

Methods for Evaluating Structural Fund Employment Effects Methodological alternatives and the empirical case of Lithuania

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Aim of presentation: To discuss merits and drawbacks of some methodological alternatives considering their applicability to the Lithuanian case.

Related project: The Public Policy and Management Institute has carried out a project for the Lithuanian Ministry of Finance on evaluation of the effects of Structural Fund on employment in Lithuania.

Structure of presentation

- ▶ Methodological alternatives considered
 - ▶ EC recommended 'bottom-up' approach
 - ▶ Macroeconomic modelling
 - ▶ Questionnaires
 - ▶ Direct econometric estimation
- ▶ Some theoretical considerations related to direct estimation in reduced-form models
- ▶ Empirical implementation
 - ▶ Specification issues
 - ▶ Level of aggregation
 - ▶ Data issues
- ▶ Main findings

EC recommended 'bottom-up' approach

Some related EC evaluation documents:

- ▶ EC(1997) 'Counting the Jobs: How to evaluate the employment effects of Structural Fund interventions'
- ▶ EC (2007) 'Measuring Structural Funds Employment Effects'

Logic: *SF* interv. \Rightarrow *gross jobs* \pm *adjustments* = *net jobs*.

$Net\ jobs = gross\ jobs \cdot (1 - deadweight) \cdot (1 - displacement) \cdot multiplier.$

Ranges of recommended adjustment for:

- ▶ additionality = $(1 - deadweight) \in [0.2, 0.8]$
- ▶ displacement (and substitution) $\in [0.1, 0.7]$
- ▶ indirect effects (income multiplier, supplier effects, etc.) $\in [1, a], a \geq 1.5.$

Implied 'total' adjustment factors:

- ▶ the worst case: = 0.06
- ▶ the best case : = $\begin{cases} 1.08, a = 1.5 \\ 2.16, a = 3 \end{cases}$
- ▶ an average case ($a = 1.5$): = 0.375.

How satisfactory is such an adjustment range like [0.06 - 2.16]? Can it be considerably reduced? Do we have an accurate measure of gross jobs? A sound logical structure which is not that useful in practice?

Use of macroeconomic modelling

Macroeconomic models (macro-econometric, CGE, DSGE, etc.)

Advantages:

- ▶ Leans on a 'received' macroeconomic theory
- ▶ Accounts for the global interaction and macroeconomic constraints
- ▶ Provides a better understanding of potential mechanism of impact and of relative importance of different instruments and their use
- ▶ Allows predicting the future impact

Concerns:

- ▶ Variety of types of impulses - efficiency of use of funds
- ▶ Identification of the effects / specificity of inference
- ▶ Complementarity / additionality
- ▶ Sensitivity to a theoretical / empirical structure (change of a single equation, confidence bounds, testing of over-identification restrictions, etc.)
- ▶ Level of details is low

Ex-ante and ex-post evaluation - do we see any difference? More fit for the former?

Specific issues in Lithuania:

- ▶ Failed significance of SF effects at an aggregated level (identification, multicollinearity)
- ▶ 'Loose' results for a disaggregated model: significant financing effects, but poor econometric results for some sectors

Evaluation based on questionnaires

Merits:

- ▶ Aims at measurement of impact
- ▶ Specific details can be regarded
- ▶ Potential future impact can be evaluated
- ▶ A relatively fast way to get an estimate

Problematic issues:

- ▶ Local and partial estimate (a specific firm and/or sector knowledge, geographical constraints)
- ▶ Subjective and complex perception: unformalized conditionality, informational domination and difficulties in separating a particular impact
- ▶ Lack of incentives, especially, after a project has been implemented
- ▶ Level of details and representability

Better suited for counting *gross jobs*? Is it a first step: collecting data for the further econometric research?

Direct econometric estimation at a detailed level

Advantages:

- ▶ Any level of detail, e.g. sectoral-regional, micro, as far as the data allows it
- ▶ Particular estimation and, hence, a specific evaluation of the effects
- ▶ Better segregation/identification of SF impact due to a panel structure, spatial effects can be taken into account
- ▶ Possibility to identify formally various effects (direct/indirect, temporary/permanent, etc.)

Cautions:

- ▶ Conditional inference: what set of indicators to condition upon? Back to some structure?
- ▶ Reveals only what is contained in the data (for instance, lagging effects)

The best alternative for the ex-post evaluation?

Summarizing remarks

- ▶ In various states of evaluation cycle - starting from an ex-ante and ending with an ex-post evaluation - different modelling and measuring methods are more appropriate. The ex-post evaluations should be directed towards the measurement of effects rather than modelling.
- ▶ Identification of SF impact and a detailed characterization, e.g. by type of intervention, regions, sectors of economic activity and so on, requires a detailed level of disaggregation.
- ▶ An extensive meta-analytical research is needed for the *gross jobs* \Rightarrow *net jobs* calculation approach to become useful, i.e. a detailed conditional description/estimation of adjustment coefficients would be very helpful in order to understand, how the adjustment coefficients differ for various funds, economic sectors, in different economies or business cycle states, etc.
- ▶ A *gross jobs* indicator seems to be more relevant for the operational management of SF projects; for the final impact is revealed by the *net jobs* indicator. Hence, provided a direct estimate of the latter without the former is possible, there is no need to require collecting data on *gross jobs*.
- ▶ Unless coupled with some further econometric research, the questionnaire-based evaluation of net jobs is unlikely to be accurate.

Estimation of effects in the structural and reduced form models (1)

Consider a linear structural model:

$$\Gamma Y_t = DX_t + HF_t + u_t,$$

where, for each period $t = 1, \dots, T$, $Y_t = (Y_{1,t}, \dots, Y_{n,t})'$ stands for a vector of n endogenous variables, $X_t = (X_{1,t}, \dots, X_{k,t})'$ denotes a vector of k exogenous variables, excluding relevant indicators of financial support, F_t contains m financial support indicators, u_t is an orthogonal vector of zero mean error term, uncorrelated with X_t and F_t , and Γ , D and H are the respective matrices of parameters. A reduced form of it is

$$Y_t = BX_t + CF_t + v_t, \quad B = \Gamma^{-1}D, C = \Gamma^{-1}H, v_t = \Gamma^{-1}u_t,$$

with an equation of i^{th} endogenous variable being

$$Y_{i,t} = \sum_{j=1}^k b_{i,j} X_{j,t} + \sum_{j=1}^m c_{i,j} F_{j,t} + v_{i,t}, \quad i = 1, \dots, n,$$

The main problem of applying the reduced form directly for the estimation of the effects of SF is that, often, k is large as compared to T and, usually, $B = \Gamma^{-1}D$ does not impose a sufficient number of zero restrictions on ...

Estimation of effects in the structural and reduced form models (2)

the reduced form parameters $b_{i,j}, j = \overline{1, k}$.

In some lucky cases the system under consideration has relatively few exogenous variables, i.e. k is small. If this is not the case, a standard way to solve the problem of dimensionality is to approximate BX_t by using its projection on the r first principal components of X_t . Let f_t denote a vector containing the first $r \ll k$ principal components of X_t with Λ denoting the respective matrix of parameters. Then the reduced form equation can be cast in the following form

$$Y_t = \Lambda f_t + CF_t + \xi_t, \quad \xi_t = v_t + BX_t - \Lambda f_t,$$

where r can be pre-defined or, better, selected using some information criterion.

Even if conditioned on a full set of exogenous variables, we can directly measure an impact of funds on any relevant dependent variable avoiding the structural modelling-related complications, provided that unexplained variance related to $BX_t - \Lambda f_t$ decays fast enough with an increasing r .

A stylized structural model

Producers' demand of labour and capital is defined by the first-order conditions of the objective function:

$$\forall i, \max_{L_i, K_i} p_i(Y_i^d) \cdot Y_i - w \cdot L_i - ucc \cdot K_i \text{ s.t.}$$

$$Y_i = A_i K_i^\alpha L_i^{(1-\alpha)} \text{ and } Y_i^d = \left(\frac{p}{p_i}\right)^\varepsilon, \varepsilon > 0, \text{ with } Y_i^d = Y_i.$$

Workers' demand of real wages is described by a Phillips curve:

$$\frac{w}{p} = w_0(1 - U)^\gamma, \quad U = 1 - \frac{L}{L^*}, \quad \frac{L^*}{Pop} = (1 - U)^\lambda \quad \gamma, \lambda > 0.$$

The necessary conditions for profit maximization and the remaining equations together with $\frac{ucc}{p} = r + \delta$ leads to a log-linear relationship:

$$\ln(L_i) = h(r + \delta, Pop)$$

Besides and error term, we augment this specification by including:

- ▶ individual effects related to potentially different α s, ε s or some other time-invariant, but producer-specific exogenous factors
- ▶ other potential exogenous variables (German GDP and CPI to proxy foreign demand and price changes, loans to proxy a foreign inflow of funds observed during the period)
- ▶ means of SF in the way to be specified in the next slide

Identification of type of effects

The SF impact might be highly nonlinear, but, to keep things manageable, let us augment the above-discussed log-linear relationship by the following SF interventions-related terms:

$$\ln(L_{i,t}) = h_i(X_{i,t}) + \theta_1 f_{i,t} + \theta_2 cf_{i,t} + \theta_3 NF_{i,t} + \theta_4 CNF_{i,t} + \xi_{i,t},$$

where:

$X_{i,t}$ - a vector of values of exogenous variables, possibly varying for different subjects i and time periods t ,


$f_{i,t}$ - an amount of SF received by an i^{th} subject at a moment t (related to *direct temporary effect*)

$cf_{i,t} = \sum_{j=t_0}^t f_{i,j}$ - cumulated amount received by a subject up to a moment t (related to *direct permanent effect*)

$NF_{i,t} = F_t - f_{i,t}$ - an amount of SF received by other subjects (related to *indirect temporary effect*)

$CNF_{i,t} = \sum_{j=t_0}^t NF_{i,j}$ - cumulated amount of *NF* (related to *indirect permanent effect*)

Remark: depending on the aggregation level - an entity receiving funds - an interpretation of direct/indirect effects differs: e.g. micro and sectoral-regional.

Comments: the net effect is obtained by aggregating the effects over all subjects, but the *gross jobs* \neq *direct effects*. How can we measure the *gross jobs*? Non-identified 

Dependent variable: in our case, the dependent variable is the number of jobs or, more precisely, the number of full-time employed persons.

Two sources of required data:

- ▶ The SFMIS database of the Lithuanian Ministry of Finance provides the data on subjects (subject code) and an amount of funds received by it.
- ▶ The Department of Statistics has a database on the employed persons by subjects, and various characteristics of subjects, e.g. sector, region, legal status, the date of establishment and so on.

The code of a subject allows linking the funds received by a subject to the employment state. This allows hoping for the econometric estimation of the effects of SF interventions.

Two complications: micro data are confidential and an announcement of some of data is lagging substantially.

Two main aggregation levels considered:

- ▶ Quasi-micro level: subject level, but a certain aggregation is a must due to the confidentiality restriction.
- ▶ Sectoral/regional level: the degree of freedom and flexibility of inference is lower.

In either case, the data were available, at best, only up to 2007. Is it really an ex-post stage of evaluation?

Net jobs created or saved: temporary/permanent and direct/indirect

Table: The estimated number of net jobs created or saved in Lithuania due to 2004-2008 SF interventions

| | | | |
|-----------------------|-------|----------------|-------|
| Total | 26773 | Total | 26773 |
| Temporary | 13670 | Direct | 20186 |
| Permanent | 13103 | Indirect | 6587 |
| Permanent / Total (%) | 48.9 | Total / Direct | 1.33 |

Note: The sectoral-regional disaggregation level-related results.

The econometric estimation leans on the data period from 1995 to 2007.

An estimate for the whole period, i.e. 2004-2008, is obtained by projecting the impact.

Table: The estimated number of net jobs created or saved in Lithuania by type of SF interventions

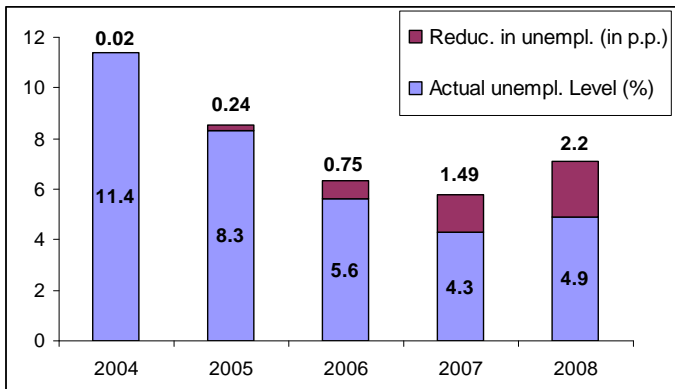
| Indicator | Intervention type | | | |
|-----------------------------|-------------------|----------|------------|-----------|
| | Total | Hum.Cap. | Publ.Infr. | Priv.Cap. |
| (Net) jobs | 26773 | 6814 | 14513 | 5447 |
| Costs (thous.of Litass) | 114.3 | 104.4 | 116.2 | 121.9 |
| Share of permanent jobs (%) | 48.9 | 43.1 | 50.9 | 51.1 |
| The usage rate of funds | > 50 | > 50 | > 75 | > 50 |

Note: The sectoral-regional disaggregation level-related results.

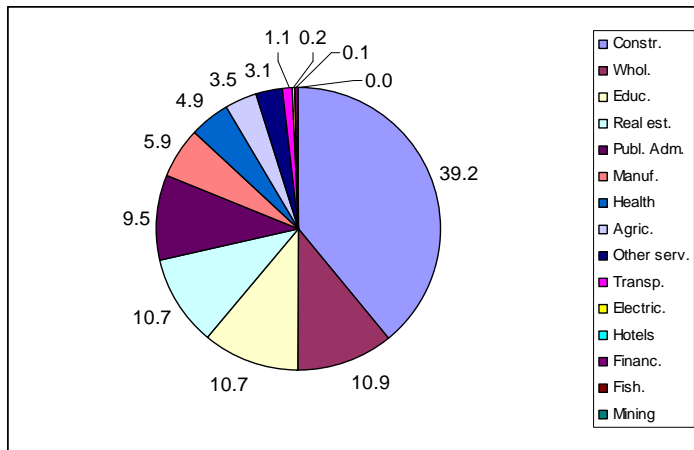
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A change in the unemployment rate due to *net jobs* created or saved



Sectoral effects of SF interventions



Regional effects of SF interventions

