



# Broadband investment and welfare under functional and ownership separation



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## ABSTRACT

We study how the vertical industry structure affects investment in network quality and social welfare, with a focus on the prospective deployment of high-speed broadband access networks (the so-called NGA). We model pros and cons of vertical separation, namely, pro-competitive effects and loss of some efficiencies of vertical integration, and distinguish functional separation from ownership separation. Our findings challenge the presumption that (compared with vertical integration) vertical separation reduces investment incentives and involves a trade-off between promoting consumer surplus and ensuring investment. While investment is higher under ownership rather than functional separation, the latter may yield the highest social welfare among vertical industry structures. Furthermore, the incumbent may voluntarily opt for functional separation, but in some of these cases, prohibiting separation improves welfare.

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## 1. Introduction

The deployment of very high-speed broadband infrastructures, so-called Next Generation Access Networks (NGA), is widely recognized as a key factor to foster job creation and economic growth.<sup>1</sup> Network investment to roll out the optical fiber closer to customer premises exhibits high sunk costs and uncertain returns. National Regulatory Authorities (NRAs) are thus called to design a suitable framework to promote investment and ensure effective third-party access to enduring bottlenecks.

Behavioral remedies have often been ineffectual in preventing non-price discrimination (or sabotage) against

the incumbent's rivals over existing copper networks.<sup>2</sup> Policy makers in several countries have thus argued that a structural remedy such as vertical separation of the bottleneck owner may be required to ensure provision of fully equivalent access products to all downstream firms. While vertical separation is likely to promote fair competition in retail markets, one should ascertain that it preserves the incentives to invest in improving the quality of the access network.<sup>3</sup>

<sup>2</sup> Many cases of non-price discrimination have come before NRAs and national courts in the EU (BEREC, 2011). Indeed, telecommunications incumbents have been alleged of providing rivals with poorly maintained unbundled lines, delaying processing of rivals' orders, denying relevant technical information, or imposing undue requirements.

<sup>3</sup> In the EU energy industry, vertical separation is viewed as a key driver for investment in network size (such as cross-border gas transportation or electricity transmission capacities) that serves to build the single market. Empirical evidence shows however that ownership separation stifles network investment in the electricity industry (Gugler et al., 2013).

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<sup>1</sup> A prominent example is the 'Digital Agenda for Europe' ([http://ec.europa.eu/information\\_society/digital-agenda](http://ec.europa.eu/information_society/digital-agenda)).

This paper studies how the vertical industry structure affects NGA investment, and more generally social welfare. The main purpose is to determine which form of vertical separation of the bottleneck owner (if any) should be recommended, and in what circumstances.

We build a model that considers the main pros and cons of vertical separation. On the one hand, vertical separation delivers bottleneck access to all access seekers on equivalent terms. Hence, it may increase broadband competition, thereby fostering innovation and service quality improvements.<sup>4</sup> We thus assume that, under vertical separation, downstream firms have the same ability to use the improved network quality and offer value-added services (i.e. they enjoy the same demand-side investment spillover), which can be even higher than under vertical integration.

On the other hand, vertical integration entails greater coordination between upstream and downstream activities.<sup>5</sup> We assume that this feature of vertical integration has the demand-side effect of raising the end users' perceived quality of broadband services (e.g. due to lower transaction costs).

We consider two forms of vertical separation (see e.g. Cave, 2006). Functional separation implies creating an independent business unit managing bottleneck activities, with a 'firewall' between bottleneck and competitive activities. Ownership separation implies divesting the separated unit, and thus a change of ownership of bottleneck assets.<sup>6</sup> In our model, functional separation ensures greater coordination between upstream and downstream markets than ownership separation. Under functional separation, the firm's owners can take strategic decisions as infrastructure investment in the interest of the whole company, but cannot fully control tactical decisions as retail pricing.<sup>7</sup>

We allow the vertical industry structure to affect competitive conditions in downstream markets, and the access charge to depend on the vertical structure.<sup>8</sup> We also endogenize the choice of the vertical industry structure, both from the NRA's and the incumbent's viewpoint. In some cases, the incumbent might voluntarily opt for separating activities. In such cases, the NRA should be informed in advance since it should be able to assess the related effects (Directive 2009/140/EC, Recital 64).

<sup>4</sup> This is the case in the UK for mandatory 'equivalent' unbundling of the incumbent's network (Nardotto et al., 2012).

<sup>5</sup> Indeed, vertical integration can exploit scope economies and enhance the availability of information (OECD, 2003).

<sup>6</sup> After the break up of AT&T in the US in 1984, ownership separation has been rarely imposed in telecommunications, but it may become an effective option to deploy NGA. In the EU, Directive 2009/140/EC (<http://eur-lex.europa.eu>) allows NRAs to impose functional separation to foster competition in relevant markets. This remedy is already active in the UK, where the incumbent has made organizational changes to provide bottleneck services on an 'equivalence of inputs' basis.

<sup>7</sup> We discuss this assumption in detail in Section 4.1.

<sup>8</sup> We assume that the NRA sets a linear access charge to maximize welfare before NGA investment is made (in Sections 4.2 and 4.3, we respectively discuss other access pricing schemes and the NRA's commitment ability). The NRA has no direct control over NGA investment. This is generally the case when the investing firm does not receive public subsidies.

We find that, for any vertical structure, the (regulated) access charge optimally rises above cost, depending on the combination of a negative and a positive effect on welfare. The negative effect is due to the increase in retail prices, which makes consumers switching from the high- to the low-quality firm, or exiting the market at all. Instead, the positive effect is due to the increase in network quality, which in turn raises consumers' valuation of improved services, net of investment cost.

Contrary to common wisdom, vertical separation does not always lead to a higher access charge relative to vertical integration, and a higher access charge does not always lead to higher investment. If the relevant demand-side spillover from investment is high enough, vertical (mostly ownership) separation increases NGA investment, unless efficiencies from vertical integration are very high.

Vertical separation also increases consumer surplus, as long as it effectively improves downstream firms' ability to offer value-added services. When consumer surplus is higher, NGA investment is also higher under vertical separation. In such a case, vertical separation does not entail the expected trade-off between promoting consumer surplus (due to the pro-competitive effects of separation) and ensuring NGA investment (that could be hampered by the loss of efficiencies of vertical integration).

Finally, vertical separation may improve social welfare (gross of the one-off cost of separation). Functional separation often provides the highest welfare, though it never yields the highest NGA investment. Interestingly, when functional separation is socially beneficial, it is also the incumbent's preferred option (while the incumbent never opts for ownership separation). Thus, the real issue for the NRA is to assess when banning, rather than imposing, functional separation does improve welfare.

This paper is organized as follows. Section 2 reviews the literature. Section 3 introduces and solves the model. Section 4 discusses the main assumptions. Finally, Section 5 concludes.

## 2. Relevant literature

Despite the importance of the issue, there is little formal analysis of the effects of the vertical industry structure on network investment and social welfare.

Buehler et al. (2004, 2006) show that investment in network quality is often smaller with ownership separation, which cannot yield both a lower retail price and a higher network quality relative to vertical integration. Nonetheless, they assume an exogenous access charge.

Chen and Sappington (2009) recognize that the access charge depends on whether the incumbent is vertically integrated or ownership separated, and find that the effect on investment depends on the nature of downstream competition. However, they focus on process rather than product innovation.

A few papers consider functional separation. Cremer and De Donder (2013) find, in an unregulated setting, that ownership separation reduces investment, output and welfare relative to functional separation ('legal unbundling').

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