Technology Standardization matters for Competition and Growth

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When a technology becomes the new standard, firms that are closer to the new technology frontier immediately gain in terms of sales and market shares. Yet, these effects are temporary since standardization creates a common technological basis for everyone, which allows followers to catch up and the economy to grow.

## The Implications of Technological Standardization for Competition

The development and production of goods and services is often subject to a myriad of technical standards. From payments systems to specifications for door frames or autonomous vehicles, industrialized societies rely heavily on technical standards in every sector of the economy. By defining a common set of rules, guidelines and specifications, standardization guarantees the interoperability of devices, compatibility of inputs, or the safety and quality of products at the benefit of both producers and consumers. Technological standardization also entails the selection of one technology among competing ones as it aims at assuring the widespread proliferation of the best technologies and practices within each industry. In this sense, the process of standardization goes hand in hand with technological progress: when new technologies emerge, new standards are defined in order to facilitate their large-scale adoption.

Yet, the ability of firms to adapt to the new standard -which we refer to as the new technology frontier- depends on their past technological choices. Indeed, some firms -given their innovation history- could be technologically better prepared to deploy the technologies described in the new standard. As such, firms close to the new frontier may have an immediate competitive advantage and benefit from a shift in market power in their favor. This raises a well-known trade-off between rewarding successful innovations and avoiding the creation of monopolies. Bergeaud, Schmidt and Zago (2022) contributes to the debate. By introducing a new measure of proximity of firms to the technological frontier, we show how the selection of one technology among competing ones through standardization affects competition, innovation and growth.

Our new measure of proximity to the frontier uses text analysis to study the extent to which the semantic content of firms' patents overlaps the content of a newly issued standard. We apply this algorithm to patents belonging to US firms. Hence, we cross this measure with Compustat balance sheet data and study the impact of standardization at the firm and sectoral level between 1985 and 2010.

As shown in Figure 1, we provide evidence that, when a new standard is released (at time 0), firms closer to the new technological frontier gain immediately in terms of market shares. We also find that, if the market is competitive, frontier firms invest more in R&D and capital formation while this is not the case if the level of competition is too low. These results are consistent with the interpretation of standardization as a shock that reduces the level of competition, benefiting technological leaders (Aghion et al. 2005) in the short-run.

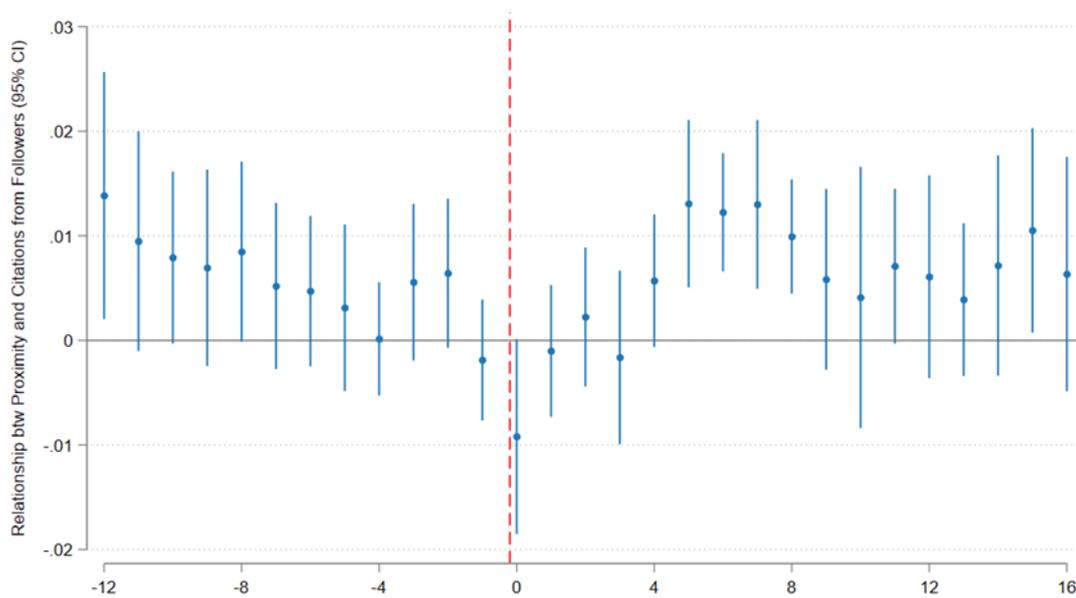**Figure 1: Market Shares and Proximity to the Technological Frontier**
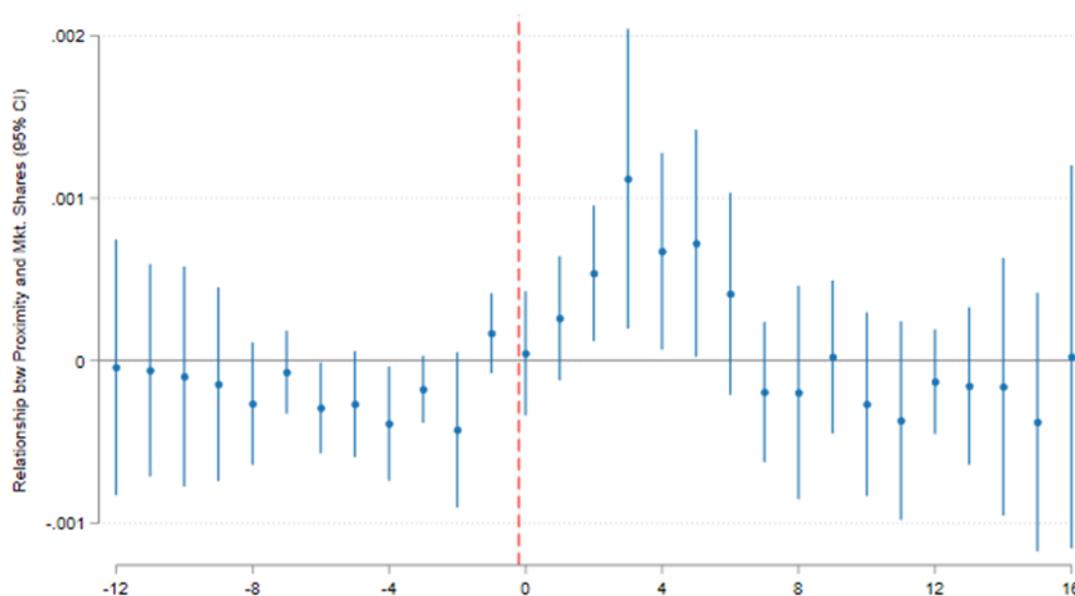
Note: This figure shows the estimated relationship between the proximity of firms' patents to the frontier (defined by a technical standard published at time zero) and market shares.

Spillover Effects and Growth through Followers

Yet, these effects are only temporary. In fact, standardization aims at creating a common ground, which allows laggards to catch up in the long-run through spillovers. In Figure 2, we show that this mechanism is in place. By exploiting the full network of patents' citations, we give evidence that patents closer to the new frontier are more cited after the publication of the standard. In particular, citations come from followers, i.e. from those firms that were far away from the new technology frontier at the moment of the standard release. Indeed, followers exploit the common knowledge set by the standard to foster research and development. We show that, thanks to such spillover effect, they are able to innovate more in the long-run and surpass leaders in the market both in terms of research output and sales.

Figure 2: Citations by Followers and Proximity of Leaders to the Frontier

Note: This figure shows the estimated relationship between the proximity of firms' patents to the frontier (defined by a technical standard published at time zero) and citations from followers (firms with no patent close to the frontier at the moment of the standard release).

This mechanism grants followers to grow faster than leaders in the long-run. This process of technological catch-up drives long-term growth in the industry. Table 1 reports the decomposition of the average sectoral growth between leaders and followers when a new standard is introduced in the industry.

Table 1: The Effects of Technology Standardization on Sectorial Growth

	Industry	Leaders	Followers
Mean Sectoral Growth Rate (%)	1.64	1.04	0.60
(1yr-Cumulative) Change in Growth due to Tech. Standardization (pp)	-0.03 (0.06)	0.08 (0.02)	-0.11 (0.07)
(4yr-Cumulative) Change in Growth due to Tech. Standardization (pp)	0.11 (0.05)	0.02 (0.02)	0.09 (0.04)

Note: The first line of this table shows the average sectoral growth and its decomposition between leaders and followers. The second and third line show the cumulative effect of the introduction of a standard on sectoral growth respectively one and four year after the official publication of the standard. Standard errors are in parenthesis.

In the cross-section, the average industry grows by 1.64% per quarter. With a rate of 1.04% (0.60%), leaders (followers) explain 63% (37%) of sectoral growth. As reported in the second line, in the first year after the introduction of the standard, sectoral growth is not significantly different from zero. Yet, when looking at the decomposition, we find that the growth rate of leaders increases significantly by 0.08pp, as they have an immediate competitive advantage in the market. This effect is counterbalanced by the negative change (-0.11pp) in growth rate of followers. In fact, since by definition followers are far away from the frontier, they immediately give up market shares to leaders and grow less in the short-run. However, over the four years following the introduction of the standard, the contribution among leaders and followers reverses. In fact, in the long-run, the industry growth increases by 0.11pp. This result is mostly explained by followers, for which the growth rate increases (significantly) by 0.09pp. These results are consistent with previous works on the effects of technology diffusion on growth, such as Bloom et al. (2013) and Furman et al. (2021).

Final Remarks

In light of this evidence, Bergeaud, Schmidt and Zago (2022) not only sheds light on the effect of standardization on competition and innovation, but it has a clear policy implication as it proves that, under a competitive market structure, standardization rewards frontier firms only in the short-run while stimulating further R&D investment by laggards in the long-run. This mechanism fosters innovation, competition and –ultimately– it boosts economic growth. ■

About the authors

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