Technological competitiveness of renewables in the new multipolar global economy

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While the international crisis has put to the fore the vulnerability of the global economic system, the link between the recession and global value chains has become the object of renewed interest in policy discussions. The impact of the crisis on global value chains has proved to be neither straightforward nor clear, and a number of questions is still unresolved on the extent to which drop in trade flows can be explained by the global interdependence of production. Among the various causes which influenced trade dynamics, sectoral composition effects appeared to play a key role in inducing resilience to adverse shocks, with careful cost-benefit assessment of reducing production being determinant in the investment strategies.

In the wake of the growing environmental and energetic crises, clean energy technologies gained much prominence over the past few years. Also, climate policies proved decisive for the start of such an unprecedented "technological transition", aimed at relocating trends of energy intensive industries. Empirical evidence shows in particular that world trade in renewable energy technologies outperformed that in manufacturing as a whole, while the impact of the crisis on it was comparatively less severe.

The present analysis focuses on the recent evolution of technological competitiveness in renewable energy technologies, showing that a new important world division of labour has been taking place in spite of the ongoing international crisis.

Over the past five years "second generation technologies" proved to be the most dynamic component of international trade in renewables[1], with an average yearly increase of 25 % (about twice as much that of the manufacturing as a whole), mainly determined by the dramatic growth of trade in the photovoltaic. Important differences also emerged at the regional level, as Japan and a large number of newly industrialized countries in its area of economic influence (including Nic's and Nec's), and China played a prominent role in the export of pv technologies (43% is the total export share of all these countries for pv in 2009). However, looking at the whole dynamics of trade geography further significant aspects can be singled out once all the specific components of the "second generation" renewable technologies are considered. In fact Europe and the United Stated did partially catch up with pv exports while continuing to increase export shares in the other solar technologies. At the same time a significant increase of export shares emerged for wind power in Japan, China and India (in 2009 the total export share of these countries for wind power was over 23%).

The whole trade dynamics in "second generation" renewables technologies can be clearly related to the figures of investment flows in renewables technologies shown in the latest UNEP reports (2010 and 2011), as well as by the figures of foreign direct investment presented in the 2010 World Investment Report on the activities undertaken in the environmental field. Figures in these reports are mostly aggregate and often heterogenous from the point of view of both the nature and the technological "profile" of the investments. However, it turns to be quite evident that a huge effort has been made throughout all advanced and newly industrialized economies in order to tackle the "structural" transition to renewable energy, and that for this reason the trend of investment has been only slightly diverted by the effects of the economic meltdown.

Foreign direct investments played even a more fundamental role as they paved the way to the development of renewable energy technologies in newly industrialized countries while boosting the production activity and export shares. In fact, as stressed by the World Investment Report, they increasingly developed along a "North-South" trajectory until 2007, although they decreased

[1] Data on trade and patents are from the ENEA's Observatory on Technological Competitiveness (ENEA-Technology Transfer Unit).

dramatically after the economic meltdown had started. However, a significant recovery of total FDI flows has been recorded over the past year while an unprecedented outward investment dynamics has been singled out for the newly industrialized countries giving rise to investment flows of growing strength along “South-South” trajectories. This seems to suggest that in the latest years the growth of renewable technology exports in the newly industrialized countries is rather the outcome of a renewed capacity of production as well as the premise of a built-in process of technological development. As a matter of fact, the analysis of the patenting activity points out that in these economies innovation processes in renewables technologies just started taking place in the latest period and that both solar and wind power technologies were significantly involved. In all these countries (including most Nics and Necs countries, China and India) patent shares in pv and wind power appear to be still much lower than the export shares, but their trend is increasing and technological specialization is clearly emerging as far as wind power technologies are concerned.

In the case of wind power technologies a prominent role is being also played by the other two countries belonging to the BRICS group (Russia and Brazil), while further insights can be drawn from the analysis of the “off-shore” applications. over the very recent period. In fact about 8% of total patents in the “off-shore” wind power are held by Brics countries (mainly China and Russia) in the period 2007-2009, while technological specialization has been growing over time. However “off-shore” wind power has become an emerging technological niche for a large number of (often small) countries throughout the world in Europe, Asia and Efta countries, with a widespread distribution of patent shares across countries.

As far as European countries are concerned, wind power technologies are still fundamental in shaping their technological specialization in “second generation” technologies but solar thermal and solar concentrating technologies have grown much in importance over the most recent years involving an increasing number of countries. In pv technologies the European position is, instead, still lagging behind with only few countries holding significant patent shares. Germany and France hold the highest pv shares (4% and 8% in the period 2007-2009) but they are still despecialized. Pv technologies are in fact a point of concern for Europe as the demand for pv energy soared over the most recent years and this was at the origin of deepening trade deficits in a large number of countries. The case is quite peculiar for Italy which turned to be second in place in world pv ranking for energy production while recording increasingly large trade deficit in spite of the economic slowdown. This shows, in other terms, the crucial importance of coordinating energy and industrial policies when structural changes in the production system have to be tackled; and seems to be a convincing explanation for the catching up process in pv technology development which is clearly shown by patent patterns in both a number of European countries and the United Sates since the second half of the last decade.