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Haute école de gestion
Genève

The Swiss market for construction wood: estimating elasticities with time series simultaneous equations

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Motivation

Construction wood and climate change

- Carbon sequestration in wood products and wood building
- Lower CO2 emissions than other materials such as concrete, cement or steel
- Swiss forest grows → potential for more exploitation

Economic health of the Swiss forest sector

- No financial incentives for more wood mobilization (price too low)
- Forest industry is already subsidized or public owned and may therefore target a given revenue, rather than target profit (Farsi and Krähenbühl, 2015)

Policy relevance

Is supply and demand for construction wood sensitive to price changes and thus to financial incentives?

Would subsidies increase the Swiss wood supply and its use in the building sector?

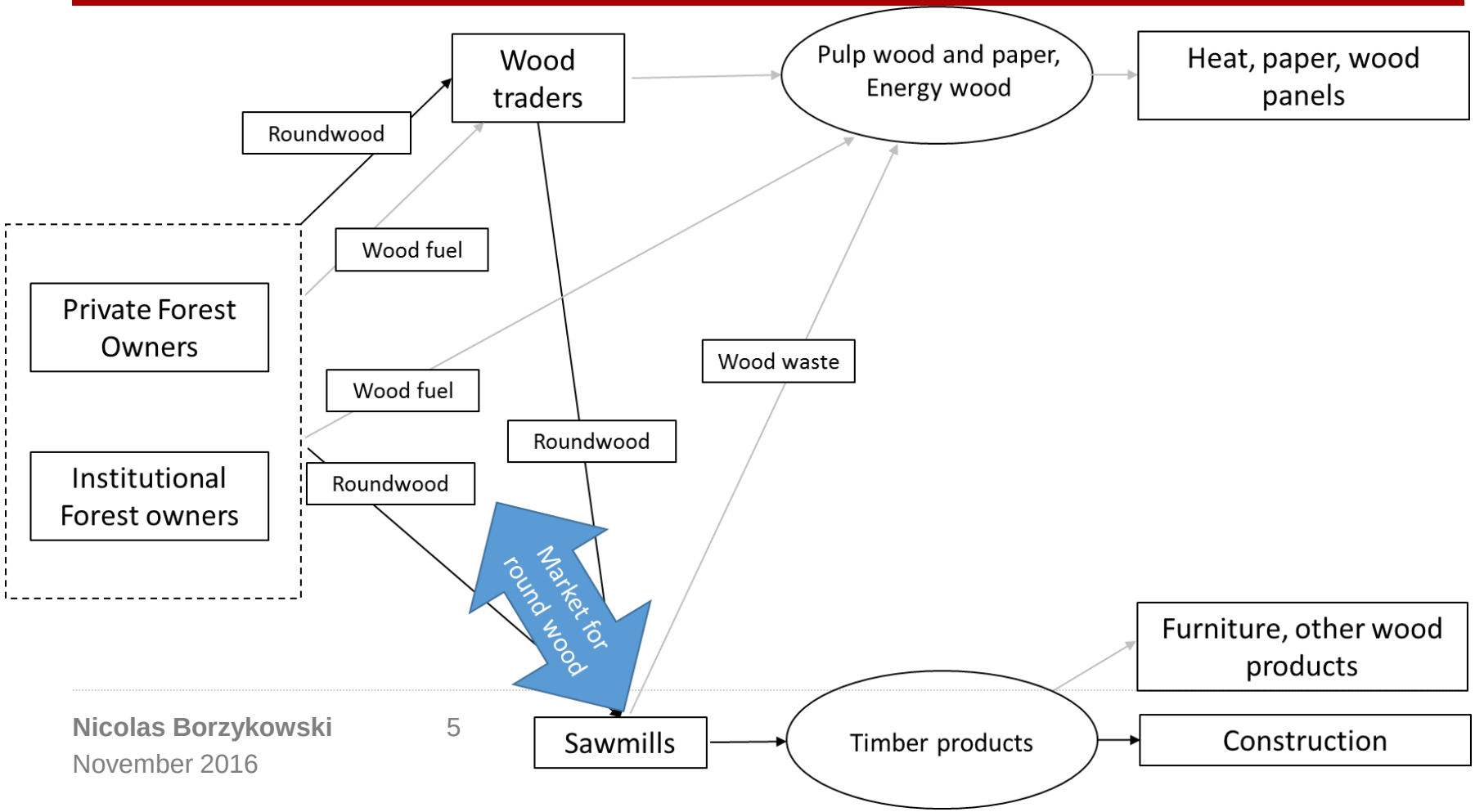
Previous researches

Most research on North-America and Scandinavian countries (Buongiorno) in the 80's mostly

More recently

- Song et al. (2011) find price-inelastic demand and supply for softwood lumber in the US.
- Iriarte-Goñi and Ayuda (2012) find different elasticities for construction wood along time in UK.
- Kristöfel et al. (2016), on wood pellet (energy wood), finds a low demand elasticity and unitary supply elasticity

The Swiss wood market



Data

Time series (1947-2013 → 66 annual macro-observations)

- Non-stationary time series imply that the Error Correction Model (Engle and Granger, 1987) needs to be estimated if series are co-integrated, to avoid spurious regression.
- 2 steps
  1. Long run model on variables' level
  2. Short term model on variables first differences, which includes the lag of the residuals of the long run model (error correction term)

Endogeneity

- Price and quantities are simultaneously determined
- Endogeneity implies that a system of simultaneous equations needs to be estimated : Demand and Supply
- Estimated by 2SLS or 3SLS (~to an instrumental regression)
- Both together acknowledged since Hsiao (1997)

Long run model

$$\begin{cases} Q_t^D = & \alpha^D + \beta_1^D P_t + \beta_2^D P_{t-1} + \beta_3^D Psubs_t + \beta_4^D Investment_t + \beta_5^D T_t + \epsilon_t^D \\ Q_t^S = & \alpha^S + \beta_1^S P_t + \beta_2^S P_{t-1} + \beta_3^S Wage\ in\ forestry_t + \beta_4^S Penergy_t + \beta_5^S Vivian90_t + \beta_6^S Lothar00_t + \epsilon_t^S \end{cases}$$

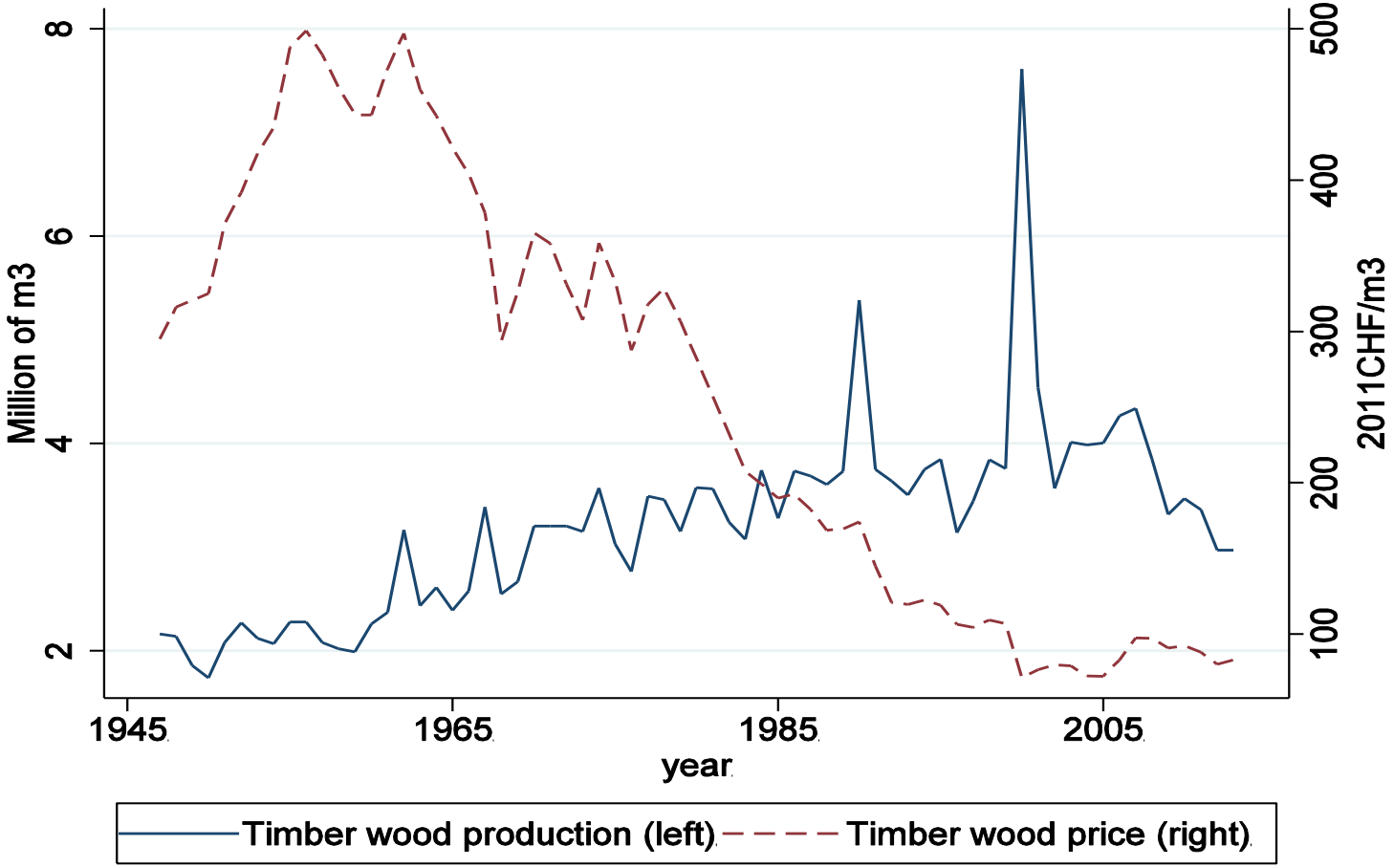
Demand variables

- Price (weigthed average)
- Lag of price
- Price of steel (substitute)
- Investment in construction
- Time trend

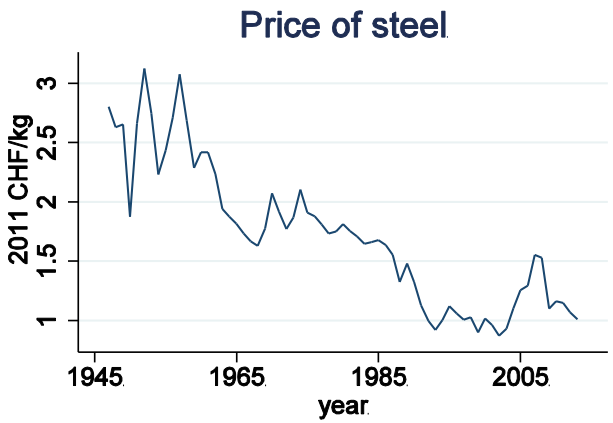
Supply variables

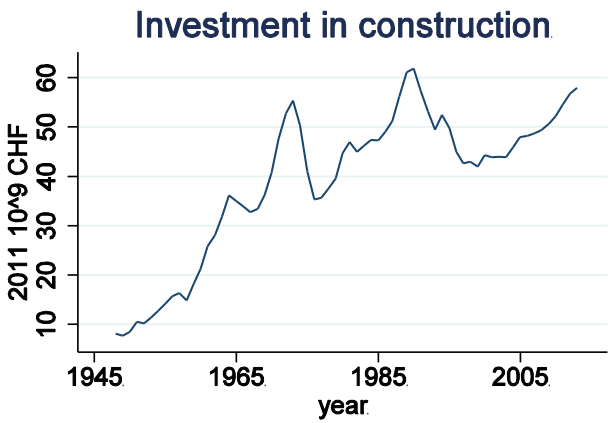
- Price
- Lag of price
- Wage in forestry (price of the labor input)
- Price of energy wood (substitute or complement in production)
- Hurricane Vivian and Lothar (dummies)

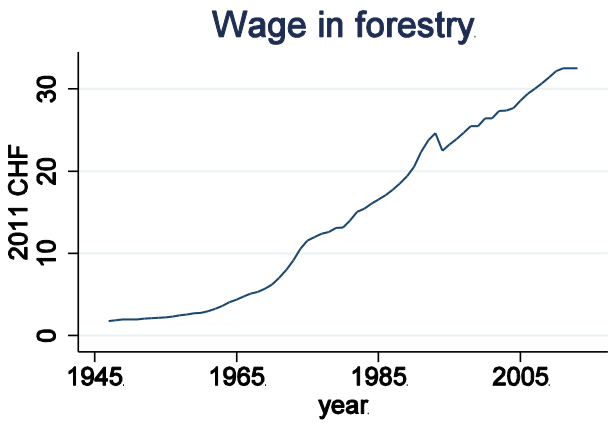
Endogenous variables

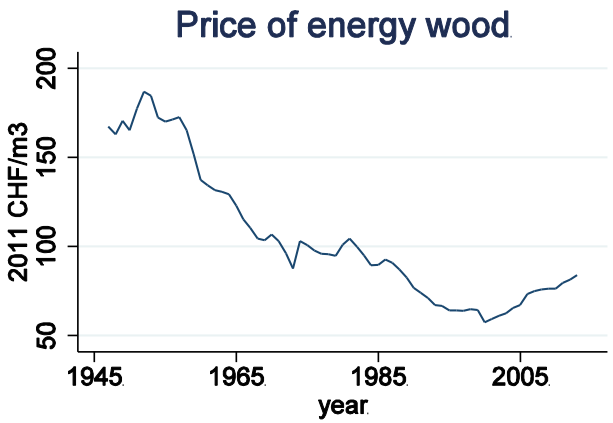


Covariates


Price of steel
2011 CHF/kg
1
1.5
2
2.5
3
1945
1965
1985
2005
year


Investment in construction
2011 10^9 CHF
10
20
30
40
50
60
1945
1965
1985
2005
year


Wage in forestry
2011 CHF
0
10
20
30
1945
1965
1985
2005
year


Price of energy wood
2011 CHF/m3
50
100
150
200
1945
1965
1985
2005
year

Structural breaks

Long time series come with a number of structural breaks.

Breaks on levels (change in constant) are easy to handle by adding a dummy

Breaks on regimes (change in slope) → endogeneous variable x2 → intruments x2

Tests:

Supremum Wald test on P as unique variable: **regime break in 1962**

Gregory and Hansen test: : **level breaks in 1991, 2000** (Vivian, Lothar) and **regime breaks in 1996 and 1998.**

Clemente et al. (1998) test: **level breaks in 1968 and 1977**

We present the model with no breaks but accounting for natural hazards since results of other models do not differ significantly.

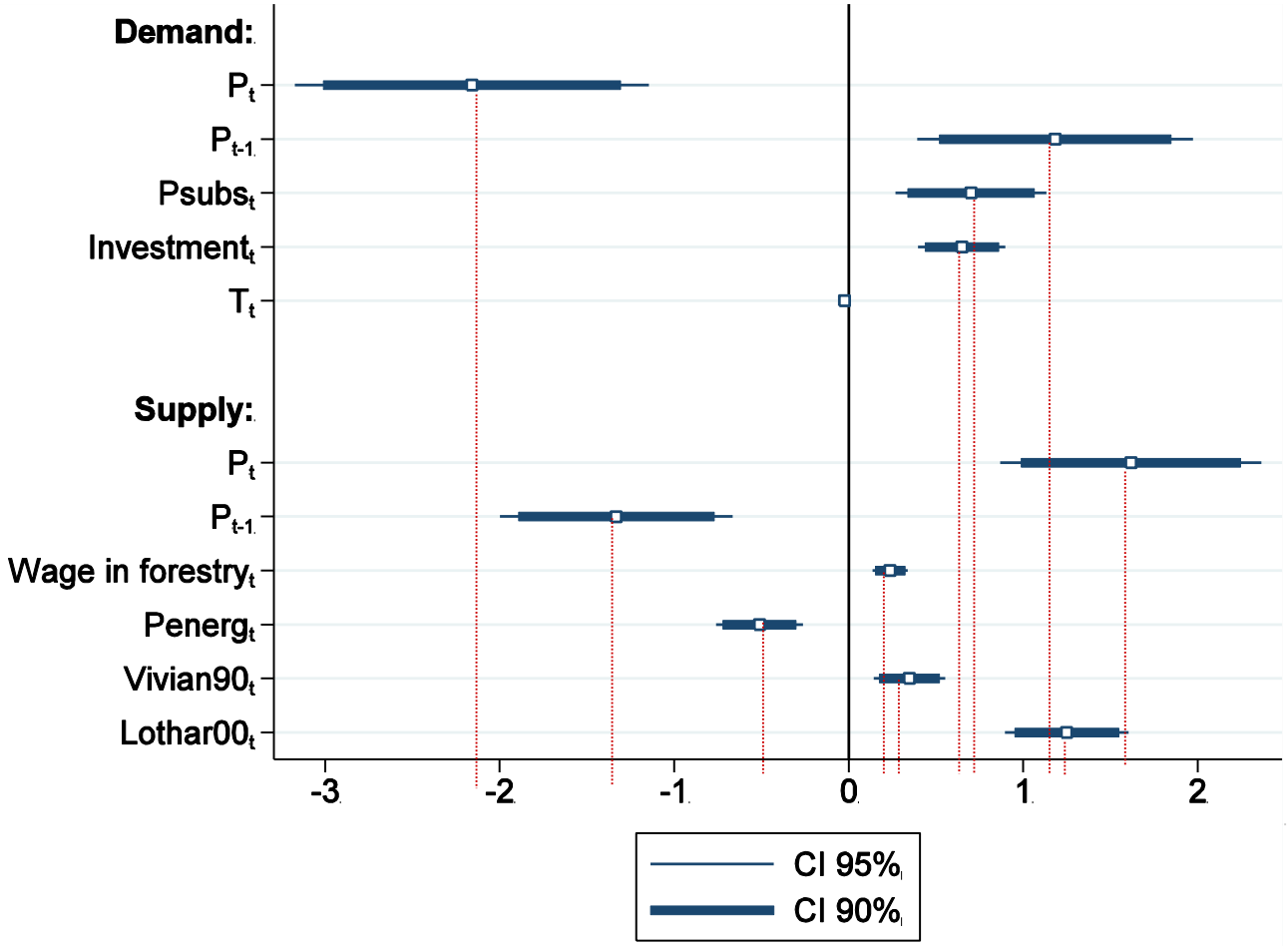
Tests linked with endogeneity

Are instruments strong?

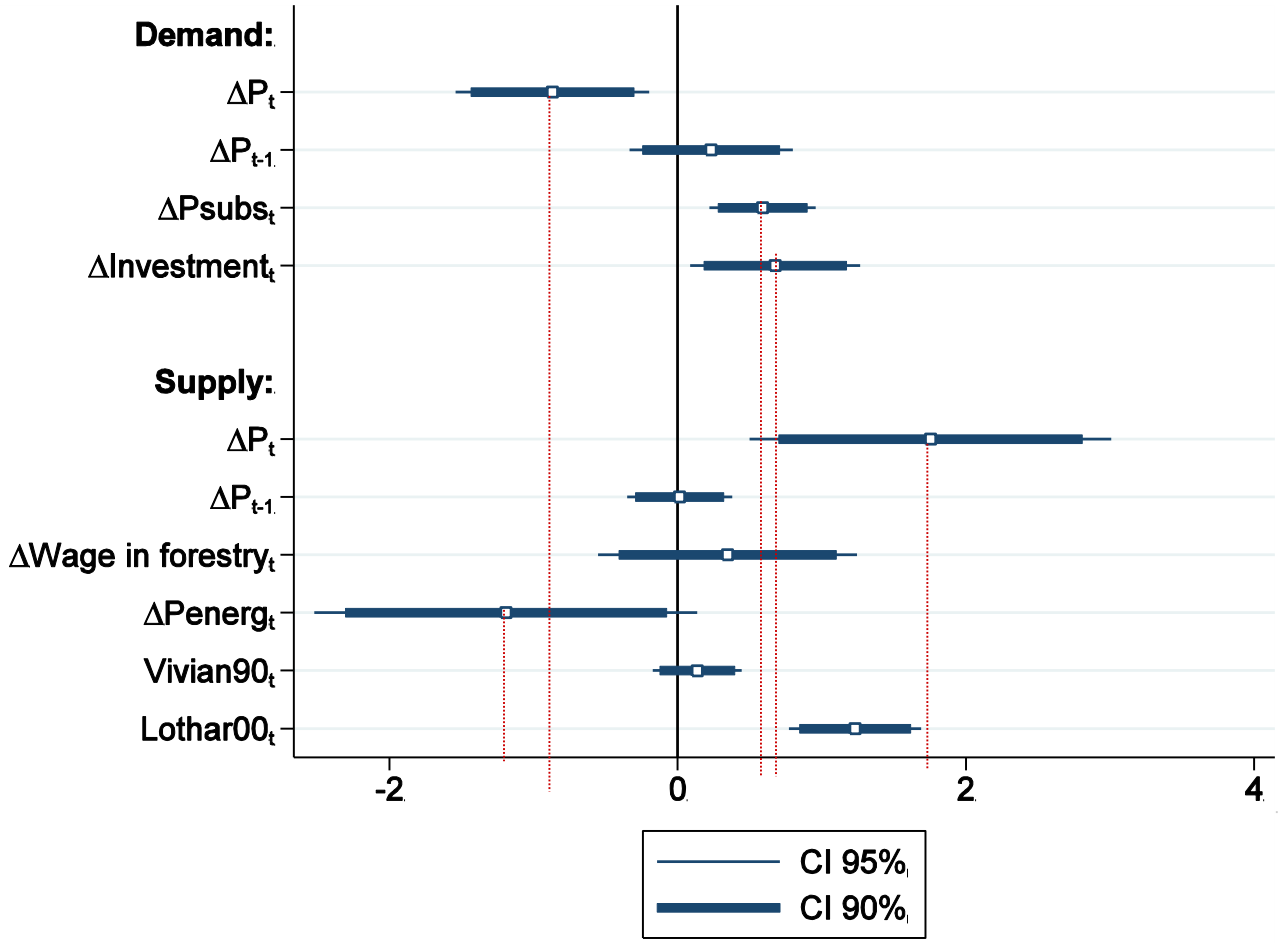
- OLS F-statistic for the first stage of the 3SLS is higher than 10 (rule of thumbs)
- But low Cragg-Donald F-statistic provided by the command *ivreg2*
  - 20- 30% maximal IV relative bias
- Equations are not underidentified
- Sargan test for overidentification gives mixed results

Equations may be overidentified and instruments are not very strong (although not completely weak)…

Results: Long run



Results: Short run



Conclusion

- **Supply and demand are responsive to price changes**
  - Financial incentives can therefore be effective in increasing the provision and use of wood in the building industry
  - This would lead to increased CO2 sequestration and lower CO2 emissions than using concrete or steel

- **Policies aiming at promoting the use of energy wood may be counterproductive**
  - Producers tend to substitute construction wood for energy wood if the relative price is too low. Indeed, marginal costs are lower for the energy wood production and profit may be higher with energy wood production.

Refinements

- International trade
- Product heterogeneity
- Use heterogeneity
- Price of capital?

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Thank you for your attention!

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