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SCIENCE AND EDUCATION FOR SUSTAINABLE LIFE

# Worldwide share of Cut-To-Length harvesting method and explaining factors

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This is a study within the PhD studies of Mikael Lundbäck. The co-authors of this presentation, me (Tomas Nordfjell) and Carola Häggström are supervisors

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# Purpose

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- Explain important reasons for the fully mechanized cut-to-length harvesting method (CTL) to be chosen

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- Explain important reasons for the fully mechanized cut-to-length harvesting method (CTL) to be chosen

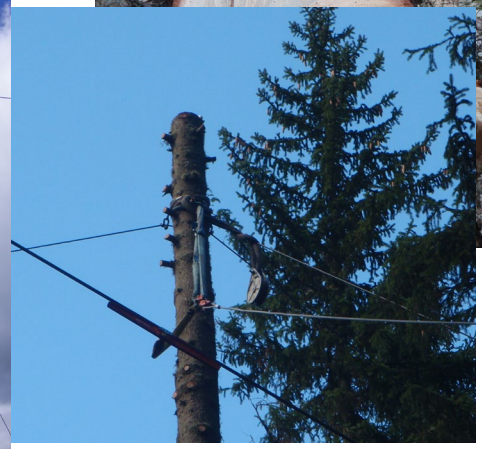
The study is limited to 32 of the dominating wood producing countries that in total harvest about 75% of the total industrial roundwood in the world

# Three groups of methods

## Fully Mechanized CTL

# Fully mechanized FT/TL

# Others



# Results

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**37%** of this wood is produced with fully mechanized CTL

**33%** with fully mechanized FT/TL technique, and the remaining **30%** is produced with other technique, that might be partly mechanized CTL or FT/TL, sky-line, helicopter or manual/motormanual technique.

| Country | Annual harvest (M m³ solid under bark) | Fully mechanized CTL (%) | Fully mechanized FT/TL (%) | Others (%) |
|---|---|---|---|---|
| Ireland | 2.7 | 98 | 0 | 2 |
| Sweden | 67.2 | 95 | <1 | <5 |
| Finland | 54.3 | 95 | <1 | <5 |
| Norway | 10.3 | 95 | <1 | <5 |
| UK | 8.7 | 90 | 0 | 10 |
| Estonia | 6.6 | 80 | 5 | 15 |
| Eastern Canada | 57.9 | 75 | 20 | 5 |
| Uruguay | 11.3 | 75 | <1 | 25 |
| Latvia | 11.4 | 70 | 5 | 25 |
| Germany | 42.8 | 65 | 10 | 25 |
| Spain | 13.3 | 60 | <1 | 40 |
| Italy | 2.1 | 60 | <1 | 40 |
| France | 25.1 | 55 | 10 | 35 |
| Lithuania | 4.7 | 50 | 5 | 45 |

Preliminary results

| Country | Annual harvest (M m³ solid under bark) | Fully mechanized CTL (%) | Fully mechanized FT/TL (%) | Others (%) |
|---|---|---|---|---|
| Brazil | 145.1 | 45 | 25 | 30 |
| Australia | 30.1 | 45 | 50 | 5 |
| Austria | 12.2 | 35 | <1 | 65 |
| Russia | 198.2 | 35 | 10 | 55 |
| Czech Republic | 14.1 | 30 | 10 | 60 |
| South Africa | 14.4 | ~30 | ~60 | ~10 |
| Chile | 44.6 | 25 | 25 | 50 |
| Poland | 36.8 | 20 | 10 | 70 |
| USA | 356.6 | 15 | 70 | 15 |
| Belarus | 11.3 | 10 | 10 | 80 |
| New Zealand | 28.7 | 10 | 55 | 35 |
| Romania | 11 | 5 | 5 | 90 |
| Western Canada | 99.9 | 5 | 80 | 15 |
| Bulgaria | 3.5 | < 5 | < 5 | 95 |
| Slovakia | 8.8 | < 5 | < 5 | 95 |
| Ukraine | 8.2 | < 5 | < 5 | 95 |
| Turkey | 20.4 | 2 | 6 | 92 |
| Malaysia | 13.9 | <1 | <1 | >95 |

Preliminary results

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**We have only been able to test variables that could be found for all countries, and that is an important restriction**

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**But, we understood that the share of steep slopes on forest land was an important variable. The way to get this variable will be presented in a session tomorrow**

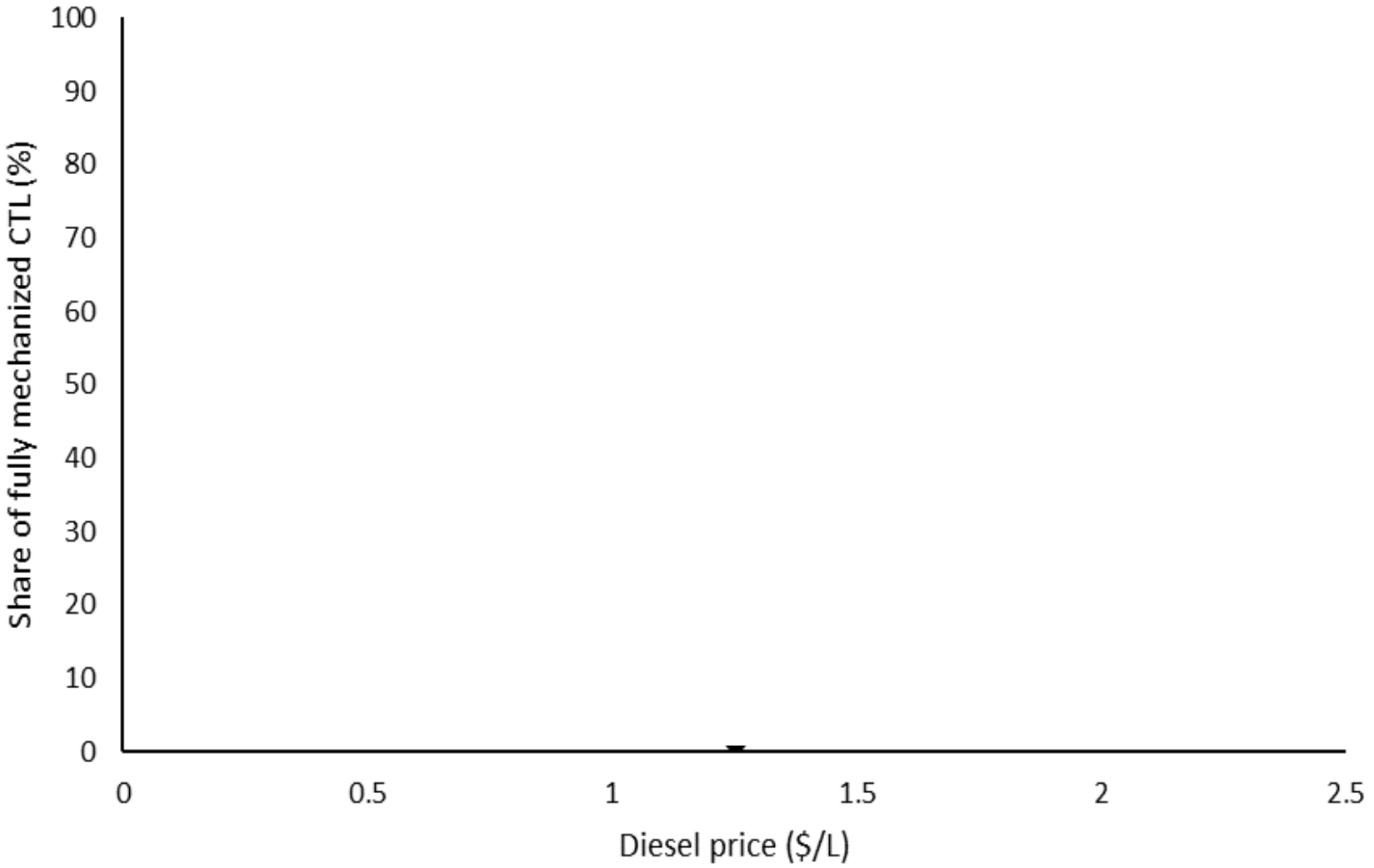
# Finally, The regression model !

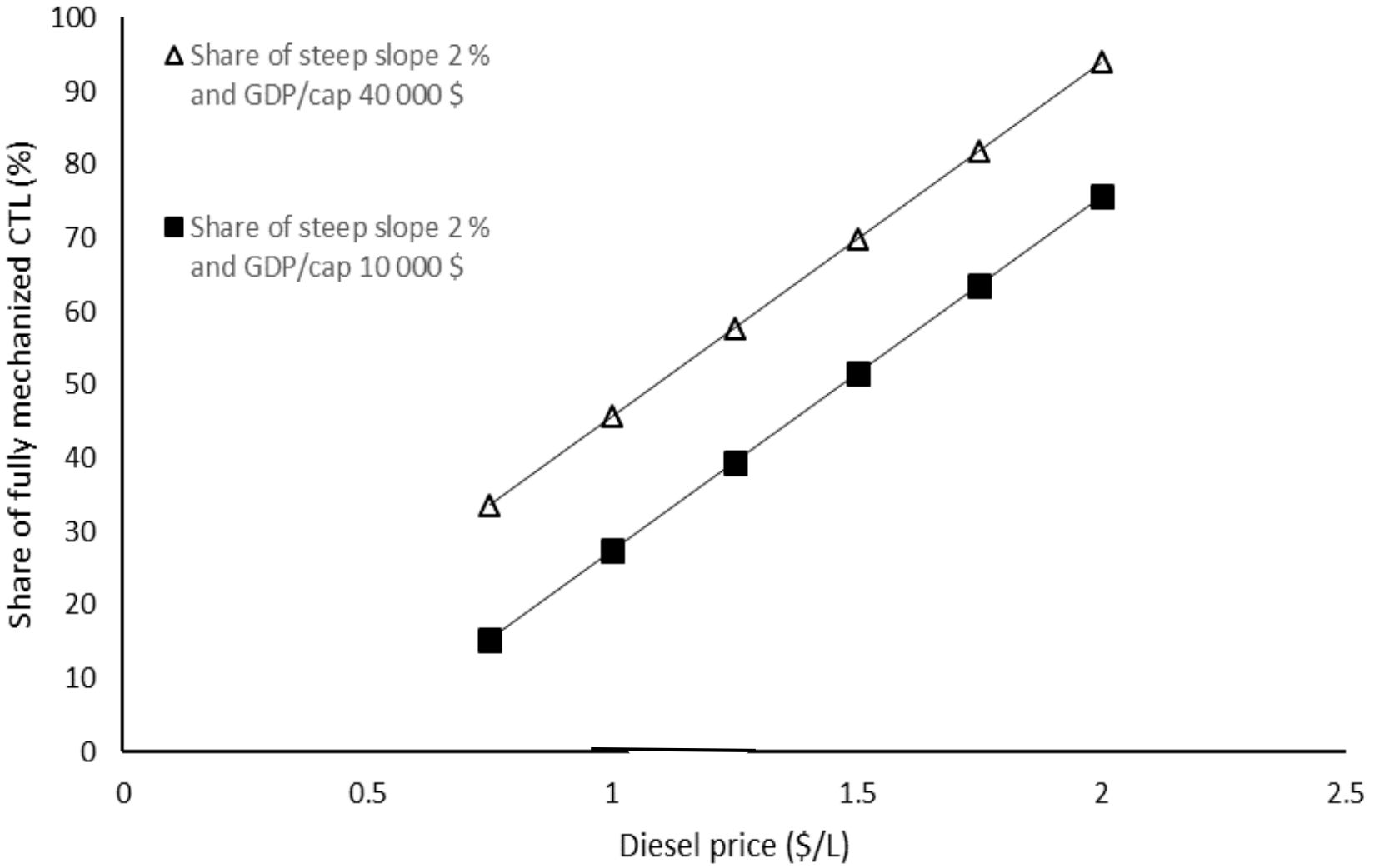
| Variable | Parameter estimate | SE | p-value | VIF | $R^2$-adj (%) | RMSE |
|---|---|---|---|---|---|---|
| Full model | - | - | <0.001 | - | 0.63 | 20.08 |
| Intercept | -25.35 | 13.67 | 0.074 | - | - | - |
| Diesel price | 48.25 + | 11.04 | <0.001 | 1.31 | - | - |
| Share of slope >20° | -0.7839 − | 0.1983 | <0.001 | 1.00 | - | - |
| GDP per capita | 0.0006083 + | 0.0002812 | 0.039 | 1.31 | - | - |

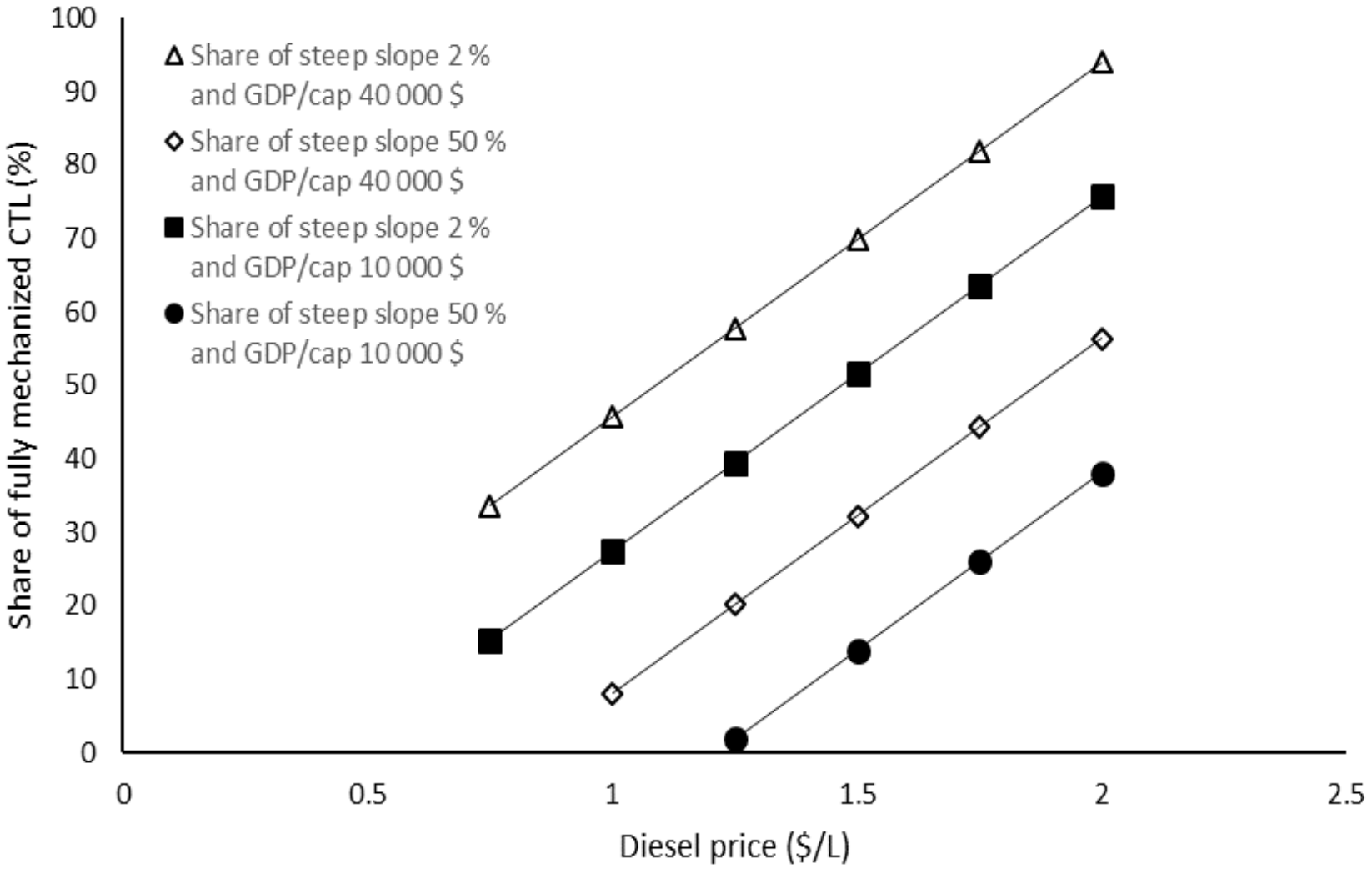
Share CTL (%) =
-25.35 + 48.25*Diesel price – 0.7839*share of slope >20° +
0.0006083*GDP per capita

| Variable | Unit |
|---|---|
| Diesel price | $/Liter |
| Share of slope >20° | % |
| GDP per capita | $ |

# Results, regression




Share of steep slope 2 % and GDP/cap 40 000 $
Share of steep slope 2 % and GDP/cap 10 000 $
Share of fully mechanized CTL (%)
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
Diesel price ($/L)


Share of steep slope 2 % and GDP/cap 40 000 $
Share of steep slope 50 % and GDP/cap 40 000 $
Share of steep slope 2 % and GDP/cap 10 000 $
Share of steep slope 50 % and GDP/cap 10 000 $
Share of fully mechanized CTL (%)
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
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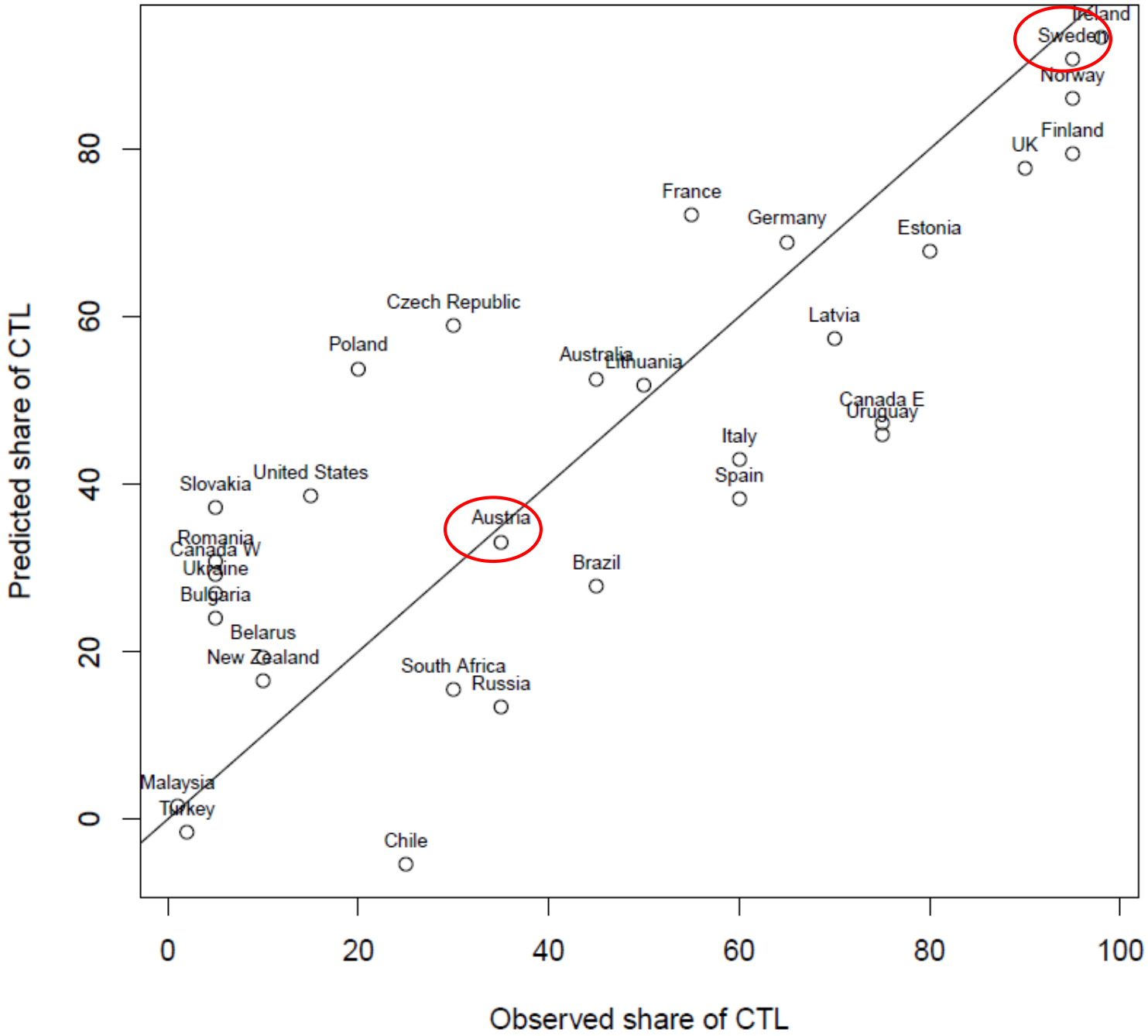
2.5
Diesel price ($/L)


Predicted share of CTL
Observed share of CTL
0
20
40
60
80
100
Iceland
Sweden
Norway
Finland
UK
France
Germany
Estonia
Latvia
Czech Republic
Poland
Australia
Lithuania
Canada E
Uruguay
Italy
Spain
United States
Slovakia
Austria
Romania
Canada W
Ukraine
Bulgaria
Brazil
Belarus
New Zealand
South Africa
Russia
Malaysia
Turkey
Chile

# Discussion: Application of the model on new countries (prediction)

| Country | Annual harvest of industrial roundwood (M $m^3$ under bark) | Prediction<br>Share of fully mechanized CTL (%) |
|---|---|---|
| Argentina | 11.8 | **19** |
| China | 164.4 | **0** |
| India | 49.5 | **12** |
| Indonesia | 74.0 | **7** |
| Japan | 21.3 | **23** |
| Mexico | 5.4 | **9** |
| Myanmar | 6.0 | **0** |
| Nigeria | 10.0 | **2** |
| Portugal | 11.0 | **62** |
| Thailand | 14.6 | **16** |
| Vietnam | 6.7 | **0** |

# Thank you for listening!

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