



Global Economy Watch

Rise of the robots – good news or bad for businesses and society?



Dear readers,

Waves of innovation have always shaped the way households, businesses and society operate and interact. Technological progress has also been the key driver of rising standards of living, particularly since the Industrial Revolution.

However, recently the debate has focused on the impact that technological change will have on the labour market. We have previously argued that technology can actually create jobs and we believe in some sectors, for example, where human contact is important, there is currently less scope for robots to replace people.

It is however likely that future technological change will eventually displace some workers, though these is some debate as to exactly how many jobs are at risk. This would obviously impact workers who could face lower job prospects, but there would also be knock-on implications for society and on the level of income inequality.

Linked to this, we examine how policymakers can combat rising inequality by looking at a range of large and small rich economies who have managed to contain income inequality, and have identified a common set of stylised

policies they follow. These are to:

- Provide equal educational opportunities;
- Support low income workers; and
- Maintain a fair and transparent tax and public spending system.

We also assess whether it is sufficient to look at GDP when assessing the extent to which Western economies have recovered from the financial crisis. Our analysis shows that household spending growth per person has not kept pace with real GDP growth in most advanced economies. In the UK, for example, real household spending per person is still lower than its pre-crisis level.

We also continue to monitor developments on Brexit as post-referendum statistics are gradually being published in the UK. Taking these changes into account we are still expecting GDP growth to slow next year, but are now projecting UK growth of around 0.9% in 2017 (up from 0.7% previously). At the same time, a falling pound could push inflation back above its 2% target by 2018. We will have more to say on this in our next UK Economic Outlook report, which will be published in mid-November.

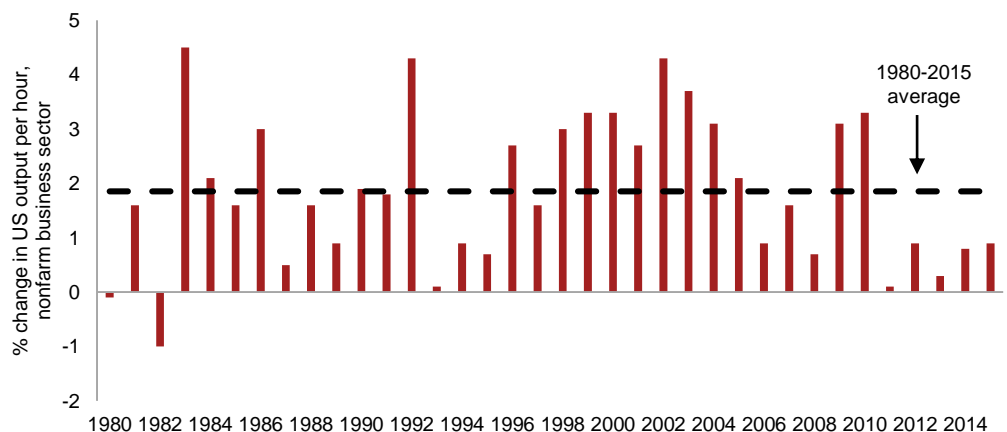


Kind regards

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Fig 1: The IT boom in the late 1990s and early 2000s led to years of above average productivity growth in the US



Sources: PwC analysis, US BLS



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Economic update: Are households feeling the benefits of the recovery?

How far have the advanced economies recovered since the crisis?

Last month marked eight years since the collapse of Lehman Brothers – widely considered as the defining moment of the global financial crisis. In most of the G7 and other major Eurozone economies, output levels have surpassed their pre-crisis levels. But is it enough to only consider real GDP when assessing the extent of the recovery?

In a [recent blog](#), our UK chief economist, John Hawksorth, assessed some alternatives to total GDP growth that may better capture the extent to which individual households in the UK are feeling the benefits of the recovery. We have now extended this analysis to other leading economies.

Household spending growth per person is lagging behind real GDP growth in most advanced economies

We found that the recovery in real household spending per person has not kept pace with that of real GDP in the majority of the 12 advanced economies we considered (see Figure 2). For seven of these countries real household spending per person is still below its pre-crisis level.

This measure paints a less optimistic picture of the post-recession recovery for the average person, and presents a challenge for businesses focused on consumer goods and services as their revenue is more sensitive to household spending patterns. This emphasises the point that some businesses should look at more than just GDP trends when making revenue projections.

Fig 2: Of the G7, real household spending per person remains below its pre-crisis level in the UK and Italy

	% change, Q1 2008 – Q2 2016		
	Real GDP	Household spending per person	
Ireland**	32.6%	-5.6%	●
Canada	12.2%	7.7%	●
US	11.4%	7.0%	●
UK	7.6%	-0.9%	●
Germany	7.1%	5.6%	●
France	4.0%	2.1%	●
Netherlands	2.8%	-4.4%	●
Japan	0.4%	2.9%	●
Spain	-2.2%	-8.9%	●
Portugal	-5.6%	-2.6%	●
Italy	-8.0%	-6.9%	●
Greece*	-26.9%	-24.4%	●

● Performed worse than GDP ● Performed better than GDP

*Data represents change to 2015 Q4

**GDP number is skewed by growth of 26.3% in 2015

Sources: PwC analysis, OECD, US BEA, ONS

Focus on: Three key policy measures to contain inequality

Inequality is on the rise in rich economies

Income inequality has gradually crept up the agenda of policymakers in recent years. There are two main reasons for this. First, a more equal society could increase economic growth. Recently, an [IMF Staff Discussion Note](#) found that a 1 percentage point increase in the bottom 20%'s income share is associated with a 0.38 percentage point increase in economic growth over the next five years.

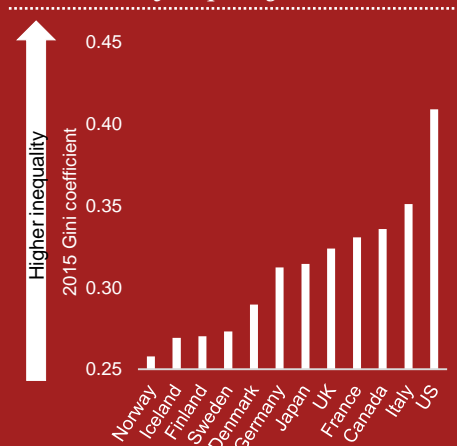
Second, greater economic inequality could lead to greater social friction and potentially undesirable political outcomes. Looking at trends in OECD economies over the past 35 years, for example, shows that income inequality—as measured by the Gini coefficient—has gradually increased, and books like *'The Spirit Level'* have argued that this has been associated with increasing social problems (although proving causality here is more difficult).

Therefore, countries that have been successful in creating or maintaining conditions supportive of low levels of inequality are understandably in the spotlight. In the G7, this includes economies like Germany and Japan (see Figure 3). And across the OECD, the Nordic countries continue to have some of the lowest levels of inequality.

So what makes these economies more equal? We have identified three key policy features that we think have contributed to maintaining relatively low levels of income inequality in these advanced economies:

1. Providing equal educational opportunities: Access to high-quality

Fig 3: Nordic countries have some of the lowest levels of inequality in the OECD



* 1 = perfect inequality, 0 = perfect equality

Sources: Global Consumption and Income Project

education, with strong links to employers, is a feature associated with most economies that have low levels of income inequality. The Nordic approach focuses more on generous government funding of the education sector to support universal access. Specifically, the five Nordic states (Denmark, Sweden, Finland, Iceland and Norway) spend an average of 6.5% of GDP on education, compared to the OECD average of 4.8%.

The German approach focuses more on maintaining links with businesses. For example, its dual education and vocational training system engages students in apprenticeships alongside school lessons.

This makes it easier for students to get a job in a skilled profession without formal tertiary education. Engaging businesses also helps offset a skills mismatch.

2. Supporting low income workers:

Protecting the vulnerable, by ensuring low-income workers earn a living wage, is another feature associated with more equal societies. In Sweden and other Nordic economies, for example, this comes through collective bargaining where trade unions are focused on limiting wage and gender inequality.

Other more equal OECD economies including Slovenia, the Czech Republic and the Netherlands set relatively high national minimum wages (a trend the UK has started to copy recently, though it is too soon to judge the effect of this on its income inequality levels).

3. Maintaining a fair and transparent tax and spending system:

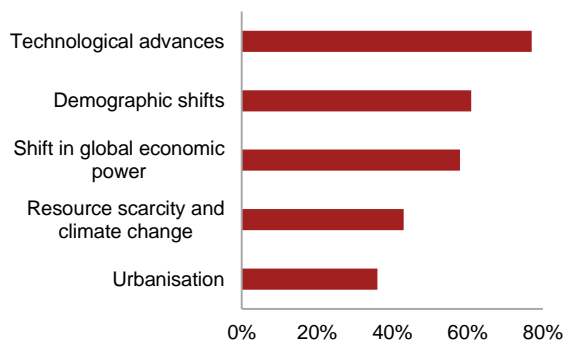
Nordic countries operate relatively generous welfare systems which redistribute income from the wealthy to the less well-off in the form of benefits to low earners, child allowances, and housing support. However, our research shows that this is not enough.

In most Nordic countries, the tax return of every citizen is publicly available. Transparency extends throughout government: in Denmark, ministers release monthly expenses; in Sweden, government spending records are publicly available. This transparency holds politicians to account and ensures everyone pays into the system, trusting their money will be used appropriately for redistribution and the provision of good quality public services.

The impact of technological breakthroughs on businesses and society

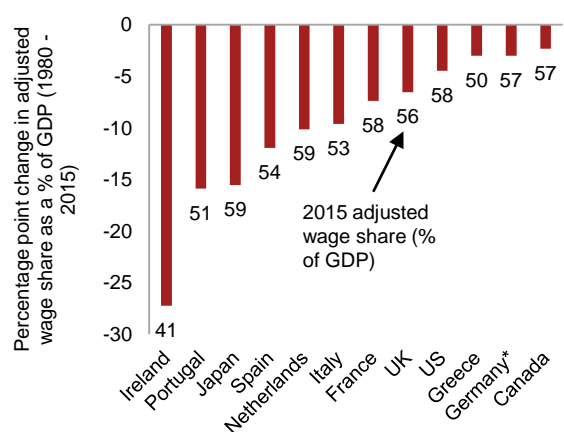
Fig 4: Most business leaders expect technological advances to have a transformative effect on their sector

Which top three global trends do CEOs believe will be most likely to transform wider stakeholder expectations of businesses within their sector over the next five years?



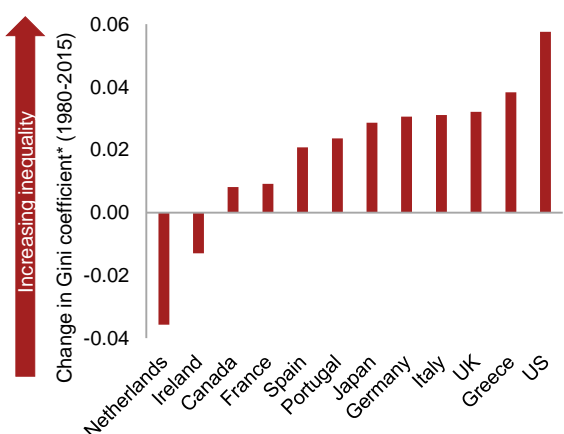
Source: PwC's 19th Annual Global CEO Survey

Fig 5: Labour's share of national income has fallen significantly since 1980 in many advanced economies



*Germany data is for the period 1991-2015
Sources: PwC analysis, AMECO

Fig 6: Since 1980 the US has experienced the largest rise in inequality and has the highest Gini coefficient



* 1 = perfect inequality, 0 = perfect equality
Sources: PwC analysis, Global Consumption and Income Project

The debate around the impacts of technology is hotting up

In 2005, there were less than one million industrial robots in the world. Today there are 1.8 million - higher than the population of Philadelphia. And looking forward, the [International Federation of Robotics](#) project that growth in the number of industrial robots will accelerate and reach around 2.6 million by 2019.

Typically, technological changes have a positive impact on labour productivity. For example, the information technology boom, which started in the late 1990s, increased US productivity to 2.8% per annum (1995-2004 period) compared to its long-term average of 1.9% per annum (see Figure 1). But what do technological breakthroughs mean for businesses and society as a whole?

Technological breakthroughs can help businesses contain costs...

Technology already plays a major role in the manufacturing sector but as robots become better and more sophisticated, we expect their impact to gradually permeate more industries, and, potentially the services sector, which accounts for most jobs in industrialised economies. Most business leaders are already taking notice of these changes and are factoring it into their corporate strategy. At a global level, our latest annual [survey](#) shows that 77% of CEOs think that technological progress is the megatrend most likely to transform how businesses interact with their stakeholders (see Figure 4).

For businesses, technology can lower costs and increase efficiency. For example, robotics could help businesses make better use of their existing capital stock and increase margins. If so, this could create further demand for traditional forms of investment (e.g. warehouses and machinery). The prices of goods and services could also drop (or increase more slowly) if businesses pass on these productivity gains to consumers through lower prices, which they should do so long as markets are competitive.

...but what impact does technological change have on jobs?

Innovation is usually cited as the main driver of a decrease in labour's share of total output (see Figure 5) and the increase in the Gini coefficient – a measure of income inequality (see Figure 6).

While technological change could have helped shape these trends, we don't think it's the only game in town. Increased competition from China and other emerging markets, and offshoring to those countries, may also have played a role, although this trend could moderate over time (or even reverse) as we have seen [reshoring pick up in some advanced economies](#). Also some other factors that could explain the rise in inequality include declining trade union power since the early 1980s in many advanced economies as well as changes in tax systems in some countries that have favoured higher earners (notably in the US and the UK).

It is, however, realistic to suggest that more "sophisticated" technological change could have displaced some labour, particularly at the lower skilled end of the market. For example, in the US (and other western economies) this could partly explain the loss of 6.5 million manufacturing jobs over the last 35 years (but with no corresponding drop in output). This approach, however, ignores the fact that labour could have been absorbed into other sectors of the economy – the US services sector, for example created around 50 million jobs over the same period.

Are these societal trends likely to continue?

Looking ahead, technology that complements labour is expected to have less adverse effects on jobs than technology that replaces labour. In many consumer services sectors, for example, where human contact and care is of central importance, there is less scope for robots – at least for the time being – to replace humans.

In other areas, however, automation may represent more of a threat to jobs, though the debate on the scale of this effect remains heated. [Frey and Osborne \(2013\)](#) estimate that around 47% of current jobs in the US could be at high risk from technological progress over the next two decades, but [an OECD study](#) finds that only 9% of jobs would fall into this category if you look in more detail at the multiple tasks required for these jobs. Digital technologies also create new jobs, as we have argued in [past research](#), so the effect is by no means all negative.

Who will be the main winners from technological progress?

Technological breakthroughs are a disrupting force for businesses and workers. But for those businesses that can adapt fastest to new technologies, and workers with characteristics that machines don't currently have, such as creativity and empathy, improvements in technology could deliver substantial economic gains.

Projections: October 2016

	Share of 2015 world GDP		Real GDP growth				Inflation			
	PPP	MER	2015	2016p	2017p	2018-2022p	2015	2016p	2017p	2018-2022p
Global (Market Exchange Rates)		100%	3.0	2.5	2.9	2.9	1.6	2.1	2.4	2.5
Global (PPP rates)	100%		3.4	3.0	3.4	3.4				
G7	31.5%	46.4%	1.9	1.4	1.7	1.9	0.2	0.8	1.9	1.8
E7	36.2%	25.9%	4.8	4.7	5.3	5.0	0.4	1.4	3.3	3.3
United States	15.8%	24.5%	2.6	1.5	2.2	2.3	0.1	1.2	2.2	2.0
China	17.3%	15.2%	7.1	6.5	6.5	5.7	1.5	1.8	1.8	2.8
Japan	4.2%	5.6%	0.6	0.6	0.5	0.8	0.8	0.1	1.3	1.5
United Kingdom	2.4%	3.9%	2.2	1.8	0.9	2.1	0.0	0.6	1.8	2.1
Eurozone	12.0%	15.8%	2.1	1.6	1.5	1.5	0.0	0.2	1.3	1.4
France	2.3%	3.3%	1.2	1.4	1.5	1.6	0.1	0.3	1.2	1.2
Germany	3.4%	4.6%	1.4	1.6	1.4	1.4	0.1	0.3	1.5	1.7
Greece	0.3%	0.3%	-0.3	-1.3	0.3	1.5	-1.1	-0.3	0.5	1.3
Ireland	0.3%	0.4%	26.3	4.2	3.3	2.5	0.0	0.8	1.8	1.7
Italy	1.9%	2.5%	0.6	0.9	1.0	1.2	0.1	0.2	1.1	1.4
Netherlands	0.7%	1.0%	2.0	1.6	1.6	1.8	0.2	0.8	1.5	1.3
Portugal	0.3%	0.3%	1.5	1.3	1.3	1.2	0.5	0.7	0.9	1.5
Spain	1.4%	1.6%	3.2	2.6	2.3	2.0	-0.6	-0.4	1.3	1.2
Poland	0.9%	0.6%	3.6	3.5	3.4	3.5	-0.9	-0.3	1.0	2.4
Russia	3.3%	1.8%	-3.7	-1.7	1.0	1.5	15.5	7.3	6.8	4.0
Turkey	1.4%	1.0%	4.0	3.2	3.5	3.0	7.7	8.2	7.8	7.0
Australia	1.0%	1.7%	2.5	2.6	2.8	2.7	1.5	1.8	2.5	2.5
India	7.0%	2.8%	7.1	7.7	7.7	6.5	4.9	4.1	4.3	5.0
Indonesia	2.5%	1.2%	4.8	4.8	5.2	5.4	6.5	5.7	6.1	5.1
South Korea	1.6%	1.9%	2.6	2.7	2.6	3.3	0.7	1.0	1.6	3.3
Argentina	0.8%	0.9%	2.4	-0.8	2.1	2.5	-	30.0	-	-
Brazil	2.8%	2.4%	-3.8	-3.0	1.0	3.0	9.0	9.0	6.5	5.0
Canada	1.4%	2.1%	1.1	1.0	1.9	2.2	1.1	1.5	1.9	2.0
Mexico	2.0%	1.6%	2.5	1.9	2.5	3.3	2.7	2.7	3.1	3.0
South Africa	0.6%	0.4%	1.3	0.3	1.0	2.0	4.6	6.0	5.5	5.5
Nigeria	1.0%	0.7%	2.7	-1.0	1.0	3.0	9.0	14.5	13.5	11.0
Saudi Arabia	1.5%	0.9%	3.5	1.0	1.5	2.5	2.2	4.0	3.2	2.5

Sources: PwC analysis, National statistical authorities, Datastream and IMF. All inflation indicators relate to the Consumer Price Index (CPI). Argentina has recently launched a new CPI measure, which only contains data from April 2016. We therefore do not report an inflation measure for 2015, and will provide 2017 and 2018-2022 projections once a longer series is available. Ireland's GDP growth in 2015 was boosted by some very high investment figures by subsidiaries in Ireland. Note that the tables above form our main scenario projections and are therefore subject to considerable uncertainties. We recommend that our clients look at a range of alternative scenarios.

Interest rate outlook of major economies

	Current rate (Last change)	Expectation	Next meeting
Federal Reserve	0.25-0.5% (December 2015)	Rate rise delayed until December 2016 or later	1-2 November
European Central Bank	0.0% (March 2016)	No rate rise for the foreseeable future	20 October
Bank of England	0.25% (August 2016)	Further small rate cut possible but not certain	3 November



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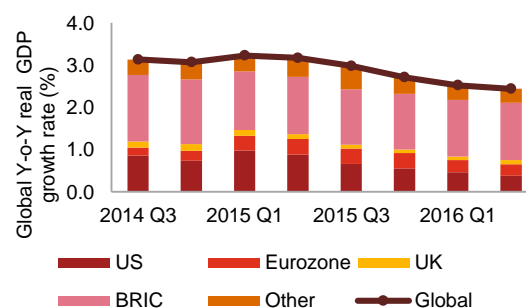
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Chart of the month

Global year-on-year (Y-o-Y) GDP growth in the second quarter of 2016 fell to 2.4%, its lowest rate since the first quarter of 2013.

The contribution of the US economy fell for the fifth quarter in succession to 0.4 percentage points (pp) but the UK's contribution remained around 0.1pp, despite the run up to the EU referendum.

Chart of the month: Global GDP growth falls to lowest rate since the start of 2013



Note: Based on 2015 market exchange rate (MER) GDP weights
Sources: PwC analysis, Datastream, National Statistical Agencies

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