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# Measuring economies of vertical integration in network industries: An application to the water sector

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**Abstract**

This paper provides a framework that aims at distinguishing the technological economies of vertical integration from the vertical economies resulting from an inefficient input allocation due to upstream market imperfections. To illustrate our analysis, we use consistent panel data econometric methods to estimate cost functions on a sample of North-American water utilities. Contrary to what has been found for other network industries (electricity and gas for instance), we show that the global and technological economies of vertical integration are not significant except for the smallest utilities.


*JEL classification:* C33; L22; L95

*Keywords:* Vertical integration; Water network; Cost function; Panel data

## 1. Introduction

Unprecedented transformations aiming at introducing more competition into sectors traditionally considered as natural monopolies have been an important feature of public policy in the

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[1] Preliminary versions of this paper were written when the author was a Postdoctoral Fellow at CIRANO, then a researcher in the Laboratory GEA.

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two last decades. One of the key recommendations of policy-makers has been to break up monopolies before introducing more competition.[2] Behind this recommendation is the idea that natural monopoly and potentially competitive parts of a utility should be separated to prevent competition distortions. In most network industries, the result has been to introduce competition at the production stage while maintaining transmission and, in some cases, distribution as local monopolies.

However, it has been recently argued that vertical disintegration of utilities can result in cost efficiency losses if production stages are characterized by strong economies of vertical integration.[3] Identifying the determinants of economies of vertical integration (EVI) is however not straightforward. EVI may be first the consequence of market imperfections and monopoly power at the upstream stages of the production process: if there are market imperfections, input allocation at the downstream stage will be distorted resulting in higher costs. But a vertically integrated structure can also be a cost effective solution if there are substantial needs for coordination and adaptation across stages. This may occur if there are significant technological complementarities across production stages or if using intermediate markets involves high transaction costs.

A global measure of economies of vertical integration, as proposed by Kaserman and Mayo (1991) or Kwoka (2002), does not permit distinguishing the technological and transactional economies from those resulting from an inefficient allocation of inputs due to market imperfections at an upstream stage. Yet, identifying the sources of EVI may be crucial in some cases. In particular, disintegration may only be cost effective if upstream markets are competitive enough. A regulatory authority should then promote a vertically disintegrated structure only if price distortions on the upstream markets can be limited. The conclusion given by a global measure of vertical integration could be subject to controversy in such a case. For network industries (e.g. electricity, water, gas) characterized by strong technological interdependencies between production and distribution stages, identifying the source of EVI is particularly important. Recently, Nemoto and Goto (2004) have proposed a framework to estimate those technological externalities by introducing the capital stock of the upstream stage into the downstream stage cost function. Whereas this econometric study is the first to be explicit about the sources of EVI, it however does not take into account market imperfections as a potential source of EVI. By separately estimating the cost functions of vertically integrated and non-vertically integrated structures and by imposing marginal cost pricing on the upstream market, we make possible the distinction between the two sources of EVI.

Within network industries, the water sector seems to be a special case in which direct competition and production stage separation have not yet really been observed.[4] Water utilities

[2] The question of liberalization of these industries, its economic implications and political issues are also in the core of the structural reforms in the EU, see European Commission (1999).

[3] Interestingly, most of the empirical studies trying to assess the presence of economies of vertical integration have reported substantial cost efficiency gains for vertically integrated structures. Working on a sample of US electric utilities, Kaserman and Mayo (1991) have shown that the cost is on average 11.96% higher for vertically disintegrated services than for vertically integrated ones. Also working on a sample of US electric utilities, Kwoka (2002) concludes that disintegration may result in a substantial cost increase, 42% on average. Two recent studies suggest however that the economies of vertical integration might be lower. Nemoto and Goto (2004) using a panel of 9 Japanese utilities observed from 1981 to 1998, report a cost efficiency gain for the vertically integrated structure between 0.13 and 2.97%. Last, Jara-Díaz et al. (2004) based on a sample of Spanish electric utilities, conclude that joint generation and distribution may save 6.5% of costs.

[4] England is a special case. The 1998 Competition Act has opened up the scope for more competition in water industry. Inset appointments which allow the existing regulated water utility to be replaced by another for a specific site are now authorized. Common carriage which occurs when one service supplier shares the use of another's assets is also authorized by OFWAT.