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# Determinants of China's lumber import: A bounds test for cointegration with monthly data



Han Zhang<sup>a,d</sup>, Qing Zhao<sup>b</sup>, Jari Kuuluvainen<sup>c</sup>,  
Changhai Wang<sup>d</sup>, Shiping Li<sup>a,\*</sup>

<sup>a</sup> College of Economics and Management, Northwest A&F University, No. 3 Taicheng Road, Yangling 712100, Shaanxi, China

<sup>b</sup> School of Geomatics, Yangling Vocational & Technical College, No. 24 Weihui Road, Yangling 712100, Shaanxi, China

<sup>c</sup> Department of Forest Sciences, University of Helsinki, P.O. Box 27, 00014 Helsinki, Finland

<sup>d</sup> Rural Development Institute, Chinese Academy of Social Sciences, No. 5 Jianguomennei Avenue, Beijing 100732, China

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### ABSTRACT

This paper estimates the long- and short-run demand equations for imported lumber based on classical production theory. Chinese monthly data from January 2000 to December 2013 are used. To account for the mixed integrated orders of variables and to control for the potential endogeneity, the bounds testing approach for cointegration is employed within an autoregressive distributed lag framework. The results show that there exists a long-run cointegrating relationship between China's lumber import and some specific explanatory variables. In the long run, the import demand is found to be elastic with respect to the lumber import price and a macroeconomic shifter at the 5% statistical level. Imported lumber seems to be a complement to other input factors, but the effect is not statistically significant. As expected, the short-run price and income elasticities are smaller in absolute terms than their long-run counterparts. The projection indicates China's future lumber imports will probably keep growing, but with a slower annual growth rate than observed in the past.

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\* Corresponding author. Tel.: +86 18220826522.

E-mail address: [lishiping32@126.com](mailto:lishiping32@126.com) (S. Li).

## Introduction

Since 2010, China has become the world's largest importer of lumber. China's lumber import has climbed quickly from US\$1.2 billion (5.5 million m<sup>3</sup>) in 2003 to \$6.8 billion (24.0 million m<sup>3</sup>) in 2013, with a corresponding growth in world market share from 4.6% to 19.3% (United Nations, 2015). Along with the rapid increase in lumber import, China's domestic production of lumber has also experienced a period of growth at an even higher speed, and it has surged from 11.3 million m<sup>3</sup> in 2003 to 63.0 million m<sup>3</sup> in 2013 (State Forestry Administration, 2015). The interesting "double soaring" appearance reflects China's flourishing demand for lumber, which is mainly fueled by its booming economic development and the roaring exports of forestry products as the "world factory" mid-stream of the global value chain (Zhang and Buongiorno, 2012). The number of sawmills in China was estimated to be approximately 915 in 2012, of which 72.5% are private-owned, with the top four enterprises accounting for approximately 8.5% of total industry revenue (IBIS, 2012). In recent years, a highlighted and remarkable phenomenon is the growing presence of Chinese-owned sawmills in countries with abundant forest resources. By the end of 2013, China had 164 forestry investment and cooperation projects located in 18 countries (72% in Russia), among which 5.78 million and 37.68 million hectare forestlands have been purchased and rented, respectively (State Forestry Administration, 2015).

However, quantitative information on price and income elasticities of China's lumber import is still very limited. This information is of special interest not only to Chinese decision makers but also internationally. For example, China's large amount of lumber imports has raised international criticism for environmental reasons (Environmental News Network, 2007; Zhang et al., 2012). In modern international economics theory, trade elasticities play critical roles in economic forecasting and international economic policy analysis on things such as the effects of exchange rate fluctuations and policy interventions (Houthakker and Magee, 1969; Marquez, 2002). A core issue behind many international economic policy debates, political factors aside, is the different beliefs in the magnitude of trade elasticities (Hong, 1999). Therefore, the objective of this paper is to investigate the determinants of China's lumber import demand, with a special focus on the long- and the short-run effects of price and income. To this end, a monthly data set on China's lumber import volume, prices and a variable describing economic activity from January 2000 to December 2013 is collected. Using the bounds testing approach and the autoregressive distributed lag (ARDL) model in a cointegration framework, long- and short-run price and income elasticities of China's lumber import demand are estimated.

There are a plethora of studies on the determinants of import demand in different countries. Only those studies that are related to lumber import demand are considered here. Formal econometric estimation of lumber import demand elasticities began around the 1970s and followed two main constituents. The first studies have not accounted for the presence of non-stationary residuals and spurious regression. These studies include the work of Buongiorno et al. (1979), Adams et al. (1986), Lewandrowski et al. (1994), Myneni et al. (1994), and Bernard et al. (1997), among others. The most frequently used econometric technique to estimate the elasticities in these papers is ordinary least squares (OLS). However, the results of these different studies cannot be compared because they cover a broad variety of commodities and countries, and also vary greatly in time span and data frequency. To find common information on elasticities across countries, panel data analysis was conducted in Turner and Buongiorno (2004).

The other group of studies is based on cointegration theory and has become prosperous in recent years. Baek (2012) adopted the Phillips–Hansen fully modified ordinary least squares (FM-OLS) to examine the long-term determinants of U.S. lumber imports from Canada. Nagubadi and Zhang (2013) and Babula et al. (2013) used a vector autoregression (VAR) based Johansen cointegration test to revisit the same question. Instead of single equation specifications as in the above three papers, Song et al. (2011) established a simultaneous demand-supply system for the U.S. softwood lumber market, where the price was treated as an endogenous variable. A residual based augmented Dickey–Fuller (ADF) test was applied to examine the existence of cointegration.

Despite the differences in treating the time series properties of data, both of the above two constituencies consider the import demand for forest products in the context of classical production theory. Within this framework, the derived lumber demand can be expressed as a function of a macro-economic driver, the import price and domestic substitutes measured in the same currency. We have

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