European Evaluation Helpdesk for Rural Development

PRODUCTIVITY EFFECTS OF CAP INVESTMENT SUPPORT: EX POST EVALUATION FROM SWEDEN USING MATCHED PANEL DATA

FACTSHEET OF THE EUROPEAN EVALUATION HELPDESK FOR RURAL DEVELOPMENT - MARCH 2017

IMPROVING COMPETITIVENESS IN RURAL ENTERPRISES

In Sweden roughly 35% of the population lives in rural areas. Out of Sweden's small enterprises (0-9 employees), rural enterprises contributed approximately 30% of the total turn over. Moreover, compared to urban areas, a larger proportion of the population in rural areas run their own enterprise, making firm competitiveness vital.

The purpose of this ex post evaluation was to assess the influence of measure 121, dispersed during the Swedish RDP period 2007-2013 on firm competitiveness and to answer the CEQ15: "How and to what extent has the measure contributed to improving the competitiveness of the beneficiaries?" The period assessed is from 2007- 2012.

UTILIZING CUTTING-EDGE METHODS TO MEASURE PRODUCTIVITY EFFECTS OF INVESTMENT SUPPORT

This study used firm-level micro data to estimate the productivity effects of investment support (measure 121). The recently developed Coarsened Exact Matching (CEM) method was used to model the selection bias attached to the assignment of support and to estimate the causal effects.

In order to disentangle the effects of subsidies, a fixed effects (FE) panel analysis is used to relate firm productivity to a series of factors reflecting internal (size, managerial and financial capacity) and external characteristics (access to external knowledge).

In order to account for the fact that firms can receive different levels and types of subsidies depending on the nature of the investment project and the characteristics and choice of the firm, the continuous treatment effect is estimated.

Working steps:

1. Data collection (merge firm-level employer-employee matched data to data on support receiving firms).
2. Establishing a theory of change (what type of effects can be expected based on theory)
3. Method and identification
4. Estimation and interpretation of results and policy conclusions

Data

Firm-level data was obtained from Statistics Sweden and contained detailed information about the characteristics of firms and their employees in Sweden. These data are matched with data from the Swedish Board of Agriculture, which contained information about firms that have received subsidies (both type of support and the amount of funding received) from the Swedish RD programme 2007-2013.

A total of 7300 firms were granted investment support during the programme period of which it was possible to link 5000 to firm-level data by identity numbers. This data was analysed using a counterfactual panel data model. One of the limitations of using data like this is that it is not possible to include all firms that received investment support during the 2007-2013 programming period (2012 was the latest year for which firm-level data was available from Statistics Sweden).

FURTHER INFORMATION

- Swedish RDP 2007-2013 measure 121 related to investment support for firm competitiveness
- Ex post evaluation conducted by the Jönköping International Business School Discipline of Economics, Finance and Statistics

Independent variables

Variable	Definition
Internal characteristics I_{it}	
Capital	Value of material assets
Labour	Number of full-time equivalent employees
Age	Average age of employees
Education	Share of employees with three or more years of university education
Female	Percentage of female employees
Exports	Dummy=1 if the firms is exporting
Multi-firm	Dummy=1 if the firm has more than one establishment
Investment support T_i	Dummy=1 if firms has received investment support
Investment support Γ_i	Amount of support divided by firm turnover
External characteristics E_{it}	
Population density	Population per square kilometer in municipality
Industry diversity	Distribution of employees across industries in municipality
Specialization	Locational quotient measuring the municipal share of employees within agriculture relative to the national share
Land	Share of agricultural land in municipality

Theory & method

One argument against the negative productivity effect coupled to the size of the support could be that there were time lags in the effects. This means that firms may still appear unproductive in the short term after they are granted support and only increase their productivity as a result of the subsidy over a longer period. In order to test this, the panel data models were estimated using forward values of productivity as in Gustafsson et al. (2016). Research suggests that if the size of the subsidy induces firms to become more productive in the future the coefficients will switch signs and become positive. Results showed no evidence of this.

Another concern that complicates any evaluation of subsidies is that firms may receive support from different sources, which may affect the outcome. Some agricultural firms that received investment funding during the RD programming period 2007-2013 also received other types of funding either from the RD programme or from other sources. Disentangling the effect of one particular support became difficult due to the interconnected effects that arise when a firm receives multiple subsides at different points in time. Summary statistics found that two percent of the firms granted investment support (measure 121) were also granted support from other Pillar 2 axis 1 subsidies (e.g. for vocational training and information actions (measure 111) and for adding value to agricultural products (measure 124)). Only one percent of the firms were granted additional support from Axis 3 (e.g. for undertaking agricultural diversification (measures 311-313)).

Due to data limitations, this study could only address situations where support dispersed through Pillar 2 influenced the results. In order to test this, the models were estimated including the total amount of other Pillar 2 payments dispersed to each firm (as in Michalek et al., 2014). This test proved that the coefficient is insignificant and results are robust.

Estimation and interpretation of results and policy conclusions

The outcomes are estimated using difference-in-difference methods (CEM matching), which allows one to disentangle the role played by the support and control for selection biases. The results of this study can be seen in four compounding steps.

1. Results indicated that firms receiving support have a higher level of total factor and labour productivity compared to those not receiving support (Table 1). This may be reflective of investment induced productivity effects as a result of improved access to credit as argued in Blancard et al. (2006) and Serra et al. (2008). This means that the support has enabled firms to modernise their holdings and realise investments with new production techniques, which in turn improved their productivity.

2. Estimating the model with the continuous treatment effect gave a different and more nuanced picture of the effects associated with Pillar II investment support (Table1). These results indicated that firms in the treatment group have a higher level of productivity compared to the control group, however, as their dependence on investment support increased as a source of income the effect on productivity became negative.

Table 1: Investment support on Total Factor Productivity (TFP)

Effect of investment support on TFP (all firms)

Variable	FE	FE–CEM	FE–CEM
Investment support T_i	0.136*** (0.012)	0.108*** (0.016)	0.121*** (0.016)
Investment support Γ_i	-	-	-0.349*** (0.054)
Industry	YES	YES	YES
Year	YES	YES	YES
Firms	67749	66753	66753

****, ** denote significance at the 1 and 5 percent respectively. Internal and external characteristics are included in all estimations.*

These results are consistent with the theory (Bergström, 2000) and the findings in Zhu et al. (2012), in that increased dependence on subsidies may lower motivation and give rise to a lack of effort, which results in a negative effect on firm productivity. These results may also reflect rent-seeking behaviour, as firms may choose to re-allocate productive resources to the process of seeking subsidies, as argued in Holmström (1999).

3. In order to further disentangle the productivity effects of investment support, the sample was split with respect to firm size and type of agricultural firm (Standard Industrial Classification). This model considered four classes (1) small firms (1 employee), (2) larger firms (more than 1 employee), (3) dairy firms (SIC 1410) and crop firms (SIC 1110-1302). The results indicated an existence of intra-industry differences with regard to subsidies (Table 2). These results are stimulating as they indicated that Pillar II investment subsidies had a positive and significant effect on firm productivity only for the small and medium sized firms as opposed to larger firms receiving support. Larger firms were less productive compared to their non-support receiving counterparts as a result of the subsidy. Zhu et al., (2012) found similar results, specifically, that an increase of one percentage point in the share of total subsidies in total farm income led to a 0.89 decrease in technical efficiency.

Send your questions to:

info@ruralevaluation.eu

4. Lastly, in order to test if results held across investment types, a final model was used to distinguish between support to physical assets and to renewable energy (Table 3). Outcomes suggest that the negative effect of increased subsidisation only applies to investment in physical assets and not to investments in renewable energy. These results were intriguing as they indicated differences, not only with regard to the size of the support and the firm, but also with regard to the investment type.

Table 2: Total Factor Productivity split by firm size and type

Results FE–CEM; effect of investment support on TFP

Variable	1 empl.	> 1 empl.	Diary	Crop
Investment support T_i	0.136*** (0.026)	0.017 (0.016)	0.157** (0.025)	0.106** (0.040)
Investment support Γ_i	-0.354*** (0.069)	-0.347*** (0.082)	-0.273*** (0.204)	-0.430** (0.200)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
Firms	58974	13658	6993	25595

****, ** denote significance at the 1 and 5 percent respectively. Internal and external characteristics are included in all estimations.*

Table 3: Total Factor Productivity split by investment type

Results FE–CEM; effect of investment support to renewable energy

Variable	TFP	TFP	Labour prod.
Investment support T_i Renewable energy	0.115*** (0.031)	0.133*** (0.032)	0.151*** (0.032)
Investment support Γ_i Renewable energy	-	-0.326 (0.173)	-0.345 (0.172)
Industry	YES	YES	YES
Year	YES	YES	YES
Firms	66753	66720	66720

****, ** denote significance at the 1 and 5 percent respectively. Internal and external characteristics are included in all estimations.*

The overall challenges encountered during the use of these methods were:

1. Estimating the counterfactual outcome;
2. Controlling for selection bias attached to the assignment of support (e.g. supports are granted to firms that are generally better performing firms, which may bias the estimates);
3. Controlling for the fact that firms may receive multiple subsides, which can make it difficult to disentangle the role of one single support (e.g. measure 121).

KEY POINTS AND RECOMMENDATIONS

1. Selection bias is often a difficulty, which must be overcome. Therefore, in order to successfully account for other effects, including those related to other objectives/ axes linked to measure 121, one must have access to detailed firm-level data (indicators need to be analysed at the level of the beneficiaries, e.g. the firm), which are not readily available in all Member States.
2. It is important to consider the use of difference-in-difference (counterfactual approaches), otherwise the results will be biased and cannot be used for policy recommendations.
3. Evaluation of continuous treatment effects is critical, as illustrated in this case, as the size of the support is taken into account.
4. Control for the type of investment that the support is granting, as there may be differences in the effects depending on the investment type (e.g. investments in renewable energy vs. physical assets).
5. Firm-level data which is employer-employee matched and has spatial reference is crucial to control for potential internal and external sources of endogeneity.

European Evaluation Helpdesk for Rural Development

T +32 2 737 51 30
info@ruralevaluation.eu
http://enrd.ec.europa.eu/evaluation/

EVALUATION WORKS!

European Network for Rural Development

The Evaluation Helpdesk works under the supervision of Unit C.4 (Monitoring and Evaluation) of the European Commission's Directorate-General for Agriculture and Rural Development.

The contents of this fact sheet do not necessarily express the official views of the European Commission.