Flash Economics

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Demographic ageing demands extensive robotisation, but robotisation requires a highly skilled workforce

Demographic ageing is progressing rapidly in China, Japan, South Korea, Germany, Spain, Italy, and now even in the United States and France. To maintain decent growth while the working-age population is shrinking, and as countries increasingly reject immigration, the only solution is to implement robotisation to achieve productivity gains, even though robotisation alone is not sufficient to ensure rapidly increasing productivity. The level of robotisation is high in Japan, South Korea, China, and Germany, fairly high in the United States, and low in France, Italy, and Spain.

It is not surprising that countries with a high level of robotisation also tend to have a highly skilled workforce, with the exception of South Korea and the United States, where workforce skills are weak. In the United States, a flow of highly skilled immigrants has been observed until now.

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Widespread demographic ageing in OECD countries and in China

Charts 1A/B/C show the **fertility rate** (number of children per woman) in China, Japan, South Korea, Germany, Spain, Italy, the United States, and France.

Chart 1A
Fertility rate (births per woman)

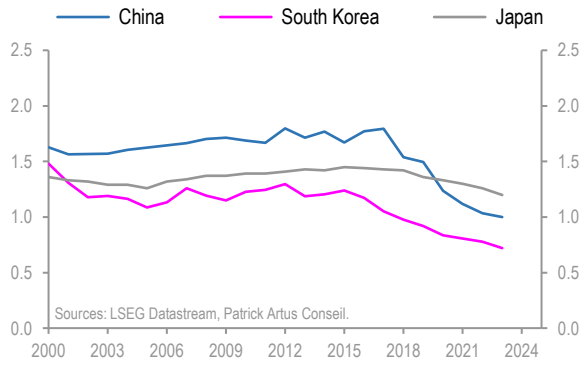


Chart 1B
Fertility rate (births per woman)

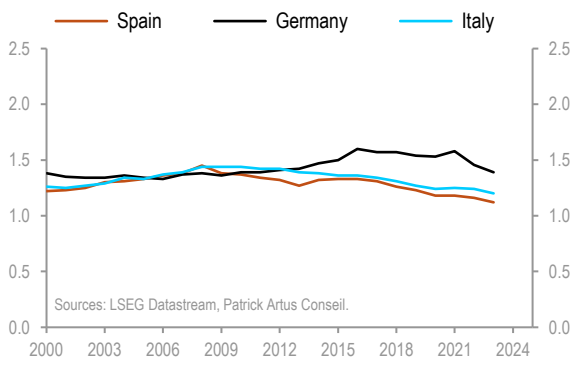
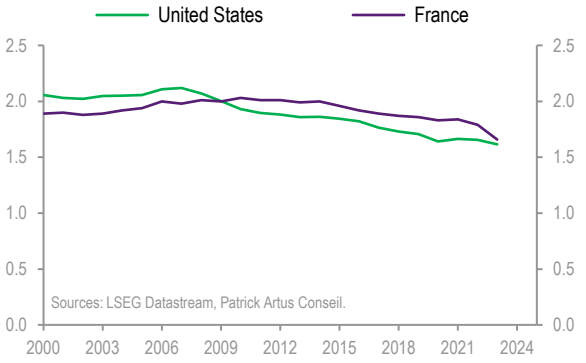


Chart 1C
Fertility rate (births per woman)



None of these countries ensures generational replacement, with a fertility rate below 2, even in the recent period in the United States and France.

Charts 2A/B/C show the **growth of the population aged 15 to 64**.

Chart 2A
Annual growth rate of the population aged 15 to 64 (%)

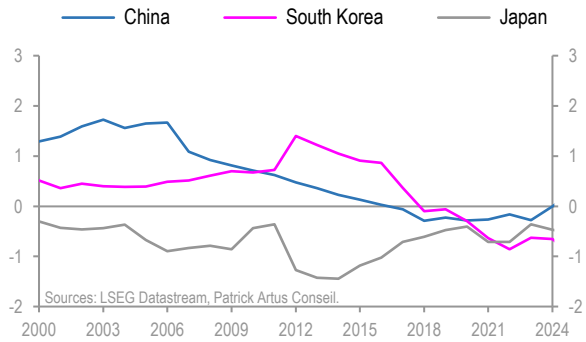


Chart 2B
Annual growth rate of the population aged 15 to 64 (%)

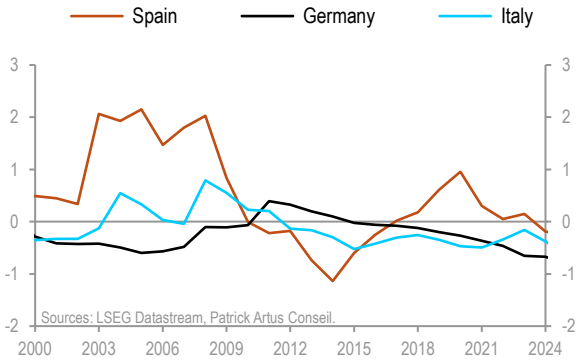
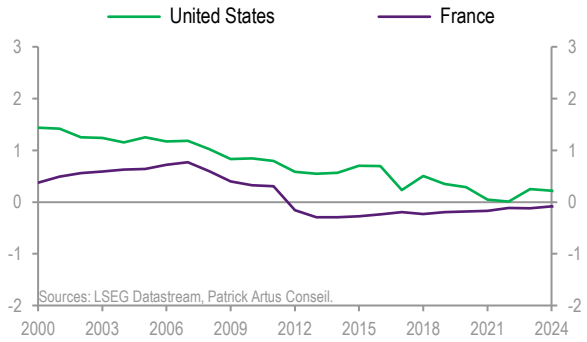


Chart 2C
Annual growth rate of the population aged 15 to 64 (%)



A decline in the working-age population is observed in the recent period across all these countries, except in the United States (thanks to immigration, which has nevertheless been falling since the arrival of Donald Trump). Countries that previously experienced high levels of immigration—such as the United States, France, Spain, and Germany—are increasingly rejecting the idea of large-scale immigration.

It is likely that, in the future, the working-age population will decline in all the countries analysed above.

The only remaining solution is robotisation, to ensure productivity gains (Charts 3A/B/C and Charts 4A/B/C) that would sustain production levels despite the decline in the working-age population.

Chart 3A
Growth in labor productivity per worker (in % per year)

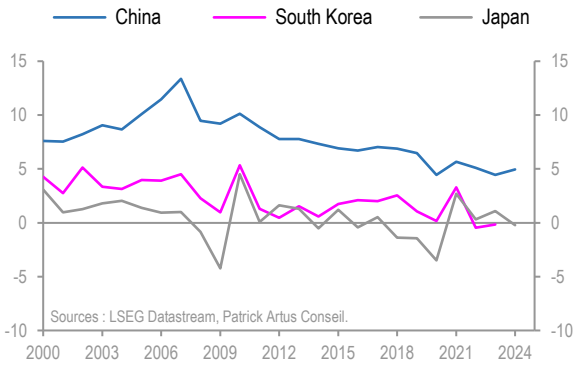


Chart 3B
Growth in labor productivity per worker (in % per year)

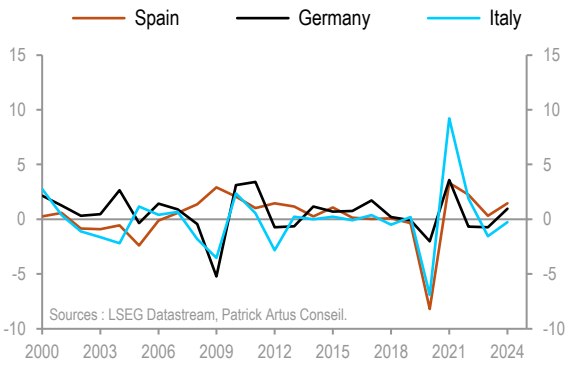


Chart 3C
Growth in labor productivity per worker (in % per year)

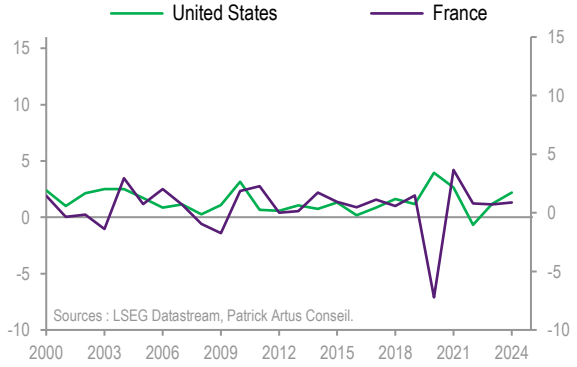


Chart 4A
Labour productivity per worker (2000 = 100)

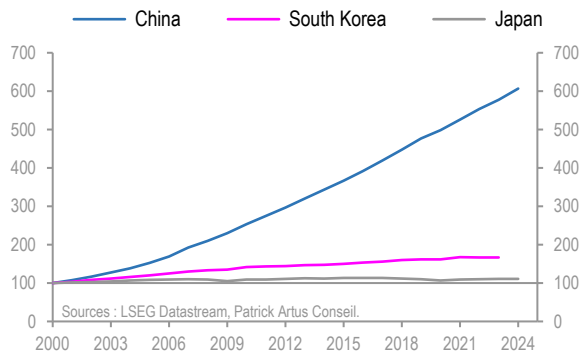


Chart 4B
Labour productivity per worker (2000 = 100)

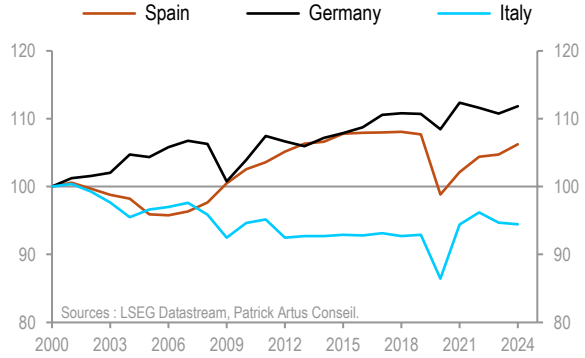
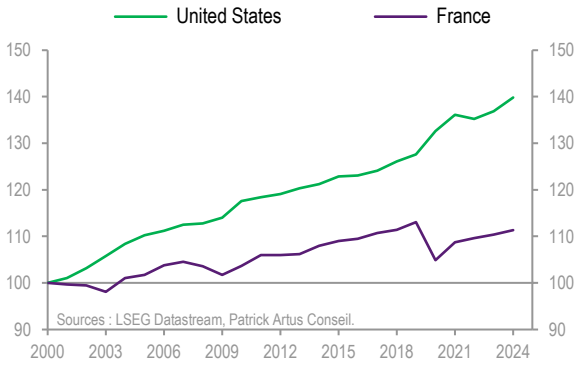


Chart 4C
Labour productivity per worker (2000 = 100)



Which countries are making significant efforts in robotisation?

Table 1 shows the number of industrial robots per 10,000 employees. It shows that South Korea, Germany, Japan, and China are highly robotised, the United States is in an intermediate position, while Italy, France, and Spain are less robotised.

Table 1 : Robots installed per 10,000 employees in the manufacturing industry (2023)

Country	Robots installed per 10,000 employees
South Korea	1012
China	470
Germany	429
Japan	419
United States	295
Italy	228
France	186
Spain	174

Source : World Robotics 2024

When comparing the level of robotisation (Table 1) with productivity gains (Charts 3A/B/C and Charts 4A/B/C), it becomes clear that only China and South Korea combine high robotisation with strong productivity growth. In Japan and Germany, productivity has stagnated since 2010 despite robotisation efforts.

Robotisation and workforce skills

Table 2 shows the overall score from the OECD PIAAC survey, which measures the skills of the working population.

Table 2 : Results of the OECD PIAAC survey (by decreasing score from the 2023 survey, overall score*)

Country	2016	2023
Japan	292	285
Germany	271	267
France	258	253
United States	261	251
South Korea	268	246
Spain	249	246
Italy	249	240

*In 2016, average score in numeracy and literacy
Source: OECD

The PIAAC survey is not conducted in China, but it is known that the education level of the population in China has significantly improved (Table 3).

Table 3 : Adults' educational attainment distribution (Percentage of population in the same age)

Country	United States		European Union (25 countries*)		China	
Educational attainment	Bachelor's or equivalent level	Master's or equivalent level	Bachelor's or equivalent level	Master's or equivalent level	Bachelor's or equivalent level	Master's or equivalent level
2010	20.90	9.45	12.45**	13.10**	3.48	0.43
2020	24.97	12.10	15.16	16.34	7.79	1.08
2023	25.31	12.85	15.23	17.62	nd	nd

Source : OECD
* Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Swede
** in 2014

It is clear that **countries with a high level of robotisation** (China, Japan, Germany) **also have a highly skilled workforce, while countries with low robotisation levels** (France, Spain, Italy) **also have low workforce skill levels**. Workforce skills are low in South Korea, which appears inconsistent with its high level of robotisation.

Summary: how to escape the trap of demographic ageing and declining birth rates?

The decline in fertility rates affects all countries, including the United States and France in recent years.

Immigration is increasingly being rejected. To prevent the decline in the working-age population from leading to a drop in production levels, productivity gains must be strong, which requires a significant effort in robotisation. However, this effort alone has not been sufficient to boost productivity in Japan and Germany.

Strong robotisation is observed mainly in countries with a highly skilled workforce, which is logical, as competent workers (and employers) are needed to operate robots. The first priority for France, Spain, and Italy should therefore be to strengthen workforce skills, which means improving the quality of the education system and vocational training.

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