Allocating pre-production costs in multi-year enterprises

Short Training Course on Agricultural Cost of Production Statistics

2017
1 – What are pre-production costs?

• Pre-production costs are incurred at least one year in advance of the time period when the commodity is actually produced and can be sold on the market.

• They are also called establishment or installation costs.

• **AEAA Handbook definition**: “The pre-productive period begins with the first expense associated with establishing the crop enterprise and ends in the crop year just before the crop yields a substantial percent of its expected mature yield (usually 70-80%).”

• Examples:
  
  o Establishment of a new coffee plantation: preparation of the soil, buying and planting the coffee trees, expenses related to tree nursery, etc.

  o Establishment of a new orchard for the production of flowers, etc.
2 - Why pre-production costs should be allocated?

• To obtain relevant and comparable cost and revenue estimates, pre-production expenses need to be allocated to the year or years in which production takes place

• For production which are entirely harvested in a single-year (ex: annual crops), all the pre-production costs are allocated to this production year

• When production is distributed over several years (ex: plantations, orchards, perennial crops), the question becomes more complex
• **What costs should be allocated?**
  
  o *All cost items* (direct, indirect, labour, land, capital)
  
  o They should be estimated using the same methodologies as those described in this training (and in the Manual)

• **Secondary products**: the revenues and costs associated with the selling of secondary products during the pre-productive years (ex: banana production on cacao plantations) should be added/deducted to/from preproduction costs

• **The production of the commodity before it reaches its mature yield** should also be accounted for and valued
• When there is a substantial lag between the moment costs are incurred and production effectively takes place:

=> it is important **adjust nominal costs for inflation**

• **Pre-production costs** = the net returns during the pre-productive years adjusted to the end of the pre-productive period:

\[
PPC = \sum_{t=1}^{H} (1 + i)^{H-t} R_t
\]

o \( R_t \) is the difference between revenues and costs in year \( t \) (= net returns, usually negative during the pre-production period)

o \( H \) is the length in years of the pre-productive period

o \( i \) is the annual inflation rate
Accumulated costs (capital and non-capital) are allocated to the productive years using a linear depreciation schedule:

\[ D = \frac{PPC - SV}{N - H} \]

- \( D \) is the portion of the establishment costs that will be charged against each productive year.
- \( N-H \) is the length in years of the productive period (\( N \) is the total life span of the enterprise).
- \( SV \) is the value of the enterprise, excluding land, at the end of its productive cycle (salvage value).
• **Time adjustments:**
  
  - PPC and SV should be expressed in the prices referring to the last pre-productive year
  
  - The amounts charged to each production year should be expressed in current prices:
    \[ D_t = D(1 + i)^t \]

• **Advantages:**
  
  - Easy to implement and understandable
  
  - Similar to what is usually done to estimate capital depreciation

• **Drawbacks:**
  
  - Is the linear depreciation schedule a realistic/appropriate one?
  
  - The determination of SV is not easy
• The accumulated total is amortized over the production period using an annuity formula

• The annual amount to be charged against each production year (A) is such that:

\[ PPC - \frac{SV}{(1 + r)^{N-H}} = \sum_{t=H+1}^{N} \frac{A}{(1 + r)^t} \]

Net PPC at end of the pre-production period prices (“present”)  
Present value of the amount to be charged

• It follows that:  

\[ A = \frac{r}{1 - (1 + r)^{H-N}} NetPPC \]
• **Time adjustments:** the amounts $A$ charged to each production year need to be adjusted for inflation only if $r$ is a real interest rate (i.e. excluding inflation)

• **Advantages:**
  - It is consistent with business accounting practices
  - It is economically founded

• **Limitations:**
  - Determining $SV$ (an option could be 0)
  - Sensitivity to the choice of the interest rate $r$
Example: installation costs of a new coffee plantation in Colombia

• Assumptions
  o H = 3 (marginal production starts at year 2, neglected here)
  o N-H = 7 (variable depending on production type)
  o r (nominal interest rate) = 15%
  o SV = 0 (excluding the value of land, the remaining is biomass)
  o PPC = 9.000.000 COL per hectare

• Results:
  o Net PPC = 9.000.000 per hectare (SV is 0)
  o A = 2.163.243 per hectare (~ 720 USD)

-> This amount is charged against the revenues of each production year
• Adapted to situations where the farm is at the production equilibrium or steady-state, i.e. having reached the maximum of its potential yield

• Allocated PPCs are determined as a share of current costs (CC)

• This share is closely related to the steady-state replacement rate of the assets, for examples:
  o 5% of a herd may need to be replaced annually to maintain stable the number of heads
  o 10% of a plantation may have to be renewed each year to maintain a stable average plantation age (and therefore yield)
The calculation are done in 4 steps:

- **Step 1:** determine the ratio \( r = \frac{\text{PPC}}{\text{CC}} \) (assumed to be fixed for a given time period under the assumption of fixed technology)
  - CC = change in asset value + operating costs associated with these assets
  - This operation has to be done with data spanning a sufficiently large time period (e.g. average of 3 years) to reduce the risk that outlier observations might distort the ratio

- **Step 2:** apply \( r \) to the estimated annual current costs \( \text{CC}(t) \)

- **Step 3:** \( r \cdot \text{CC}(t) \) is charged against production for the year \( t \)
7 – Market value approach

• Similar to the CC method, with the **PPC estimated using opportunity costs (market values)** instead of actual costs:
  
  o PPC are estimated as the foregone revenues from the selling of the assets (livestock, trees, etc.) instead of holding them
  
  o For example, market prices for replacement animals are used to estimate PPC for a livestock farm, as opposed to building up the actual costs associated with livestock breeding herd
  
• **Advantage**: ease of implementation; particularly adapted for livestock pre-production expenses

• **Drawbacks:**
  
  o Markets might not exist or may be too thin, in which case the current cost method may be used
  
  o Market valuations might be biased towards future earnings and not historical costs
• It is an allocation rule based on a **non-linear depreciation schedule**

• PPC calculation:
  - Establishment expenses comprise capital as well as variable costs
  - Production occurring during the pre-production period for the main commodity are not deducted from PPC

• The amount to charge against each production year is proportional to the share of current production in the total expected production for the productive years:

\[
D(t) = PPC \left[ \frac{Q(t)}{N} \sum_{t=H+1}^{N} Q(t) \right]
\]
8 – Yield or production-based allocation (2/3)

• **Example:** N=10, H=3, PPC=500

<table>
<thead>
<tr>
<th>Years</th>
<th>Production shares (%)</th>
<th>Allocated PPC (D)</th>
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• **Advantages:**
  
  o Easy to implement and intuitive
  
  o Assumes a non-linear depreciation schedule, reflective of the farm’s production cycle

• **Drawbacks:**
  
  o It is dependent on the schedule assumed for yields, which varies necessarily across varieties, regions, etc.
  
  o It has to be refined to include revenues and costs associated with secondary commodities
9 – References
