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TECHNICAL PROGRESS AND GROWTH SINCE THE CRISIS

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The 2008 crisis revived doubts about growth and resuscitated the debate on secular stagnation initiated by Hansen in 1938. Particularly in a post-crisis context of zero or very low growth, Schumpeterian theory may seem to be outdated. Nevertheless, in this article, we show that it remains a valid conceptual framework.

We begin by recalling the main highlights of Schumpeter's model of growth. We then argue that this conceptual framework remains relevant to many aspects of growth, notably secular stagnation, structural reforms and the debate on inequality. We show that because of creative destruction, the growth in productivity induced by innovation is underestimated. In addition, we explain why the Schumpeterian framework calls for a complementarity between structural reforms and macroeconomic policy. Finally, we show the positive impact of innovation and creative destruction on social mobility.

Keywords: technical progress, growth, Schumpeter, innovation, secular stagnation, inequality, structural reforms.

Even as macroeconomics seemed to have succeeded in containing the likelihood of a serious recession, the 2008 crisis shook many macroeconomic certainties and reopened debate about the sustainability of growth. In reality, the debate on the increasing weakness of growth is much older: it emerged in the 1930s, and media coverage dates back to 1972, when the Massachusetts Institute of Technology published the Meadows Report, *The Limits to Growth*. This report showed that the pursuit of exponential economic growth could only lead to exceeding material limits, and that growth would stop because of both the system's internal dynamics as well as external factors, first of all energy.

The economic stagnation engendered by the crisis in the industrial countries has put questions about growth back at the heart of the economic debate. Some have perceived the crisis as a harbinger that growth is running out of steam (Gordon). For others, the crisis has highlighted the phenomenon of widening inequalities and the marginalization of the middle classes. Finally, the crisis has revived debates on growth policies, especially between those who favour purely macroeconomic policies and those who advocate structural reforms.

In this article, after briefly presenting the highlights of the Schumpeterian model, we defend the idea that this conceptual framework has not been invalidated by the crisis and that it remains relevant in three ways. First, we show that productivity growth is likely to be poorly measured, casting doubt on the idea of secular stagnation and rehabilitating the theory of creative destruction. Furthermore, the Schumpeterian paradigm demonstrates the need for structural reforms to support innovation and growth. Finally, it helps to rethink the debate on inequality by showing the positive impact of innovation and creative destruction in promoting social mobility.

1. The Schumpeterian Model

The Schumpeterian growth model developed in 1987 by Philippe Aghion and Peter Howitt (Aghion and Howitt, 1992) is based on four ideas inspired by Schumpeter.

The first idea is that long-term growth results from innovation. Without innovation, the economy is stationary. A stationary economy prevailed before capitalism and works like a closed loop, reproducing itself identically.

The second idea is that innovation does not fall from the sky and that it is an eminently social process. It results from investment decisions (in research and development, training, the purchase of computers, etc.) on the part of entrepreneurs, who are seen as the pillars of capitalism. Unlike in the classics and the Marxist vision, Schumpeter's entrepreneurs are not related to any particular social group. They are the ones who innovate,¹ who create. They respond to positive or negative incentives from institutions and public policies: for example, the presence of hyperinflation or insufficient property rights protection in a country discourages innovation.

The third idea is the concept of creative destruction: new innovations make previous innovations obsolete; in other words, Schumpeterian growth is the scene of permanent conflict between the old and the new; it tells the story of the innovators of yesterday who turn into daily managers falling into a routine, trying to prevent or delay the entry of new competitors into their sector of activity.

The fourth idea is that productivity growth can be generated either by innovation “at the boundaries” or by the imitation of more advanced technologies. The more a country develops (that is to say, approaches the technological frontier), the more innovation becomes the engine of growth and takes over from the accumulation of capital and technological catch-up (imitation).

2. The Debate over Secular Stagnation

The 2008 crisis has revived doubts about growth and once again brought up the concept of secular stagnation. This is not a new idea. In 1938, the economist Alvin Hansen explained during his Presidential Address to the American Economics Association (AEA) that, in his view the United States was condemned to weak growth in the future. His reasoning was based on a predictable slowdown in population growth and a lack of aggregate demand. In 1938, the world economy was just recovering from the effects of the 1929 crisis, and Hansen did not anticipate a Second World War that would result in boosting public spending and thus aggregate demand.

More recently, in regard to the Internet revolution, Robert Solow noted in 1987 the paradox that “you can see the computer age everywhere but in the productivity statistics”. Solow noted that the spread of Information and Communication Technologies (ICT) in the US economy did not seem to be translating into significant gains in productivity and growth. This finding was shared by Robert Gordon (2000), for whom the Internet revolution is not comparable to previous industrial revolutions; productivity growth has remained low, and it is benefiting only the ICT-producing sectors. For Gordon (2012), the risk

1. Schumpeter distinguishes inventions, i.e. the discovery of new scientific knowledge, from innovations, i.e. the introduction of these inventions into the productive sphere. For Schumpeter, it is the innovations that explain the dynamics of growth, and the bearer of innovations is the entrepreneur who introduces the inventions provided by technical progress into the economic process.

of secular stagnation reflects a supply problem. Gordon advances the idea that the great innovations have already taken place, using the parable of the fruit tree: the best fruit are also the ones that are picked the most easily (low-hanging fruit), after which the picking becomes more difficult and less juicy.

In addition, the onset of the 2008 subprime crisis led Larry Summers along with others to use the term “secular stagnation” to describe a situation they consider similar to that described by Hansen in 1938. The idea put forward by Summers is that demand for capital goods is so weak that it would require a negative interest rate to restore full employment and keep output at its potential.

The idea of secular stagnation has gained emulators. Indeed, eight years after the subprime crisis, in 2016 most developed economies are still plagued by a lag in production, with serious output gaps. This situation contrasts sharply with these economies' past cyclical behaviour, when GDP was rapidly brought back to its potential. This leads to questioning the causes of the disruption of the growth path that has occurred for almost ten years, reviving the debate around “secular stagnation”.

The thesis of secular stagnation related to an insufficiency of supply is refuted by several economists: thus, Crafts (2002) evaluated the US economy over a very long period and showed that the contribution of the diffusion of information and communication technology (ICT) to output and productivity has grown considerably faster than the contribution of the steam engine and the distribution of electricity. In addition, Fraumeni (2001) and Litan and Rivlin (2001) showed that the evaluation of growth has been low because many forms of improvement in the quality of certain services (trade, health, etc.) resulting from the diffusion of ICT are not taken into account in national accounts statistics.

Schumpeterian economists have a more optimistic view of the future than Gordon, for several reasons:

- The ICT revolution has drastically and radically improved the technology of the production of ideas (Dale Jorgenson) by creating positive diffusion externalities between sectors. In fact, in a recent work, Salomé Baslandze showed that while the direct impact of the ICT revolution on US growth was of a limited duration, this revolution has had a much longer-lasting indirect effect. It has enabled companies in the most “high-tech” sectors,

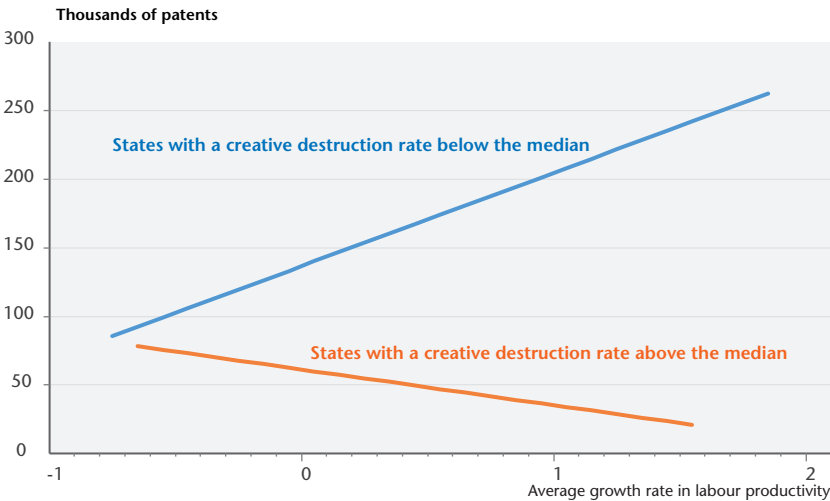
the sectors most dependent on new ideas in related fields and sectors, to improve the productivity of their production and innovation activities. The effect of this diffusion of knowledge has resulted in a reallocation of productive resources from traditional sectors to these “high-tech” sectors, which has had a significant and lasting impact on US growth (Baslandze, 2016).

- Globalization, which is contemporary with the ICT wave, has significantly boosted the potential gains from innovation (scaling effect) as well as the potential losses of not innovating (competitive effect). It is therefore hardly surprising that in recent decades we have witnessed an acceleration of innovation, in quantity and also in quality, particularly with regard to the volume and impact of patents. Akcigit *et al.* (2016) highlighted the link between patent production and productivity growth.
- Nevertheless, this acceleration of innovation is not fully reflected in the evolution of productivity growth, in particular because of a measurement problem (Aghion *et al.*, 2017). This measurement problem is likely to be exacerbated when innovation is accompanied by a high rate of creative destruction. Chart 1 below shows that the number of patent applications is positively correlated with the growth of labour productivity in US states where creative destruction² is weaker, whereas the correlation is negative in US states where creative destruction is stronger. The same phenomenon is found when considering business sectors: the correlation between patent production and productivity growth is more positive in the sectors that experience the least amount of creative destruction.

Why does more creative destruction imply more errors in measuring productivity growth? The reason is that, when analysing the growth of the monetary value of the output of a sector or a country, statistical institutes do not know how to distinguish between what results from inflation and what reflects the real growth in the value of goods. With regard to an object that remains the same from yesterday to today or an object that is modified only at the margins between yesterday and today, we can easily distinguish what is due to inflation and what corresponds to a real improvement in the good's quality. But how is

2. Creative destruction is measured as the average of the number of jobs created and the number of jobs destroyed (US data *Quarterly Workforce Indicators series*).

Chart 1. Correlation between patent applications and the growth of labour productivity in the United States, 1994-2010



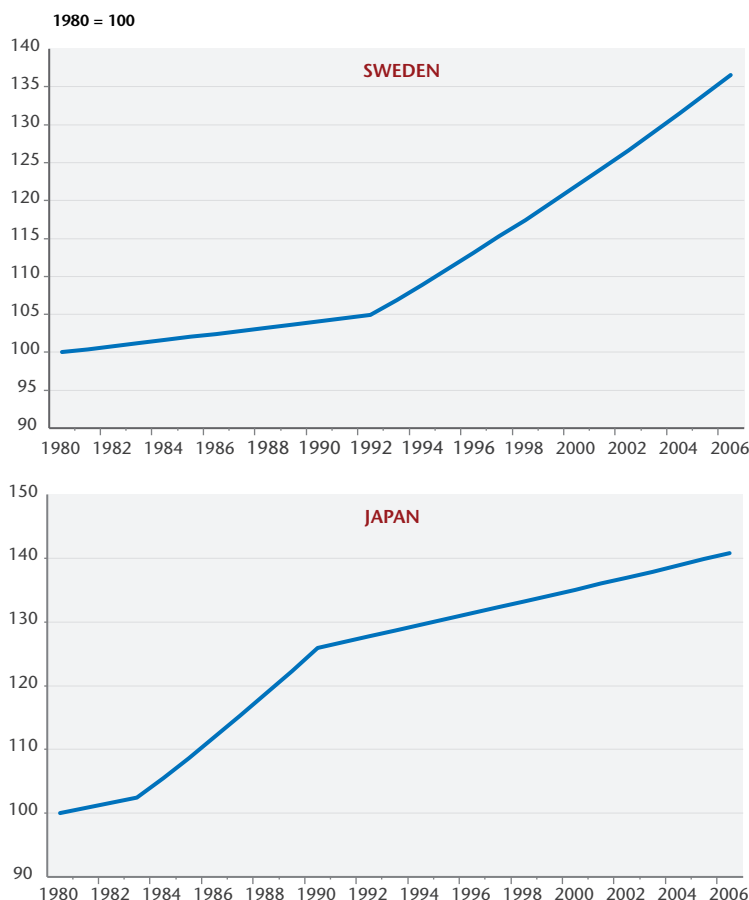
Source: Aghion (2017).

this to be done when an object is replaced by another object between yesterday and today? In this case, the statistical offices systematically use imputation: in other words, for each category of goods, the statistics institutes calculate the inflation rate based on the inflation measured on the goods that have not been replaced between yesterday and today. Then they extrapolate this measure by stating that this rate of inflation is the inflation rate for all products, including those that were replaced between yesterday and today. Yet it can be shown that because of the use of extrapolation, the growth rate of productivity in the United States has been underestimated by nearly 0.6 percentage point per year on average over the last thirty years (Aghion *et al.*, 2017). Similarly, in France over the last ten years, actual growth in productivity exceeds measured productivity growth by 0.5 percentage point; in other words, actual growth is twice the measured growth (Aghion *et al.*, 2018).

— Finally, our optimism about the prospects for future growth is based on the observation that many countries, starting with ours, are lagging in benefiting from the technological waves, and benefiting only partly, in particular because of structural rigidities and inappropriate economic policies. For example, some countries have not fully transformed from catch-up economies into innovation economies. The comparison between

Sweden and Japan (Bergeaud *et al.*, 2014) is particularly instructive: productivity growth is accelerating in Sweden, whereas it is slowing down in Japan (Chart 2).

Chart 2. Trend in factor productivity growth in Sweden and Japan



Source: Bergeaud *et al.*, 2014.

Moreover, innovation and policies to promote innovation can be used to act not only on supply, but also on demand, and avoid the situation described by Summers, namely stagnation characterized by a liquidity trap and insufficient aggregate demand. Thus, Benigno and Fornaro (2015) used a Keynesian-inspired model to show that two stationary states can be reached: on the one hand, a stationary state characterized by a full employment equilibrium and growth that meets

its potential; and on the other hand, a stationary “stagnant trap”. In this equilibrium, the weakness of aggregate demand depresses investment in innovation, pulling the nominal interest rate to zero and perpetuating weak aggregate demand. To determine the equilibrium that will be chosen, Benigno and Fornaro emphasize the crucial role of expectations: when agents anticipate low growth, and thus low income, this leads to a decrease in aggregate demand, and therefore a decline in corporate profits and investment. Unfavourable expectations may thus create the conditions for a stagnation characterized by low aggregate demand, involuntary unemployment and inefficient monetary policy. On the other hand, policies to encourage and subsidize innovation can pull an economy out of the “stagnation trap”: innovation not only acts on supply, but also boosts expectations and stimulates aggregate demand.

3. Structural Reforms and Macroeconomic Policies

The US economy has proved more resilient than the European economy in the wake of the 2008 financial crisis. Some have blamed the lack of macroeconomic responsiveness in Europe, while others have pointed to France's slow pace in adopting structural reforms that would have affected potential growth. In the face of a recession, there are in fact always those who on the one hand advocate stimulus policies (notably using the deficit and public spending) and on the other those who advocate a state withdrawal, except for guaranteeing the regulation of the markets.

Our feeling is that both factors are in play simultaneously; in particular, persistent rigidities in the goods and labour markets reduce the impact of any “proactive” macroeconomic policy. Basically, we are just paraphrasing the European Central Bank President Mario Draghi, who declared two years ago at Bretton Woods that the ECB could carry only half the load by easing its monetary policy, and that it was up to the States to do the other half by undertaking reform.

To encourage companies to innovate, it is crucial to reform the products market: according to the IMF, this would have a greater impact than labour market reform. An analysis of labour market reforms shows that these have only a relatively modest effect on productivity and GDP (see Barnes *et al.*, 2011; Bouis and Duval, 2011), especially if the public expenditures associated with these measures are

offset by additional austerity measures elsewhere (Antonin, 2014). On the other hand, according to the IMF's Global Integrated Monetary and Fiscal Model (GIMF), if labour market reform is accompanied by product market reform, then the potential for growth rises sharply. In the euro zone, the simultaneous reform of the goods and products market would increase GDP by 4.1 percentage points after 5 years,³ and by 12.3 points in the long term (Schindler *et al.*, 2014).

In fact, the preliminary results of research conducted by Aghion, Farhi and Kharroubi (2017) suggest a *complementarity* between structural reforms and a more counter-cyclical monetary policy (with lower interest rates during a recession and higher interest rates during an expansion). A counter-cyclical monetary policy is conducive to growth, especially in sectors subject to credit constraints or liquidity constraints. It reduces the amount of liquidity that entrepreneurs must set aside to guard against future liquidity risk. Moreover, the effect will be stronger in countries with weaker regulation of the goods market.⁴ Conversely, when the goods market is highly regulated, the cyclical evolution of short-term interest rates has no impact on growth: companies benefit from extra income and are not sensitive to changes in financial conditions. In addition, the unexpected decline in yields on government bonds in the euro zone countries – following the ECB's announcement of the Monetary Securities Transaction programme (MST) in September 2012 – had a much stronger impact on the growth of the most indebted sectors, but only in countries that had weak regulation of the goods and services markets. In countries with strict regulation, the fall in yields had either no effect or a positive effect on the least indebted sectors. The regulation of the goods and services market has thus diverted the financing of the ECB from the indebted sectors to the sectors benefiting from extra income.

In other words, by being bolder about structural reform, we will not only encourage our German neighbours and the ECB to accept more flexible macroeconomic policies, but above all we will increase the extra growth to be expected from this macroeconomic easing.

3. Reform of the goods market alone (or the labour market) would increase GDP by 1.7 points (respectively 1.4 points) after 5 years.

4. Regulatory intensity is measured using the OECD Barriers to Trade and Industry indicator

4. Inequality and Inclusive Growth

In recent decades, income inequality in the developed countries has increased at an accelerating pace, particularly at the top of the income ladder: the “top 1%” has seen its share of total income rise rapidly. Various explanations have been proposed to account for this fact, but these have not always adequately taken account of the data and empirical analysis. The strong correlation between inequality and innovation reflects that innovation has a causal link with extreme inequality: the revenue from innovation contributes significantly to the growing share of income held by the “top 1%” (Aghion *et al.*, 2015). It is crucial to understand that the increase in the “top 1%” results partly from innovation and not only from land and speculative rents. Innovation increases inequality, but it also has virtues that other sources of high income do not necessarily have.

First, innovation is the main driver of growth in developed economies. This is largely supported by empirical studies, which show an increasing correlation between growth and R&D investments and between growth and patent flows as a country moves closer to the technological frontier. Second, while it is true that in the short term innovation benefits those who have generated or permitted it, in the long run the benefits of innovation are dissipated because of imitation and creative destruction (replacement by new innovations) and because patents expire after 20 years. In other words, the inequality generated by innovation is temporary in nature. Third, the link between innovation and creative destruction means that innovation generates social mobility: it allows new talent to enter the market and to oust (partially or totally) existing firms. It is interesting, in this regard, to note that, in the United States, California (which is currently the most innovative US state) is well ahead of Alabama (which is among the least innovative US states) both in terms of income inequality at the top 1% of the income scale and in terms of social mobility.

Overall, then, innovation propels its beneficiaries into the highest segments of the income distribution, and at the same time innovation stimulates social mobility.

How can growth be reconciled with innovation and social mobility? One promising approach might be to first identify the levers of growth in the context of the economy in question, and then to analyse the effects of each of the levers of growth on the various measures of inequality: income inequality in the broad sense (Gini, etc.), the share of

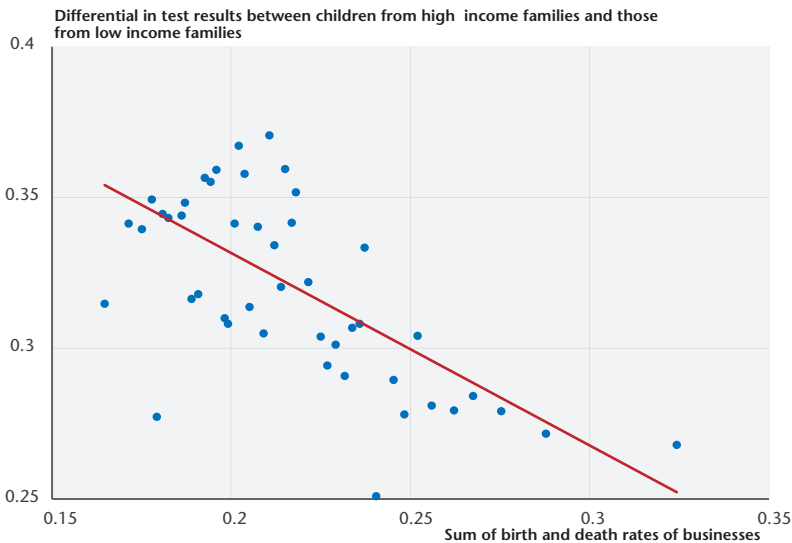
income captured by the top 1% of the income scale, and social mobility. We have seen that innovation affects these different measures of inequality differently, and in particular that it increases social mobility.

It turns out that the main levers of growth through innovation have a positive effect on social mobility. These levers have been identified in previous studies⁵ as education (especially higher education), a more dynamic labour market and a more competitive goods and services market, and innovation-friendly taxation. What is the effect of these different levers of growth on social mobility?

Education is “inclusive” in that it tends to increase social mobility and reduce income inequality in a broad sense: Chetty *et al.* (2014) show how, for example, social mobility is positively correlated with the results obtained in educational tests.

Perhaps more surprising is the fact that the flexibility of both the labour market and the products market also appear to favour social mobility, as shown in Chart 3 below, based on the ongoing work of

Chart 3. Social mobility and the creative destruction of businesses in the United States



Sources: The corporate data is based on the survey data *Business Dynamics Statistics* and the data on social mobility is from the *Equality of Opportunity Project*.

5. Cf. Philippe Aghion, Gilbert Cette, Elie Cohen and Jean Pisani-Ferry, 2007, *Les leviers de la croissance française*, Paris, La Documentation Française.

Alexandra Roulet. Using US data, we observe that when creative destruction increases, the difference in outcomes between children from high-income families and children from low-income families decreases, and consequently social mobility increases.

This is encouraging news: the levers of growth through innovation also have the virtue of stimulating social mobility. Finally, one thing is certain in the light of our previous discussion: tackling innovation through inadequate taxation is tantamount to reducing not only growth but also social mobility.

5. Conclusion

In this article, we examined three debates rekindled by the crisis of 2008: the debate on secular stagnation, the debate on the relationship between macroeconomic policy and structural reform, and the debate on widening inequalities and the link between inequalities, innovation and growth.

We have tried to explain how, in each of these debates, the Schumpeterian paradigm makes it possible to reason differently and suggests both new questions about the growth process and some solutions in terms of growth policies.

First, our discussion of secular stagnation has led us to believe that productivity increases are not measured correctly and are in fact largely underestimated, and that overall while our economies are actually subject to secular trends, linked to the diffusion of new technological revolutions, it is difficult to speak of stagnation once growth has been correctly measured.

Our discussion on macroeconomic policy and structural reform showed that there is complementarity between macroeconomic policies (fiscal and/or monetary) that are more reactive to the economic cycle, and structural reforms that promote fluid markets: this is what we call the “Draghi approach”.

Finally, our analysis of the relationship between innovation and inequality has shown that while innovation helps to increase the share of the top 1% in a country's total income, at the same time innovation and the reforms underpinning it tend to stimulate social mobility by virtue of creative destruction. As a result, a smart fiscal policy must treat

innovation differently from other sources that increase inequality at the top of the income ladder.

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