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Global Economy Watch

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Northern Europe and East Asia are the global hotspots for idea creation

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Dear readers,

At the simplest level, it is ideas that power the global economy. Ideas can lead to the creation of businesses which generate innovative products and services to sell. The best ones can strengthen competition, increase productivity and ultimately, raise living standards. In this edition of Global Economy Watch we outline the results of analysis into the most idea intensive economies in the world.

Although our research shows that South Koreans are granted more patents per million people than anywhere else (see Table 1), our headline finding was that idea intensity is concentrated in two geographical regions: Northern Europe (Sweden, Finland, Netherlands, Germany, Denmark, Austria, Belgium and Norway all make the top 20) and East Asia (South Korea, Japan, Singapore and China are also among the best performers). These regions appear to have outperformed their peers by focusing on a small number of sectors, within which they have been granted an abundance of patents.

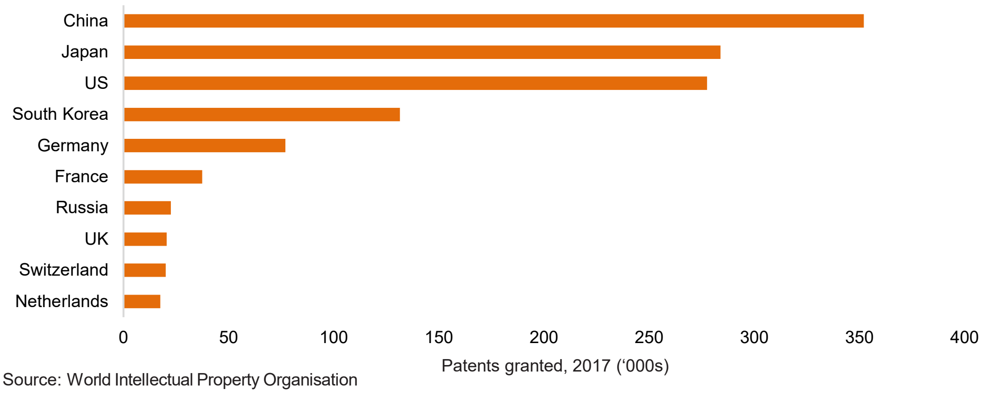
Our main recommendation for governments elsewhere is to consider the proportion of research and development relative to GDP.

We found a strong positive correlation between idea generation and combined public and private spending on R&D. Firms continue to produce a wealth of ideas, and in our top performers, governments offer incentives to help them develop their ideas into revenue-generating reality.

Our second article looks at intergenerational inequality in the G7. Across the economic groups, the youngest cohort of workers in the study – those born between 1980 and 1984 – have seen their income grow the slowest in the past 15 years. This is most likely because their careers were the least established when the global financial crisis hit in 2008.

Lastly, we consider the significant fall in bond yields so far in 2019. Investors' desire for safe-haven assets has pushed yields down far further than economic fundamentals might suggest. Seen from another angle, however, low (or negative) yields offer governments an enticing opportunity to borrow extremely cheaply to finance some expensive but growth-generating opportunities, such as improving infrastructure.

Fig 1: China, Japan and the US led the world in the absolute number of patents granted in 2017



Source: World Intellectual Property Organisation

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Northern Europe and East Asia are the global hotspots for idea creation

From an early age children are encouraged to think creatively and come up with new ideas. As adults, these thoughts are fundamental to innovation and productivity, and ultimately raising living standards. Global productivity growth has slowed markedly since the 2008 financial crisis, leading to a renewed focus on idea creation among governments. But how successful have these administrations been in fostering innovative economies?

Patent datasets are an appropriate proxy for measuring technological innovations, albeit with some limitations (not all innovations are patentable and not all patentable innovations are patented.) Patents are exclusive rights for an individual or company to make or sell a new product for a specified period of time (generally 20 years). The patent owner has the right to prevent others from exploiting the invention commercially in the countries and regions where the patent has been filed and granted.

According to the World Intellectual Property Organisation, the number of patents granted around the world has more than doubled since 2000, from 510,000 to nearly 1.4m in 2017. Although some of this increase is the result of more stringent recording processes, it is clear that there has been impressive growth in the creation of patent-worthy ideas.

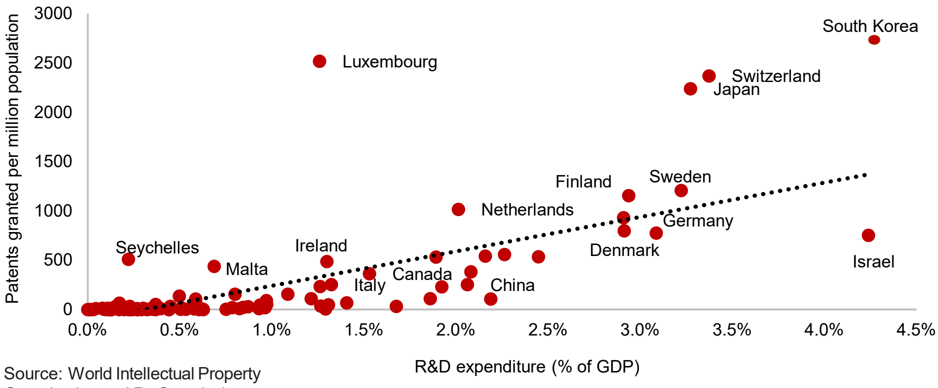
The world's 20 largest economies recorded over 90% of the patents granted in 2017. China, Japan and the US topped the table in terms of the absolute number of patents granted, followed by South Korea and a group of European countries.

Table 1: Top 20 idea-intensive economies, 2017

Rank	Country	Patents granted per million population
1	South Korea	2,554
2	Luxembourg	2,517
3	Switzerland	2371
4	Japan	2239
5	Sweden	1207
6	Finland	1157
7	Netherlands	1016
8	Germany	930
9	US	853
10	Denmark	798
11	Austria	777
12	Israel	752
13	France	558
14	Singapore	543
15	Belgium	537
16	Norway	533
17	Ireland	486
18	Canada	365
19	UK	311
20	China	254

Source: World Intellectual Property Organisation and PwC analysis

Fig 2: There is a strong positive correlation between economies that spend a lot on research and development and those that create a wealth of ideas



Source: World Intellectual Property Organisation and PwC analysis

We would expect the developed economies with large urban populations to make the largest contribution to idea creation, given economies of scale. A more useful proxy is to compare idea intensity. We have calculated the number of patents granted per million population in Table 1.

South Korea comes out as the most idea intensive economy. Part of South Korea's success can be attributed to government investment in Pangyo Techno Valley (PTV), an innovation hub established in 2011. Firms with a presence in PTV have access to tax cuts and low-interest loans, in the hope that PTV can act as an incubator for ideas. Its reputation as the Silicon Valley of South Korea suggests that the model is working.

Our analysis shows that the level of idea intensity varies significantly, even among the top performers. Germany is almost three times as idea intensive than the UK, according to our analysis. Table 1 shows that idea intensity is also concentrated in two distinct regions: Northern Europe and East Asia. All of the Scandinavian countries (other than Iceland), feature in the list. There is some indication that these regions have specific areas of expertise which may have helped to spur idea intensity.

Of the 36 technology groups defined in the International Patent Classification (IPC), around 10% of Nordic ideas were focused on environmental technologies in 2017. This aligns with information released by Enerdata, which showed that electricity generated from renewables for Norway (98%) and Sweden (55%) far exceeded the global average (26%) in 2018. This sectoral focus on innovation across the Nordics can be explained in two parts. First, their geography suggests that these countries are well placed to benefit from renewable technologies, particularly in wind and hydropower. Second, all five countries have set ambitious targets for emissions reductions by 2050.

China, South Korea and Japan also rank highly for idea intensity, and there is evidence of specialisation here too. Three sectors prevail across the region: computer technology, electrical machinery and digital communication technologies. Growth in the number of patents in these sectors in these three economies has risen rapidly since 2010, averaging 11% a year, compared with 8% in the US. In 2017, China had more patents granted in computer technologies alone (28,700) than the total number of patents granted to Canada, Australia and Spain combined.

How can other economies raise their idea intensity? Higher spending on research and development (R&D) is one potential policy. Indeed, there is a strong positive relationship between R&D expenditure and idea intensity, as shown in Figure 2. More than 100 economies are included in this analysis and the resulting correlation coefficient is estimated to be around 0.7, implying that around 70% of a change in a country's idea intensity can be explained by a change in its research and development spending.

Our analysis shows that some regions are much more idea intensive than others. Scandinavia and East Asia are the stand-out performers in terms of their idea creation capabilities. This success seems to be in part explained by honing in on a small number of patent technology areas, which has allowed these economies to develop specialist capabilities.

A consensus is also beginning to build around the link between innovation and economic growth. For example, Maradana et al (2017), found that for 19 European countries there was a strong long-run relationship between six different indicators of innovation (including patents) and economic growth on a per-head basis. This emphasises the point that a country's ability to generate new ideas has a meaningful impact on whether it can continue to push up living standards of its residents.

Economic update: Bond yields in safe havens have fallen steadily

When the economic outlook deteriorates, investors tend to look for safer places to store their wealth, such as government bonds and gold. Higher demand for these less risky vehicles pushes up their price and lowers the yield that investors receive. To this extent, bond yields are a proxy for economic confidence. The US 10-year government bond yield has fallen steadily during 2019, and especially since the Federal Reserve cut interest rates in July.

This mirrors the pattern seen elsewhere in the global economy this year, where bond yields have generally been in retreat.

In many European economies, long-term government bonds have turned negative, which essentially means that investors are paying governments to store their wealth. The yield on a 50-year government bond in Switzerland turned negative in mid-August.

The availability of extraordinarily cheap borrowing should inspire governments, especially those with fiscal surpluses, to increase their levels of public spending. This is an ideal opportunity to improve infrastructure or strengthen social safety nets, with the added bonus that economic growth ought to benefit, too.

Fig 3: So far in 2019 the US 10-year government bond yield has fallen steadily

Source: Federal Reserve of St Louis

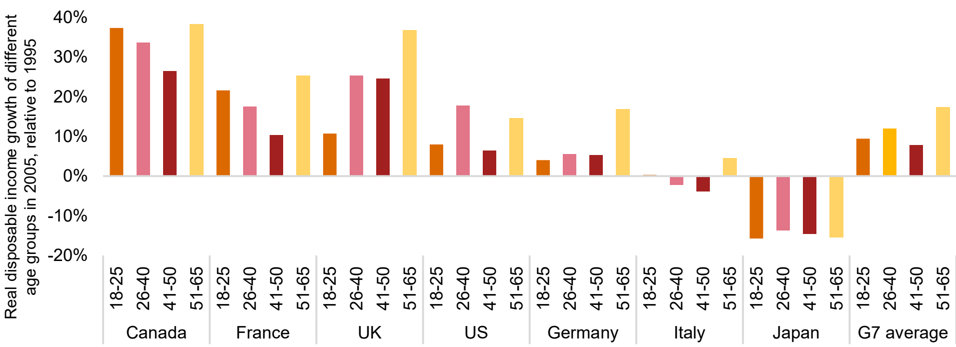
Intergenerational inequality in the G7

In the developed world there is evidence that younger people are less financially successful than their parents and grandparents. In the US, the Federal Reserve has found that millennials' propensity to spend is similar to previous generations but that their incomes are lower and they have fewer assets. To what extent is this true elsewhere?

Figure 4 shows the change in real income growth of different generations in the G7 between 2000 and 2015. The oldest cohort—born between 1960 and 1964—saw their incomes rise by an average of 20% over the period. But the income of the 1980-84 group grew by just 4%. This cohort saw the slowest growth in incomes in every G7 member.

In some ways, this is to be expected. By 2015 the 1960-64 cohort were reaching the apex of their careers. But the magnitude by which the income of older cohort outperformed that of the youngest is a concern. Growth of 4% over 15 years shows the effect of the global financial crisis on young workers. Members of this cohort were in the formative years of their careers when the crisis put downward pressure on wages, limiting job opportunities and remuneration. Other factors are at play too. The lack of inflation in Japan hit all incomes, but those of the young the most.

Fig 5: Relative to workers of the same age 20 years ago, 51-65 year-olds saw the strongest growth in their disposable incomes in 2015, while 41-50 year-olds fared the worst



Source: OECD

Figure 5 shows the change in disposable income for those in various age brackets in 2015 relative to those of the same age 20 years earlier. Generally those in 2015 were better off, with the exceptions of several groups in Japan and Italy. But the pace of expansion was very uneven. On an average basis across the G7, those aged 51-65 in 2015 had disposable incomes that were 17% higher than those of the same age 20 years earlier. Growth in the incomes of other age groups were much slower. Those aged between 41 and 50 in 2015 saw the smallest improvement.

Why should the past 20 years have been so different for two groups of relatively similar ages? The financial crisis may be important here too.

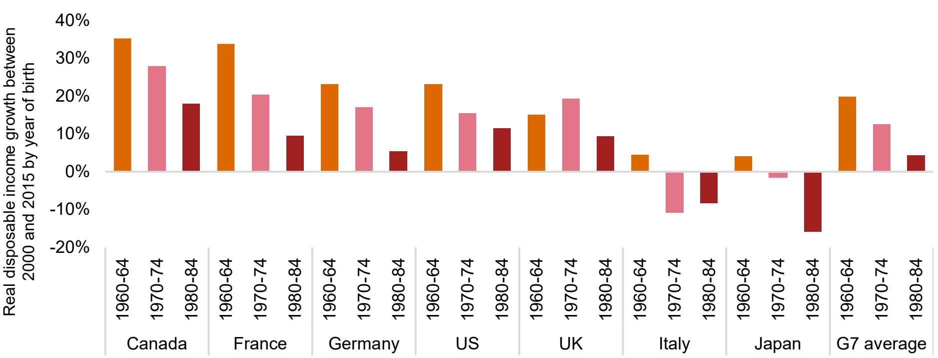
The older group are likely to have been more senior (and less vulnerable) at a time of acute labour market distress, while those aged 41-50 in 2015 may have missed out on a period when they may have expected their wages to rise quickly. Another consideration might be the rapid growth in executive and senior remuneration over the past two decades, which is likely to have disproportionately benefited the oldest group.

There are significant country variations in the fortunes of the younger age groups. In Canada and France, the growth in the disposable income of 18-25 year-olds and 26-40 year-olds more or less kept pace with that of the 51-65 group over the period. This is not the case in the UK or Germany, where the young fared worse than their predecessors.

One likely reason for this is the prevalence of part-time work, which has grown fastest for young workers in the economies which have seen the slowest growth in disposable income, such as Germany. In Canada, the incidence of young workers in part-time employment has barely moved.

The high disposable incomes of the baby-boomer generation looks set to continue, barring the implementation of redistributive policies. The slower income growth of younger workers also shows the long-term effects of major financial crises, which continue even after economic stability has been restored.

Fig 4: Workers born in 1960-64 consistently saw faster growth in their disposable incomes between 2000 and 2015 than either of the younger cohorts in the labour market



Source: OECD

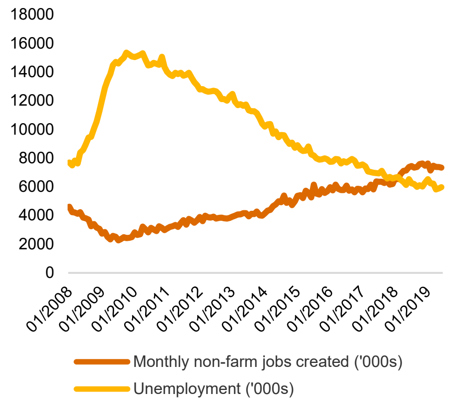
Global economic projections commentary: September 2019

The Americas

Following the July interest rate cut by the US Federal Reserve—made in response to concerns that trade tensions with China would continue to squeeze investment and that private consumption growth would continue to slow—PwC has upgraded its projection for economic growth in 2019 to 2.5%, from 2.3% previously. The transmission effects of July's cut will see the greatest impact in 2020, so we expect consumer price inflation to stand around the Fed's 2% target by the end of 2019.

In Canada, high household debt continues to exert a drag on consumer spending and trade-related uncertainty is holding down exports and investment. Consequently, we expect growth to slow to 1.6% in 2019. Meanwhile, in Brazil, weakness in production and manufacturing saw the economy shrink again in the first quarter and promised social reforms have yet to materialise. As such, we expect Brazil to grow by just 1.2% in 2019. In Mexico, growth was weak at the start of the year owing to uncertainty around major infrastructure projects. However, the recent lifting of US steel tariffs on Mexican exports should reduce trade uncertainty, and both consumption and confidence remain strong. As a result, we still expect Mexico to grow by around 1.8% in 2019.

US: The labour market remains a source of economic strength



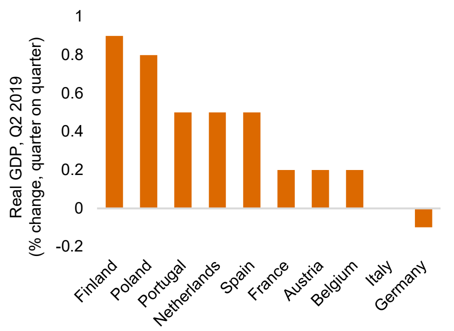
Source: Eikon from Refinitiv

Europe

The latest national accounts data from Eurostat showed that the Eurozone grew by 0.2% quarter on quarter in the second quarter of 2019, compared with 0.4% in the first. The Germany economy sagged again, falling by 0.1%, as the woes of the manufacturing sector continued. Growth held up better in the peripheral countries, notably Poland and Portugal. Prospects for an immediate bounce-back in core economies look slim, given the continuation of the trade conflict between the US and China, which is sapping business confidence.

We think it is likely that the European Central Bank will deploy more monetary stimulus in 2019 to support the economy and try and rev up inflationary expectations. The other risk we are continuing to monitor is the possibility of US tariffs being imposed on European goods. If this goes ahead, the impact will be limited to specific sectors of the European economy.

Eurozone: A weak quarter in Germany pulled down the regional performance in Q2



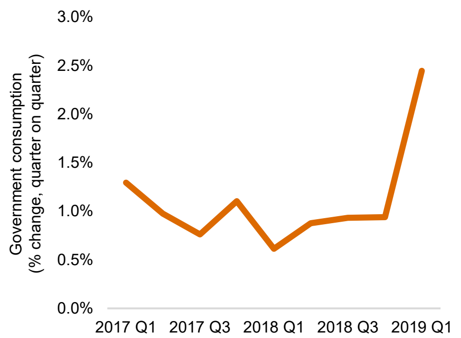
Source: Eurostat

Eastern Europe, Middle East and Africa

The World Cup, stronger infrastructure investment and robust global growth led to better than expected performance in Russia in 2018, with the economy expanding by 2.3%. However, weaker external conditions have weighed on output in the first half of 2019, in addition to further US economic sanctions. Despite these challenges, demand for rouble-denominated government bonds has soared this year and spending on the new development goals will start in the second half of 2019, which will see around 3% of GDP invested annually on priorities such as infrastructure and education. We expect output to rise by 1.5% this year, before improving to 1.8% in 2020.

Following a subdued fourth quarter of 2018, the Polish economy expanded by 4.8% year on year in the first quarter of 2019, easing fears of a slowdown. As a result, we upgraded our 2019 GDP forecast from 3.8% to 4%. Growth was a little slower in the second quarter, but we expect Poland to continue to outperform its European neighbours. Government spending will support growth as the ruling Law and Justice party introduce a number of expansionary policy measures ahead of October's parliamentary election.

Poland: Government spending increases sharply in run up to October election



Source: Eikon from Refinitiv

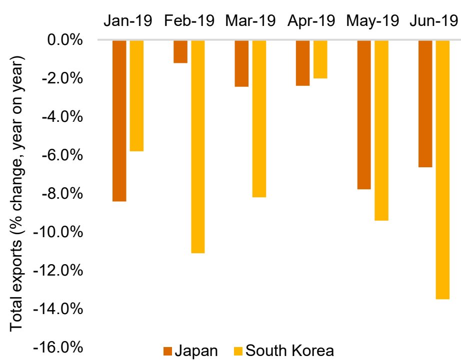
Asia

The continuation of trade tensions have led to a series of downward revisions to our economic projections for Asia in 2019-20. A political dispute between Japan and South Korea contributed to falling exports in both countries so far this year, and has led us to take down our projection for Japanese growth in 2019 to 0.9% (from 1%) and for South Korea to 2.3% (from 2.8%).

We continue to expect that the Chinese government would increase public investment in the event of a shortfall in consumption or net exports to ensure that it meets its economic targets. Growth of 6.2% in 2019 is likely to slow fractionally, to 6.1% by 2020.

In Australia, a combination of weak household consumption and slowing export growth has led us to revise down our projection for overall GDP growth in 2019 to 2.2%, from 2.8%. For economic growth to pick up significantly in 2020 the government would need to deploy additional fiscal stimulus and the Reserve Bank of Australia to cut interest rates—which are already at a record low—still further.

Japan and **South Korea:** a political dispute has contributed to falling exports



Source: Eikon from Refinitiv

Projections: September 2019

	Share of 2018 world GDP		Real GDP growth				Inflation			
	PPP	MER	2018	2019p	2020p	2021-2025p	2018	2019p	2020p	2021-2025p
Global (Market Exchange Rate ('MER'))		100.0%	3.3	2.8	2.8	2.8	2.8	2.3	2.4	2.6
Global (Purchasing Power Parity ('PPP') rates)	100.0%		3.8	3.3	3.4	3.5	3.3	2.8	2.9	3.0
G7	30.1%	45.9%	2.2	1.7	1.6	1.5	2.0	1.7	1.8	2.0
E7	38.2%	26.7%	5.4	5.0	5.2	5.2	3.4	3.5	3.5	3.6
United States	15.2%	24.2%	3.1	2.5	2.1	1.8	2.3	2.0	1.9	2.1
China	18.7%	15.8%	6.6	6.2	6.1	5.9	2.3	2.4	2.6	2.9
Japan	4.1%	5.9%	0.6	0.9	0.3	0.6	1.0	0.9	1.3	1.2
United Kingdom	2.2%	3.3%	1.4	1.1	1.2	1.8	2.5	2.0	2.0	2.0
Eurozone	10.0%	14.2%	1.8	1.2	1.4	1.5	1.6	1.3	1.6	2.0
France	2.2%	3.3%	1.7	1.3	1.4	1.8	1.9	1.3	1.6	1.9
Germany	3.2%	4.7%	1.4	0.6	1.3	1.4	1.7	1.6	1.8	2.3
Greece	0.2%	0.3%	1.9	1.7	1.8	1.5	0.6	0.8	1.3	1.8
Ireland	0.3%	0.4%	8.2	4.9	4.1	3.0	0.5	1.1	1.2	1.9
Italy	1.8%	2.4%	0.7	0.1	0.6	0.8	1.1	0.8	1.2	1.7
Netherlands	0.7%	1.1%	2.6	1.8	1.6	1.9	1.7	2.3	1.8	2.0
Spain	1.4%	1.7%	2.6	2.3	2.0	2.0	1.7	0.8	1.5	1.9
Poland	0.9%	0.7%	5.2	4.0	3.5	3.0	1.9	2.0	2.5	2.5
Russia	3.1%	1.9%	2.3	1.5	1.8	1.7	4.0	4.5	4.0	4.7
Turkey	1.7%	0.9%	0.4	(2.3)	1.9	2.5	16.3	16.7	13.6	11.4
Australia	1.0%	1.7%	2.8	2.2	2.6	2.7	1.9	2.0	2.3	2.5
India	7.8%	3.2%	7.4	7.0	7.2	7.7	2.3	4.2	4.8	5.0
Indonesia	2.6%	1.2%	5.2	5.2	5.2	5.2	3.2	3.4	3.8	4.1
South Korea	1.6%	1.9%	2.8	2.3	2.6	2.8	1.5	1.4	1.6	2.0
Brazil	2.5%	2.2%	1.3	1.2	1.5	2.2	3.7	4.3	3.9	4.0
Canada	1.4%	2.0%	1.8	1.6	1.7	1.7	2.2	1.7	1.9	1.9
Mexico	1.9%	1.4%	2.1	1.8	1.8	2.7	4.8	3.2	2.7	3.0
South Africa	0.6%	0.4%	0.7	0.6	1.1	1.5	4.6	4.8	5.1	5.4
Nigeria	0.9%	0.5%	2.0	2.3	2.5	2.5	12.4	11.4	11.4	11.5
Saudi Arabia	1.4%	0.9%	2.1	1.7	1.9	2.1	3.3	2.8	2.9	3.0

Sources: PwC UK analysis, National statistical authorities, Eikon from Refinitiv and IMF. All inflation indicators relate to the Consumer Price Index (CPI). Note that the tables above form our main scenario projections and are therefore subject to considerable uncertainties. PwC recommends that our clients look at a range of alternative scenarios. UK and Ireland numbers are contingent on a reasonably smooth Brexit.

Interest rate outlook of major economies

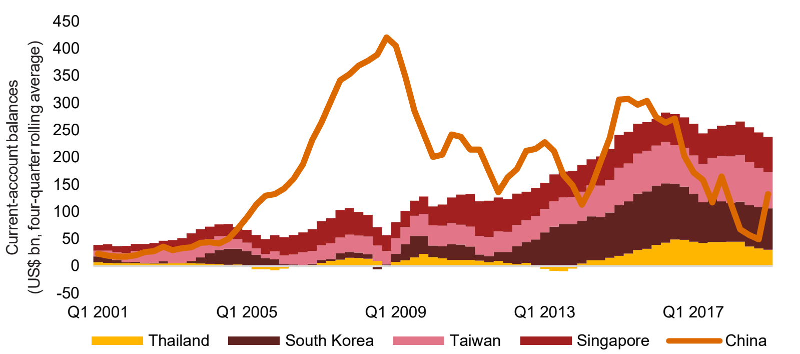
	Current rate (Last change)	PwC expectations	Next meeting
Federal Reserve	2-2.25% (July 2019)	Another rate cut in the second half of 2019 is possible	September 17-18
European Central Bank	0.00% (March 2016)	No rate rise in 2019	September 12
Bank of England	0.75% (August 2018)	No rate rise in 2019	September 19

Chart of the month

In the aftermath of the 2008-09 global recession, China's enormous current-account surplus and cheap borrowing by rich countries that it funded were considered by some as a factor behind the crisis. China no longer has such an imbalance. However, in recent years a group of Asian counties (see chart) have since built up an external surplus of comparable size to that of China in the 2000s.

Such surpluses suggest that currencies might be being held at artificially low levels or that greater social safety nets may be required to stimulate domestic spending. Deepening local financial systems may also be wise to encourage more excess savings to be invested at home.

A group of Asian economies are amassing huge current-account surpluses



Source: Eikon from Refinitiv