Is LFA support a good value for money? Comparative regional CGE analysis

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Abstract

We compare the economic impacts of the Less Favourable Area (LFA) measure – a part of EU's Rural Development Plans (RDP) - on 20 regions in Finland (NUTS 3) and 16 regions in Poland (NUTS 2) over the years 2004-2006 . Our research tools are two similar regional computable general equilibrium (CGE) models, RegFIN and RegPOL. We address issues concerning regional and national economic impacts and efficiency of LFA measure in both countries. Our results indicate that it causes some upward pressure on prices, i.e. on land rent, the prices of agricultural products and on other sectoral producer and consumer prices. We also find out that LFA seems not "purely decoupled" as it affects the production decisions of the farmers to some extent. As the result, at national level agricultural production declined due to LFA in both countries. At the regional level, however, the effects were mixed- in all Finnish regions (except Lapland) agricultural production declined and among Polish regions we observed a polarization effect, where regions specializing in agriculture tended to

increase their production, while more urban regions reduce it. On average, more rural regions proved more efficient in utilizing the LFA funds than urban regions.

JEL Classification: P50, C68, O18

Keywords: Comparative Economics, Computable General Equilibrium Models, Regional and Rural policy

Introduction

Compensatory payments for Less Favoured Areas (LFA) was one of the key measures of Rural Development Plans across EU countries in the last financial period. It absorbed 21% of European Agricultural Guidance and Guarantee Fund (EAGGF) Guarantee Section funds in years 2000-2006, and was the second largest measure of all, after agri-environmental measure. This was also a very important measure at the particular countries' level, absorbing even up to 50% of their rural budgets (as e.g. in Finland). LFA was introduced in 1975 and at that time was perceived as a major change in the nature of Common Agricultural Policy (CAP). This was because it introduced regional dimension and also initiated area-based annual payments to farmers. This idea of decoupled payments expanded later on other measures during CAP reforms (Dax, 2005). Over the time, the spatial importance of the measure expanded together with increasing eligibility of the EU regions. In 1975 the EU average area classified as LFA was 32.9% while in 2005 it was 56.5%, with such high country levels as 100% in Finland and 52.4% in Poland (EC 2005).

At the same time, the controversy over the measure has been growing and it became an interesting subject to study for following reasons.

First, because LFA objectives have been changing and proliferating along the time. In the original Council Directive 75/268/EEC, there was one main objective and two sub objectives specified as follows: "ensure the continuation of farming in the areas, thereby maintaining a minimum population level and conserving the countryside". Then, with Council Regulation EC 1257/1999 new objective appeared, as

"maintenance of a viable rural community". The current objectives, according to the most recent EC regulation 1968/2005, are "through the continued use of agricultural land" contributes to "maintaining the countryside" as well as "maintaining and promoting sustainable farming systems". The social objectives as e.g. rural depopulation have disappeared while the concern for the maintenance of agricultural land use and environmental protection has increased (IEEP, 2006).

Second, LFA by assumption should have a decoupled nature, as it is a per hectare measure, so one expects some effects on land rents but not on agricultural production. Hennessy (1998) and Adams et. al. (2001) remind that according to economic theory, lump-sum payment to fixed amount of land area (as LFA) should be treated as subsidy of land, which is a subsidy of a production input. The payment level does not depend on farmer's current production decisions, so they should not alter them. The LFA payment should be then fully reflected in higher land rents. However, it is argued sometimes that the market imperfections and wealth effects cause these kinds of payments to induce a production response despite their decoupled nature. In practise, we do not expect pure coupled or decoupled forms to exist, so it is worth testing to what extent the LFA really affects agricultural production.

Third, the measure is now under a political scrutiny both at the EU and country levels. Recently an evaluation study of LFA ordered by European Commission's DgAGRI (Directorate General for Agriculture) was published (IEEP, 2006) and also there is a political agreement to revise the LFA measure in 2010. One obvious question would be the impact of removing LFA from the Rural Development Plans

and what would be the best replacement. The measure was very popular among the countries mainly because of its high uptake, which resulted from relative easiness of this measure comparing to others, like investment grants, which were secured by much higher requirements.

Our main focus in this paper is in quantifying the economic impacts of LFA at the regional and national levels. We analyse all 20 NUTS 3 (Nomenclature of Units for Territorial Statistics) regions in Finland and 16 NUTS 2 regions in Poland. The common time frame is a period between the years 2004 and 2006[1]. We investigate whether LFA really affects the land rent and wages, agricultural prices and the production level as well as whether it has some spill-over effects on food prices, employment, GDP and depopulation. We also analyse which regions use LFA more efficiently than others.

Regional picture of Finland and Poland

Before we describe the model for the policy analysis, we would like to propose a typology for regional comparison, i.e. define the regions according to the same criteria for Finland and Poland. The simplest rural typology for the regions would be Organisation for Economic Co-operation and Development (OECD) classification of predominantly rural (PR), intermediate/significantly rural (IR) and predominantly urban (PU) regions, which is based on the percentage of the population living in rural

[1] LFA was first introduced in Poland in 2004, when it joined EU, and that is why our financial period is cut from the financial perspective of 2000-2006 to three years only, before the next financial perspective started from 2007-2013.

areas. It is EU wide recognized typology which proved effective for many regional and policy studies (Terluin, 2006).

Here, however, we propose to extend the OECD typology by adding one more dimension, i.e. dependence of rural population on agriculture. This would be represented by percentage of rural population actually employed in primary sector versus secondary and tertiary sectors. So adopting similar logic to OECD typology, the predominantly agricultural (PA) regions would be the ones where more than 50% of rural population is employed in agriculture, then significantly/intermediate agricultural (IA) would be the ones where it is less than 50% and higher than 20%[2], and predominantly tertiary (PT) regions would be those where agriculture counts less than 20% in employment of rural population, so occupation in services or industry dominate. Such a presentation gives a more detailed picture of what the rurality means in different regions and together with OECD typology gives us 9 types[3] of regions, as in Table 1.

The advantage of the typology is that it visualises rural population distribution according to the place of living and the occupation among the regions. We use the typology to bring our results closer to what they mean for rural people who, after all, should be main beneficiaries of rural policy. This typology makes the comparison between various regions and countries easier. The results are analysed for similar

[2] We could use 15% edge analogically to OECD, but because of a clearer data evidence for the two countries we used the 20% edge.

[3] In practice, type 7 and 8 are not likely to appear, so generally we distinguish 7 meaningful types or regions.

regions in the two countries. According to this typology we identified five types of regions in Poland and five types in Finland, as presented in Chart 1[4].

It is quite clear that Finnish regions are more rural (most of them are PR) than Polish, however Polish regions are more agricultural (PA and IA). In Finland only one region is PA (Kainuu), one is IA (Keski-Pohjanmaa) and the other 15 are PT while in Poland there are two regions PA (Lubelskie and Swietokrzyskie), four regions IA and no PT regions. In Poland all predominantly rural regions are still heavily oriented on work in the agricultural sector while in Finland rural population works primarily in industries and services. Poland does not have yet IR-PT regions, which type is represented by two regions in Finland (Kymenlaakso and Varsinais-Suomi). Finland has no regions which would be IR-PA, but Poland still has two (Podlaskie and Lodzkie). We expect those regions to be shifting downwards, towards IR-IA and PR-IA regions. The structure would then become more similar to Finnish one in that respect. Similarly, both Poland and Finland has only one PU-PT region each, Lodzkie and Uusimaa[5] respectively.

Summarising, in Finland 75% of the regions are Predominantly Rural - Predominantly Tertiary (15), 10% are Intermediate Rural - Predominantly Tertiary (2), then 5% is Predominantly Rural - Predominantly Agricultural (1), 5% is Predominantly Rural - Intermediate Agricultural (1), and 5% Predominantly Urban - Predominantly Tertiary (1). In Poland 44% of the regions are Intermediate Rural -

[4] For identification of rural vs. urban communities we used municipalities for Finland (Local Administrative Unit [LAU] 1) and communes for Poland (LAU 2), which were the lowest available levels for density ratio calculations.

[5] Uusimaa was not quite yet PR in 2002 but now it is, so was classified as PU-PT type.

Intermediate Agricultural (7), 25% are Predominantly Rural - Intermediate Agricultural (4), 12.5% are Predominantly Rural - Predominantly Agricultural (2), 12.5% are Intermediate Rural - Predominantly Agricultural (2) and 6% are Predominantly Rural - Intermediate Agricultural (1).

All regions in Poland are much poorer than in Finland. The richest Polish region is poorer than the poorest Finnish region. Not surprisingly among the most wealthy regions are in both countries the capital-city regions (Mazowieckie and Uusimaa) and predominantly urban/predominantly tertiary regions (Slaskie and Uusimaa). The poorest in both countries are predominantly rural - predominantly agricultural regions (Kainuu and Lubelskie), see Chart A.1.

The distribution of LFA measure by regions is determined by eligibility criteria, demand from the farmers, goodness of applications, etc. Therefore, LFA support is not evenly distributed between the regions, both in absolute and relative terms, even in Finland, where 100% of the area is eligible for LFA. In terms of regional Gross Domestic Product (GDP), LFA accounted of between 0.1% to 3.5% of GDP in Finnish regions and from 0.04% to 2.1% in Polish regions (see Chart 2). The highest shares are in Etelä-Pohjanmaa (PR-PT), Keski-Pohjanmaa (PR-IA) and Pohjanmaa (PR-PT) for Finland. The corresponding regions are Podlaskie (IR-PA), Warminsko-Mazurskie (PR-IA) and Lubelskie (PR-PA) for Poland. What we can see from the typology, is that most of those regions are predominantly rural but the level of agricultural occupation differs from predominantly agricultural to predominantly tertiary.

Our common period of analysis is 2004-2006. The following Chart 3 gives the sum of LFA received during this period. Finland received 1 191 Mio. EUR. The largest sums were for Etelä-Pohjanmaa (PR-PT), Varsinais-Suomi (IR-PT) and Pohjanmaa (PR-PT). The corresponding figure was about 910 Mio. EUR for Poland. Regions that got the highest amount in absolute values were Mazowieckie (IR-IA), Podlaskie (IR-PA) and Wielkopolskie (PR-IA). We can see from the typology that half of the regions which received the highest support were predominantly rural and the other two were intermediate rural. Dependence on agriculture varied from predominantly agricultural to predominantly tertiary. The lowest support was received in both countries by predominantly urban-predominantly tertiary regions.

Methodology

The regional economic effects of the LFA measure was evaluated by means of two similar regional Computable General Equilibrium (CGE) Models, RegFIN and RegPOL. They have the same structure of equations, representing the countries as small, open economies, in a static framework. The advantage of using similar models is that we control for any differences in the simulation results which would come from the differences in the research tool. The other advantage is that the models are regional, i.e. operating at NUTS 3 and NUTS 2 regions which is not very common feature of CGEs yet.

RegFIN was introduced ten years ago by (Törmä and Rutherford, 1998, 2004, 2007). The regional model has been used in 15 additional reported applications dealing with evaluation of infrastructure developing projects (to mention some of the latest (Törmä and Zawalinska, 2007a, 2007b). The RegPOL model was created by

(Zawalinska, 2007c) by replicating RegFIN to Polish economy[6]. The general design of the models is summarised in Table 2.

The RegFIN/RegPOL model is static, so the length of the adjustment of the regional economy to the shock is unknown. For this reason, we can report only comparative-static results between the benchmark and full adjustment year. The LFA subsidies were introduced as a shock decreasing the tax rate of the land input. We present here long run results (capital is endogenous in agriculture) and for the years 2004-2006.

Data

The databases for the models are regional Social Accounting Matrices (SAMs). The cores of the SAMs are regional Input-Output (IO) tables, combined with additional regional data on direct and indirect taxes and subsidies, sectoral employment, migration, and structure of investments. In case of Finland, we used the latest available national and regional IO tables, produced by Statistics Finland for 2002 (Statistics Finland, 2006) accompanied by additional regional statistics from there. In case of Poland, only the national IO tables were available, and we used the latest one of 2000. In addition we created 16 regional IO tables and SAMs for Poland ourselves. We decided for a hybrid technique combining the Augmented Flegg Location Quotient (AFLQ) technique (Flegg and Webber, 2000; Tohmo, 2004), technical coefficients from national IO table (CSO, 2004) and additional regional accounts data ordered directly from Polish Statistical Office. Based on our data work, we are aware, that the Finnish data is more reliable and consistent than their Polish

[6] Technical description and a list of the applications are presented in www.helsinki.fi/ruralia/seinajoki/ytp.

counterparts. Despite this deficiency, the model verified that the Polish data work properly both from the technical and economic theory standpoints.

Results

Despite the fact that LFA was smaller in absolute terms in Poland than in Finland, the shock tended to have larger effects for the former. The reason for this is that the LFA support means more in terms of additional income there compared to Finland. The other reason is that Poland is more agriculturally oriented, so has more hectares in cultivation than Finland. This affects the regional values of the shock variable, land tax rate.

The first interesting aspect we wanted to investigate was how LFA subsidies change the land rents. In theory, higher rents would mean higher production costs and prices for agriculture and possibly spill-over effects to the producer and consumer prices of the other sectors. When the subsidy is given, land would become cheaper with respect to labour. If production stays constant and there are substitution possibilities, the resulting additional demand for land would push up land rents. As we allowed for capital to adjust (long run scenario), there is a possibility of a supply increase. Our results suggest, however, that the demand effects overcome the demand effects causing a positive impact on welfare.

LFA support capitalised in land rents as the economic theory predicts. With a positive substitution elasticity (as present in our model) rising land rents could be substituted with a relatively cheaper labour. According to our results, indeed the price ratio between land and labour changed in favour of labour - wages increased by

only 0.2% in Finland and by 0.4% in Poland. Chart 4 shows the total effect of LFA on land rents (see also land-labour elasticity value in Table A.1).

The increase in land rents is on average higher in Poland than in Finland, 22% and 8% respectively, which in absolute values gives on average increase by 8 EUR per ha in Poland and 13 EUR in Finland. The three most affected regions in Poland are Kujawsko-Pomorskie, Warminsko-Mazurskie and Podlaskie and in Finland Uusimaa, Pirkanmaa, and Kanta-Häme. The regional differences of total rent values by regions are presented in Chart A.2.

Increasing land rents and wages would, on the other hand, have a positive effect on factor incomes of farmers and land owners. The total effect on agricultural production depends on the balance of the two effects. First, as land rents and wages grow, land owners get more factor income. This might bring more real purchasing power to the regional economy depending on how consumer prices behave. Second, as production costs increase, they negatively affect supply. The outcome for the purchasing power very among the regions, as presented in Table 3.

We observe that factor income increases in Finland for all regions, the change being highest in Etelä-Pohjanmaa and lowest in Ahvenanmaa. In Poland, the positive factor income effect is visible in thirteen regions, and negative only in three regions: Slaskie, Mazowieckie and Pomorskie. Poland's response to LFA support seems to be stronger in both factor income and growing consumer prices for the regions that have positive factor income effects. We measure purchasing power by the change of real spending by the regional households. Both countries have eight regions that can

consume more in real terms. The top four in Finland are Etelä-Pohjanmaa, Kanta-Häme, Keski-Pohjanmaa and Itä-Uusimaa. The top four are Warminsko-mazurskie, Podlaskie, Kujawsko-Pomorskie and Lubelskie. Again Poland gains more on average than Finland. We can thus conclude that the LFA support has some positive but quite modest purchasing power effects for regions in Finland and in Poland.

The overall impact of LFA is measured by the change of real regional GDP. The LFA support is very small compared to the whole regional economy, so it is no surprising that the effects on GDP are minor. In Finland there is actually economic growth due to LFA only in Etelä-Pohjanmaa, Kanta-Häme, Keski-Pohjanmaa and in Itä-Uusimaa. The results for Poland indicate a stronger influence; there are six regions that gain at least 0.1% in GDP: Warminsko-mazurskie, Podlaskie, Lubelskie, Kujawsko-Pomorskie, Wielkopolskie and Opolskie. However, there are fourteen regions in Finland and seven regions in Poland which loose in terms of GDP. We can thus conclude that the LFA support has some small positive effects on economic growth for some regions only, mostly those more agricultural orientated.

The most interesting aspect of the LFA support is whether it has an effect on agricultural production (decoupling issue). We saw earlier that LFA creates new private consumption in most cases. The total effects, however, is dependent also on how the prices behave. The results for the corresponding price and quantity changes are presented in Table 4.

In light of our results, agricultural prices increase due to LFA in all regions both in Finland and in Poland. This comes from the fact that the prices of production factors, land and labour, increased. The percentage change in price rise in Finland is highest

in Uusimaa (4%) and lowest in Lappi (0.4%). In Poland the response is even higher, the biggest price increase is in Slaskie (9.4%) and the lowest in Swietokrzyskie (2.1%).

As far as agricultural production is concerned, Finland and Poland behave differently. In Finland LFA causes production to decline in all regions but Lappi. The output change is from -1.8% in Uusimaa to -0.2% in Varsinais-Suomi. In Poland not only the changes are much higher in absolute terms, but also they are in different directions. Agricultural production in half of the regions decreases but in the other half it increases. Interesting observation is a specialization effect, so the increase in production is in the regions most agricultural orientated while the decline is in the regions turning more into secondary and tertiary sector. At the national level, however, the agricultural production slightly decreases in both countries, by 0.7% in Finland, and 1.5% in Poland.

In the first part of the paper we introduced a two-dimensional typology for different regional types. According to this typology we identified 2 extreme types of regions (Type 1 and Type 9) which behave similarly in both countries. The results for other types are more diverse and more difficult to be generalized in the between and within countries comparisons. In terms of this typology, the most urban and tertiary (Type 9) regions reduce their agricultural production the most, by 4.3% in Poland and by 1.8% in Finland - see Table 5. On the other hand regions most specializing in agriculture (PR-PA, IR-PA and PR-IA) actually increase their production in Poland, on average by 1.5%, 1.3% and 0.7% respectively. In Finland, this effect seem to also appear, but in a weaker form. Agricultural production tend to decrease, but quite

clearly more dynamically in urban regions than in the rural ones (4.3% decline in PU-PT compared to 0.9% in PR-PA regions).

As for spill-over effects, they are relatively small. The most interesting one is probably how the LFA support is transmitted into food prices when its raw materials price increases. In Finland food prices went up due to LFA from 0.2-0.5% at the regional level[7]. The corresponding production loss was from 0.1-0.7%. Further, the results suggest that the effect on total employment was somewhat negative in both countries. As wages increased and production declined in the food economy, employment decreased. The total loss in employment was -0.1% in Finland and -0.4% in Poland. We can thus conclude that LFA creates little spill-over effects in the over-all regional economy.

Last, we report some observations on effectiveness and efficiency of the LFA support. We evaluate this only from the socio-economic perspective (we do not deal with environmental goals). So among socio-economic goals we distinguished "maintenance of agricultural production" (but without increase), "preventing depopulation" and assume no negative effects on the regional economies. Thus we conclude that the goals were partially fulfilled. First, despite the decoupled character, LFA slightly affected farmers' decisions in the long-run, so national agricultural productions declined; accompanied in addition by the polarisation regional effect (some regional increases vs decreases in agricultural production on regional level). Second, LFA had no effects on migration, the changes are almost none and the patterns of net migration remain the same. Regions which tend to depopulate

[7] We are not yet able to compare these results with Poland because the food sector is aggregated with other processing sectors.

continue in this direction and those gaining inhabitants in net terms keep this position. So the second economic goal of LFA is not valid anymore and rightly disappeared from the agenda, as discussed in the first part of the paper. Third, as for economic effects on regional economies the results are mixed. Quite clearly more urban and services oriented regions lost from the LFA policy in both countries (in Type 9 regions GDP declined by -0.1% in Finland and -0.5% in Poland), while more rural tend to gain or are not affected (in Type 1 regions GDP increased by 0.2% and did not change in Finland) – see Table 6.

At the national level, changes in GDP are negligible because LFA alone is quite a small shock to the economy. The evaluation of the third goal is thus difficult, but we could risk the statement, that LFA due to its distributional effect (rural/agricultural regions tend to gain more) it has some features of a cohesion instrument, which tend to decrease the distance of the rural vs urban regions. However, since the catching up effect is at the expense of the urban regions (which loose) there is a question if it is really a desirable cohesion policy tool.

We also evaluated efficiency by means of a benefit-to-cost ratio defined as percentage change in regional GDP to the unit change of the shock in land tax rate, see Chart 5.

The diagonal line separates the relatively more efficient regions where per one unit of land tax rate shock, brought more than a proportionate positive change in GDP. In Finland the relatively most efficient region were Etelä-Pohjanmaa (PR-IA) and Keski-Pohjanmaa (PR-PT). The shock value of the former was 0.066 which brought result of 0.21% increase in GDP. In Poland the relatively most effective regions were

Podlaskie (IR-PA), Warminsko-Mazurskie (PR-IA) and Wielkopolskie (PR-IA). The shock value for the most efficient region Podlaskie was 0.153 and the outcome, in terms of the change of GDP, was 0.8%. It seems on average, that Polish regions are more efficient in terms of using LFA than Finnish. This could potentially be explained by the fact that they are regions relatively poor in capital comparing to the Finnish ones and within Poland, so the rule of decreasing marginal return from the capital could hold, indicating that the same amount of capital brings higher returns if the initial capital endowment is lower.

Conclusions

We compared the economic impacts of the Less Favourable Area (LFA) measure of Rural Development Plans in Finland and Poland over the years 2004-2006 on regions in Finland and Poland. The research tools were two similar regional computable general equilibrium (CGE) models, RegFIN and RegPOL. We evaluated the measure according to its economic effectiveness, efficiency and impact on the regional and national economies in both countries. Our main results indicate as follows:

LFA capitalizes in higher land rents. It also shifts up prices of agricultural products and food prices. The effect is higher in the relatively more agricultural regions. LFA measure is fairly effective in restraining agricultural production in the long run. At the national level it has a little down ward effect on agricultural production. At the regional level, it has a distributional effect on the production structure, i.e. more

agricultural oriented regions tend to maintain or even increase agricultural production while more urban and services oriented decrease the production.

LFA measure has no effects on migration and negligible effect on employment. The most efficient regions in gaining from the LFA support are quite rural and agricultural in both countries, i.e Etelä-Pohjanmaa (PR-IA) and Podlaskie (IR-PA). Clearly, the worst impact of this measure is on the most urban and services oriented regions (PU-PT), Uusimaa in Finland and Slaskie in Poland.

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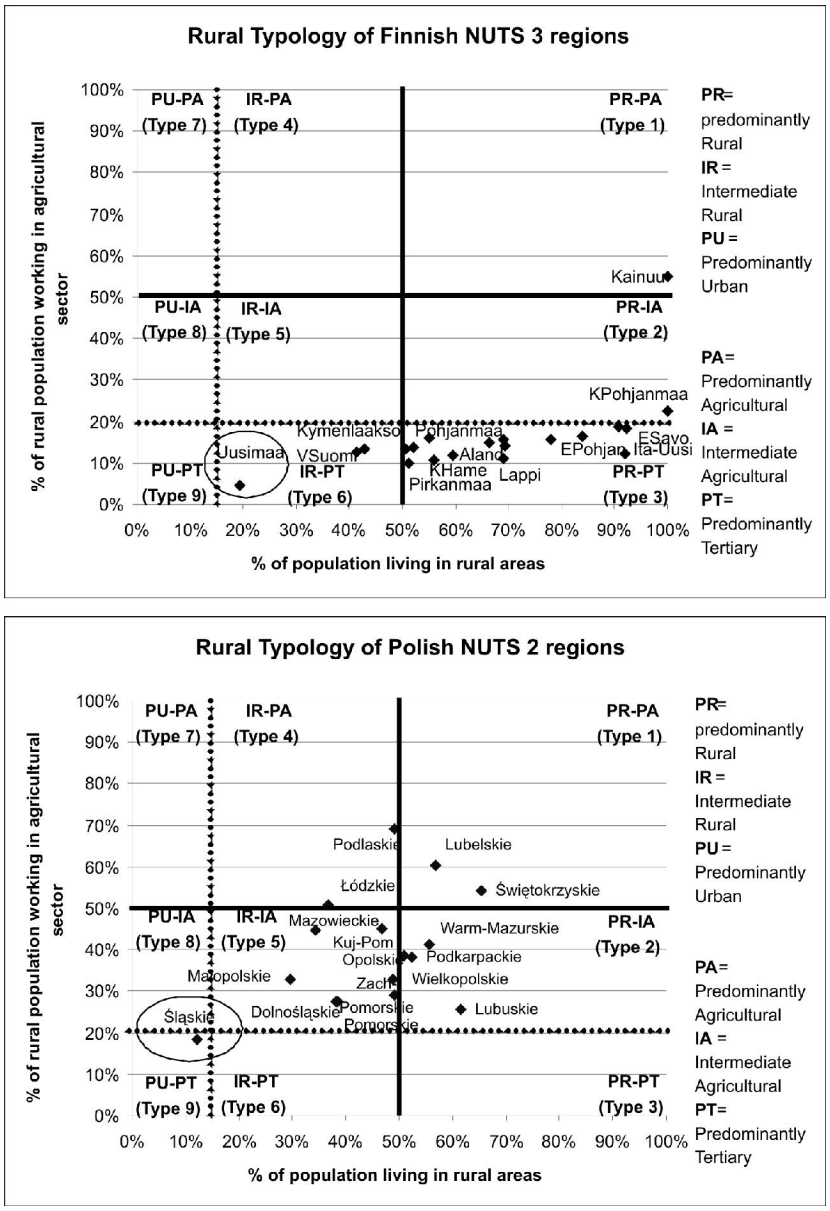

Chart 1. Two-dimensional OECD based typology for Finnish and Polish regions, 2002.
137x200mm (300 x 300 DPI)

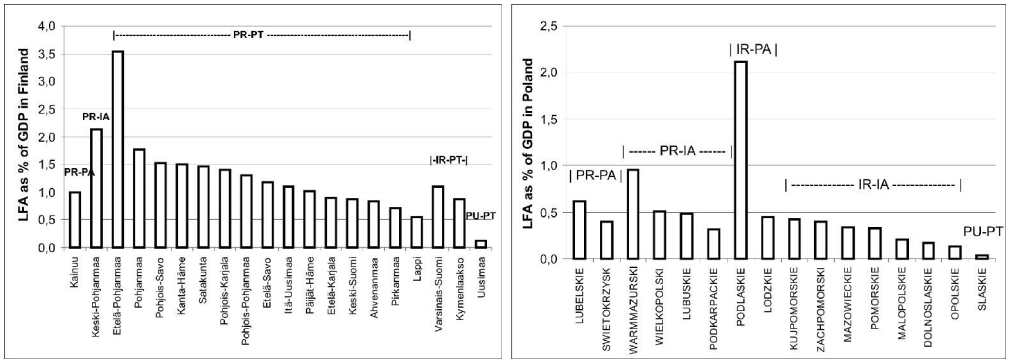

Chart 2. LFA received by the regions in percentage of regional GDP, total of 2004-2006.
234x83mm (300 x 300 DPI)

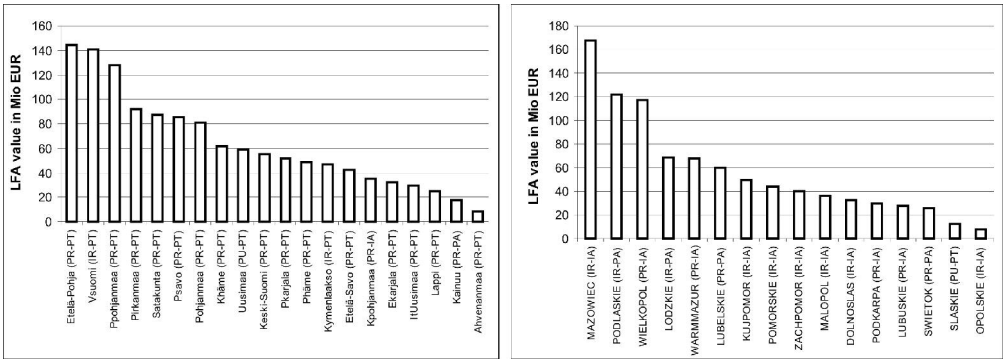

Chart 3. LFA received by the regions in absolute terms, Mio EUR, total for 2004-2006.
233x83mm (300 x 300 DPI)

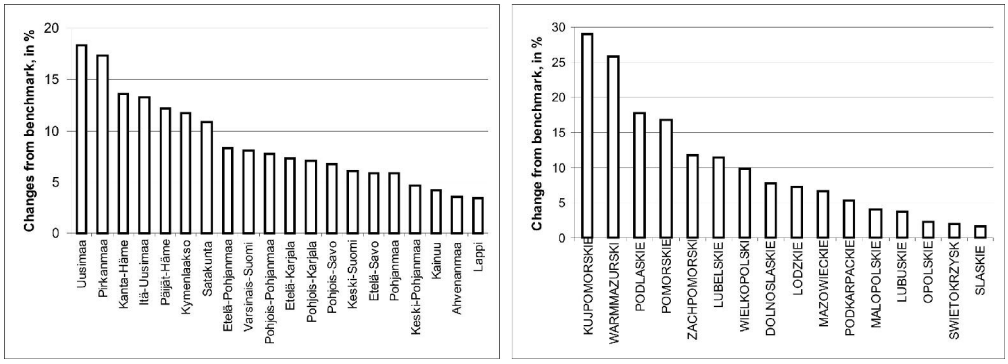

Chart 4. Changes of land rents due to the LFA support, total of years 2004-2006, percentage change compared to benchmark.
232x82mm (300 x 300 DPI)

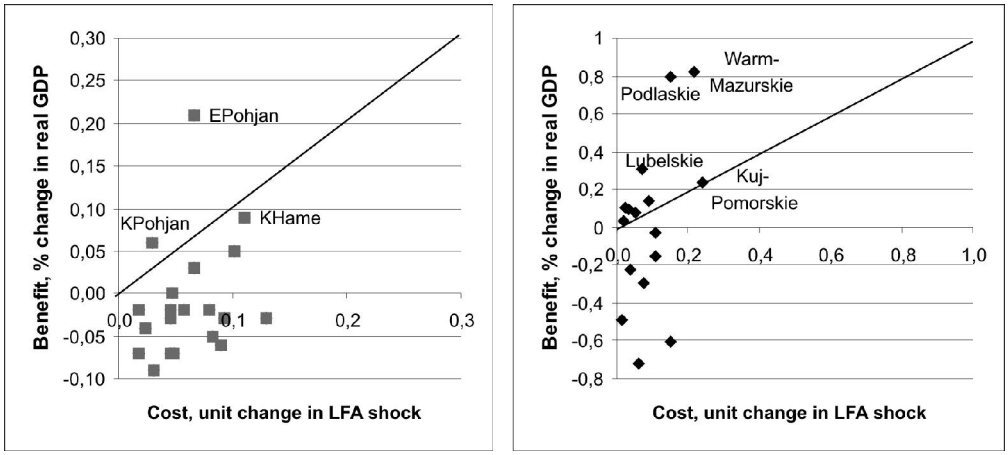

Chart 5. The efficiency of the LFA support, total of 2004-2006.
157x70mm (300 x 300 DPI)

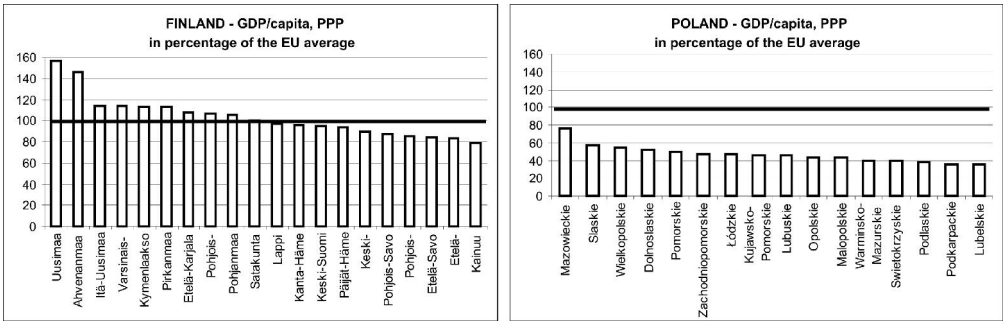

Chart A. 1 GPD per capita in Polish and Finnish regions.
233x74mm (300 x 300 DPI)

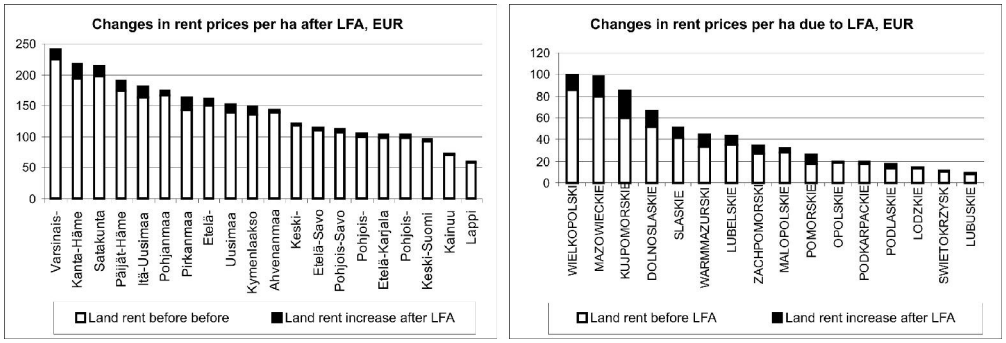

Chart A. 2 Regional differences in land rent reactions due to the LFA support, total of 2004-2006, Eur/ha.

234x78mm (300 x 300 DPI)

Table 1. Two-dimensional OECD based rural typology of regions

	% employed in agricultural sector			
% share in total population	Rural population:	**P**redominantly **A**gricultural above 50%	**I**ntermediate **A**gricultural between 20-50%	**P**redominantly **T**ertiary below 20%
	Predominantly **R**ural above 50%	**Type 1 PR-PA**	**Type 2 PR-IA**	**Type 3 PR-PT**
	Intermediate **R**ural between 15-50%	**Type 4 IR-PA**	**Type 5 IR-IA**	**Type 6 IR-PT**
	Predominantly **U**rban below 15%	**Type 7 PU-PA**	**Type 8 PU-IA**	**Type 9 PU-PT**

Table 2. RegFIN / RegPOL model features at a glance

General Features
- regional computable general equilibrium (CGE) simulation models
- static short and long run regional policy analysis possible
- basically Walrasian, price adjustment equilibrates regional economy
- rigid real wages cause classical unemployment in the labour market
- net migration explained by GDP and unemployment differentials

Benchmark data provided by Central Statistical Offices
- IO tables and SAMs for 20 NUTS 3 regions in Finland used and 16 NUTS 2 in Poland created with indirect methods
- based on regional and national accounts
- based on regional income and expenditure data
- benchmark calibrated for latest available year 2002 (Finland) and 2000 (Poland)

Consumption
- each region has one representative consumer household which maximizes welfare (Cobb-Douglas utility function)
- public sector is divided into two inter-related agents: national and regional governments which act as separate decision makers (Leontief structures)

Production
- constant returns to scale and perfect competition assumed
- regional production is modelled through cost minimization of firms
- labour and capital as primary inputs (CES production function)
- inter-sectoral inputs are modelled via an input-output model (Leontief structure)
- 27 sectors for Finland and 15 sectors for Poland (NACE) per region

Foreign and domestic trade
- domestic and foreign export and import included
- domestic production and exports modelled as joint products (CET production function)
- domestic and imported goods assumed qualitatively different (Armington assumption)

Taxation and transfers
- taxes for factors and outputs denoted
- representative consumer pays lump-sum income taxes to both governments
- regional income and expenditure flows through public budgets denoted

Implementation
- originally programmed by prof. Thomas F. Rutherford in GAMS/MPSGE
- the version used here programmed by prof. Mark Horridge using GEMPACK

Table 3. Changes in purchasing power due to the LFA support, total of 2004-2006, percentage change compared to benchmark

Percentage change from benchmark value (Finland)	Factor income	Consumer price index	Real spending by the households	Real GDP	Percentage change from benchmark value (Poland)	Factor income	CPI	Real Spending	Real GDP
EPOHJANMAA	0,97	0,43	0,54	0,21	WARMMAZURSKI	2,03	0,62	1,40	0,82
KHAME	0,60	0,29	0,31	0,09	PODLASKIE	2,04	0,67	1,37	0,80
KPOHJANMAA	0,48	0,26	0,22	0,06	LUBELSKIE	0,94	0,60	0,33	0,31
IUUSIMAA	0,45	0,23	0,22	0,05	KUJPOMORSKIE	1,04	0,46	0,59	0,24
VSUOMI	0,38	0,22	0,16	0,03	WIELKOPOLSKI	0,79	0,47	0,32	0,14
PSAVO	0,32	0,22	0,10	0,00	OPOLSKIE	0,45	0,44	0,00	0,10
PKARJALA	0,27	0,20	0,07	-0,02	LODZKIE	0,51	0,36	0,14	0,09
PPOHJANMAA	0,25	0,19	0,06	-0,02	PODKARPACKIE	0,49	0,39	0,09	0,08
LAPPI	0,14	0,15	-0,01	-0,02	SWIETOKRZYSK	0,38	0,40	-0,02	0,03
SATAKUNTA	0,34	0,22	0,12	-0,02	LUBUSKIE	0,50	0,37	0,13	-0,03
KSUOMI	0,17	0,16	0,01	-0,03	ZACHPOMORSKI	0,36	0,38	-0,02	-0,15
PIRKANMAA	0,23	0,18	0,05	-0,03	MALOPOLSKIE	0,14	0,32	-0,18	-0,22
PHAME	0,31	0,21	0,09	-0,03	DOLNOSLASKIE	0,08	0,30	-0,21	-0,30
KAINUU	0,16	0,17	0,00	-0,04	SLASKIE	-0,23	0,22	-0,44	-0,49
KYMENLAAKSO	0,20	0,17	0,02	-0,05	POMORSKIE	-0,14	0,27	-0,41	-0,60
UUSIMAA	0,05	0,10	-0,05	-0,06	MAZOWIECKIE	-0,23	0,20	-0,43	-0,72
EKARJALA	0,12	0,15	-0,03	-0,07					
POHJANMAA	0,25	0,17	0,08	-0,07					
AHVENANMAA	0,10	0,15	-0,05	-0,07					
ESAVO	0,12	0,16	-0,05	-0,09					

Table 4. Price and output changes in agricultural due to the LFA support, total of years 2000-2004, percentage change compared to benchmark

Percentage change from the benchmark value (Finland)	Price of agricultural products	Agricultural production	Percentage change from the benchmark value (Poland)	Price of agricultural products	Agricultural production
LAPPI	0,4	0,4	LUBELSKIE	3,0	2,3
VSUOMI	0,8	-0,2	WARMMAZURSKI	2,6	2,3
KPOHJANMAA	1,0	-0,3	PODLASKIE	3,0	2,1
EPOHJANMAA	1,0	-0,5	OPOLSKIE	2,4	1,5
KSUOMI	0,9	-0,5	PODKARPACKIE	2,8	0,7
IUUSIMAA	1,5	-0,7	SWIETOKRZYSK	2,1	0,7
PSAVO	1,2	-0,8	WIELKOPOLSKI	3,0	0,6
PPOHJANMAA	1,2	-0,9	LODZKIE	3,0	0,5
KHAME	1,3	-0,9	KUJPOMORSKIE	3,6	-0,1
KAINUU	1,2	-0,9	LUBUSKIE	3,7	-0,7
POHJANMAA	1,2	-1,0	ZACHPOMORSKI	4,4	-1,8
KYMENLAAKSO	1,8	-1,1	MALOPOLSKIE	4,5	-1,8
PHAME	1,6	-1,1	DOLNOSLASKIE	5,4	-2,6
AHVENANMAA	1,5	-1,1	SLASKIE	9,4	-4,3
PKARJALA	1,3	-1,2	POMORSKIE	8,5	-5,3
PIRKANMAA	1,7	-1,2	MAZOWIECKIE	9,0	-7,7
EKARJALA	1,7	-1,4			
SATAKUNTA	1,8	-1,4			
ESAVO	1,8	-1,7			
UUSIMAA	4,0	-1,8			

Table 5. Percentage changes of agricultural production compared to benchmark due to the LFA support, total of years 2004-2006

	Rural population: % employed in agricultural sector			
% share in total population	**AGRICULTURAL PRODUCTION:** F: FINLAND P: POLAND	**P**redominantly **A**gricultural above 50%	**I**ntermediate **A**gricultural between 20-50%	**P**redominantly **T**ertiary below 20%
	Predominantly **R**ural above 50%	F: -0.9% P: 1.5%	F: -0.3% P: 0.7%	F: -0.9% P: -
	Intermediate **R**ural between 15-50%	F: - P: 1.3%	F: - P: -2.5%	F: -0.9% P: -
	Predominantly **U**rban below 15%	F: - P: -	F: - P: -	F: -1.8% P: -4.3%

Table 6. Regional GDP effects of the LFA support, total of the years 2004-2006, percentage change compared to benchmark

	Rural population: % employed in agricultural sector			
% share in total population	**AGRICULTURAL PRODUCTION:** F: FINLAND P: POLAND	**P**redominantly **A**gricultural above 50%	**I**ntermediate **A**gricultural between 20-50%	**P**redominantly **T**ertiary below 20%
	Predominantly **R**ural above 50%	F: 0.0% P: 0.2%	F: 0.3% P: 0.3%	F: 0.0% P: -
	Intermediate **R**ural between 15-50%	F: - P: 0.5%	F: - P: -0.2%	F: 0.0% P: -
	Predominantly **U**rban below 15%	F: - P: -	F: - P: -	F: -0.1% P: -0.5%

Table A.1 Land – Labour elasticities in the RegFIN and RegPOL models

Sector	Elasticity value*
1 agriculture**	0.240
2 fishing	1.235
3 mining	0.752
4 manufacturing	0.673
5 electricity gas and water	0.717
6 construction	0.400
7 trade	0.549
8 hotels and restaurants	0.724
9 transport	0.350
10 financial services	0.689
11 dwelling	0.212
12 public administration	0.664
13 education	0.654
14 health	0.811
15 other private and public services	0.560

* In case of AGRICULTURE it is land-labour elasticity

** AGRICULTURE includes foresting and hunting for Poland