output gap by 2018. Taking the model projection for potential output growth from 2016-2020, which is 1.6 percent per year on average, we obtain 2.0 percent average annual growth rate for the period 2016-2020, which is required to close the output gap in 2018. Table 5 below provides an overview of the output gap assumptions that feed into our model. Annual growth for 2016 and 2017 are linearly interpolated using 2015 growth and trend growth of period 2016-2020. As our trend GDP growth is derived via a growth accounting approach, we also adjust the contribution of labor, capital and TFP when the actual projected GDP is modified by the aforementioned method. Specifically, we calculate a ratio of the adjusted actual GDP growth over trend GDP growth, which we then apply to all three input contributions. In the long-run (2021-2025), we assume actual GDP growth coincides with the trend GDP growth.

Table 5: Output gap assumptions for medium term projections.

	Output gap in 2015 (percent)	Year in which Output gap closes	Model projected trend growth 2016-2020 (percent)	Projected growth rate 2016-2020 (percent)
United States	2.0	2018	1.6	2.0
Europe*	1.9	2020	1.5	2.3
*Of which: Euro Area**	2.4	2020	1.7	2.1
South Korea	0.5	2018	3.7	3.8
Argentina	1.0	2020	2.3	2.5
Brazil	2.0	2020	1.8	2.2
Chile	2.0	2020	3.3	3.8
Czech Republic	1.5	2020	2.1	2.4
Hong Kong	1.0	2018	1.7	1.9
Indonesia	0.5	2020	5.0	5.1
Mexico	1.0	2020	2.5	2.7
Russian Federation	1.5	2020	1.1	1.4
Taiwan	1.0	2020	2.8	3.0
Thailand	2.0	2020	3.6	4.0

Source: The Conference Board Global Economic Outlook, 2016
*For all countries in Europe we assume output gap to close in 2020, except in the U.K, where we assume it to be closing in 2018

As is evident from Table 6, estimated global growth for 2015 is 2.5 percent, which is 0.9 percent lower than our last year GEO projection for 2015. More than half of this decline is due to the lower GDP growth in China in our alternative estimates. We expect China to grow at 3.7 percent in 2015, which is significantly lower than the 6.5 percent growth we projected for 2015 in last year's outlook using official data. The global economy is projected to see a moderate increase from 2.5 percent to 2.8 percent in 2016. This improvement is mainly driven by emerging markets, which are expected to grow at 3.5 percent, more than half a percent higher than the 2.9 percent growth they had in 2015. Mature economies, on the other hand, show not much improvement in their growth rate. In the medium-term (2016-2020), our projections show mature economies to grow at their 2016 growth rate, while the growth rates of emerging markets tend to increase somewhat, with 4 percent growth on average.

Table 6: Projected GDP growth by region (%)

	2015	2016	2016-2020	2021-2025
United States	2.5	2.4	2.0	1.6
Europe*	1.7	1.8	2.1	1.7
Of which: Euro Area	1.4	1.6	1.9	1.5
Japan	0.6	1.2	1.4	1.6
Other Mature**	2.5	2.8	3.2	2.7
MATURE ECONOMIES	**2.0**	**2.1**	**2.1**	**1.8**
China	3.7	3.7	4.5	3.6
India	6.1	6.2	6.0	5.5
Other Developing Asia	4.7	4.8	4.6	4.2
Latin America	-0.3	1.1	2.5	2.4
Of which: Brazil	-2.2	-0.2	2.2	2.3
Of which: Mexico	2.5	2.8	2.7	2.5
Middle East & North Africa	3.2	2.6	2.3	2.2
Sub-Saharan Africa	3.4	4.4	5.0	5.2
Russia, Central Asia and Southeast Europe**	-0.9	1.8	2.4	2.3
EMERGING MARKETS	**2.9**	**3.5**	**4.0**	**3.6**
WORLD	**2.5**	**2.8**	**3.1**	**2.8**

Source: The Conference Board Global Economic Outlook 2016
Notes: Projections are based on trend growth estimates, which – for the period 2016-2020 – are adjusted for remaining output gaps.
* Europe includes all 28 members of the European Union as well as Iceland, Switzerland and Norway.
** Other mature economies are Australia, Canada, Israel, Hong Kong, South Korea, New Zealand, Singapore, and Taiwan Province of China.
*** Southeast Europe includes Albania, Bosnia and Herzegovina, Macedonia, Serbia and Montenegro, and Turkey.

While emerging markets contributed just over 70 percent of global growth during 2011-2015, their contribution will decline to just above 65 percent in the next five years, even though global growth improves marginally by 0.3 percentage point (see Table 7). This decline in the pace at which the emerging markets grow has a big impact on the speed at which they influence the composition of world income. While emerging markets increased their share in world GDP from 43 percent in 2005 to 54 percent in 2015 – an increase of 9 percent in 10 years, during the next 10 years, their share is projected to increase to 56 percent – an increase of 4 percent.

Table 7: Regional contribution to Global Economic Growth

	2011-2015	2016	2016-2020	2021-2025
United States	0.4	0.4	0.3	0.3
Europe*	0.2	0.3	0.4	0.3
Japan	0.0	0.1	0.1	0.1
Other Mature**	0.2	0.2	0.2	0.2
MATURE ECONOMIES	**0.8**	**1.0**	**1.0**	**0.8**
China	0.7	0.6	0.7	0.6
India	0.4	0.4	0.4	0.5
Other Developing Asia	0.3	0.3	0.3	0.3
Latin America	0.1	0.1	0.2	0.2
Middle East & North Africa	0.1	0.1	0.1	0.1
Sub-Saharan Africa	0.1	0.1	0.1	0.1
Russia, Central Asia and Southeast Europe***	0.2	0.1	0.1	0.1
EMERGING MARKETS	**1.9**	**1.8**	**2.1**	**2.0**
WORLD GDP GROWTH	**2.7**	**2.8**	**3.1**	**2.8**

Source: The Conference Board Global Economic Outlook 2016
Note: Sum of regional contributions may not add up precisely to World GDP growth because contributions are expressed in log changes and World growth in annual percent changes.

3. Comparison of GDP Projections with Other Studies

A number of researchers have attempted projecting global economic growth (e.g. Jorgenson and Vu, 2013; Lee and Hong, 2010; Fogel, 2007; Wilson et.al., 2011, among others). However, not all these projections are updated on annual basis, and, therefore, often do not reflect the most up to date information and dynamics of the global economy. A few organizations such as IMF, OECD, Oxford Economics, Goldman Sachs and Price Water Coopers provide up to date projections. In this section we compare the methodology and results from The Conference Board's growth projections with some of these studies.

As mentioned before, our projection model is based on Jorgenson's growth accounting framework. However, Jorgenson and Vu (2013)'s projections for all input components are based on the performance of the near past, while in our methodology this only holds for the inputs capital services and TFP growth. Our methodology is closely akin to Lee and Hong (2010), in terms of both the growth accounting framework as well as the regression approach to estimate and project input factors. However, their work only covers Asian countries while ours includes

33 mature economies and 32 emerging markets. IMF projections for the World Economic Outlook use a 'bottom-up' approach, where the individual country projections produced by respective country teams are aggregated through a series of iterations. Therefore, the methodology can vary from country to country and between different series. The Oxford Economics uses a global model with a smaller set of countries (46), where an error correction model, which jointly models short- and long-run relationships, is estimated using co-integration techniques. The model is estimated explicitly for the 46 individual countries, and also for six regions that uses information on 154 countries implicitly. The short-run component of the model is used to analyze business cycle fluctuations and short-run dynamics, whereas the long-term component is used to make the projections. The methodologies used in some other studies are less explicit, and not available to public. For instance, the methodology used in the Price Water Coopers' projection is not publically available, but it appears their projections are based on expenditure based models.

Table 8: Comparison of Projections of GDP growth among difference sources

	GEO Nov. 2015	IMF Oct. 2015	Oxford Economics Oct. 2015	PWC Oct. 2015
	2016-2020	**2016-2020**	**2016-2020**	**2017-2021**
United States	2.0	2.5	2.6	2.5
Japan	1.4	0.7	1.0	1.3
Germany	1.7	1.4	1.5	1.6
France	1.9	1.7	1.6	1.9
Italy	1.9	1.1	1.1	1.3
United Kingdom	2.0	2.2	2.4	2.3
China	4.5	6.2	5.6	5.7
India	6.0	7.6	6.9	6.1
Brazil	2.2	1.7	1.0	3.1
Russia	1.4	1.0	1.2	1.9
MATURE ECONOMIES	**2.1**	**2.1**	**2.2**	
EMERGING MARKETS	**4.0**	**5.0**	**4.6**	
WORLD	**3.1**	**3.8**	**3.6**	**3.6**

Sources: The Conference Board Global Economic Outlook 2016; International Monetary Fund (IMF) - World Economic Outlook Database, October 2015;; Oxford Economics, Global Economic Model, October 2015; Price Water Coopers (PWC), Global Economy Watch- Economic Projections, October 2015

Table 8 presents a comparison of the projection results from the different studies. For the medium term, IMF projection for the global economy is higher by 0.7 percentage point than our projection for the period 2016-2020. This difference is mainly emanating from emerging economies while our projections for mature economies are similar to that of IMF's projections. In general for most countries in the mature group, our projections are slightly above IMF's projections, with the exception of the U.K and the U.S. Our estimates for emerging economies, however, are lower by 1 percent, primarily due to lower forecasts for China and India. As mentioned before, our projections for the global economy in general and emerging markets in particular are also reflective our alternate series on Chinese GDP growth rates, which are considerably lower than the official estimates, which form the basis for IMF projections. Between our projections for the next five years (2016-2020) and PWC's projection for 2017-2021, our projections are lower for most countries except for Italy, France, Germany and Japan, where our projections are slightly optimistic or the same. In particular, our projection for China is quite lower than PWC's, whereas the projections for India are similar. As mentioned before, our projections for China will be lower in general compared to most other sources, as other sources are based on official data. Our global projection is half a percentage point lower than PWC's forecast.

Oxford Economics' projections for 2016-2020 are higher than our projections for the U.S., the U.K., China, and India, whereas they are lower for Japan, Germany, France, Italy, Brazil and Russia. While the difference between our projections and Oxford Economics' projections for mature economies is quite low, they differ by more than half a percentage point for the emerging markets, consequently leading to an almost half a percentage point difference for the global economy.

In general, our medium-term projections for mature economies tend to be quite in line with IMF and Oxford Economics, while we differ substantially for the emerging economies, thus resulting in a lower Global GDP growth in our projection.

4. Closing Remarks

Projecting future growth is an ambitious undertaking. The only way we can forecast the future is to begin with looking at past performance, supplemented by assumptions on output gaps and some of the future trends in underlying variables. The results will therefore crucially depend upon the assumptions we make regarding the relationships between GDP growth and various factors that are expected to influence growth as well as assumptions about the near term cyclical factors acting on these economies.

The growth accounting framework provides a good starting point for projecting output growth in the medium and long term. It uses information from projected factor inputs – capital and labor – and productivity to project output growth. Therefore, the final projection results are strongly dependent on the approach to estimate factor inputs, particularly capital and total factor productivity growth rates. We believe that our methodology combining simple growth accounting and regression analysis using economic variables makes it possible to be more explicit about understanding the sources of growth and the drivers of change over time.

Our projections of GDP growth may be seen as relatively low compared with other studies. Much of this difference is visible in the emerging markets, of which our alternate estimate for China contributes a major part of the overall decline, as we maintain that official Chinese GDP growth rates are overstated. However, over a time span as long as the one we have used, there will likely be deviations in both directions. Despite the transparency and comparability of our approach, the disadvantage is that there is no simple framework that can take into account all the country specific factors and potential shocks in the future. That said, our goal is not to provide an explicit forecast in the sense of the precise point forecasts on growth, but rather to provide a reasonable way of benchmarking trend growth across a large group of economies.

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Appendix

In order to evaluate the accuracy of our projections, 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 simultaneous equation system to predict capital services and TFP growth in periods 5 (1999-2005) or 6 (2006-2015). Together with the labor contribution, we then calculated the projected GDP growth. In the appendix table below, we list the actual and projected values for capital service growth, TFP growth and GDP growth, and the corresponding difference between the projected and actual values. Three points worth noting when reading the numbers in the appendix tables 1 and 2 below:

1. Because we specify lagged variables as explanatory variables in the simultaneous equation system, the projected capital services growth and TFP growth is affected by the performance of the previous period. That is why in period 6 (2006 − 2015), which contains the 2008-2009 crisis and the European debt crisis, the projected growth is higher than the actual growth for most mature economies. This also explains why in our medium-term projection (2016-2020), the base scenario growth continues the downward trend. The model specification determines the path dependence nature of the projection and is not able to forecast any unforeseeable shocks, either negative (such as a global financial crisis, or the breakup of the euro zone) or positive (such as a strong acceleration in technological progress and innovation that will lift the world growth out of the sluggish trajectory).

2. The deviation between the projected GDP growth and actual GDP growth for period 5 and 6 comes not only from the differences in the projected and actual capital services growth and TFP growth. It is also partially due to the fact that in our projected GDP growth, we approximate the actual employment growth by the growth in working age population. The discrepancy will be especially evident in countries with volatile labor participation rate and employment rate.

3. Our medium and long-term projections for China and India may seem low compared with the actual GDP growth in the past decades in these two countries. However, when comparing with the projections in period 5 and 6, these projections indicate a gradual slowdown in China and India instead of a sudden drop from 2015 onwards. It is a result of combined slowdown in all of the input factors. Specifically, China will run out of the demographic dividend during 2016-2020 as its working age population growth will decline; capital services growth gradually slow down as the return to capital declines after many years of intensive investment and the economy is shifting towards a more consumption driven growth model; last but not the least, productivity has been contracting due to several structural weaknesses of the economy as well as the erosion in catch-up potential. As the country matures the easy productivity gains from learning the leaders exhaust and future productivity growth has to originate from technological progress and innovation. Even though, India still has much potential for investment led growth – provided its large demographic dividend and underdeveloped infrastructure – the realization of this potential crucially depends upon India's ability to reform its economy in order to ensure efficient allocation of resources, and also to improve its human capital.

Appendix Table 1: Actual and projected growth of capital services, TFP and GDP and the differences, Period 5 (1999-2005)

Period 5 (1999-2005)									
MATURE ECONOMIES	**Capital services growth (%)**			**TFP growth (%)**			**GDP growth (%)**		
	Actual	Projected	Difference (Projected - Actual)	Actual	Projected	Difference (Projected - Actual)	Actual	Projected	Difference (Projected - Actual)
United States	3.9	3.3	-0.5	1.2	0.7	-0.4	3.1	2.8	-0.3
Austria	2.8	3.3	0.5	0.6	0.8	0.2	2.2	2.9	0.6
Belgium	3.8	3.4	-0.4	0.2	0.5	0.4	2.3	2.6	0.3
Cyprus	2.1	2.0	-0.1	1.5	1.5	0.0	4.0	4.3	0.3
Czech Republic	6.0	4.5	-1.4	1.9	1.0	-0.9	3.6	2.6	-1.0
Denmark	3.4	3.7	0.3	0.1	0.7	0.6	1.9	2.6	0.7
Finland	3.3	3.2	0.0	1.2	1.3	0.1	3.3	3.6	0.3
France	3.3	2.8	-0.4	0.4	0.6	0.2	2.2	2.7	0.5
Germany	1.7	2.1	0.4	0.8	0.9	0.1	1.1	1.9	0.8
Greece	5.8	3.6	-2.2	-0.4	0.6	0.9	3.8	3.6	-0.2
Hungary	6.6	4.0	-2.6	0.4	1.1	0.7	4.1	3.7	-0.3
Iceland	4.3	4.8	0.5	1.9	1.4	-0.6	4.3	4.0	-0.3
Ireland	7.7	6.1	-1.6	0.4	1.0	0.6	6.3	6.4	0.1
Italy	2.8	3.0	0.1	-0.5	0.5	1.0	1.4	2.7	1.3
Luxembourg	6.1	4.9	-1.1	-0.3	0.4	0.7	4.5	5.0	0.5
Malta	1.6	3.1	1.5	2.5	1.5	-1.0	3.1	3.2	0.1
Netherlands	2.8	3.7	0.9	0.7	0.8	0.1	2.3	3.0	0.7
Norway	3.8	2.8	-1.1	0.3	-0.1	-0.4	2.3	1.6	-0.7
Poland	4.2	2.9	-1.2	2.0	1.9	-0.1	3.5	3.0	-0.6
Portugal	5.2	3.7	-1.5	-1.3	0.4	1.7	1.7	2.9	1.2
Spain	5.4	3.8	-1.7	-1.0	0.4	1.4	3.8	4.7	0.9
Sweden	3.0	4.3	1.3	1.2	0.9	-0.3	3.2	3.8	0.6
Switzerland	3.2	3.1	-0.1	0.4	0.8	0.4	1.9	2.3	0.4
United Kingdom	4.7	4.6	0.0	0.4	0.7	0.2	3.1	3.6	0.5
Japan	1.5	2.8	1.2	0.8	1.0	0.2	1.1	2.2	1.1
Australia	5.1	4.4	-0.7	0.1	1.0	0.9	3.4	4.5	1.1
Canada	4.3	3.9	-0.4	0.2	0.9	0.7	3.3	4.1	0.8
Hong Kong	3.6	6.1	2.5	1.8	0.4	-1.4	4.5	4.0	-0.5
Israel	4.5	4.9	0.4	-0.4	0.6	1.1	3.3	4.8	1.6
New Zealand	4.1	4.7	0.6	0.3	1.1	0.7	3.9	5.1	1.1
Singapore	3.3	6.7	3.4	2.9	0.6	-2.3	5.6	5.2	-0.4
South Korea	6.0	7.2	1.2	2.7	1.5	-1.3	6.1	5.8	-0.4
Taiwan	6.0	6.9	0.9	1.3	0.8	-0.5	4.2	4.5	0.3

	Capital services growth (%)				TFP growth (%)				GDP growth (%)		
EMERGING MARKETS	Actual	Projected	Difference (Projected - Actual)		Actual	Projected	Difference (Projected - Actual)		Actual	Projected	Difference (Projected - Actual)
China	11.4	10.1	-1.3		1.2	0.3	-0.9		8.1	6.5	-1.6
India	6.7	6.7	0.0		0.8	0.8	0.1		6.4	6.4	0.1
Indonesia	4.4	6.9	2.5		0.9	-0.5	-1.4		4.2	3.6	-0.5
Malaysia	3.8	6.8	3.0		2.1	-0.8	-2.9		5.5	4.4	-1.2
Pakistan	3.9	4.7	0.8		1.8	-0.1	-1.8		4.9	3.5	-1.4
Philippines	3.4	4.3	0.8		1.2	0.5	-0.7		4.3	4.1	-0.2
Thailand	2.1	6.7	4.6		2.6	-0.2	-2.9		5.2	5.0	-0.2
Vietnam	13.3	11.6	-1.7		-0.3	0.5	0.8		7.0	7.5	0.5
Argentina	1.2	2.5	1.3		-0.6	1.0	1.5		0.5	3.5	3.0
Brazil	3.0	2.4	-0.6		-0.3	1.2	1.5		2.6	4.1	1.4
Chile	6.4	5.4	-1.0		-0.5	1.3	1.7		3.9	5.6	1.6
Colombia	2.8	3.4	0.6		-0.3	0.5	0.9		2.4	4.0	1.6
Mexico	4.2	2.4	-1.8		-0.3	0.5	0.8		2.8	2.6	-0.2
Venezuela	0.9	-0.6	-1.4		-0.1	-1.2	-1.1		1.4	-0.3	-1.7
Algeria	1.3	1.7	0.4		1.6	-1.1	-2.7		4.7	2.1	-2.6
Egypt	3.2	5.6	2.3		1.4	0.4	-1.0		4.2	4.4	0.1
Iran	2.6	1.6	-1.0		1.4	-1.2	-2.6		5.1	1.8	-3.3
Morocco	4.4	4.3	-0.2		-0.1	0.9	0.9		3.8	4.7	0.9
Saudi Arabia	3.2	2.4	-0.8		0.6	-2.9	-3.6		4.1	-0.1	-4.2
United Arab Emirates	4.0	3.8	-0.1		1.3	-1.3	-2.6		6.2	3.3	-2.9
Ethiopia	4.2	7.4	3.2		0.9	1.6	0.7		4.6	6.9	2.3
Ghana	0.9	3.8	2.9		3.5	1.9	-1.6		5.0	5.2	0.2
Kenya	2.5	3.7	1.2		0.2	1.3	1.1		3.1	4.7	1.7
Nigeria	3.2	3.5	0.4		5.2	-1.1	-6.3		8.2	1.9	-6.3
South Africa	4.2	4.5	0.3		0.2	0.7	0.5		3.7	4.1	0.5
Tanzania	0.2	7.5	7.3		4.7	1.8	-2.9		6.4	7.2	0.8
Belarus	2.6	4.2	1.5		5.3	0.1	-5.2		6.6	2.0	-4.6
Kazakhstan	0.1	0.0	-0.1		7.6	-1.9	-9.5		9.2	-0.6	-9.8
Russian Federation	-1.7	-1.4	0.3		5.8	-0.7	-6.5		6.7	0.3	-6.4
Turkey	5.9	3.4	-2.6		-0.3	0.1	0.5		3.7	2.4	-1.3
Turkmenistan	0.9	3.3	2.3		3.6	-1.4	-5.0		6.7	2.7	-4.0
Uzbekistan	-0.2	3.0	3.2		3.9	0.9	-3.0		5.0	3.6	-1.4

Period 5 (1999-2005)

Appendix Table 2: Actual and projected growth of capital services, TFP and GDP and the differences, Period 6 (2006-2015)

Period 6 (2006-2015)										
MATURE ECONOMIES	**Capital services growth (%)**				**TFP growth (%)**				**GDP growth (%)**		
	Actual	Projected	Difference (Projected - Actual)		Actual	Projected	Difference (Projected - Actual)		Actual	Projected	Difference (Projected - Actual)
United States	2.2	2.5	0.3		0.1	1.0	0.9		1.4	2.5	1.1
Austria	1.8	2.7	0.8		0.2	0.9	0.8		1.1	2.7	1.6
Belgium	3.8	3.4	-0.5		-1.0	0.7	1.7		1.1	2.6	1.5
Cyprus	2.1	1.2	-0.9		-0.6	1.4	2.1		0.3	2.1	1.7
Czech Republic	4.3	3.9	-0.4		0.1	2.0	1.9		1.7	3.7	1.9
Denmark	2.7	3.7	1.0		-0.8	0.9	1.6		0.3	2.5	2.2
Finland	3.6	3.1	-0.5		-1.2	1.2	2.4		0.5	2.9	2.4
France	2.2	2.3	0.1		-0.4	0.8	1.1		0.8	2.1	1.3
Germany	1.7	2.4	0.7		0.2	1.3	1.0		1.3	2.9	1.5
Greece	3.4	2.7	-0.6		-2.5	1.0	3.6		-1.8	1.7	3.5
Hungary	4.9	3.7	-1.2		-1.6	1.6	3.1		0.7	3.7	3.0
Iceland	0.8	4.4	3.6		1.3	1.4	0.1		1.8	3.8	2.0
Ireland	4.2	4.9	0.7		-0.8	0.8	1.6		1.1	3.3	2.2
Italy	0.8	1.9	1.2		-0.6	0.7	1.3		-0.5	1.5	2.0
Luxembourg	4.7	3.3	-1.4		-1.0	0.2	1.2		2.6	3.3	0.7
Malta	0.5	3.2	2.8		1.1	1.3	0.2		2.2	4.3	2.1
Netherlands	1.7	3.0	1.4		-0.1	0.9	0.9		0.9	2.4	1.5
Norway	4.6	1.7	-2.9		-1.9	0.8	2.7		1.3	2.6	1.3
Poland	5.2	3.1	-2.1		0.6	2.2	1.6		3.8	4.5	0.7
Portugal	2.6	2.1	-0.5		-1.1	0.6	1.6		-0.1	1.4	1.5
Spain	3.1	3.2	0.0		-0.6	0.6	1.2		0.5	1.9	1.4
Sweden	3.3	4.6	1.3		-0.5	1.1	1.6		1.7	4.0	2.3
Switzerland	2.8	3.6	0.9		0.3	1.0	0.8		1.9	3.3	1.4
United Kingdom	2.8	3.3	0.5		-0.6	0.9	1.4		1.2	2.8	1.6
Japan	1.0	1.9	0.9		0.1	1.5	1.4		0.5	2.4	1.9
Australia	6.9	4.1	-2.9		-1.3	1.0	2.3		2.8	4.1	1.3
Canada	4.1	3.5	-0.6		-0.7	1.3	1.9		1.8	3.7	1.9
Hong Kong	3.2	4.0	0.7		1.2	1.1	0.0		3.4	3.8	0.4
Israel	4.2	5.0	0.8		0.2	1.3	1.1		4.0	5.8	1.8
New Zealand	4.2	4.3	0.1		-0.7	1.4	2.1		2.1	4.5	2.4
Singapore	5.2	4.9	-0.4		0.2	0.9	0.6		5.3	5.9	0.6
South Korea	5.0	6.1	1.0		1.3	2.1	0.8		3.5	5.5	1.9
Taiwan	3.0	5.2	2.3		1.6	1.3	-0.3		3.4	4.6	1.1

Period 6 (2006-2015)											
EMERGING MARKETS	**Capital services growth (%)**				**TFP growth (%)**				**GDP growth (%)**		
	Actual	Projected	Difference (Projected - Actual)		Actual	Projected	Difference (Projected - Actual)		Actual	Projected	Difference (Projected - Actual)
China	12.0	9.7	-2.3		-0.5	0.7	1.2		6.9	6.8	-0.1
India	9.1	7.3	-1.8		1.8	1.5	-0.3		7.5	6.2	-1.3
Indonesia	7.3	6.9	-0.4		0.8	1.1	0.3		5.7	5.8	0.1
Malaysia	5.2	5.5	0.3		0.4	0.6	0.1		4.8	5.3	0.5
Pakistan	5.9	4.5	-1.4		-0.9	0.0	0.9		3.6	4.0	0.3
Philippines	5.3	4.8	-0.5		1.3	1.6	0.3		5.5	5.4	-0.1
Thailand	3.8	6.1	2.3		0.4	1.0	0.6		3.3	5.3	2.0
Vietnam	12.8	8.6	-4.2		-1.6	2.2	3.8		6.0	7.8	1.8
Argentina	5.6	2.1	-3.5		-1.7	1.1	2.8		2.6	3.2	0.6
Brazil	6.6	3.4	-3.2		-1.4	1.0	2.4		2.6	3.7	1.1
Chile	8.2	5.3	-2.8		-1.7	0.8	2.5		3.8	5.2	1.3
Colombia	7.5	3.7	-3.7		-0.8	1.4	2.2		4.6	4.9	0.4
Mexico	4.5	2.0	-2.6		-1.0	0.9	1.8		2.4	3.1	0.8
Venezuela	5.9	-1.3	-7.2		-3.1	1.2	4.3		1.8	1.4	-0.4
Algeria	4.9	0.6	-4.3		-1.2	1.4	2.6		2.9	3.3	0.5
Egypt	6.4	3.3	-3.1		-1.1	1.4	2.6		4.3	5.4	1.1
Iran	3.8	1.2	-2.7		-0.9	1.7	2.6		2.0	2.9	0.9
Morocco	8.0	4.4	-3.6		-1.4	0.9	2.3		4.4	5.0	0.6
Saudi Arabia	6.9	-1.1	-7.9		-0.4	1.3	1.8		5.5	1.7	-3.8
United Arab Emirates	6.7	2.8	-3.9		-2.5	0.3	2.8		3.4	3.6	0.2
Ethiopia	7.2	6.1	-1.1		3.8	2.7	-1.2		9.8	8.0	-1.8
Ghana	4.2	3.2	-0.9		3.1	2.9	-0.2		7.4	6.5	-0.9
Kenya	7.6	3.5	-4.1		-0.2	3.1	3.3		5.0	6.3	1.3
Nigeria	12.4	2.9	-9.6		-2.5	2.5	5.0		5.8	5.4	-0.3
South Africa	7.4	5.8	-1.6		-2.0	0.7	2.7		2.7	5.0	2.3
Tanzania	5.7	7.8	2.1		1.9	4.0	2.0		6.7	10.0	3.2
Belarus	9.1	5.8	-3.3		0.2	3.1	2.8		4.4	5.9	1.5
Kazakhstan	6.1	1.2	-4.9		1.0	3.6	2.6		5.5	5.2	-0.4
Russian Federation	2.8	1.4	-1.4		0.6	2.9	2.4		2.4	4.0	1.7
Turkey	7.4	3.0	-4.4		-1.9	0.9	2.8		3.7	4.0	0.3
Turkmenistan	1.8	2.4	0.5		8.4	3.8	-4.6		10.6	6.2	-4.4
Uzbekistan	2.3	4.4	2.0		5.7	4.3	-1.4		8.3	7.9	-0.4

Appendix Table 3: Model predicted growth rates and contributions for 2016-2020 and 2021-2025

MATURE ECONOMIES	Average annual growth 2016-2020 (trend growth projection)						Average annual growth 2021-2025 (trend growth projection)				
	GDP	Labor Quantity	Labor Composition	Capital Services	TFP		GDP	Labor Quantity	Labor Composition	Capital Services	TFP
United States	1.6	0.2	0.1	0.7	0.5		1.6	0.2	0.1	0.6	0.6
Austria	1.6	-0.1	0.1	0.9	0.7		1.4	-0.3	0.1	0.9	0.8
Belgium	1.7	0.2	0.2	0.8	0.5		1.6	0.0	0.2	0.7	0.7
Cyprus	1.7	0.5	0.2	0.1	0.8		1.9	0.3	0.2	0.2	1.1
Czech Republic	2.1	-0.2	0.1	0.9	1.2		2.1	-0.3	0.1	0.9	1.3
Denmark	2.0	0.2	0.1	1.2	0.5		2.2	0.1	0.1	1.3	0.7
Finland	1.3	-0.1	0.2	0.7	0.5		1.6	0.0	0.2	0.7	0.7
France	1.4	0.1	0.2	0.6	0.5		1.5	0.1	0.2	0.6	0.7
Germany	1.7	-0.3	0.1	0.9	1.0		1.5	-0.5	0.1	0.8	1.1
Greece	1.3	-0.1	0.3	0.5	0.6		1.8	-0.3	0.3	0.8	1.0
Hungary	2.3	-0.2	0.2	1.5	0.9		2.7	-0.2	0.2	1.5	1.2
Iceland	3.1	0.3	0.3	1.2	1.3		3.2	0.2	0.3	1.3	1.3
Ireland	2.2	0.3	0.2	1.4	0.3		2.6	0.5	0.1	1.5	0.5
Italy	1.0	-0.1	0.1	0.4	0.7		1.2	-0.2	0.1	0.5	0.9
Luxembourg	2.2	0.5	0.2	1.4	0.1		2.1	0.5	0.2	1.2	0.3
Malta	1.5	0.2	0.2	0.3	0.8		1.1	-0.1	0.2	0.1	0.9
Netherlands	1.5	0.0	0.1	0.9	0.6		1.5	-0.2	0.1	0.9	0.7
Norway	2.0	0.4	0.1	1.5	-0.1		2.0	0.3	0.1	1.5	0.1
Poland	2.9	-0.3	0.1	1.6	1.5		2.6	-0.3	0.1	1.3	1.5
Portugal	1.0	-0.3	0.5	0.4	0.5		1.3	-0.3	0.5	0.4	0.7
Spain	1.4	-0.2	0.3	0.7	0.6		1.5	-0.3	0.3	0.7	0.8
Sweden	2.7	0.1	0.1	1.9	0.6		2.9	0.2	0.1	1.9	0.8
Switzerland	2.4	0.4	0.1	0.8	1.1		2.1	0.0	0.1	0.8	1.2
United Kingdom	1.9	0.2	0.1	1.2	0.5		2.0	0.1	0.1	1.2	0.7
Japan	1.4	-0.4	0.1	0.3	1.2		1.6	-0.3	0.1	0.4	1.3
Australia	2.9	0.5	0.1	1.7	0.5		2.9	0.4	0.1	1.6	0.7
Canada	2.4	0.2	0.1	1.5	0.6		2.4	0.1	0.1	1.4	0.7
Hong Kong	1.7	-0.1	0.1	1.2	0.5		1.1	-0.4	0.1	0.8	0.5
Israel	4.9	0.2	0.1	3.5	1.1		5.1	0.3	0.1	3.6	1.2
New Zealand	2.9	0.3	0.2	1.5	0.8		3.0	0.2	0.2	1.5	1.0
Singapore	3.3	0.5	0.3	2.4	0.2		2.4	0.1	0.3	1.9	0.2
South Korea	3.7	0.2	0.2	1.6	1.7		3.2	-0.3	0.2	1.6	1.7
Taiwan	2.8	-0.2	0.2	2.0	0.7		2.2	-0.5	0.2	1.8	0.6

EMERGING MARKETS	Average annual growth 2015-2019 (trend growth projection)						Average annual growth 2020-2025 (trend growth projection)				
	GDP	Labor Quantity	Labor Composition	Capital Services	TFP		GDP	Labor Quantity	Labor Composition	Capital Services	TFP
China	4.5	0.0	0.1	4.7	-0.3		3.6	-0.2	0.0	4.1	-0.4
India	6.0	0.7	0.1	4.1	1.0		5.5	0.6	0.1	3.9	0.8
Indonesia	5.0	0.6	0.2	4.1	0.1		4.5	0.4	0.2	3.9	0.0
Malaysia	3.3	0.7	0.1	3.2	-0.8		2.7	0.5	0.1	3.0	-0.9
Pakistan	3.7	1.3	0.2	2.3	-0.1		3.7	1.2	0.1	2.2	0.1
Philippines	5.5	0.7	0.2	3.7	0.9		5.3	0.6	0.2	3.6	0.8
Thailand	3.6	0.0	0.3	3.3	0.1		3.3	-0.2	0.2	3.3	0.0
Vietnam	5.8	0.4	0.2	4.3	0.9		5.5	0.2	0.2	4.1	0.9
Argentina	2.3	0.5	0.1	1.1	0.6		2.3	0.4	0.1	0.9	0.9
Brazil	2.3	0.5	0.2	1.3	0.3		2.3	0.3	0.2	1.1	0.6
Chile	3.3	0.7	0.2	2.7	-0.2		3.0	0.4	0.2	2.4	0.0
Colombia	4.4	0.5	0.1	3.3	0.4		4.2	0.4	0.1	3.3	0.4
Mexico	2.5	0.9	0.2	1.5	-0.1		2.5	0.7	0.2	1.5	0.1
Venezuela	-0.3	0.5	0.2	0.2	-1.3		-0.5	0.4	0.2	-0.3	-0.8
Algeria	1.9	0.7	0.2	2.0	-1.0		1.6	0.5	0.2	1.7	-0.8
Egypt	3.5	1.0	0.2	2.3	0.0		3.5	0.9	0.2	2.1	0.2
Iran	2.4	0.4	0.1	1.9	-0.1		2.3	0.3	0.1	1.9	0.0
Morocco	3.5	0.7	0.2	2.2	0.4		3.2	0.5	0.2	2.0	0.5
Saudi Arabia	2.2	0.7	0.1	3.7	-2.2		1.3	0.4	0.1	2.9	-2.0
United Arab Emirates	2.4	0.3	0.0	3.8	-1.7		1.9	0.1	0.0	3.4	-1.6
Ethiopia	8.8	1.6	0.2	3.8	2.9		8.4	1.5	0.2	3.7	2.8
Ghana	5.8	1.1	0.2	2.9	1.5		5.5	1.0	0.2	2.8	1.4
Kenya	6.3	1.5	0.2	2.3	2.1		6.7	1.5	0.2	2.4	2.4
Nigeria	4.8	1.3	0.1	3.7	-0.3		4.9	1.3	0.1	3.4	0.0
South Africa	3.2	0.6	0.3	2.6	-0.3		3.3	0.5	0.3	2.6	-0.1
Tanzania	9.4	1.6	0.2	4.7	2.7		9.8	1.6	0.2	5.0	2.7
Belarus	3.0	-0.6	0.0	1.9	1.6		2.7	-0.6	0.0	1.6	1.6
Kazakhstan	3.8	0.1	0.1	3.1	0.5		3.4	0.2	0.1	2.7	0.3
Russian Federation	1.5	-0.5	0.2	0.7	1.2		1.3	-0.5	0.2	0.5	1.1
Turkey	2.9	0.4	0.1	1.6	0.8		2.9	0.3	0.1	1.3	1.2
Turkmenistan	6.7	0.7	0.1	3.5	2.2		5.2	0.5	0.1	3.2	1.3
Uzbekistan	8.0	0.7	0.1	3.5	3.5		7.3	0.5	0.1	3.6	2.9