The United States-Canada Softwood Lumber Agreement 2006: An Actual Versus Optimal Export Tax

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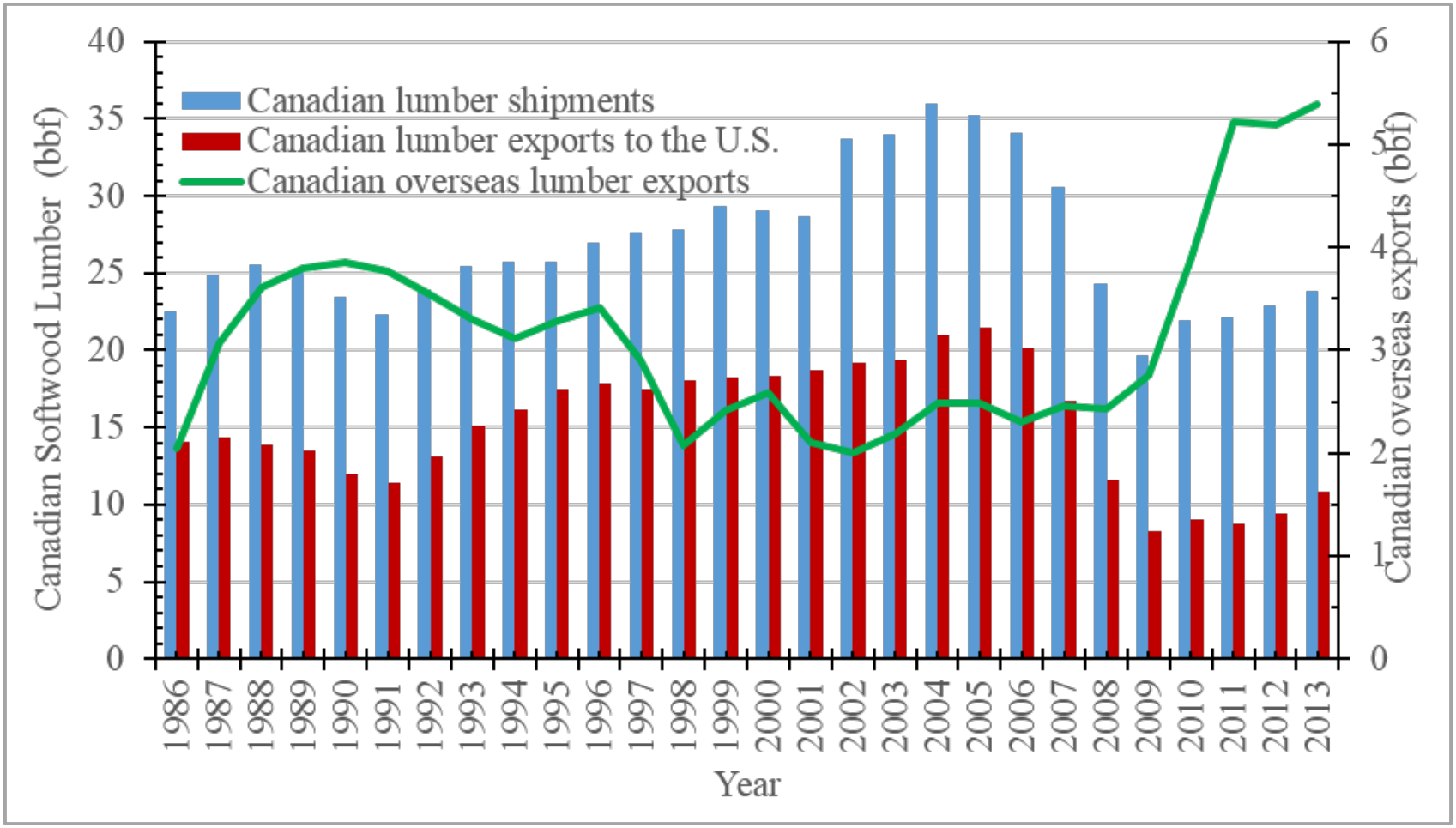
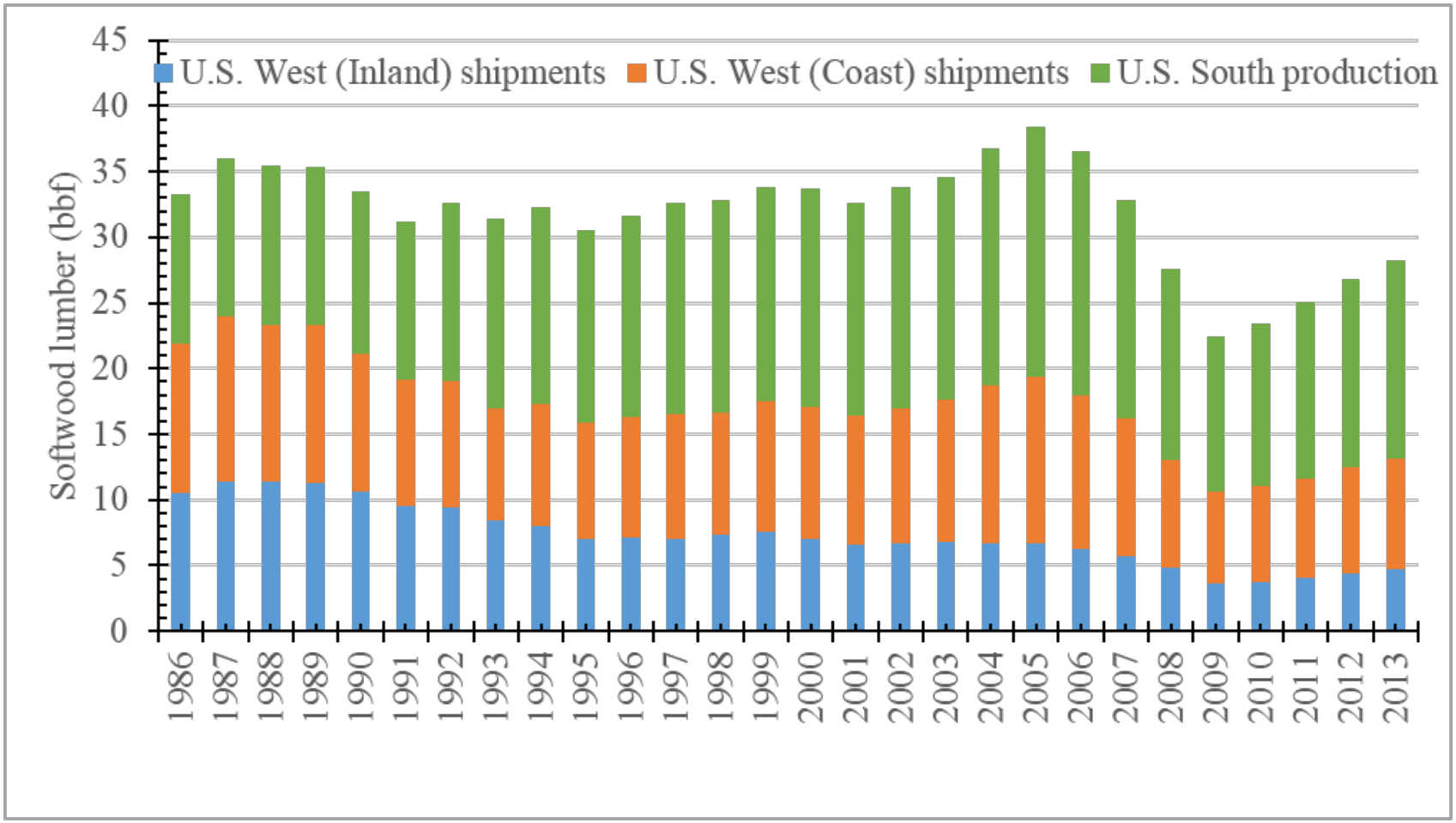
Softwood lumber production in Canada



Canada exports more than two-thirds of its domestic production to foreign markets

(Data: Random Lengths)

Softwood lumber production in the U.S.



The U.S. produces annual average of 30 bbf softwood lumber (Data: Random Lengths)

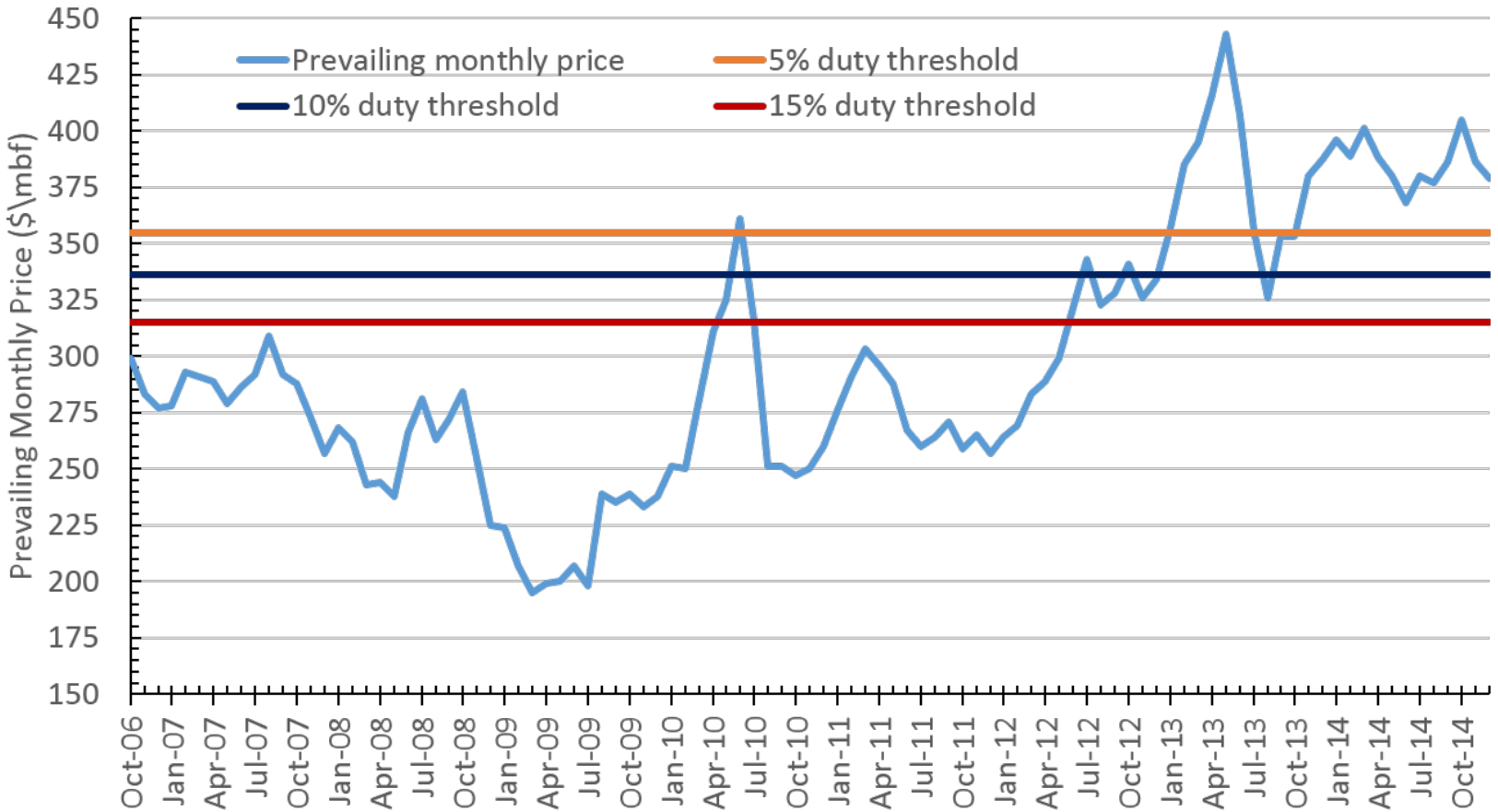
Softwood Lumber Agreement (SLA) 2006

Prevailing monthly price*	Option A (Alberta and BC)- Export tax as a % of price)	Option B (Manitoba, Saskatchewan, Ontario and Quebec)- Export tax as a % of price, with export allocation
Over $US 355	No export charge	No export charge and no volume restraint
$US 336-355	5%	2.5% export charge + export volume to the US cannot exceed the region's share of 34% of expected US consumption for the month
$US 316-335	10%	3% export charge + export volume to the US cannot exceed the region's share of 32% of expected US consumption for the month
$US 315 or under	15%	5% export charge + export volume to the US cannot exceed the region's share of 30% of expected US consumption for the month
***Four-week average of random lengths framing lumber composite price**		

The export tax is a function of the monthly lumber price

The prevailing lumber price and Export tax

Prevailing monthly price= four-week average of RL Framing Lumber composite price available three weeks before.



Is SLA 2006 effective?

- Mixed findings are reported on the effectiveness of SLA 2006 to limit the Canadian lumber exports to the U.S.
- To investigate whether the export tax rate of 0-15% is economically optimal, i.e. is it too high or too low?
- To determine the optimal export tax under the framework of SLA 2006 and uncover empirical evidence supporting our theoretical insights.

The two-stage game

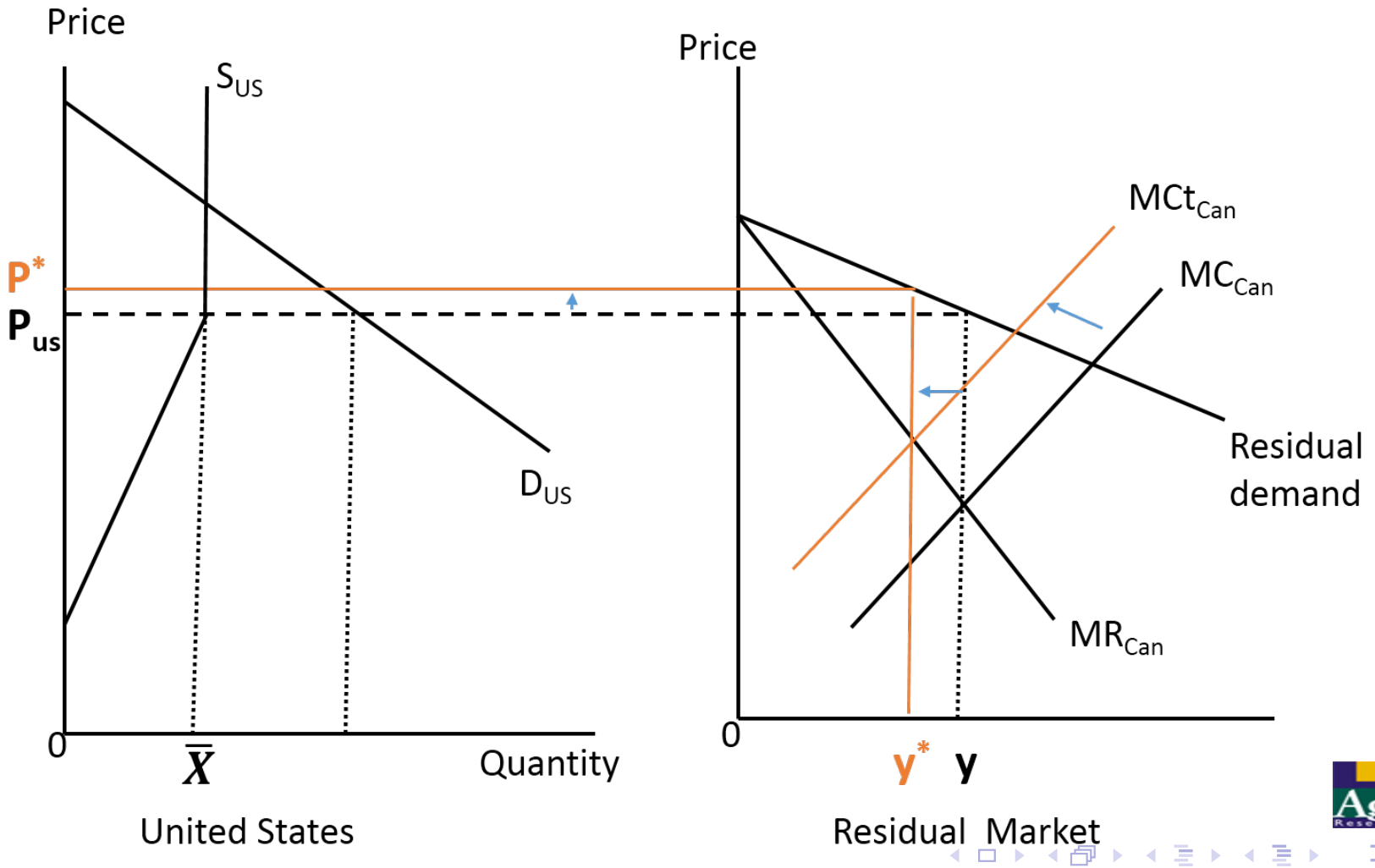
- We consider strategic aspects of trade policy to set up a two-player sequential game of the softwood lumber trade between the U.S. and Canada.
- We develop a two-stage game of the softwood lumber trade in which the U.S. is assumed as the home country and Canada as the foreign country.

The two-stage game

- The U.S. has a capacity constraint in domestic softwood lumber production, and can produce only $\overline{x}$ amount of lumber at its full capacity.
- In the residual demand portion of the softwood lumber market in the U.S., Canada acts as a monopolist and exports y quantity of softwood lumber.

The two-stage game

Market demand and Residual demand of softwood lumber in the U.S.



The two-stage game

Two Stages:

1. Canada and the U.S. negotiate and set the level of export tax t imposed on the Canadian lumber shipments to the U.S. While the U.S. is no longer able to alter its level of the production above $\overline{x}$, the U.S. uses the rate of export tax t as a bargaining tool.

2. Assuming t as given, Canada maximizes the monopoly profits in the residual portion of the U.S. softwood lumber demand.

The two-stage game

- Let the linear inverse demand function be

$$P = P(Q) = a - b(\overline{x} + y) \tag{1}$$

  where a and b are demand parameters and always positive.

- Suppose a **sequential**-form game of perfect information with $N = 2$ and the strategy space of the U.S. firm is $[0, \overline{x})$ and Canadian firm has $[0, \infty)$.

The two-stage game

Using the standard backward induction method, the second stage is:
The profit function of the Canadian firm is specified as:

$$\pi_{ca} = (1 - t)y(a - b\overline{x} - by) - c_{ca}y \tag{2}$$

Solving the FOC of condition (2) for the level of Canadian softwood lumber (y) results in:

$$y^m = \frac{a - b\overline{x}}{2b} - \frac{c_{ca}}{2b(1 - t)} \tag{3}$$

$$P^m = \frac{a - b\overline{x}}{2} + \frac{c_{ca}}{2(1 - t)} \tag{4}$$

The two-stage game

In the first stage, two governments negotiate and set the optimal t under which U.S. maximizes the domestic social welfare. The total U.S. social welfare (consumer surplus and producer profit) is:

$$G(US) = \frac{1}{2b}\left[\frac{a+b\overline{x}}{2} - \frac{c_{ca}}{2(1-t)}\right]^2 + \overline{x}\left[\frac{a-b\overline{x}}{2} + \frac{c_{ca}}{2(1-t)} - c_{us}\right] \tag{5}$$

Solving the FOC of condition (5) for the optimal export tax results in:

$$t^* = 1 - \frac{c_{ca}}{a-b\overline{x}} \tag{6}$$

The two-stage game

Remark 1: The optimal rate of the export tax is mainly determined by linear demand parameters, the U.S. softwood lumber production capacity, and the per unit lumber production costs in Canada. The higher the magnitudes of the U.S. production capacity and the Canadian lumber production costs, the lower the level of the export tax.

Empirical estimation: the optimal export tax

$$t^* = 1 - \frac{c_{ca}}{a - b\overline{x}}$$

In order to estimate the linear demand parameters a and b, the aggregate reduced-form lumber price equation is specified as:

$$p_t = \alpha_0 + \alpha_1(\overline{x}_t + qc_t) + \alpha_2 pb_t + \alpha_3 xc_t + \alpha_4 ws_t + \alpha_5 wc_t + \alpha_6 h_t + \alpha_7 nov_t + \alpha_8 dec_t + \alpha_9 jan_t + \alpha_{10} feb_t + \alpha_{11} p_{t-1} + \alpha_{12} p_{t-2} + \cdots + \alpha_{22} p_{t-12} + \epsilon_t \quad (7)$$

Empirical Estimation

Variables, their descriptions and sources [2006:10–2013:12]

Variable	Description	Source
p_t	Lumber composite price[a]	Random Lengths[b]
qc_t	Canadian lumber exports to the U.S.	Random Lengths
$coex_t$	Canadian overseas lumber exports	Random Lengths
vc_t	Canadian lumber inventory	Random Lengths
x_t	U.S. domestic lumber production: sum of production from U.S. South, U.S. West (Inland and Coast)	Random Lengths
Uti_t	Capacity utilization rate of NAICS 321-1	U.S. Census Bureau
$\overline{x}_t$	U.S. softwood lumber production capacity	x_t / Uti_t
pb_t	Price index of common building bricks	U.S. BLS
xc_t	Canadian-U.S. dollar exchange rate	USDA Economic Research Service
ws_t	Wage rate of U.S. sawmill workers	U.S. BLS
wc_t	Wage rate of Canadian sawmill workers	Statistics Canada
h_t	Housing starts in the U.S.-seasonally adjusted annual rate	U.S. Census Bureau
cca_t	Softwood lumber production costs in B.C. interior	RISI Info

[a] Random Lengths lumber composite price

[b] Various monthly issues of Random Lengths Yardstick (2006-2013)

[c] U.S. Department of Labor, Bureau of Labor Statistics

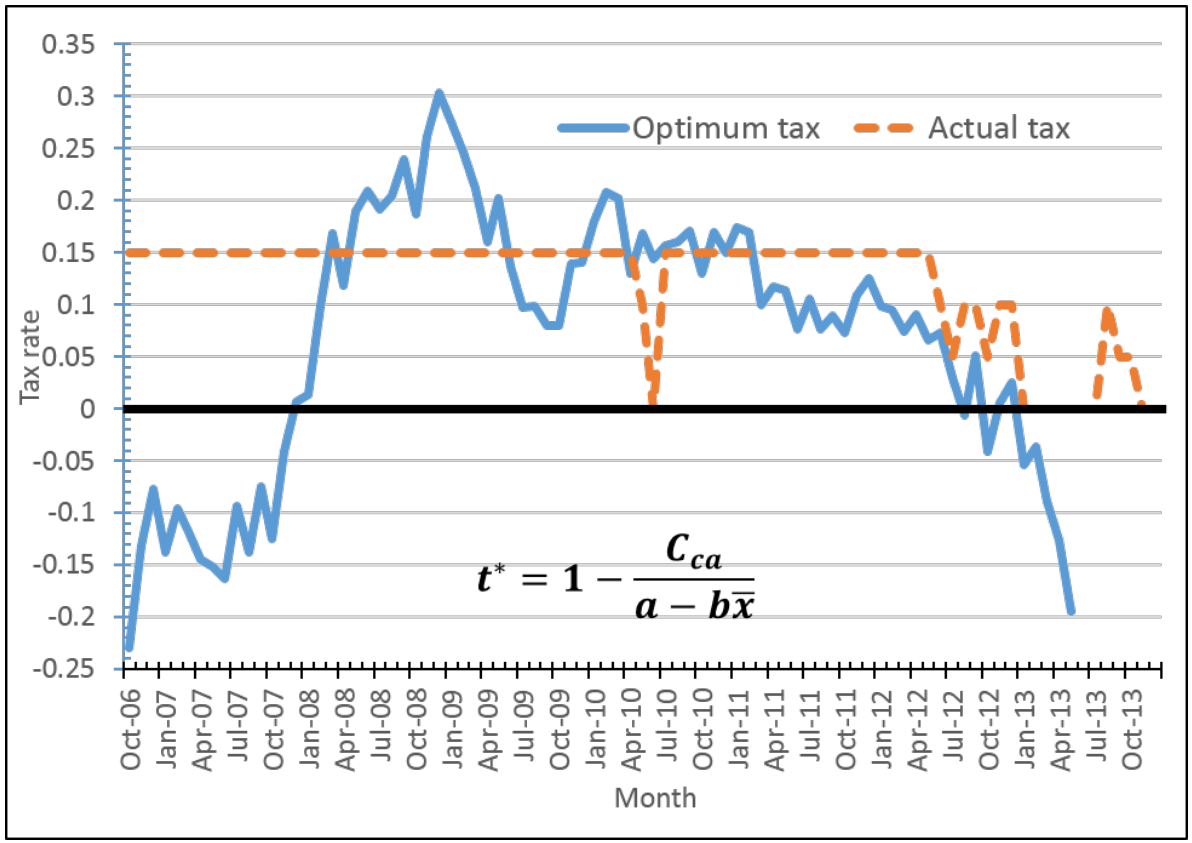
Empirical Estimation

LIML results of the softwood lumber price equation

Variable	Coefficient estimate	Std. error
Intercept ($\widehat{a}$)	167.185**	73.42
U.S. production Capacity + Canadian export supply ($\widehat{b} = \overline{x}_t + qc_t$)	0.0126**	0.006
U.S. price of bricks (pb_t)	−1.286**	0.32
U.S.-Canada dollar Exchange rate (xc_t)	−65.046**	22.41
U.S. wage rate (ws_t)	13.556**	3.55
Canadian wage rate (wc_t)	0.272	0.37
Housing starts (h_t)	0.012*	0.006
First lag of lumber price (p_{t-1})	0.990**	0.10
Second lag of lumber price (p_{t-2})	−0.337**	0.09
November	7.835**	3.80
December	9.365**	4.78
January	5.209	4.07
February	8.527*	4.51
R-squared	0.89	
External instruments	2	
First-stage Cragg-Donald F-statistics	10.93	
Test of overidentifying restrictions [P-value]	0.037[0.85]	
Portmanteau (Q) test for white noise at 12 lags [P-value]	12.21[0.43]	
The residual based ADF test [P-value]	−5.90[0.00]	

Empirical Estimation

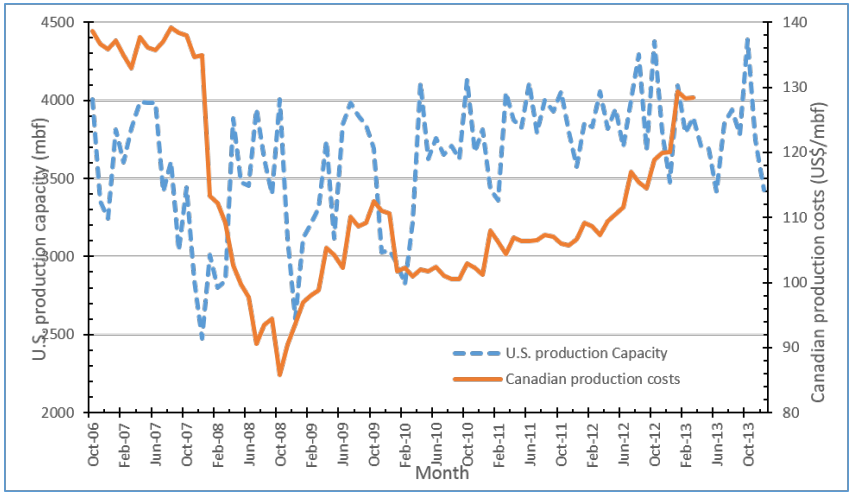
The monthly optimal export tax ranges widely from -23% to 30%. It is about 15% most of the months.

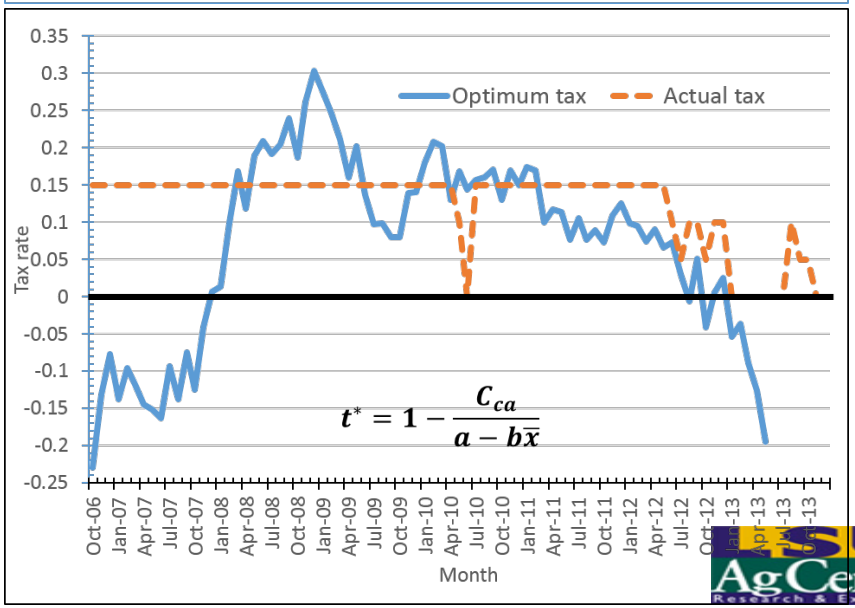


Empirical Estimation

$$t^* = 1 - \frac{c_{ca}}{a - b\bar{x}}$$

- Since a and b are constants, c_{ca} and $\bar{x}$ are the major determinants.
- $\bar{x}$ doesn't change substantially; so c_{ca} is most important.





Conclusions

- The optimal export tax is mainly determined by the level of Canadian lumber production costs and the U.S. lumber production capacity.
- The empirical estimation reveals that the monthly optimal export tax ranges widely from -23% to 30%.

Conclusions

The level of Canadian lumber production costs, i.e. the efficiency level of the Canadian saw-mill industry is found to be the major determinant of the optimal export tax.

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