



Regional productivity convergence: An analysis of the pulp and paper industries in U.S., Canada, Finland, and Sweden



Jakir Hussain*, Jean-Thomas Bernard

Department of Economics, University of Ottawa, Ottawa, Canada

ARTICLE INFO

Article history:

Received 27 August 2016

Received in revised form 22 March 2017

Accepted 12 April 2017

Available online 20 June 2017

JEL classification:

C22

F33

Keywords:

TFP convergence

Multilateral TFP index

Pulp and paper industry

Translog cost function

Regional productivity

ABSTRACT

In this paper we investigate the presence of productivity convergence in eight regional pulp and paper industries of U.S. and Canada over the period of 1971–2005. Expectation of productivity convergence in the pulp and paper industries of Canadian provinces and of the states of its southern neighbour is high since they are trading partners with fairly high level of exchanges in both pulp and paper products. Moreover, they share a common production technology that changed very little over the last century. We supplement the North-American regional data with national data for two Nordic countries, Finland and Sweden, which provides a scope to compare the productivity performances of four leading players in global pulp and paper industry. We find evidence in favour of the catch-up hypothesis among the regional pulp and paper industries of U.S. and Canada in our sample. The growth performance is at the advantage of Canadian provinces relative to their U.S. counterparts. The two Nordic countries, that had the lowest productivity levels in 1971, erased most of the gap and in some cases moved ahead of their North-American counterparts.

© 2017 Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Published by Elsevier GmbH. All rights reserved.

1 Introduction

Productivity is one of the major determinants of the competitive position of a national industry in the world market.¹ Chambers and Gordon (1966) argue that under constant returns to scale, productivity of the trade exposed sector determines the wage rate not only of this sector but also of the whole economy. This important indicator has attracted the attention of researchers and academicians who have developed a large literature dealing with various measurement issues,² and of national statistical agencies that implement specific programs designed to assess productivity of parts or the whole economy.³ In this paper we investigate the presence of productivity convergence in eight regional pulp and paper industries of U.S. and Canada over the period of 1971–2005.

The Canadian pulp and paper manufacturing industry is fairly large according to the usual economic indicators and it is one of

the major industrial sectors in national and regional economies of Canada. The economic significance of Canadian pulp and paper industry lies on the fact that this industry has always been a net contributor to the balance of payments. In the world market, Canada and U.S. are the two leading players for the pulp and paper industry.⁴ Moreover, they are direct competitors, particularly in the U.S. market. The level of integration between the two countries is also very high and both countries are trading partners in cases of both pulp and paper products.

According to Denny et al. (1992), productivity growth over longer periods is primarily determined by the technological advancement in an industry and that advance is highly correlated across nations. In the case of pulp and paper, the global industry share a common production technology and the basics of paper making have changed very little over the last century (Kuhlberg, 2015). At the first stage, wood fiber that is the main raw material

* Corresponding author. Tel.: +1 613 709 5996.

E-mail addresses: mhuss076@uOttawa.ca (J. Hussain), jbernar3@uOttawa.ca (J.-T. Bernard).

¹ Other local factors such as taxation and government regulations also play a role in this respect.

² For a brief survey, see Hulten (2001).

³ OECD provides guidance to the member countries in this endeavour. See OECD (2011).

⁴ According to the most recent statistics published by FAO (2013), U.S. is the leading producer of wood pulp, accounting for almost 30 percent of total world production, followed by Canada which accounts for almost 11 percent of the global production. In case of paper and paperboard production both U.S. and Canada are among the top five producers in the world and they jointly account for 22 percent of total world production. In both type of products, they are among the top five exporting countries.

is freed from raw wood through chemical and/or mechanical processes to yield pulp, and at the second stage, the mixture is spread over a rolling screen to be dried and to obtain various paper and cardboard products. Moreover, mill owners purchase their equipment from a very small group of manufacturers that serve the world market and they are the main innovators in this industry. According to Ghosal (2009), the U.S. pulp and paper industry perform little R&D and its R&D intensity (0.5 percent) is one of the lowest among U.S. manufacturing industries.⁵ Here are three major challenges that the pulp and paper industry in industrialized countries faced since the early seventies: First, the oil crisis of the seventies opened the way to other energy sources including biomass use. Second, fiber supply changed from round wood to wood chips, and recycled paper brought a growing contribution. Third, governments enforced more stringent environmental regulations on water and air emissions.

The above discussion makes it clear that we have two leading players of the global pulp and paper industry which share a common production technology that changed little during the last century and are trading partners with high level of exchanges in both pulp and paper products. Furthermore, they compete on the world market for fairly homogeneous products. Such a setting should lead to total factor productivity (TFP) convergence. While multiple reasons to expect TFP convergence between the pulp and paper industries in Canada and U.S. are present, productivity performance of the industry may or may not be uniform even across regions within a country.

In this paper we analyze the productivity performance of the pulp and paper industries in Canada and the U.S. over the period extending from 1971 to 2005 by taking advantage of regional disaggregated data on four Canadian provinces—Alberta, British Columbia (BC), Ontario, and Québec—and on four U.S. states—Georgia, Illinois, Maine, and Washington. Canada and U.S. have huge forestlands that support diverse forestry due to soil and climate conditions, and hence the wood fiber supply differ significantly from one region to the next. Furthermore, most of the forestlands in Canada are owned by the provinces⁶ that have their own forestry regime to provide access to industrial uses, and that apply their own environmental regulations. In order to take the diversity of conditions at the regional level into consideration, we build our sample to include the four largest Canadian forestry provinces, and the U.S. states are selected to represent regional industry conditions as well as to represent the industry of similar size. The use of regional disaggregated data allows us to investigate whether the regional industries within a country follow a uniform path over the course of time. Moreover, this also allows us to investigate the presence of convergence in terms of TFP in the pulp and paper industry.

We supplement the North American regional level data with national data for two Nordic countries—Finland and Sweden. The inclusion of Finland and Sweden is justified in the sense that this gives us the opportunity to compare performances of the North American regions with those of others who are competing with them in the global market.⁷ Furthermore, the input mix is disaggregated into five components—labour, capital, materials, electricity, and other energies, which are mostly fossil fuels. To the best of our knowledge there are only three studies available that investi-

gate the productivity performance of the pulp and paper industry at regional levels in Canada (see Denny et al., 1981; Hailu, 2003; Shahi et al., 2011) and there is no empirical study that examines the performance of this industry at regional levels in U.S.

In order to estimate TFP, we employ two widely used methods of productivity measurement—the index number technique and the econometric estimation approach. With the index number technique we exploit an extension of the translog transitive multilateral productivity index by using the relationship between the price indexes of output and inputs and the translog cost function. The econometric approach involves estimating a translog system that allows non-neutral technical change. Following Jin and Jorgenson (2010) we decompose the TFP growth rate into autonomous and induced technical change components. The use of direct parametric estimation enables us to provide estimates of price elasticities and of factor biases to technical change. We also provide confidence intervals of our elasticity estimates.⁸

Keay (2000) provides Canada relative to U.S. TFP ratios for nine manufacturing industries covering the first ninety years of the twentieth century. He finds little evidence of productivity gap on behalf of the Canadian manufacturers and concludes that the Canadian manufacturers were equally productive as their U.S. counterparts during the sample period. The pulp and paper industry, which is by far the largest industry in his sample, displayed an above average performance.

Our findings do not support the productivity assessment of Keay (2000) for the pulp and paper industry when we compare the weighted average TFP levels of the four U.S. and four Canadian regions for the overlapping 1970–1990 period. TFP grew at a higher rate in the Canadian provinces after the 1988 Free Trade Agreement (FTA), and they almost closed the gap by 2005.⁹ Overall, Finland and Sweden had the best TFP growth performance while Illinois experienced the worst in this respect. Moreover, based on our results we find statistical evidence of productivity convergence taking place across the pulp and paper industries in the four U.S. states and the four Canadian provinces.

The rest of the paper is organized as follows. Section 2 provides a review of the existing literature. Section 3 presents the theoretical background of the productivity estimation approaches used in this study. Section 4 describes the dataset while Section 5 discusses the results. Finally, Section 6 adds some concluding remarks.

2 Literature review

Although the pulp and paper industry is of significant importance to the regional economies of several industrialized countries, there have only been a limited number of studies that look into the productivity performance of this industry using regional level data. Moreover, existing studies differ in terms of productivity measurement approaches, number and the measure of output(s) and inputs, and the coverage of sample periods. Denny et al. (1981) examine the growth rates of TFP for twenty Canadian manufacturing industries, including the paper industry, covering the period of 1961–75 in four regions of Canada—BC, Ontario, Québec, and the ‘Rest of Canada’. Their estimated annual TFP growth rates vary between 0.80–1.04 percent across regions. Hailu (2003) compares the TFP growth rates in four regions of Canada—Ontario, Québec, BC, and the Atlantic and

⁵ The R&D intensity of the Canadian pulp and paper industry was 0.6 percent in 2008.

⁶ Public forestland ownership in the four provinces in our sample ranges from 90 percent in Québec to approximately 100 percent in Alberta and BC.

⁷ According to FAO (2013), in 2011, both Finland and Sweden were among the top five leading paper and paperboard exporters in the world. They jointly account for 13 percent of global wood pulp production which places them among the top five producers in the world.

⁸ For a discussion on the importance of parameters of the elasticity of substitution and the direction of technical change, see León-Ledesma et al. (2010).

⁹ Bernard and Hussain (2017) compare the TFP performance of the pulp and paper industry in three contiguous Canadian provinces and U.S. states (BC/Washington, Ontario/Illinois, and Québec/Maine) for the period of 1971–2005. They find that a positive impact in favour of the three Canadian provinces is associated with the 1988 FTA and that the price of material played a role in this respect.

Download English Version:

<https://daneshyari.com/en/article/4759831>

Download Persian Version:

<https://daneshyari.com/article/4759831>

[Daneshyari.com](https://daneshyari.com)