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**Article — Published Version**

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Intereconomics

*Suggested Citation:* Nascia, Leopoldo; Pianta, Mario (2009) : Forces of inequality? The impact of technology and globalisation, Intereconomics, ISSN 1613-964X, Springer, Heidelberg, Vol. 44, Iss. 6, pp. 332-336,  
<https://doi.org/10.1007/s10272-009-0312-0>

This Version is available at:

<https://hdl.handle.net/10419/66197>

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# Forces of Inequality? The Impact of Technology and Globalisation

In searching for the causes of the general increase of inequality in Europe over the past two decades, technological change and increasing international integration are major forces that need to be investigated. While they have affected the overall changes in economic structures with complex – direct and indirect – influences on income distribution, we focus here on their specific impact on three issues: a) inequalities between profits and wages; b) the polarisation of employment by professional skills; c) wage polarisation.

In advanced countries, technological change has been characterised by the emergence of the new techno-economic paradigm based on information and communication technologies (ICTs), with a growing role played by the production and use of knowledge, by R&D and innovation, and by the diffusion of new organisational forms. In Europe and the United States this has led to strong structural changes with the decline of old industries – often with a workforce of medium skilled, unionised workers – and the emergence of new industries (and firms) with high opportunities for Schumpeterian profits associated with temporary monopolies due to technological advantages. Moreover, in labour markets an increase in the demand for workers with higher skills – complementary to the new information technologies – may have led to a polarisation of employment, professional qualifications and wages. All this may have resulted in higher inequalities as profits increased faster than wages, and disparities among wage-earners expanded.

In parallel, the international integration of advanced economies has increased – in terms of trade, cross-border organisation of production and foreign direct investments (FDI) – shaping the process of globalisation. The growth of financial activities in global markets has opened major opportunities for profits and rents, creating a dangerous source of instability and speculative bubbles that eventually burst in the crisis of 2008. Capital took advantage of the opportunities

of high returns in financial markets and in international production systems controlled by transnational firms; the result has been an increase in financial rents, profits and their share of total income. Moreover, greater international trade and FDIs have led to changes in labour markets leading to a polarisation of skills and wages, both in advanced and developing countries; all these mechanisms may have contributed to greater inequalities.

In addition to technological change and globalisation, labour market policies in the past decades have been characterised by deregulation, a loss of workers' rights, greater flexibility and precarisation, while social policies have reduced the space for redistribution and social protection; again, all these actions may have contributed to rising inequalities within each national context.

The operation of such forces of inequality has generally been documented for national economies; however, both technological change and international integration are highly uneven processes with strong industry specificities; in this article we investigate how they have affected the evolution of manufacturing and service industries, focusing on the impact on inequalities between profits and wages, in terms of professional skills, and among wages.

## Profit and Wage Inequalities

The functional distribution of income between profits and wages is relevant for inequality as it reflects the overall balance of power between capital and labour; the large majority of people rely on wages as their main source of income, and therefore an increase in the profit share is bound to lead to greater inequality in the personal distribution.

Different theoretical contributions have dealt with the distributive effects arising from innovation and international integration. In the mainstream neoclassical approach, it is assumed that complete markets, mobility of factors, price and wage flexibility, perfect information and competition ensure that maximising agents respond to shocks in technology and trade in such a way that a new efficient equilibrium is reached, with an optimal income distribution between wages

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and profits reflecting the contributions to growth of capital and labour. Such a view has been questioned by several studies that have investigated the empirical evidence on the distributive effects of technology and globalisation.

*The Role of Technology:* The impact of innovation on income distribution is a neglected issue in the literature, even if the Schumpeterian perspective has long emphasised the disequilibrium effects of technological change, with the patterns of “creative destruction”, temporary monopolistic profits and innovation-based competition. Neo-Schumpeterian authors have pointed out the sectoral specificities of technological change and the possibility of a mismatch between the emerging techno-economic paradigm and the previous social and institutional arrangements that regulate the distributive outcome.<sup>1</sup> Technological change, in this perspective, is a major force behind the expansion of profits and economic growth, and can be used by leading firms as a tool for appropriating greater shares of incomes.

Empirical studies on the relationship between technology and profit growth have generally considered the latter as an incentive to introduce innovations, both in industry and firm level studies.<sup>2</sup> Technological change, however, is not a homogeneous process and a (Schumpeterian) distinction has been made between strategies of technological competitiveness, based on new products and new markets, and a search for price competitiveness, based on the introduction of new processes and savings on labour costs. Their distributional consequences differ; in the former, innovation (when adequate demand exists) leads to new output and Schumpeterian profits, with room for stable or expanding wages; in the latter, increased productivity and profits may come at the expense of employment and wages. This approach has been developed and empirically tested by Pianta and Tancioni,<sup>3</sup> considering 11 industrial sectors and 10 European countries

over the 1994-2001 period. The average real rate of change of wages per employee is less than half that of total profits (proxied by operating surplus) in the overall sample. This however conceals major differences across industries. In high innovation sectors – characterised by technological competitiveness – profits increase by close to 8 per cent a year, three times as fast as wages. In low innovation industries – characterised by price competitiveness – profits growth is 3.5 per cent, again more than twice that of wages. Therefore, the benefits of innovation tend to go more to profits than to wages but, nonetheless, wage dynamism in the former group is twice that in low innovation sectors.

The econometric models developed by Pianta and Tancioni shed light on the determinants of profit and wage growth, showing that the distributional conflict is a strong factor in the evolution of incomes and that both profits and wages grow on the basis of increases in labour productivity. Wages tend to grow faster in the sectors where innovation expenditure (largely due to wages for highly skilled researchers) is higher, while profits are driven both by the importance of new products and market power, and by restructuring through the diffusion of new processes and wage depressing job reductions.

The lesson of such evidence is that technological change has the general effect of favouring profits over wages. Profits increase through separate mechanisms in industries relying on technological or price competitiveness; conversely, wages grow only when innovation is associated with higher skills of labour; the result is greater inequality rooted in the functional distribution of incomes.

*The Role of International Integration:* A large body of literature has addressed the relationship between the increasing international openness of economies and the dynamics of wages and profits.<sup>4</sup> Feenstra and Hanson argued that in advanced countries the relocation of production abroad (or even the threat of relocation) depressed domestic wage dynamics, especially for blue collar and low-skilled white collar

<sup>1</sup> C. Freeman, F. Louca: As time goes by. From the industrial revolutions to the information revolution, Oxford 2001, Oxford University Press.

<sup>2</sup> D. Teece: Profiting from technological innovation, in: Research Policy, Vol. 15, No. 6, 1986, pp. 285-305; P. Gerosky, S. Machin, J. Van Reenen: The Profitability of Innovating Firms, in: RAND Journal of Economics, Vol. 24, No. 2, 1993, pp. 198-211; S. Klepper: Industry Life Cycles, in: Industry and Corporate Change, Vol. 6, No. 1, 1997, pp. 145-181.

<sup>3</sup> M. Pianta, M. Tancioni: Innovations, wages and profits, in: Journal of Post Keynesian Economics, Vol. 31, No. 1, 2008, pp. 101-123. Countries include Austria, Finland, France, Germany, Italy, Norway, Spain, Sweden, the Netherlands and the United Kingdom; innovation data come from CIS 2 and CIS 3 surveys, profit and wage data from the OECD database STAN.

<sup>4</sup> W. Cline: Trade and income distribution, Institute for International Economics, Washington 1997; A. Cornia (ed.): Inequality, growth and poverty in an era of liberalization and globalization, Oxford 2004, Oxford University Press; R. Kanbur: Globalization, growth and distribution: framing the questions, Commission on Growth and Development, Working paper No. 5, 2008; R. Feenstra, G. Hanson: Global production sharing and rising inequality: a survey of trade and wages, in: E. K. Choi and J. Harrigan (eds.): Handbook of international trade, London 2003, Blackwell; R. Freeman: Globalization and inequality, in: W. Salverda, B. Nolan and T. Smeeding (eds.): The Oxford Handbook of Economic Inequality, Oxford 2009, Oxford University Press.

workers. Richard Freeman points out that globalisation has meant a doubling of the labour force available in the world economy and a lowering of the overall capital/labour ratio; a greater (relative) scarcity of capital tends to lead to higher profits and inequality. His review of the empirical evidence concludes that increasing trade, greater openness of national economies and tariff reductions are likely to contribute to greater inequalities within countries.

Globalisation has gone well beyond an increase in trade. Offshoring and outsourcing have reshaped the international production of multinational firms. Greater international integration, in turn, may compound the effects of technology as firms and industries that face foreign competition are more likely to introduce innovations. In parallel, the liberalisation of global financial markets has greatly expanded the opportunities to obtain profits and financial rents; all these developments have weakened the position of labour vs. capital and contributed to increased inequality.<sup>5</sup>

### **The Polarisation of Employment by Professional Skills**

Changes in the relative composition of employment by professional skills have been investigated by a large body of (mainly US) literature. The dominant interpretation is that the emergence of new technologies has led to a pattern of skill-biased technological change,<sup>6</sup> as innovations replace unskilled labour with workers with higher competences that are complementary to the new technologies. The job opportunities for blue collar workers in the labour market worsen and the resulting inequality is presented as a “natural” effect of technological change.

*The Role of Technology:* Many studies on firms and industries argue that in the last twenty years the upskilling of employees – roughly measured by the ratio of white to blue collar workers, or years of education – has accelerated due the diffusion of ICTs. More re-

cent work focused on the ability of computers to replace routine workers’ tasks, while activities such as decision-making (by managers) and menial jobs (such as cleaning, by the least skilled workers) cannot be automated. The outcome is a polarised employment structure where the share of middle skills is falling.<sup>7</sup>

In order to carry out a more detailed investigation, we have used data on employees by professional qualifications in 36 manufacturing and service industries for five EU countries, considering four professional groups: managers, clerks, craft workers and manual workers. When industries are grouped on the basis of their patterns of technological change – technological competitiveness in high innovation industries, and price competitiveness in traditional sectors – distinct patterns emerge; the overall skill intensity is substantially higher in the former group of industries. Between 2000 and 2003 a clear pattern of polarisation of employment emerges, with job increases for managers (+2 per cent a year) and manual workers (+1.2 per cent) and job losses for clerks (-0.2 per cent) and skilled workers (-2 per cent).<sup>8</sup> Rather than a linear move from low skilled jobs to high skilled white collar employment, as predicted by the skill bias hypothesis, we find a clear pattern of polarisation.

These data make it possible to investigate separately the determinants of employment changes in the four professional groups. The econometric models developed and tested by Nascia and Pianta show the contrasting effects of different technological strategies; product innovation and high education lead to more jobs for high skill categories; process innovation and cost reduction strategies destroy jobs for craft workers. Again, we have found that it is important to distinguish alternative patterns of technological change that contribute in different ways to a more polarised structure of employment by professional groups in Europe.

*The Role of International Integration:* The effects of technology and international integration on the

<sup>5</sup> On the factors explaining labour’s “defeat” in income distribution in advanced countries see A. Glyn: *Capitalism unleashed*, Oxford 2006, Oxford University Press. A specific form of profit distribution leading to income polarisation has been the enormous growth of remunerations of top managers; the median remuneration of the three best paid top managers in the USA has gone from 25 times the average worker’s wage in the 1970s to more the 100 times after 2000. Cf. C. Frydman, R. E. Saks: *Executive compensation: a new view from a long term perspective, 1936-2005*, Finance and Economics Discussion Series, 2007, No. 35, Board of Governors of the Federal Reserve System, Washington 2007, Fig.1, p. 47.

<sup>6</sup> D. Acemoglu: *Technical change, Inequality and the Labor Market*, in: *Journal of Economic Literature*, Vol. 40, No. 1, 2002, pp. 7-72. On the impact of innovation on labour: M. Pianta: *Innovation and employment*, in: J. Fagerberg, D. Mowery, R. Nelson (eds.): *The Oxford Handbook of Innovation*, Oxford 2005, Oxford University Press.

<sup>7</sup> D. Autor, F. Levy, R. Murnane: *The Skill Content of Recent Technological Change: An Empirical Investigation*, in: *Quarterly Journal of Economics*, Vol. 118, 2003, pp. 1279-1333; D. Autor, L. Katz, M. Kearney: *The Polarization of the U.S. Labour Market*, NBER Working Paper No. 11986, 2006; M. Moose and A. Manning: *Lousy and Lovely Jobs: The Rising Polarization of Work in Britain*, in: *Review of Economics and Statistics*, Vol. 89, 2007, pp. 118-133.

<sup>8</sup> L. Nascia, M. Pianta: *Skill bias or polarisation? Innovation and job growth in Europe*. paper for the EAEPE conference, Università di Roma Tre, 6-8 November 2008. The countries are Italy, Germany, Spain, France and the United Kingdom. Data sources are Labour Force Surveys, CIS surveys and STAN. The professional groups are an aggregation of nine original groups; reference period is 2000-2003.

employment structure are closely connected. Firms facing international competition introduce more innovations; more innovative firms have a competitive advantage in foreign markets. In open markets, competition tends to eliminate less efficient firms that have less skilled workers, leading to an upskilling of jobs. Advanced countries tend to export more – and gain jobs – in higher technology industries, while imports from developing countries lead to job losses in traditional sectors. A study by Rowthorn and Coutts argues that even when trade flows are in balance, advanced countries lose to imports as much as six low skill jobs for each high skill job gained from exports; they find that between 1992 and 2002 North-South trade has been responsible for a quarter of manufacturing job losses in the EU and half in the USA.<sup>9</sup>

Finally, efforts have been made to compare the effects of technology and trade on the reduction of low skilled workers; in the case of US industries in the 1990s, the impact of innovation has been found to be dominant, while international trade appears to play a minor role.<sup>10</sup>

A more polarised employment structure is emerging from two decades of changes in technology and in international integration; this has meant lower opportunities for jobs in mid-level skills, and – most likely – less chances of upward mobility for the low skilled. Moreover, this is likely to be associated with greater inequalities among wage-earners.

### Wage Polarisation

In the past two decades, the combination of technological change, international production, liberalisation of labour markets, increasing immigration, weakening of trade unions and social protection legislation has resulted in greater wage inequalities. Wage patterns have tended to mirror the polarised employment structure, with, at the top, a growing number of highly paid managers – including the extreme compensations of CEOs in large firms – and, at the bottom, a growing number of poorly paid unskilled manual workers, many of them immigrants, employed in menial jobs and personal services.

*The Role of Technology:* The effects of technology on wages have been studied considering workers with different educational backgrounds, workers

using or not using computers, workers in industries with different technological intensities. While wages are always higher where they are expected to be, the causal links are not always clear, as “better” workers are going to be paid more, and are also more likely to be employed in higher technology industry and to use computers more than others.

A recent article by Croci Angelini, Farina and Pianta has used a more complex approach to investigate the effects of technological change on wages in ten manufacturing and service sectors in seven European countries. Average wages of managers, white collar and blue collar workers show a wide variability between high and low technology industries, and between manufacturing and services. Econometric models are used to investigate the ratio of the average compensation of managers and white collar to blue collar wages within industries, considering the impact of different technological strategies, labour market patterns, education and training. Higher wage polarisation is found in industries with strong product innovation, a fast employment dynamics and high shares of workers with a university education. Wage compression is associated with the diffusion of new process technologies and high shares of workers with secondary education.<sup>11</sup>

Again, the possibility of opening up the “black box” of technology, using detailed information from innovation surveys, makes it possible to identify different impacts. “Schumpeterian” innovation – as expected – tends to increase wage polarisation, while the diffusion of knowledge and machinery embodying new technologies has the opposite effect of wage compression. While technology has an overall impact in increasing inequalities among wages, this analysis helps us understand the complexity of the relationships and the influence of educational factors and labour market dynamics and institutions.

*The Role of International Integration:* Less attention has been devoted to the impact of globalisation on wage polarisation. The mechanisms at work tend to mirror those shaping the employment structure. In advanced countries, greater international openness, competition from countries with cheap labour and growing imports of traditional goods tend to destroy

<sup>9</sup> R. Rowthorn, K. Coutts: Deindustrialisation and the balance of payments in advanced countries. In: Cambridge Journal of Economics, Vol. 28, No. 5, 2004, pp. 767-790.

<sup>10</sup> E. Berman, J. Bound, S. Machin: Implications of skill biased technological change: international evidence, in: Quarterly Journal of Economics, Vol. 113, 1998, pp. 1245-1279.

<sup>11</sup> E. Croci Angelini, F. Farina, M. Pianta: Innovation and wage polarisation in European industries, in: International Review of Applied Economics, Vol. 23, No. 4, 2009, pp. 309-326. The countries are France, Italy, Germany, Spain, The Netherlands, Portugal and the United Kingdom; data sources are CIS2 and CIS 3 surveys and the European Community Household Panel (ECHP, 1994 and 2001) for wages.



unskilled jobs and lower the wages at the bottom of the scale.

Conversely, the rise of large multinational firms with oligopolistic power (and strong intellectual property protection) in global markets creates opportunities for high compensation of top personnel in management, finance, R&D, marketing etc., including the extreme levels reached by CEO pay in recent years. This represents a redistribution of parts of the “rents” associated with global market power.

As international integration increases, several institutional characteristics of European countries have been weakened in the name of the need to increase “national competitiveness” and cut labour costs for firms. The power of trade unions and their role in national policymaking have diminished. The scope for national regulation of labour markets, employment protection and minimum wages has been limited by successive waves of labour market liberalisation, aiming at “competing” with the more deregulated labour markets of industrialising countries. The introduction and diffusion of fixed-term, temporary and part-time employment have led to a precarisation of work. All these developments have led to wage containment that has been particularly serious for blue collar and low skilled workers. The result has been an increase in inequalities among wage-earners.

### **Conclusions**

In the past two decades European countries have shown growing income inequalities and increased wage dispersion, while a large share of workers has

experienced a decline in real wages. Changes in economic structures, business strategies and government policies are at the root of such patterns. Technological change and greater international integration have contributed to these developments, along with developments in labour market institutions, forms of employment and social relations. The interaction between innovation and international integration influences countries’ and industries’ competitiveness, the direction of technological change, the evolution of the global division of labour and the resulting patterns of employment and income distribution. The distributional outcomes of two decades of rapid technological change and international integration, however, appear problematical; the largest benefits have gone to firms and consumers in the form of greater profits and lower prices; workers have experienced a poor development of real wages, employment losses in medium and low skill jobs, greater wage disparities and the increasing precarisation of work.

Judging on the basis of such outcomes, the prevailing policies in European countries appear more as a factor that has contributed to income disparities than as a tool for their reduction. In designing a new generation of policies against inequalities, alongside the traditional actions in support of redistribution, welfare policies and equality of opportunities, it is important to address the economic mechanisms that in the past two decades have led to greater inequalities. The patterns of innovation and forms of international integration could be reshaped with the aim of assuring a fair distribution of their benefits.