Plantations investments in southern Europe: a comparative analysis on returns, trends, and subsidy policies

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Outline of the presentation

1. Introduction
2. Materials and methods
3. Preliminary results
4. Final remarks and next research steps

Slides available on the web. Search for "Pettenella"
1. Introduction

Growing importance of PLANTED FORESTS in the global forest economy

<table>
<thead>
<tr>
<th>Year</th>
<th>1980</th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest cover (billion ha)</td>
<td>3.6</td>
<td>3.4</td>
<td>3.2</td>
<td>3.0</td>
</tr>
<tr>
<td>Wood use (billion m³)</td>
<td>2.9</td>
<td>3.5</td>
<td>3.5</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Source: FAO State of World’s Forests

- 277.9 M ha (6.95% of forest cover) → +4.42 M ha/year 1990-2015 (Payn et al., 2015)
- 76% of planted forests are considered established for productive purposes (Del Lungo et al., 2006)
- 1/3 of global industrial timber supply (Jürgensen et al., 2014) → up to 70-80% by 2050 (Carle and Holmgren, 2008; Buongiorno et al., 2012)
In SOUTHERN EUROPE → plantations are consolidated segment of investments
- Portugal and Spain: 75% of wood production from plantations (Martinez de Arano and Lasgourgues, 2014)
- Italy: >50% of the industrial roundwood domestic supply from poplar plantations in the Po valley (Assopannelli, 2012)

Semi-natural forests → multifunctionality → declining utilization rates → increasing demand of timber and biomass (bioeconomy and bioenergy policies)

Map showing predicted wood production (unit: m$^3$ ha$^{-1}$ land yr$^{-1}$) in Europe over the period 2000–2010 (source: Verkerk et al. 2015)

Introduction (3/3)

- Financial returns main driver for INVESTING in productive plantations
- Studies for main species and regions at global level: i.e. Sedjo (1983); Sedjo (2001); Cubbage et al. (2007); Cubbage et al. (2014).

Source: FAO State of World’s Forests 2007
Research Gaps and Objectives

- Lack of scientific literature (LACK OF INFORMATION) estimating and analysing investment returns from plantations in southern Europe → comparative level
  - When data and indicators have been collected, information rarely made publicly available or published in national/regional technical forestry magazines (e.g. Peupliers de France, 2016; Aunos, 2002; Borelli and Facciotto, 1997; Ragazzoni, 1993).

OBJECTIVES
...to investigate financial profitability of plantation forestry in southern Europe, focusing on the main productive forest plantation species, by:
1) providing estimations of potential investment returns;
2) analyzing their evolution in the last 10-15 years
3) analyzing the role of the major policy and market factors in influencing it.

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Materials and methods (1/5)

1) Identification of representative plantation models and management regimes

- Approach similar to the one used in Sedjo (1983); and Cubbage et al. (2007).
- Not ad-hoc analyses \(\Rightarrow\) range of situations
- Appropriate management conditions assumption

Materials and methods (2/5)

1) Identification of representative plantation models and management regimes

2) Input data collection

- Original + secondary data \(\Rightarrow\) databases, price lists, studies, bulletins, auctions, + interviews with experts from forest owners’ associations, industries and research institutes
  - Investment costs (site preparation, planting, silvicultural management, cleaning) + Agricultural Producer Price Indexes
  - Timber stumpage prices
  - Growth rates (or productiviness data, i.e. StandsSIM simulators for Portuguese plantations: http://www.isa.ulisboa.pt/cef/forchange/ftools/en/SimfIorPlatfom)  
  - Inflation indexes
  - Other input data for sensitivity analyses
Materials and methods (3/5)

1) Identification of representative plantation models and management regimes

2) Input data collection

3) Financial analysis: base-case scenario

- Capital budgeting criteria and techniques (Zinkhan and Cubbage 2003, Bullard et al. 2011):
  - Net Present Value (NPV)
  - Land Expectation Value (LEV, or Faustmann formula)
  - Internal Rate of Return (IRR)
- Discounted cash flow $\rightarrow \sim 3.5\%$ (HM Treasury, 2003) and alternatives (ECB, 2016; Snowdon and Harou, 2013; Cubbage et al., 2014)
  - Base case scenario: no subsidies and land cost

Materials and methods (4/5)

1) Identification of representative plantation models and management regimes

2) Input data collection

3) Financial analysis: base-case scenario

4) Sensitivity analyses

- Subsidies
- Land-use cost (land rent)
- Opportunity-cost of alternative land use
Materials and methods (5/5)

1) Identification of representative plantation models and management regimes
2) Input data collection
3) Financial analysis: base-case scenario
4) Sensitivity analyses

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Hybrid poplar in northern Italy

Silvicultural regime, investment costs and stumpage prices

Clone *Populus x canadensis* 'I-214' → Plywood veneer

<table>
<thead>
<tr>
<th>Operation</th>
<th>Costs</th>
<th>Site preparation</th>
<th>Planting</th>
<th>Silvicultural Management</th>
<th>Cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>€/t</td>
<td>2001</td>
<td>2002</td>
<td>2003</td>
<td>2004</td>
</tr>
<tr>
<td>Site preparation</td>
<td>252.5</td>
<td>393.5</td>
<td>515.0</td>
<td>610.0</td>
<td>700.0</td>
</tr>
<tr>
<td>Planting</td>
<td>1,554.4</td>
<td>2,021.0</td>
<td>2,585.4</td>
<td>3,140.4</td>
<td>3,705.4</td>
</tr>
<tr>
<td>Management</td>
<td>4,585.4</td>
<td>6,999.3</td>
<td>9,413.7</td>
<td>11,827.6</td>
<td>14,242.0</td>
</tr>
<tr>
<td>Cleaning</td>
<td>221.2</td>
<td>262.6</td>
<td>304.2</td>
<td>346.2</td>
<td>388.2</td>
</tr>
<tr>
<td>TOT</td>
<td>6,814.5</td>
<td>9,636.4</td>
<td>12,348.0</td>
<td>14,981.6</td>
<td>17,623.0</td>
</tr>
</tbody>
</table>

| Site preparation   | €/ha     | 2001             | 2002     | 2003                     | 2004     |
| Site preparation   | 252.5    | 393.5            | 515.0    | 610.0                    | 700.0    |
| Planting           | 1,554.4  | 2,021.0          | 2,585.4  | 3,140.4                  | 3,705.4  |
| Management         | 4,585.4  | 6,999.3          | 9,413.7  | 11,827.6                 | 14,242.0 |
| Cleaning           | 221.2    | 262.6            | 304.2    | 346.2                    | 388.2    |
| TOT                | 6,814.5  | 9,636.4          | 12,348.0 | 14,981.6                 | 17,623.0 |

Hybrid poplar in northern Italy (1/5)
Hybrid poplar in northern Italy (2/5)
Base-case scenario, 2016

<table>
<thead>
<tr>
<th>Models</th>
<th>NPV (€/ha/year) r=3.5%</th>
<th>IRR</th>
<th>LEV (€/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cmin Pmin</td>
<td>87.4</td>
<td>5.3%</td>
<td>2,496.2</td>
</tr>
<tr>
<td>CMAX Pmin</td>
<td>-213.4</td>
<td>n.d.</td>
<td>-6,096.6</td>
</tr>
<tr>
<td>Cmin PMAX</td>
<td>525.7</td>
<td>11.9%</td>
<td>15,020.7</td>
</tr>
<tr>
<td>CMAX PMAX</td>
<td>225.0</td>
<td>6.5%</td>
<td>6,627.8</td>
</tr>
</tbody>
</table>

Hybrid poplar in northern Italy (3/5)
Trend *ex-ante* and *ex-post*, 2001-2016 (real values)
NPV/ha/year, r=3.5%
Hybrid poplar in northern Italy (4/5)
Sensitivity analyses, 2016
NPV/ha/year, r=3.5%

Hybrid poplar in northern Italy (5/5)
Sensitivity analyses trends (real values)
NPV/ha/year, r=3.5%
### Eucalyptus globulus in Portugal (1/4)

#### Silvicultural regime

<table>
<thead>
<tr>
<th>Operations</th>
<th>€/ha</th>
<th>Pmin (€/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing</td>
<td>646.3</td>
<td>30</td>
</tr>
<tr>
<td>Site preparation</td>
<td>818.2</td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td>661.0</td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>1,763.9</td>
<td></td>
</tr>
<tr>
<td>TOT</td>
<td>3,889.4</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Pmin refers to the minimum price.*
**Eucalyptus globulus** in Portugal (2/4)

Productiveness input


![Climate and Site Index](image)

**Eucalyptus globulus** in Portugal (3/4)

Base-case scenario, 2017

<table>
<thead>
<tr>
<th>Region</th>
<th>NPV (€/ha/year) r=3.5%</th>
<th>IRR</th>
<th>LEV (€/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norte litoral</td>
<td>avg 305.5 – 341.7</td>
<td>9.3% - 9.8%</td>
<td>8,727.3 – 9,747.8</td>
</tr>
<tr>
<td></td>
<td>min 153.1 – 177.4</td>
<td>7.9% - 8.3%</td>
<td>4,373.0 – 5,069.5</td>
</tr>
<tr>
<td></td>
<td>max 165.6 – 190.8</td>
<td>8.1% - 8.6%</td>
<td>4,732.1 – 5,452.6</td>
</tr>
<tr>
<td></td>
<td>max 183.0 – 209.4</td>
<td>8.4% - 8.9%</td>
<td>5,228.6 – 5,982.2</td>
</tr>
<tr>
<td>Centro norte</td>
<td>avg 120.6 – 142.9</td>
<td>7.1% - 7.6%</td>
<td>3,447.2 – 4,082.0</td>
</tr>
<tr>
<td></td>
<td>min 143.3 – 167.1</td>
<td>7.6% - 8.1%</td>
<td>4,095.2 – 4,773.3</td>
</tr>
<tr>
<td></td>
<td>max 168.7 – 194.2</td>
<td>8.1% - 8.6%</td>
<td>4,821.1 – 5,547.5</td>
</tr>
<tr>
<td></td>
<td>min 52.8 – 70.4</td>
<td>6.7% - 7.2%</td>
<td>1,507.9 – 2,011.2</td>
</tr>
<tr>
<td></td>
<td>avg 54.4 – 72.1</td>
<td>6.7% - 7.2%</td>
<td>1,553.6 – 2,060.0</td>
</tr>
<tr>
<td></td>
<td>max 77.4 – 96.6</td>
<td>7.3% - 7.8%</td>
<td>2,210.7 – 2,760.8</td>
</tr>
</tbody>
</table>

**Note:**
- NPV: Net Present Value
- IRR: Internal Rate of Return
- LEV: Life Expectancy Value
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Final remarks and next research steps

- Estimations based on **assumptions** (silvicultural regime, management intensity, etc.) that **evidently cannot represent all the situations**
- We aim at estimating the **evolution** based on a range of situations → **basis for systematic monitoring** of plantation investments returns (e.g. observatory)
  - we need **Information**
    - Information → **strategic vision for the sector**
- Serve as a benchmark, that can support individuals, companies and new investors to make better investments decisions in this context

- Two elements to improve the research:
  - Include the **risk component** (market + natural) in the financial analysis → **risk indicator**
  - Include in the analysis **future prediction models** (of investments costs and timber prices evolution);

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THANK YOU FOR YOUR ATTENTION

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