Flash Economics

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To what extent can productivity gains offset the effects of population ageing on GDP?

Population ageing affects most countries and, in recent years, even the United States. We examine the situations in the United States, Germany, Spain, France, Italy, China, South Korea and Japan. The question arises as to these countries' capacity to offset the effects of ageing on GDP through productivity gains driven by robotisation and artificial intelligence. Is such a strategy effective and, if it is, is it sufficient to offset the effects of ageing?

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Widespread population ageing

Population ageing can be seen in:

- the decline in the fertility rate (**Charts 1A** and **1B**);

Chart 1A
Fertility rate (births per woman)

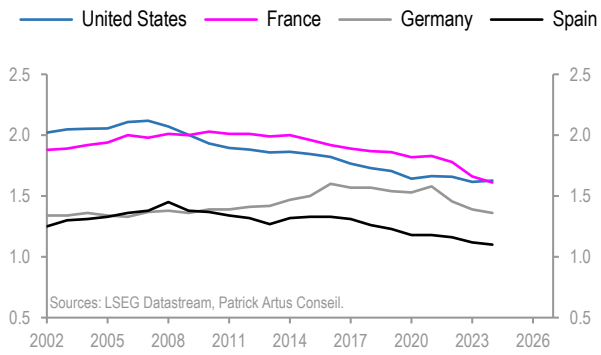
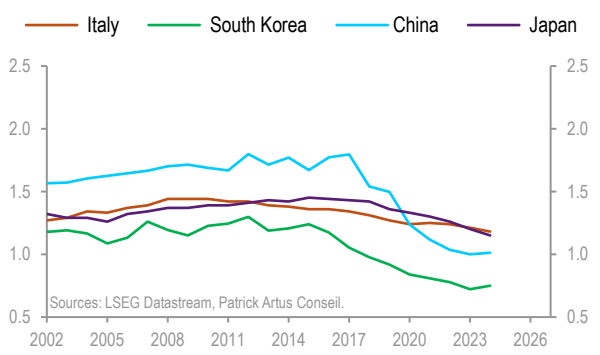


Chart 1B
Fertility rate (births per woman)



- the decline in the working-age population (aged 15-64; **Charts 2A, 2B, 2C** and **2D**), which will be particularly marked in Germany, Spain, Italy, South Korea, Japan and China.

Chart 2A
United States: Population aged 15 to 64 (millions)

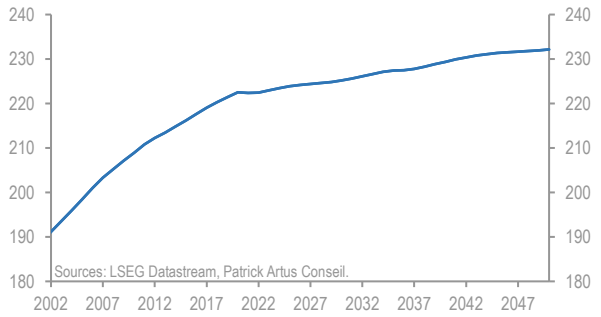


Chart 2B
China: Population aged 15 to 64 (millions)

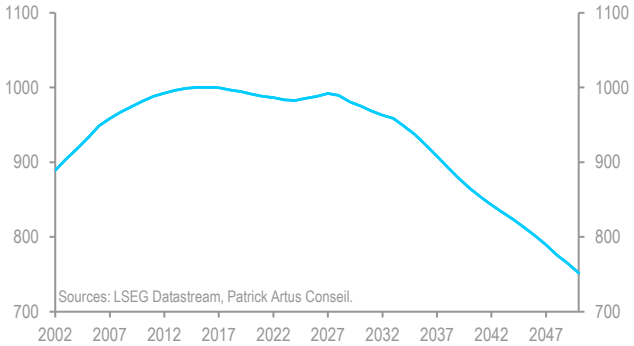


Chart 2C
Population aged 15 to 64 (millions)

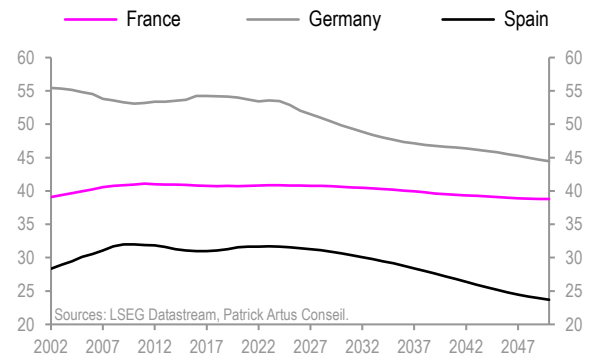
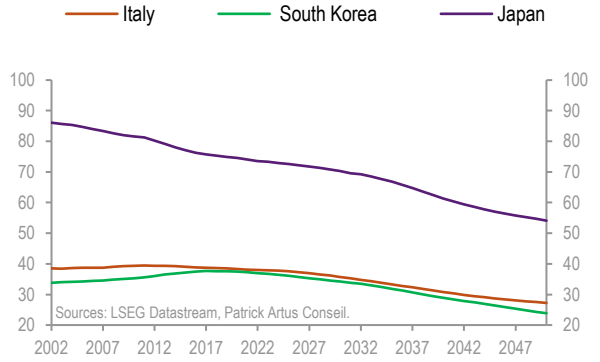


Chart 2D
Population aged 15 to 64 (millions)



The contraction in the working-age population leads, with participation rates and productivity unchanged, to **a decline in potential growth,** and hence in the level of GDP. We examine **whether this decline can be offset by faster productivity growth**.

How can labour productivity be supported?

In theory, labour productivity can be supported by:

- **intensive robotisation** (**Table 1**), which is the case in South Korea, Germany, Japan and the United States. The latest data from the International Federation of Robotics (IFR) have led to a very substantial downward revision of robot density in Chinese manufacturing industry;
- **artificial intelligence**. There is no doubt that it increases the labour productivity of those who use it, but its deployment involves a number of limitations and risks: the existence of occupations in which it cannot be used, the job losses it may cause and the possible occupational downgrading of employees forced to change jobs.

Table 1: Robot density in the manufacturing industry (industrial robots per 10,000 employees, 2024)

Country	Industrial robots
South Korea	1120
Germany	449
Japan	446
United States	307
Italy	237
France	195
Spain	183
China	166

Source: International Federation of Robotics

What productivity gains do we observe today?

Charts 3A, 3B, 4A, 4B and **4C** trace the trend in labour productivity per person employed since 2002 in the eight countries analysed. Two of the four countries where robotisation is most intensive, South Korea and the United States, record rapid productivity gains. China sees very high gains, but from a very low initial level (**Chart 3B**). Japan and Germany, despite their high level of robotisation, are seeing their productivity stagnate. The countries where robotisation is low (France, Spain, Italy) show limited productivity gains.

Chart 3A
GDP per person employed (constant 2021 PPP $)

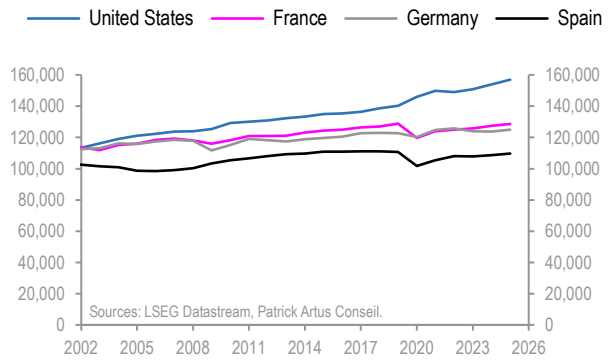


Chart 3B
GDP per person employed (constant 2021 PPP $)

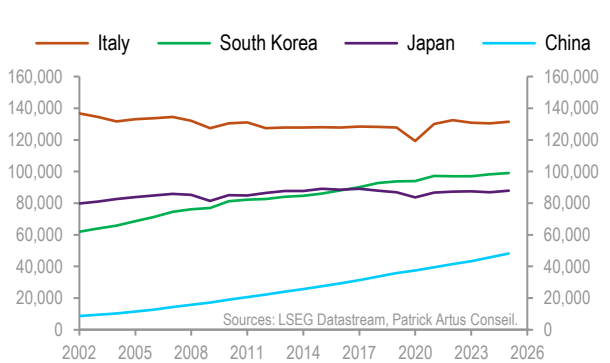


Chart 4A
GDP per person employed (2002 = 100)

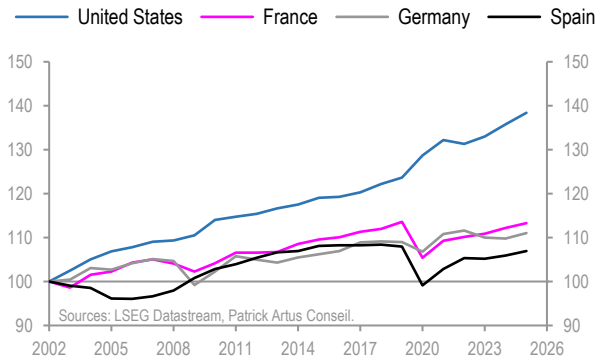


Chart 4B
GDP per person employed (2002 = 100)

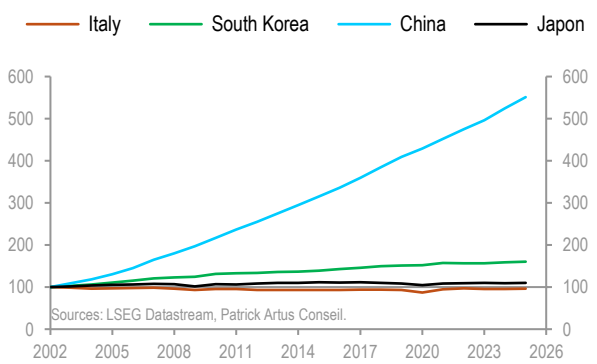
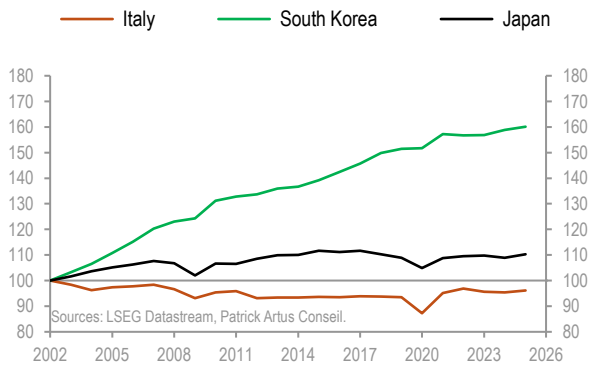


Chart 4C
GDP per person employed (2002 = 100)



Summary: can productivity gains offset the effects of population ageing on GDP?

We have observed:

- that, in the countries where ageing is most rapid (Germany, Spain, China, Italy, Japan and South Korea), intensive robotisation (Germany, Japan) is not systematically sufficient to maintain high productivity gains, these gains being weak in those two countries;
- that, in the other countries (France, United States), the link between the intensity of robotisation and productivity gains is clear. Robotisation therefore appears necessary to maintain productivity gains, without being sufficient;
- that the effects of artificial intelligence are, quite clearly, not yet visible in aggregate productivity data, at the macroeconomic level.

All in all, few countries manage to offset the effects of population ageing through productivity gains. The long-term effects of artificial intelligence nevertheless remain an unknown.

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