Forest profitability measurement: a pilot project to extend FADN to forestry sector in Italy

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Outline

Introduction 1
1 Features and characteristic of the population 3
2 Description of the software GAIA® 3
3 Forest FADN and GAIA®: adaptation to meet forest accounting needs 5
4 Usefulness of Forestry FADN results for policy impact evaluation 6
5 Final remarks 8
Bibliography 9

Introduction

The Italian forestry sector represents a controversial reality in the national rural context. While the forest area covers almost one third of the Italian surface (10.4 million ha according to INFC 2005), the sector has a marginal economic role in the Country: it shares only 1.0% of total production of primary sector and 1.5% of the generated added value.
Such marginality is due to different reasons.
One of them is the localization of forest resources in mountain and hilly areas. According to data on forest surface distribution reported by INFC (2005), around 85% of woodlands are located in mountain and hilly areas (above 300 m a.s.l.).
Furthermore, almost 80% of Italian forests are situated in steep slope areas (>20%). This makes the forest access very difficult and the logging operations cost very high. The consequent low productivity (among the lowest in Europe) explains the process of abandonment: timber harvest slowed down from 2.5 cm/ha in 1953 to 1-1.5 cm/ha in 2005.
The reduction of the active management is confirmed by the forest analysis of Italian semi-natural forests, characterized by an advanced ageing process: overripe stages represent 89.0% of coppice stands, while in high stand forests ripe and overripe stages share 35.1% of the total (Pettenella, 2009).
As concern the market, a recent study (Pettenella & Ciotti, 2008) on trends in sales of woodlots in Comelico (a county of Belluno Province, in the North-Eastern Alps) shows that over the last fifty years the stumpage price changed from an average of 276.5 €/cm in 1955 to 52 €/cm in 2005 (-81.2%). This decline had effects more pronounced also in following stages of the forest-wood value chain.
According to Pettenella (2009) the structure of Italian forests is characterized by a significant dualism. On one hand a couple of thousands public companies (0.6% of the total number of owners) controls 43.9% of forests with a relatively large individual surface which allows profitability and continuity of management. On the other hand a huge, not well identified, number of private companies have an average size so small to allow only home consumption of firewood and poles harvesting.

Over the recent years, the EU enhanced the forest related policies in the Rural Development Plan (RDP). The EU Forestry Strategy and Agenda 2000 stated that incomes from forests can play an important role in maintaining a good social structure,

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improving the economic development of rural areas (Sekot & Niskanen, 2001). The implementation of such policies obviously depends on the presence of forest enterprises and on their capacity to be competitive.
On the other side, woodlands are recognized as an important factor for biodiversity conservation, soil and water resource protection and climate regulation. Besides, the enlargement of the forest area implies increasing sources of renewable energy in the future. Such contribution is becoming more and more important, in particular after the adoption of the Commitment for Greenhouse Gas Emission Reduction up to 2020 (European Parliament, 2008).
The increasing importance of the forest sector is reflected by the growing share of the European financial budget addressed to forestry measures: it raised from 9.7% in the period 2000-2006 to 12-14% in the present implementation period (2007-2013).
The new orientation of European Rural Development policies is summed up in the first two axis of the RDP 2007-2013, concerning the purposes of the forest related measures which are: i) to improve the competitiveness of forest enterprises, mainly co-funding structural investments (forest structural measures), and ii) to enhance the sustainable use of woodlands supporting forest management practices oriented to environmental, protective or tourist services provision.
Together with the large acknowledgement of the objectives, there is a growing interest in monitoring the results and in evaluating the socio-economical effects of the measures and related disbursement. This explains the increasing demand by Regional Administrations for data on forestry sector. In Italy, the authorities in charge of the RD plans implementation are the Regional Governments (corresponding to NUTS2[1]) and they are responsible both for the implementation of the measures and for their assessment.
The National Institute of Agricultural Economics (INEA), already responsible of the Italian Farm Accountancy Data Network (FADN) and of the Italian National Rural Network, use to provide methodological support to regional administrations on evaluation processes. The main problem regards the lack of economical data due to the absence of a systematic investigation on the forest enterprise performances at national level.
In such context, INEA, within the activity of the "Forest Observatory", is developing the project "Forestry FADN". The objective is to extend the accounting survey to forestry owners and logging enterprises, in order to provide statistically significant data, useful for the evaluation. Accounting results at farm level are considered as "target variables" in the measurement of RD measure impact indicators, outlined by the EC (as listed in paragraph 4).
A pilot survey has been programmed in Veneto region for the year 2010, due to the fact that forest reality in Veneto is characterized by the contemporary presence of most of the forest type present in Italy and of several kind operators, features that makes it an interesting test bench for the investigation.

The main aim of this paper is to present this project and the software which will be used to collect the accounting data. In the first paragraph the characteristics and composition of the population will be illustrated. It has been the first step of the survey, useful to understand the type of Italian forest companies, and estimate their size. The second paragraph will describe the software GAIA® used in Italy for the data collection process of the national FADN. The system has been developed for agricultural context and, as a consequence, it is necessary an harmonization process to adequate the multi-annual scheme of forestry production with the annual scheme of agriculture. This changes are illustrated in the third paragraph which explains how emerging problems (inventory and

[1] *Nomenclature of Territorial Units for Statistics*

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asset evaluation) can be solved in GAIA® system. The forest accounting data developed with forestry FADN could be useful for different purposes as, for instance, for policy evaluation of rural development policies. This specific application is illustrated in the fourth paragraph, where a theoretical and methodological scheme is illustrated. At the end some final remarks to leave open the discussion.

1 Features and characteristic of the population

The population of a survey is the whole of units on which the variables of interest are observed and on which the obtained results refer to. For this specific investigation on forest accounting, the units are commonly identified as forest companies. A common definition of forest company does not exist, both at EU and at national or regional level (Sekot & Niskanen, 2001). Moreover, a forest owner is not necessarily a forest farm. In the reality, the major part of them owns only a small woodland, often abandoned or used only for firewood self-consumption. In general, the forestry sector in the Alps is represented by two typologies of actors: i) forest and agro-forestry farms (public or private), owners and managers of a forest area, sellers of standing trees or producers of a certain amount of forest products per year; ii) logging enterprises, without a forest ownership, which buy standing trees and sell roundwood or firewood, or which operate on behalf of the forest owners (as contractors).

The analysis on administrative sources of logging operations in Veneto region[2] found a population of around 500 forest farms (i.e. forest owners cutting at least 25 mc per year) and 350 logging enterprises. These units are considered a representative group for the evaluation of the forest RD measures, since they are the main potential beneficiaries.

2 Description of the software GAIA®

INEA is responsible of FADN data collection process since 1968. With the proliferation of informatics supports, INEA started to develop a software (named CONTINEA and running in DOS) with the double intent to provide a decision supporting tool for farmers and to create regional databases. With the important changes in farm management caused by different market and structural dynamics, INEA perceived the utility to have a more complex decision support tool to fulfill new needs of agricultural entrepreneurs (Bodini & Marongiu, 2009).

Over the last years, INEA introduced a new software, named GAIA® (*Gestione Aziendale delle Imprese Agricole* - "Farm Management in Agricultural Enterprises"), running in Windows environment. Starting from the accounting year 2008 GAIA is used in all Italian regions both to collect and process data and to produce regional-national data sets. and starting from 2008 accounting year. The accounting methodology is based on double-entry book-keeping system and it comes into line with the National and International Accounting Standards (IAS), in particular with the adjustments to the new accounting system introduced by the EU Directive IV and adjustments of the IASB (International Accounting System Board) (Argilés & Josep M. Slof, 2001). Since the software has been developed firstly as accounting tools for agricultural holdings, innovative elements represent the strengths of the new tool: the combination of technical information with assets management, the calculation of financial ratios and economic indicator and the opportunity to perform farm economic and financial efficiency analysis. To satisfy information demand

[2] All the logging operation in Italy need a specific authorization from the Regional Forest Services. The Veneto forest service have implemented a Database named "*gestione utilizzazioni forestali*" (logging operation management) in order to manage and control all the requests. Data ownership rights are reserved by Veneto forest service.

Contact: cesaro@inea.it

coming from agricultural research and from policy makers, GAIA® has increased the details of some farm management aspects as labour (family workers and contract workers) and off-farm activities (including forestry). In order to make possible the balance-sheet analysis, GAIA® allows to have immediately the economic results and indicators. Moreover it provides assistance in the allocation of variable costs among farm processes and activities. GAIA® scheme is structured on the base of a flow of data input which have to be followed by the operator. The logic sequence of the operations are resumed in these points:

- farm context: general data on the farm (address, localization, farm type, classification, economic size, information on farm holder, etc.)
- opening stocks: buildings, machineries, lands, breeding livestock, labour force, certifications, agricultural products, debts and credits at the beginning of the year);
- technical management of land, agricultural permanent crops, storage, labour, breeding and fattening livestock
- accountancy management: double-entry registration of receipts (sales and purchases), National and European payment and subsidies, other financial accounts (loans, interest payments, taxes);
- closing procedures: allocation of operational costs (calculation of gross margins), allocation of structural and investment costs (for permanent crops and unrealized crop production, i.e. durum wheat), allocation of extra ordinary maintenance, VAT.

The system provides two detail levels to classify lands and agricultural surfaces. The first level classifies the lands taking into account the Italian cadastre classification which differentiates among general classes as “Arable Land”, “Arboriculture” and “Forest”. Forested areas are not included in the UAA of the farms, but an indication of their presence is required.
The second level specifies the further division of UAA in smaller plots taking into account the existing crop or plantation. At this level the system asks about year and density of plantation, species composition (monoculture or mixed plantations) and values.
For instance: in the first level a surface is classify as “Arable Land” while, in the second level, different crops (“Durum Wheat”, “Maize”, etc) are specified.
Technical management section may be considered as the most flexible and innovative element. Firstly, it allows to register (in the management window) the quantity of production coming from the different kinds of crops and plantations reported in the starting inventory. Secondly, GAIA® allows to keep track of decisions made by the farmer throughout the year: in fact the registration of the receipts (sales and purchases), coming from accounting management section, is strictly connected. For instance, when the wheat stored in the farm is sold using the accountancy management section, automatically the quantity registered in the technical management window is updated.
Another important aspect is the data management. Italian accounting survey is made at a regional level and the regional offices of INEA have the task to collect data, to run data controls and to create the regional database. After that, all the data are transferred to national and European level to update the FADN data warehouse. Statistical queries and national reports are possible and, in the future, INEA is planning to create a centralized data warehouse with the possibility to get figures at different levels.

Contact: cesaro@inea.it

3 Forest FADN and GAIA®: adaptation to meet forest accounting needs

"Forestry FADN" project will benefit of the infrastructure described in the previous paragraph. But the extension of GAIA® methodology to forest sector needs some adaptations to take into account the new farm typology and the multi-annual production of forest farms.

3.1 The inventory of agricultural and forest land

The first adaptation concerns the different process of inventory of agricultural and forest land in GAIA®.
In the new version of the software an improved process of forest assets inventory has been designed. At the first level, forest area will be divided into working circles according to their function: productive, tourist, protective or environmental. The second level, indeed, is dedicated to the insertion of the results of timber inventory coming from the management plan. To use data as representative as possible of the specific stand, the plot correspond to the forest compartments. The classification for forest areas is feasible also for plantations, with the difference that normally plantations have only productive purposes. They can be registered according to the plantation year.
Since forest surfaces are not included in the UAA, a forest technical management is not possible with the current version of GAIA®. The system provides only the possibility to account for the final cut. Moreover, it does not allow to take into account the woody annual growth of standing trees.
The annual updating of stand asset values is performed with the addition of a specific window for the forest production, in the technical management section. All the calculations are carried on at compartment level. By means of stand records, the system is able to determine the balance of the woody mass at the end of the year. The monetary evaluation, indeed, is based on the stumpage prize and so it requires to know the market values of wood products (obtainable by each stand) and the related harvesting costs. The assessment of such values is particularly difficult for natural and semi-natural forest. An automatic algorithm, able to determine the stumpage value per hectare starting from compartments records, has not been outlined, yet. Thus, the methodology applied at compartment level is the following: i) to attribute a list of wood products base on those ones produced (or expected to be produced) by the farmer in the current year, ii) to assign the current unit price of such wood products, iii) to estimate - for each compartments - the harvesting cost per cubic meter, iv) to determine the stumpage price per cubic meter and multiply it by the stand mass, v) to apply a precautionary reduction coefficients, for instance 0.5, as suggested by Merlo (1994).

3.2 The forest assets evaluation

The second adaptation concerns the forest assets evaluation. The current approach in GAIA® is differentiated between plantations and semi-natural or natural forests. In the case of forests, the stand is not separated from the forested (bare) soil, therefore a single value is assigned to the asset. By contrast, in the case of plantations, the stand is evaluated separately from the bare soil. More specifically, it is valued at historical cost and treated as being permanently in an annual planting phase, which excludes the possibility of investment depreciation. At the cutting time, the value of plantation should equals the costs afforded by the farmer to establish it. The value does not include the increased value due to the timber annual growth. Thus, a capital gain or loss will be obtained, if there is a difference between the historical cost and the sale revenue.
The proposed approach for adapting the forest related accountancy scheme of GAIA®, introduces two main changes: i) the plantation evaluation methodology (stand value and

Contact: cesaro@inea.it

bare soil value) is applied also to semi-natural forest stands; ii) the application of the accrual basis to multi-annual costs and the comparison with the annual value variations of the forest asset.
The aim of those changes, in particular the latter one, is to harmonize the forest production period (which lasts over many years) with the annual agricultural one.
Such decision implies the need to update every year the value of the assets. Borchers, et al. (2002) propose to perform it according to the well known scheme of commercial double-entry book-keeping, by deriving the closing stock through the difference between the opening stock and retirements and adding the accrual of assets. Unfortunately though, the cost of an annual inventory and valuation of timber stocks exceed any reasonable amount.
According to Tzschupke (2009), the concept apply by Borchers (2002) to the forest-enterprises of the "Klosterkammer Hannover" in Lower-Saxony, is convincing and easy way to overlap the problem (Table 1). The idea is to calculate the opening value with the theoretically achievable contribution margins of each diameter class and base the results of a well established ten-years timber inventory.

Table 1: Scheme of annual updating of the value of the timber-stocks according to the proposal of Borchers et al., 2002.

Forest inventory
→ value of timber-stocks calculated differentiated according to species and diameter-classes
→ **value of the opening stock at the beginning of the year**

\+ sales revenues – harvesting costs
→ net value of exploited timber

+/- difference between net value of exploited timber and calculated net value of the annual increment
→ **value of the closing stock at the end of the year**

Source: Tzschupke (2009)

4 Usefulness of Forestry FADN results for policy impact evaluation

Over the last 10-15 years, EU regional policy has brought the idea of evidence based policy making and evaluation to quite a wide audience. For the present RD programming period, the EC defined a common framework for monitoring and evaluation (DG for Agriculture and Rural Development, 2006). In particular, the document provides information on how to measure different kind of indicators to assess effectiveness of the policies. Regarding the measurement of impacts of the competitiveness enhancement measures, the EC proposes accounting results at farm level as proxy of three socio-economic indicators (see Table 2).

Table 2: List of the common impact indicators for RD competitiveness enhancement measures and the corresponding accounting results outlined by EC as proxy.

Impact indicators	**Accounting results (target-variables)**
Economic growth	Net Added Value
Employment creation	Net additional full-time equivalent created job

Contact: cesaro@inea.it

Labour productivity	Gross added value per full-time equivalent job

Thanks to Forestry FADN investigation, it is possible to measure average values of such target-variables before and after the implementation of forest RD measures, or among farms with and without funding. Anyway, extreme caution is needed to interpret the observed differences - over the time or among the individuals - as "effects" of the policies (DG for Regional Policy, 2009). In fact, what the impact evaluation is interested in, are not only the differences, but to what extend the measure have contributed to create these differences.
The following sub-paragraph provide some basic information on the theoretical approach suggested by statistical-economical literature and an example of application in the context of forest related measures.

4.1 The counterfactual approach

Within the European Commission website, the on-line resource "EVALSED", provides guidance on the evaluation of socio-economic development with particular focus to structural and cohesion programs. For policy impact evaluation, the guide currently defined as "counterfactual" those groups of method "primarily" devoted to understand whether a given intervention (or policy) produces the desired effects on some pre-established dimension of interest (DG for Regional Policy, 2009).
The significant concept underlined by these methods is the notion of "causal effect" as difference between the outcome occurred after an intervention has taken place (the factual) and the outcome that would have occurred in the absence of the intervention (the counterfactual).
The analytical formalization of the approach is ascribed to Rubin (1974). The fundamental point upon which the counterfactual approach insist on is the fact that the "effects" are not observable because they are differences between an observable state and an hypothetical one. This is known as the "fundamental problem of causal inference" (Holland, 1986) because, data may be collected on the "factual" but it is impossible to observe what would have happened to those affected by the intervention if the intervention had not happened. To overcome the problem, it is necessary to build the "counterfactual", in general through assumptions that are not verifiable. In this sense statistics can becoming helpful in making the assumptions more credible. Several strategies has been argued to build the counterfactual. They can be divided according to the kind of used data: "experimental" or "observational" ones (not experimental). In the literature on policy impact evaluation it is possible to find both the strategies, although the application of the experimental one is often not practicable; this is also the case for the mentioned RD measure.
To better understand the counterfactual approach in the context of forest related measures, a hypothetical application is reported in the Box 1. The example aims to highlight one of the main issue the researcher have to face while implementing observational analysis over RD measures: the bias on the selection process of the beneficiaries.

Box 1: The counterfactual approach applied to an hypothetic forest related measure.
A structural measure (e.g. to enhance the competitiveness of logging enterprises), finances the purchase of new machineries for forest operations. To access the financing, the enterprises have to answer to a call and demonstrate the economic sustainability of the investments. After the call deadline, the Administration defines a rank of requiring enterprises, on the base of prefixed features, and allocates the specific budgeted funds until their end.
In this case the evaluator is asked to prove to what extend the measure has contributed to increase the competitiveness of beneficiary enterprises, in terms of Net Added Value (Y).

Contact: cesaro@inea.it

The average net contribution of the intervention over beneficiaries is the difference between the average (Y) over the population of beneficiaries and the average (Y) over the same population of beneficiaries as they have not been financed. Since it is not possible to find enterprises that are at the same time "beneficiary" and "non beneficiary", it is necessary to define a population that can be a credible alternative to the counterfactual population. A viable way is to measure the average (Y) over the population of logging enterprises that have been not financed. But, is it reasonable to assume that the two population are equal? A common problem in policies which select the beneficiaries on a call base, it is the existence of factors moving the decision of subjects to answer to this call (e.g. young age of entrepreneurs, the large economic dimension of the enterprise, etc.). The existence of these factors makes the previous assumption less acceptable. The selection bias of beneficiaries represents one of the main issue that have to be faced in impact analysis. Increasing the available data over the statistical units it is possible apply statistical matching methods that reduce the bias and allow to achieve a more accurate quantification of the impacts.
The intent of the authors is not to go in deep on the statistical-economical methods able to deal with and to reduce this selection bias. Therefore, here we mention the main ones suggested by literature: (1) the difference-in-difference (Bertrand, Duflo, & Mullainathan, 2004) and (2) the statistical matching through the propensity score (Rosenbaum & Rubin, 1983) (Sasha & Ichino, 2002).

5 Final remarks

Comparing with other productive sectors, also in the rural context, accounting schemes and procedures for forest management have been scarcely developed, especially in Italy. As a consequence the ever-present dilemma over the role of wood (product and capital asset at the same time) had been solved with different approaches, depending on the forest type (high stand, coppice or plantation), the frequency of loggings and the national economic context. Moreover accounting data about forest sector are required to investigate the impacts of the RDP 2007-2013.
This project, carried out by INEA, aims to contribute to fix accountancy procedures to collect accounting data for forest enterprises and forestry farms in Italy. The availability of a new software for agriculture (used to collect data for national FADN) makes possible an adaptation to support the theoretical approach behind forest production.
The main problem is to adapt the annual accounting scheme of agriculture to the multi-years scheme of forest production. The evaluation of assets is an important issue because it is not easy to consider the increasing value due to growing wood. Plantation and natural forests have a different management scheme but this evaluation is very important in both cases. While it has been easy to adapt the inventory mask, in case of assets evaluation there are theoretical issues to take into account. The different methods, in fact, can influence the final accounting results.
An accountancy scheme is important to make policy impact evaluation in the best way (i.e. for counterfactual analysis). Public administrations require accounting data because often the target variables are fixed starting from accounting results. So, Forestry FADN can have an utility also in this sense.
A lot of work remains now to apply this scheme to reality. Forestry FADN will be implemented first of all in a pilot area (Veneto, north Italy) to analyze different forest companies. It is not a system that permit to give a value to un-prized products and services but it can be a first step to define and standardize an accountancy scheme comparable in the space and time.

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Bibliography

Argilés, B., & Josep M. Slof, J. (2001). New opportunities for farm accounting. *SSRN eLibrary,*

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *The Quarterly Journal of Economics, 119*(1), pp. 249-275.

Bodini, A., & Marongiu, S. (2009). Innovations in the italian FADN/RICA survey system approach: The new software GAIA and its implications on the italian agricultural accounting system. Ettenhausen (Switzerland).

Borchers, J., Merker, K., Schaefer, G., & Wippel, B. (2002). Einstieg in die bilanzierung stehnder holzvorräte - ein beispiel aus der Klosterammer Hannover. *Forst und Holz, 57*, 516-519.

DG for Agriculture and Rural Development. (2006). *HANDBOOK ON COMMON MONITORING AND EVALUATION FRAMEWORK: Guidance document* No. Rural Development 2007-2013)

DG for Regional Policy. (2009). *The resources for the evaluation of socio-economic development. Sourcebooks.* http://ec.europa.eu/regional_policy/sources /docgener/evaluation/evalsed/sourcebooks/index_en.htm

European Parliament Legislative Resolution of 17 December 2008 on the Proposal for a Decision of the European Parliament and of the Council on the Effort of Member States to Reduce their Greenhouse Gas Emissions to Meet the Community's Greenhouse Gas Emission Reduction Commitments Up to 2020, (2008).

Holland, P. W. (1986). Statistics and causal inference. *Journal of the American Statistical Association, 81*(396), pp. 945-960.

INFC. (2005). *Inventario Nazionale delle Foreste e dei Serbatoi Forestali di Carbonio. Ministero delle Politiche Agricole Alimentari e Forestali*

Merlo, M., & Ruol, G. (1994). Ipotesi di remunerazione dei servizi pubblici offerti dai beni silvopastorali: un'analisi economico-finanziaria. *Genio Rurale, 4*, 4-11.

Pettenella, D. (2009). *Le nuove sfide per il settore forestale. Mercato, energia, ambiente e politiche* (Tellus ed.)

Pettenella, D., & Ciotti, M. (2008). "Le risorse forestali per le Alpi: quale mercato per il futuro?" in A.Massarutto (a cura di). *Politiche per lo sviluppo sostenibile della montagna,*

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1), pp. 41-55.

Rubin, D. B. (1974). Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of Educational Psychology, 66*, 668-701.

Sasha, O. B., & Ichino, A. (2002). Estimation of average treatment effects based on propensity scores. *Stata-Journal, 2*(4), 358-377.

Sekot, W., & Niskanen, A. (2001). *Guidelines for establishing farm forestry accountancy networks MOSEFA (monitoring the socio-economic situation of European farm forestry) european commission concerted action FAIR CT96 1414*. Leiden (etc.): Brill.

Tzschupke, W. (2009). Forestry accounting in German state and municipal-forest-enterprises - recent innovations.

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