

Has Finland advanced from an investment to an innovation-driven stage?

A widely entertained hypothesis states that as countries catch up with the global technology frontier, they need to adjust their strategies and public policies from investment to innovation promotion by means of R&D, new technologies and education. This policy shift represents what Acemoglu *et al.* (2006) identify as the shift from (a) adaptation of existing technologies to (b) innovation to create new technologies. Porter (1990) calls it a shift from an *Investment-Driven Stage* (reliant on efficient manufacturing and outsourced service exports) to the *Innovation-Driven Stage*. At this stage nations compete on their “ability to produce innovative products and services at the global technology frontier using the most advanced methods” (Porter & Schwab 2008, p.51). To generate innovations, countries/ industries/ firms shift their investment focus from physical capital to R&D. It has been claimed e.g. by the official evaluation of the Finnish national innovation system carried out in 2008 (TEM 2009) that low aggregate investment in Finland reflects such a structural change. The purpose of this paper is to explore whether Finland caught-up with the world tech-

nology frontier in the early 2000’s, and whether innovation was a key factor in it.

Using empirical evidence from harmonized industry-level EU KLEMS data for the period 1986 – 2003, and recent methodological advances, notably a robust order- m frontier methodology, I estimate the technology gap with the frontier. The dataset includes the quality of physical capital services (ICT and other) and human capital (level of education). To further explore the contribution of innovation and investment on closing the technology gap, I thereafter regress most likely determinants, such as R&D, human capital, ICT capital, and the physical capital intensities on the technology gap, using fixed-effects panel data methodology.

Contrary to findings from growth accounting studies, efficiency estimates find Finnish industries on average far from the frontier during the sample period. While this is evidence against an innovation regime, the so-called determinants of efficiency provide some support to the innovation-driven stage. Notably, improved absorption (R&D and education) capacities and investment in ICT technologies apparently aided catch-up. R&D intensity impacts are, however, industry related. Hence, increasing R&D intensity is not considered a universal remedy to industry technology gaps. Moreover, the declines of the two industries anywhere near an innovation regime, paper and pulp (21t22) and electrical and optical equipment (30t33), do not suggest a merry outlook to the Finnish innovation regime.

In addition, services intensity, market size and net tax intensity proved positively associated with efficiency. While it is natural that efficient firms pay more taxes, less expected is the

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finding in the data that net taxes have burdened the private sector only to the extent that subsidies may have distorted competition. Efficiency improves with market size, as one would expect due to improved potential for enjoying economies of scale and scope. Results on services intensity suggest that outsourcing narrows the technology gap. ■