Federal Timber Restriction Impacts on U.S. Softwood Planting – Dynamics and Investments in Forest Carbon Leakage

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INTRODUCTION

In this research, we discuss how federal timber restrictions in the Pacific Northwest could impact softwood planting in the South and how the changed planting can influence the carbon leakage calculations. Results indicate that higher timber prices would increase planting. And the timber harvest restrictions in the late 1980s has an immediate stimulus effect on planting in the South. In the long term, the negative carbon leakage would completely be abated by the gain in carbon on newly planted stands.

BACKGROUND

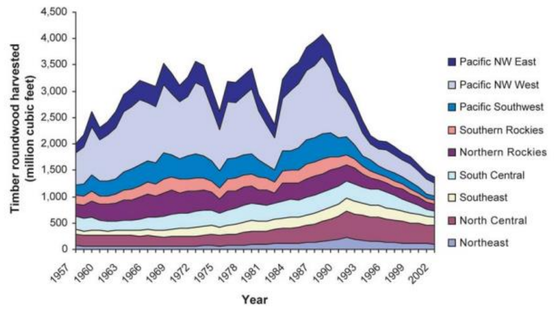
LEAKAGE

- Leakage occurs when a shock in one segment of a market occurs, causing a change in the incentives that market actors see in other segments of the market. (Murray et al., 2007)
- In the case of carbon emissions, leakage is particularly problematic because any regulations imposed in one region could reduce timber output there but encourage an increase in output in unregulated regions.

THE NORTHWEST FOREST PLAN

- For over a century, the federal forests provided a significant share of the trees harvested in the Pacific Northwest region.
- From late 1980s, the primary management goal for federal lands became conserving biodiversity.
- To protect the northern spotted owl, a federal court enjoined a large share of the national forest timber sale program in the Pacific Northwest region in 1989.
- The policy dramatically reduced timber harvests on federal lands in Oregon and Washington, which at the time provided over 30% of total softwood timber harvests in the US. (Figure 1)
- In the long run, higher prices are expected to induce planting of new forests.

Figure 1: Total public harvest by region, 1957-2002



METHOD

- Our goal is to test whether the policy shift toward lower long-term supplies of timber from federal lands encouraged new planting in the US South.
- To test this, we model the area planted in Southern US counties (Y_{it}) as a function of timber prices in the Pacific Northwestern US (PNW_t), timber prices in the Southern US (P_{it}), time stage fixed effects (T), County fixed effects ($County$), market variables (M_{it}), and climatic variables ($Climate_{it}$):

$$Y_{it} = \alpha_0 + \beta_1 P_{it} + \beta_2 P_{it} \times T + \beta_3 PNW_t + \beta_3 PNW_t \times T + \beta_5 Climate_{it} + \beta_6 M_{it} + T + County + \varepsilon_{it}$$

- We include 5 stages in the time stage fixed effects variable (T). We assume that the period over which planting increased due to the harvest restrictions lasted from 1989 to 1996.
- Additional fixed effects are included for the period before 1982, 1982-1988, 1997-2008, and post 2008.
- Both $P_{it} \times T$ and $PNW_t \times T$ control for the possible influence of confounding factors.
- Since the price effect could vary in different time stages, we add the interaction term to make sure the time-stage fixed effect can reflect the policy impact.
- We then calculated the short-term and long-term carbon leakage in the southern US from 1989.

DATA

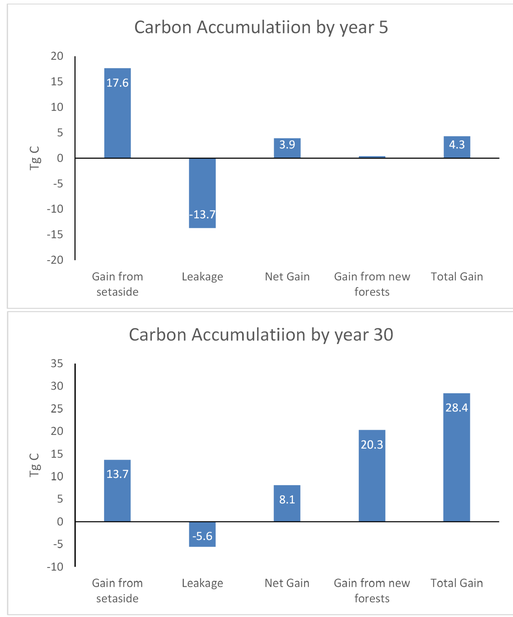
- We construct a panel dataset that covers 537 counties from seven states in the Southern US.
- Plot-level observations from the Forest Inventory and Analysis dataset (FIA) are used to determine the total planted area on a county basis from 1978 to 2014.
- Climate inputs, are collected from the Prism Climate Group (2019) and aggregated to the county level.
- County-level agricultural prices and production for corn and soybeans are collected from USDA-NASS archives to calculate annual gross revenue for each crop

RESULTS

Table 1: The impact of market and climate factors on planting area

	OLS		Robust OLS	
	Coef.	Std. err.	Coef.	Std. err.
Year 82-88 × price (PNW)	-0.768	(1.523)	-0.968	(1.528)
Year 89-96 × price (PNW)	-1.974**	(0.975)	-1.593	(0.978)
Year 97-08 × price (PNW)	-0.901	(1.239)	-0.884	(1.243)
post 2008 × price (PNW)	0.969	(1.991)	2.093	(1.998)
Year 82-88 × price (South)	8.313	(10.414)	0.084	(10.447)
Year 89-96 × price (South)	-24.001**	(9.950)	-36.460***	(9.982)
Year 97-08 × price (South)	-15.266	(9.843)	-28.961***	(9.874)
post 2008 × price (South)	-40.420***	(15.059)	-65.492***	(15.107)
Sawtimber price (PNW)	2.148**	(0.935)	1.736*	(0.938)
Sawtimber price (South)	26.928***	(9.161)	33.988***	(9.190)
Annual precipitation	5.876	(4.149)	4.644	(4.163)
Average temperature	1143.322***	(100.949)	1171.823***	(101.272)
Annual precipitation^2	-0.020	(0.018)	-0.015	(0.018)
Average temperature^2	-31.832***	(2.897)	-32.523***	(2.906)
Real oil price	-1.494	(0.971)	-1.924**	(0.974)
Annual interest rate	7.141	(7.823)	7.726	(7.848)
Revenue (Corn, $/acre)	-0.577**	(0.236)	-0.503**	(0.237)
Revenue (Soybean, $/acre)	1.027**	(0.457)	0.993**	(0.458)
Year 82-88	204.141	(323.784)	292.245	(324.818)
Year 89-96	972.329***	(291.909)	1081.088***	(292.843)
Year 97-08	576.867	(353.208)	834.732**	(354.337)
post 2008	1176.800**	(489.890)	1552.680***	(491.456)
Constant	-7211.243***	(904.762)	-7256.645***	(907.654)
Observations	14948		14948	

Figure 2: Short-term leakage calculated from 1989-2004 and long-term leakage calculated from 1989-2019



CONCLUSIONS

- The harvest restriction in the Pacific Northwest region has a significant positive impact on softwood planting in the Southern US.
- The price impact on planting varies over time.
- Temperature has a significant impact on planting while precipitation does not, and the most suitable temperature for planting is around 17.7 degrees Celsius.
- In the long run, the leakage effect could be compensated by planting.

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