Executive Summary

"Is productivity growth in electricity distribution negative? An empirical analysis using Ontario data"

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Electricity industries have been experiencing upward pressures on costs in recent years. The purpose of this paper is to estimate productivity growth in the electricity distribution segment of the industry using data on 73 Ontario electricity distributors for the period 2002-2012, and to discuss the regulatory implications.

Broadly speaking, there are two methodologies for estimating productivity growth. The first is the index approach, which is motivated by a simple, intuitively appealing idea: it compares the rate of growth of outputs to the rate of growth of inputs. The second approach involves estimation of the relationship between costs and various factors affecting costs such as the scale of operation, prices of inputs, business condition variables and technological change. Usually, the most important productivity drivers are technological change and scale effects.

Properly implemented with suitable data, the two approaches should lead to similar results. Large discrepancies require reconciliation. The two approaches are related as follows: the difference between output and input growth should be approximately equal to the combined effects of technology and scale. That is,

Productivity growth ≈ Output growth – Input growth ≈ Technology effects + Scale economies.

In the Ontario data, both approaches indicate *negative* measured productivity growth averaging about 1% per year over the period under study. There are several possible explanations. First, load growth has slowed and per-customer electricity consumption has been declining, in part because of substantial increases in electricity prices and conservation programs. Second, the infrastructure is ageing, which entails higher maintenance costs as well as facility replacement. Third, distributors are fulfilling additional responsibilities, including implementation of smart technologies (such as smart meters which were installed in Ontario during this period), integration of renewables and other distributed generation, and an increased focus on demand management programs. Smart technologies may eventually lead to improved productivity as well as improved reliability and more efficient use of electricity resources. However, it is worth recalling that the proliferation of computers in the 1980's improved macroeconomic productivity only after a relatively long lag.

Our cost model incorporates three output measures: number of customers, total deliveries of electricity and system capacity. Additional explanatory variables include factor prices for capital and labour, density of the customer base, and other distributor characteristics. We employ flexible modeling techniques to ensure consistent estimation of scale economies.

Estimation of productivity growth rates has important applications in regulated industries. One of the simplest and most commonly applied incentive regulation mechanisms is the "RPI-X" rule where regulated entities are permitted to increase prices by the rate of price inflation (RPI) minus expected productivity growth (X). The above results suggest that cost pressures experienced by Ontario distributors would justify rate increases that exceed the rate of inflation.

However, there may be substantial differences in efficiency across utilities. Some regulators assign firm-specific ‘stretch factors’ with lower requirements for those utilities that are measurably more efficient. Cost models permit systematic assignments of stretch factors by comparing observed costs to those predicted by the model. For example, if a firm’s predicted costs are higher than observed, they are assigned a lower stretch factor. It is important to distinguish between the accuracy with which industry-wide productivity factors can be estimated, and the accuracy with which one can assess the relative efficiency of an individual distributor. Though both can be obtained from the same cost model, the former is an industry-wide parameter and can therefore be estimated with much greater precision than the latter, which involves a separate prediction for each distributor.

While statistical models may capture many important cost drivers, data limitations preclude us from including additional factors such as reliability, age of assets, urban core effects and system configuration. Such omissions may influence estimates of productivity growth as well as relative efficiency rankings. It may be worth considering recent distributor-specific productivity growth in the process of stretch factor determination. Under this approach, stretch factor assignments would be based on relative cost performance as well as growth in productivity. Firms that have demonstrated recent productivity improvements (relative to other firms) would be viewed favorably, even if their costs may appear to be relative high.

Finally, as a by-product of the empirical work, we are able to assess scale economies. We find little statistical evidence of significant potential for scale related efficiency gains, given the current responsibilities and functions of distributors. This does not preclude the potential for productive mergers among specific utilities, or future gains in scale and scope as distribution industries continue to evolve.