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Martin Nordin

Does the Decoupling reform Increase Agricultural Employment in Sweden? Evidence from an Unavoidable Change

AgriFood
economics centre

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Nordin, Martin

Abstract

This study uses aggregated municipality data, for the years 2001 to 2009, to explore whether direct payments to farmers affect agricultural employment in Swedish municipalities. The decoupling reform in 2005 implied that Sweden had to introduce a grassland subsidy, one that had unexpected redistributive consequences as it suddenly increased CAP payments to grassland regions. In some municipalities, the payments more than doubled. Thus, since this particular policy change is truly exogenous, the reform is used to identify a subsidy effect. With a difference-in-difference model, a permanent increase in agricultural employment can be attributed to the grassland subsidy. Each additional job in agriculture costs about SEK 223,000 (about € 25,000) in subsidies, which is low. However, the subsidy effect is primarily saving jobs in agriculture, i.e. the grassland subsidy may be slowing down the process of structural change in grassland regions.

JEL classification: H5, J18, J21, Q1

Key words: agriculture, employment, single farm payments, Common Agricultural Policy, EU

Correspondence to:
Martin Nordin
AgriFood Economics Centre
Box 730 – Scheelevägen 15 D
220 07 Lund
Sweden

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1. Introduction

The *Common Agricultural Policy* (CAP) is supposed to protect jobs in agriculture and slow down the process of structural change in the EU's rural regions. However, despite a long-standing debate about the CAP, there is little evidence of a positive relationship between the CAP subsidies and agricultural employment.

Decoupled subsidies are assumed to have no impact on labour use (Petrick and Zier, 2012, Ahearn et al., 2006) and, when invested in labour-shedding technology, they might decrease employment rather than protect jobs in agriculture (Petrick and Zier, 2011). The subsidies may also help farmers to capitalize, and buy out farmers willing to exit the sector (Goetz and Debertin, 1996). Another concern is that the protection of farmers' incomes results in an inefficient labour allocation (Gardner, 2002), which might have long-lasting implications for rural development. On the other hand, if payments are conditioned (coupled), or if there are wealth or insurance effects (Hennessy, 1998), subsidies may increase labour use.

This study uses aggregated municipality data, for the years 2001 to 2009, to explore whether the 2005 reform of direct payments to farmers (Pillar I) affects agricultural employment in Sweden. The unexpected redistributive consequence of the reform is used to identify a subsidy effect.

With the introduction of the decoupled direct payments in 2003, implemented in Sweden in 2005, the direct payment scheme was dramatically changed. The reform was decided at the European level and, besides the decoupling of the area- and animal payments, Sweden had to introduce a grassland subsidy. That is, since the reform covered all farmland, Sweden had to make grassland eligible for support (on the municipality level the average share of grassland is 54% of total farmland in Sweden). Because the main share of the direct payments is based on historical production, the decoupling itself did not imply a substantial change in direct payments to farmers, but farmers with grassland suddenly received a large increase in their support, and the direct payments doubled in some municipalities. So, even if the reform did not have redistributive intentions, redistributed was an unavoidable consequence of the reform.

To analyze the effect of policies on economic outcomes, the policy variation has to be exogenous (Besley and Case, 2000). In the case of the introduction of the grassland subsidy, it was firstly decided at the European level, and secondly appeared as a side-effect of the decoupling reform. Additionally, the implications of the grassland subsidy seem, in retrospect, to be a surprise, and a Swedish CAPRI-evaluation of the decoupling reform (Ekman, 2005) did not even discuss the grassland subsidy. Thus, this particular policy change is therefore truly exogenous, and at the same time rather unique in its large redistributive consequences.

The implication of the grassland subsidy for agricultural employment is analyzed in both a difference-in-difference setting and an IV-setting. The identification strategy uses the fact that the increase in direct payments is directly related to the share of grassland in the municipality. The difference-in-difference estimator will therefore ascertain whether municipalities with a large share of grassland exhibit a change in their agricultural employment due to the reform (in comparison to municipalities with almost no grassland). In an IV specification we use the share of grassland as an instrument, and use the variation in direct payments, caused by the eligibility of grassland, to estimate the subsidy effect.

We find that the grassland subsidy affects agricultural employment positively, and that the increase in employment, after 2004, is linearly related to the share of grassland in the region. Because of a general decrease in agricultural employment during the time-period, the grassland subsidy primarily saves jobs in agriculture. Every saved job costs about SEK 223,000 (about € 25,000) in subsidies. Compared to Nordin and Manevska-Tasevska (2013), who explore the reform with farm data, the net and redistributive effects of the grassland subsidy are analysed here. Although the results in the studies are similar, the studies are complementary and together they provide strong evidence for a causal effect.

2. Earlier research

Due to limited access to relevant regional data, few studies have explored the impact of subsidies on agricultural employment. The research on this topic is mostly descriptive or qualitative, and most of it focuses on one single policy of the CAP (Petrick and Zier, 2011). Few have used modern evaluation techniques (Petrick and Zier, 2013) and, to our knowledge, there is no study that uses a change in the CAP payments that can be described as exogenous.

The study most similar to ours is Petrick and Zier (2011), who use German panel data to investigate whether the CAP subsidies affect agricultural employment. They use 69 of 255 landkreise regions (NUTS 3 level), and the years 1999 to 2006, and find that direct payments have a negative effect on agricultural employment. Farm investment aids and transfers to less developed areas have no impact on employment. Moreover, the full decoupling of the direct payment in 2005 seems to have had an additional negative impact on agricultural employment. They conclude that the direct payments have resulted in investments in labour shedding technology and that the decoupled payments changed factor allocation on farms. In the US, agricultural subsidies also seemed to decrease agricultural labor in the 80s, because of a capital-labour substitution (Goetz and Debertin, 1996). In France, Objective 5b, which promotes “development and structural adjustment of rural areas”, also seems to affect agricultural employment negatively (Schmitt et al., 2004). On the other hand, by using propensity score matching on German farm data, Pufahl and Weiss (2009) find a positive association between on-farm labour and participating in agroenvironmental programmes (Pillar II programme). Still, whether the government payments are coupled or decoupled does not seem to matter for off-firm labour participation in the US (Ahearn et al., 2006). By analyzing the dynamic labour use, Petrick and Zier (2012) find that investment aids slow down job cuts.

A different strand of literature focuses on the exit rate of farms. For the US, Key and Roberts (2006) use the variation in base acreage as a source of exogenous variation in government payments. They find a negative effect of government payments on the risk of farm closure. Moreover, in regions with a decreasing number of farms, the subsidies help farmers to buy out other farmers who are willing to leave the agricultural sector (Goetz and Debertin, 2001), i.e. a capitalization effect of the subsidies may increase the average farm size and the process of structural change in rural regions. Studying 110 regions (NUTS 1 and NUTS 2) in Western Europe, Breustedt and Glauben (2007) show that CAP subsidies influence exit rates negatively. On the other hand, a positive effect of subsidies on the exit rate of farmers is found in Goetz and Debertin (1996) and in Hoppe and Korb (2006).

Regarding regional economic performance in general, Esposito (2007) finds no influence of direct payments on growth. He uses regional EU (NUTS 2 level) data, for the period 1989 to 2000, to estimate a conditional growth convergence model and finds that structural fund payments (Objective 1) do have a positive impact on growth.

3. The CAP and the decoupling reform

In Sweden, the decoupling reform, implemented in 2005, implied that direct payments were not coupled to production, but that the farmers were responsible for keeping the land in good condition (cross-compliance requirement). The member countries of the EU had some options regarding the model for calculating direct payments (historical, regional or a hybrid model)[1]; Sweden decided on the hybrid model,[2] a combination of the historical and the regional model, where direct payments are calculated according to the regional model, but vary between

[1] The historical model is a farm-specific model where payments are equal to the support the farm received in a "reference" period, and in the regional model farmers receive identical payments per hectare within a region.
[2] It has been shown that subsidies are partially capitalized into land values in a hybrid model, and for Sweden grassland prices increased faster than arable land prices in 2005 and 2006 (Ciaian et al., 2011).

different geographical regions within Sweden. Notably, because direct payments are based on historical production, they are much higher in the more productive regions in the southern parts of Sweden.

A special feature of the decoupling reform was that all farmland was eligible for support.[3] In 2005 the support for grassland (€117 per hectare in 2005) was the same in all 5 regions, but over time the grassland support increased more in the most productive region, (about 14% higher in region 1 in 2009). The arable support was the same as the grassland support in region 5 (Northern Sweden and forest regions), and it still is. Compared to region 5, the arable support is about 25%, 60%, 90%, and 120% higher in the other four regions. Thus, although the grassland support is, in general, lower than the arable land support, the implication is still that some regions in Sweden have doubled their support. Thus, with the new grassland subsidy, the decoupling reform has had large redistributive consequences.

Up until today, we have not found a study that discusses the redistributive aspects of the decoupling reform. The unawareness may be caused by a general confusion in the definition of grassland. Grassland consists of grassland on arable land and semi-natural pastures, but in Swedish official land-use statistics, only semi-natural pastures are classified as grassland. The redistribution is, however, a result of the eligibility of grassland on arable land, which are categorized as arable land in the official land-use statistics (grassland constitute about half of the arable land). So, from official statistics (eligibility statistics do not exist), it seems as if only one-third of the grassland is made eligible, and that the grassland is distributed evenly over the country.

The decoupling reform also included a modulation, i.e., a transfer of money from the Pillar I budget to the Pillar II budget. The animal support was not completely decoupled in 2005, and (primarily) a special beef premium and a milk subsidy were still coupled after 2005. The coupled milk subsidy gradually increased up to 2006, and in 2007 the subsidy was decoupled and included in the direct payments. This study does not intend to evaluate Pillar II, but econometrically the Pillar II subsidies have to be considered, as they may affect the employment effect of the grassland subsidy. Pillar II consists of a wide range of programmes supporting environmental and rural development. An evaluation of the Swedish Pillar II found that many of the specific programmes were inefficient, and their impact on their respective objectives was, at best, very small (SLU, 2010).

[3] Only permanent crops, fruit and vegetables and potatoes were excluded from the decoupled direct payments.

4. Data and descriptive statistics

The panel data set consists of annual data for 261 municipalities over the period 2001 to 2009. Of Sweden's 290 municipalities, 29 are therefore excluded. Of the excluded municipalities, 24 are located in the metropolitan areas of Sweden (greater-Stockholm, Gothenburg and Malmö) where there is basically no agricultural sector (or a very small sector in comparison to the population at large), and 5 are either very small or were created during the time period. The relatively long time-period and the number of municipalities give us a large number of observations; we end up with 2,349 observations.

Data on the CAP subsidies is from the Swedish Board of Agriculture. For the direct payments there is information on the coupled payments (acre and animal subsides) and the decoupled single farm payments, and for Pillar II we have information on every single type of subsidy.

Figure 1 illustrates the mean yearly direct payments to the municipalities. To show that there has been a decrease in the direct payments since 2006, due to the modulation, Figure 1 also contains the exchange rate adjusted payments. Thus, due to the depreciation of the SEK, the payments to the Swedish farmers were almost as high in 2009 as in 2006. The payments steadily increased between 2001 and 2006.

Figure 1 about here

The implementation of the new grassland subsidy in 2005 (with the decoupling reform) implied a large increase in the direct payments for regions with a large share of grassland. Figure 2 illustrates the change in the payments for regions with different shares of grassland. The groups correspond with the decentiles of the share of grassland (ratio between grassland and total farmland)[4] constructed, i.e. the first group contains municipalities with a share of grassland less than 10%, the second group contains municipalities with a share of grassland between 10 and 20% etc. Since there are no municipalities with more than 90% grassland, we have 9 groups. The figure shows that the increase in payments is large for regions with a large share of grassland, and the size of the increase corresponds well with the grassland share. A redistribution of the direct payments happened for two reasons: i) a decrease in support for regions with the least grassland after 2004, and ii) an increase in the payments in 2005 for regions with more than 40% grassland. Additional descriptive statistics for the municipality groups are reported in Table 1.

Table 1 and Figure 2 about here

[4] Data on the hectares of grassland (betesvall och bete- och slåttervall) and total hectares of farmland are from the Swedish Board of Agriculture. We calculate an average share of grassland for the entire time-period.

The figure also shows that there was a relationship between the share of grassland and the payments in 2002 and 2004, i.e. for these years there was a change in the payments that increased with the grassland share. These variations were related to changes in the animal support. In 2002 the animal payments increased (due to a general increase in all animal subsidies), and in 2004 the milk subsidy was implemented. However, the animal payments did not increase more in the regions with much grassland, but since the share of direct payments that came from animal support was much larger in the grassland regions it implied that the relative change in the direct payments became larger in those regions. For example, in the regions with the most grassland (more than 50% grassland), the animal payments represented about 50% of the total direct payments before the decoupling reform, whereas in the regions with the least grassland (less than 30%) the animal payments represented only 10% of the total direct payments. Thus, since the milk subsidy seemed to increase more, in relative terms, in grassland regions, it has to be considered when specifying the empirical model. Moreover, the increase in the payments at the end of the period was due to the depreciation of the SEK.

The employment data at municipality level has been collected from Statistics Sweden. Based on register data (RAMS), Statistics Sweden reports the number of people employed in each sector of every municipality. To be considered employed, the individual has to work an average of at least one hour per week in November. The classification is based on the sectoral classification of the firm (the firms SNI2007 code), and the individuals are classified according to their main employment, i.e. part-time workers who work mainly outside the agricultural sector are therefore not included in the measure. From the sectoral employment measure, we construct the relative agricultural employment rate in the municipality by dividing the number of people employed in the sector with the total population in the age group 20 to 64.

Figure 3 reports the mean employment rates in the municipalities between 2001 and 2009.[5] Before 2004 the employment rate decreased in the agricultural sector, and for the period 2004 to 2009 the employment rate varied around a mean of 2.9. The figure also illustrates a large increase in the employment rate in 2004, which was mainly due to a change in the way of calculating employment in one-person businesses.

[5] Compared to employment statistics reported by the Swedish Board of Agriculture (2008), our measure of mean employment rate is almost 1% higher. This is because we exclude the metropolitan areas (with a small agricultural sector), and use the total population in the age group 20 to 64 in the denominator. The Swedish Board of Agriculture uses the total population in the age group 16 to 84 in the denominator.

Before 2004, one-person businesses with a negative corporate profit were classified as inactive, but from 2004 onwards the owners of the firms with a negative corporate profit (given that it is their main employment) are included in the employment measure. In the econometrical specification, the time fixed effects remove the average employment increase of this change. However, if the increase in the employment measure varies between municipalities, and is related to the share of grassland, it might affect the results in this study. To make the employment variable comparable over the entire time period, we assume that employment in 2004 followed the trend set during the time-period 2001 to 2003. That is, we assume that the agricultural employment rate in the municipality continues to decrease at the same rate as in the preceding years (in the municipality). In Figure 3 we see the effect of the transformation on the mean agricultural employment rate. In section 5.1 we explore the transformation and find that it biases the grassland subsidy effect downward rather than upward. Moreover, farm-level data confirms that the results in this study are not driven by the measurement change (Nordin and Manevska-Tasevska, 2013)

Figure 3 about here

Moreover, due to the decoupling and the grassland eligibility, some landowners may have entered farming just to obtain the subsidy and, if this is the case, the effect of the reform on agricultural employment might be a false one. Because the Swedish Board of Agriculture classifies every farm that receives some subsidy as a farm in agriculture, the decoupling reform increased the number of small farms in their data. Nonetheless, due to the "main income" restriction, a similar change is not found in sectoral employment data from Statistics Sweden (Swedish Board of Agriculture, 2008).

5. Empirical specification and covariates

With a fixed effect model, we estimate the overall association between CAP subsidies and employment. That is, with:

$$Emp.rate_{ij} = \alpha_i + \gamma_t + \beta DP_{ij} + \rho X_{it} + \varepsilon_{it} \qquad (1)$$

we obtain the average subsidy effect on agricultural employment. In this model, α_i represents the unobservable municipality characteristics that are constant over time, and δ_t stands for time-fixed effects. *DP* is the logarithm of the direct payments (in 2008 prices) to the farmers.[6] A vector of covariates, X, and Pillar II subsidies are included as controls.

[6] The logarithm of the subsidies is used (or some other relative measure), otherwise you assume that a certain increase in the subsidies have an equally large effect on employment in large municipalities (with large subsidy payments) as in small municipalities (with small subsidy payments).

The drawback of this model is that the variation in the subsidy is unidentified, and we are therefore not able to understand the cause of the effect, i.e. the fixed effect model does not specifically evaluate the decoupling reform and the new grassland subsidy. In a difference-in-difference approach the specifics of the decoupling reform are better modelled. The difference-in-difference estimator here will exploit the fact that the increase in the direct payments after 2004 is directly related to the share of grassland in the municipality. In contrast to the standard difference-in-difference specification where the treatment is binary, the treatment (the increase in subsidies due to the share of grassland) is continuous in this setting. Every municipality has some exposure to the grassland subsidy, but with a larger share of grassland the exposure increases. In other words, the treatment here is an increasing function of the share of grassland, and the treatment effect is the increase in agricultural employment relative to the group with the least grassland. The control group is therefore regions that receive almost constant subsidies in 2005 (see Figure 3). Thus, with a continuous treatment variable a flexible difference-in-difference specification is to divide the municipalities into M groups based on their share of grassland, where $m \in [1,...,M]$, and write the model in the following form:

$$Emp.rate_{ij} = \alpha_i + \gamma_t + \sum_{m=2}^{9} \beta_m (T * \delta_m) + \rho X_{it} + \varepsilon_{it} \qquad (2)$$

where β_m is the treatment effect, i.e. the change in agricultural employment for each of the municipality groups, and δ_m represents the eight dummy variables indicating which group the municipality belongs to. The change in employment is relative to the group with the least grassland. T is the "reform dummy" indicating the years after the reform. The municipality groups are the same as in the earlier section, i.e. the decentiles of the share of grassland.

The methodology is similar to the one in Duflo (2001), but with the exception that we change the continuous treatment variable to a set of indicator variables. This is to allow for more flexibility in the effect, and to get estimates for the municipality types compared.

A concern is that the milk subsidy, introduced in 2004 and included in the decoupled direct payments in 2007, covaries with the grassland subsidy. To capture the employment effect of the milk subsidy, we therefore use the number of milk cows (per capita) in the municipality, and add, in a similar manner to the grassland subsidies, three indicator variables (interacted with a milk reform dummy) to show the quartile of the milk cow distribution to which the municipality belongs. This is done for the coupled and decoupled milk subsidy regime, separately.

For most Pillar II subsidies the number of beneficiaries (and payments) in each municipality is very small, and we have therefore divided the Pillar II subsidies into three different measures, *Environmental subsidies*,[7] *Firm subsidies* and *Other rural subsidies*. The objective of the *Firm subsidies* is to improve firms or develop new firms, whereas the objective of the *Other rural subsidies* is generally broader, and aims at improving rural areas at large. A special compensation to the northern parts of Sweden (*Northern subsidy*), where the growing period is short, is also included. Since there are zero payments for many of the Pillar II observations (448 observations for firm subsidies, 739 observations for other rural subsidies, and 1,633 observations for the northern subsidies), it is problematic to use logarithmic measures. To overcome this problem, we add a dummy variable explaining the zero payment for each subsidy type.

Moreover, to avoid biased estimates, we include a broad set of control variables. Table A1 lists the control variables and reports the descriptive statistics. There exist large fluctuations in cereal, dairy and meat prices, fluctuations that might affect investments, technology and the labour intensity of farms. Regional cereal, dairy and meat prices are not available, but the Swedish Board of Agriculture provides us with national prices, regional data on number of animals (also dairy animals) and the acres of land used for different cereals. Thus, by weighting the prices with the regional number of animals (per capita) or the regional share of land used for different cereals, regional variation is attained and we are therefore able to control for price variations.

The income level and the *Share with high school education* and the *Share with university education* are included to capture changes in the socioeconomic structure in the municipality. We include the *Logarithm of income*, which is a measure of the mean per capita income (gross-income for individuals aged 20 or older) in the municipality deflated with the Consumer Price Index.

Older men are highly over-represented among farmers, and therefore the *Share of men* and the demographic age structure in the municipality are included in the specification. The probability of being a farmer is low for individuals with a foreign background and therefore the *Share with a foreign background* (including both first and second generation immigrants) is added. To further describe the type of municipality *Logarithmic population density* (inhabitants per km^2) and *Total Population* are included. In addition, to capture regional policy changes that might affect the regional labour market, *Logarithm of expenditures on*

[7] The compensatory allowances, aimed at maintaining sustainable farming, are included in the environmental subsidies.

education, *Logarithm of expenditures on social aid* and *Logarithm of expenditures on culture and leisure activities* are included. Data on the expenditures is per capita and deflated with the Consumer Price Index.

Youth tend to leave the rural areas, especially in the Northern parts of Sweden, and this migration pattern may have implications for agricultural employment. A variable measuring the *in and outflow* (number of migrants in and out of the municipality divided by the population size) of people captures the trend.

6. Results

6.1 The difference-in difference results

Table 2 shows the difference-in-difference results. Column (1) contains the result with the trend-adjusted employment measure. The adjusted result shows that agricultural employment increases with the grassland share. Employment increases significantly in 2005 for the regions with a share of grassland above 50%, compared to the region with less than 10% grassland. Moreover, for regions with more than 70 percent grassland, the increase in employment is significantly positive compared to regions with up to 60 percent grassland (not reported, but found when changing the reference group). The significant increase, of about .3 in the regions with the most grassland, implies that agricultural employment increases by about 9% (calculated at the mean employment rate of 3.4 in regions 8 and 9). Figure 4 illustrates the entire relationship between the employment change after 2005 and the grassland share. The figure shows that employment increases almost linearly with the share of grassland, and the only deviation from the linear takes place for the region with 30 to 40% grassland.

Table 2 and figure 4 about here

The figure (and column (2) in Table 2) also illustrates the relationship between the change in employment and the grassland share for the non-adjusted employment variable. In this model we see that the grassland subsidy has a larger effect on employment than in the model in column (1). Since agricultural employment in 2004 is, on average, assumed to decrease in the adjusted model, an implicit assumption in the adjusted model is that the grassland reform has no effect prior to the reform. However, to be eligible for the grassland subsidy, the grassland needs to be kept in good condition (cross-compliance requirement), and the introduction of the grassland subsidy in Sweden probably requires the farmers to make some basic investments in the grassland. An increase in employment already in November 2004 (when employment is measured) is therefore plausible. Thus, whereas the impact of the grassland subsidy in the model in column (2) is likely to be overstated, the result in the trend-adjusted model is likely to be underestimated.[8]

On the other hand, even if the grassland subsidy effect may be understated in the trend-adjusted model, due to the removal of an early eligibility investment effect in 2004, the effect of the grassland subsidy might, for the same reason, be temporary. That is, the effect may be related to an eligibility investment in 2005, which temporarily increases employment. In column (3) we analyze whether the effect is permanent by excluding the year 2005 from the model, i.e. the temporal impact in 2005 is therefore removed. We pursue the analysis using the trend-adjusted model. In Figure 4 we find that the relationship between the employment change and the grassland share is almost unaffected by excluding the year 2005 from the model. We can therefore conclude that the employment effect of the grassland subsidy is permanent.

A way of testing whether our continuous treatment setting exploits the entire change in the payments, due to the implementation of the grassland subsidy, is to add the payments to the model. In column (4) of Table 1 we find that the direct payments have no additional effect on agricultural employment above the grassland.[9] It is also shown that the grassland subsidy effect is not affected by the inclusion of the direct payments. From this, we can draw two conclusions. First, our difference-in-difference approach effectively identifies the grassland effect. Second, municipality-specific variations in the payments, not related to the grassland reform, do not affect agricultural employment. However, changes on the national level, as for example the exchange rate driven change in payments in 2008 and 2009 (see Figure 1 and Figure 5), which affects every municipality in the same manner, might also affect employment.

Regarding the other CAP subsidies, we find in the trend-adjusted model that the environmental subsidy has a positive effect on agricultural employment. Even if we cannot establish whether this is a causal effect,[10] we are not surprised to find such an effect, since fulfilling the requirements of the environmental subsidies is in many cases labour intensive.

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[8] Because the share of small farms increases with the share of grassland in the municipality, we have also tried including a variable that describes the share of small farms (for the years 2001 to 2003 the variable takes the value zero), to the specification, i.e. the group affected by the calculation change. Even with this transformation, which largely decreases the relative employment rate in grassland regions after 2003, the relationship between the grassland share and the increase in employment after 2004 remains.

[9] Without the share of grassland dummies, the direct payments have a positive effect on employment, which indicates that the direct payments pick up the grassland subsidy effect.

[10] For the Pillar II subsidies, reversed causation, for example, is a problem. If the economic conditions in the regional agricultural sector affect the probability of applying for subsidies, an estimated association might run from the employment level to the subsidy payments.

A positive effect of environmental programmes is found in Germany as well (Pufahl and Weiss, 2009). In regions with the most milk cows per capita, relative to the regions with the least milk cows per capita, there is a decrease in agricultural employment during the coupled milk subsidy regime, but since the introduction of the milk subsidy is not exogenous, the association is not likely to be caused by the milk subsidy.

The inclusion of the milk subsidy and Pillar II subsidies to the specification has a very small impact on the grassland subsidy effect (not reported, but found when adding the covariates stepwise to the model). Still, the inclusion of the other covariates does decrease the effect (for grassland regions with more than 50% grassland the difference-in-difference estimates decrease by about 30%), and the *Cereal, dairy and meat prices* and the socioeconomic indicators (*Logarithm of income*, *Share with high school education* and *Share with university education)* have the largest negative impact on the grassland subsidy effect.

6.2 Is the grassland subsidy saving or creating jobs?

To what extent is the grassland subsidy saving jobs instead of creating new jobs? This question is analysed by studying the estimated time trend in agricultural employment. Figure 5 shows the time trend from column (1) in Table 2, i.e. when removing the impact of the grassland subsidy (and the other covariates). The figure shows that agricultural employment is decreasing up until 2008. Thus, given the general decrease in agricultural employment the grassland subsidy is partly saving jobs, possibly because of a reduction in the rate of structural change in the sector. That is, in grassland regions the subsidy may decrease the failure rate of small farms.

Figure 5 about here

6.3 Estimating the grassland subsidy effect with an instrument

Since we have already established that the grassland subsidy increases agricultural employment in grassland regions, the IV-approach is used for (mainly) estimating the effect in monetary terms. Thus, by using the share of grassland in the municipality as an instrument, we relate the change in the direct payments to the share of grassland, and use this variation to estimate the grassland subsidy effect on agricultural employment. For the years before the introduction of the grassland subsidy, the instrument takes the value zero, and for the years 2005 to 2009 the instrument equals the share of grassland in the municipality. Apart from the instrumenting, the model is the fixed-effect model in specification (1). Here we also estimate the grassland subsidy effect on the number of individuals employed in the agricultural sector.

Table 3 shows the main estimates of the first- and second stage regressions, together with a weak IV-test. Weak instruments are problematic as they give biased estimates and underestimated standard errors (Murray, 2006; Stock, Wright and Yogo, 2002). According to the first stage result, the instrument seems to perform well. The share of grassland in the municipality has a large influence on the direct payments; a 10% higher grassland share implies a 6% increase in the direct payments after 2004. The test statistics of the weak IV-test are also very high; a rule of thumb is that the test-statistic should be above 10, and here the F-statistic is 144.5. The IV-estimate of the grassland subsidy effect (the second stage results) is 0.6 for the agricultural employment rate, and 60 for the number of individuals employed in agriculture.

Table 3 about here

6.4. A simple calculation of the cost per job

At the mean municipality characteristics, a 0.1 log points increase in the direct payments (from 16.36 to 16.46) equals a SEK 1.34 million increase in the direct payments. Moreover, with a grassland subsidy effect of 60 on the number of employed (see column (2) in Table 3), a 0.1 log points increase in the payments corresponds to an additional 6 people being employed. Thus, each job costs about SEK 223,000 in subsidies. In Sweden, the total yearly wage cost of one person in agriculture is about SEK 333,000,[11] which means that the subsidy creates jobs at a lower cost than the average wage cost. From a policy perspective, having an impact that is larger than the government expenditure is obviously desirable, but it may seem an unrealistically large effect. However, since the grassland subsidy effect is largely an effect of saving jobs in agriculture, the impact might be realistic, but for saved jobs this way of calculating the cost per job may be somewhat inappropriate. Hence, even if the subsidy is relatively small in comparison to the total work cost, it might have a large impact on survival rate for a farmer who wants to stay in farming.

In addition, some of the new jobs might be part-time, and part of the effect could be an increase in hours worked by farm employees, so that it becomes their main employment (and therefore registered in the statistics).

7. Conclusion

The redistributive grassland subsidy, introduced in 2005, had a large impact on agricultural employment in Sweden. Because employment increased with the regional share of grassland,

[11] In 2008 the monthly salary in agriculture was SEK 18,500. To obtain the total labour cost a payroll tax and a pension insurance fee should be added (they sum to about 50%).

there is strong evidence in favor of a causal effect. In the regions with the most grassland, agricultural employment increases by about 9%. In a IV-setting we find that each job costs about SEK 223,000 in subsidies, which is low. The results indicate that the grassland subsidy effect is partly an effect of saving jobs in agriculture, i.e. the grassland subsidy may decrease the exit rates of small farms and reduce the rate of structural change in grassland regions. Nordin and Manevska-Tasevska (2013) using farm data, find a similar effect.

On the other hand, the farmers have to keep all their grassland in good condition, otherwise the grassland is not eligible for support; meeting the cross-compliance requirements for grassland takes a lot of time and incurs high costs (The Swedish Board of Agriculture, 2011). An increase (or a reduced decrease) in farm working hours is therefore expected, and it is probably related to changes in land use practices. Thus, because the grassland subsidy does not increase farm output (Nordin and Manevska-Tasevska, 2013), it is subsidy eligibility (improving the environmental benefits) that is produced.

Moreover, finding a positive effect of the environmental subsidies, which are also labour intensive, complies with the main result of the study. Hence, the policy implication is that the introduction of labour-intensive subsidies has a large impact on agricultural employment, and at a low cost. However, since the grassland subsidy was introduced in a decoupled system, and the decoupling reform might have had a negative effect on employment in general (as in Germany (Petrick and Zier, 2011)), it is not certain that the grassland subsidy would have had the same effect in a coupled system. That is, if farms in grassland regions have reallocated labour from ordinary production to environmental production, and, it might not have happened if the payments had not been decoupled.

The results in this study are policy relevant, because there is an ongoing discussion on whether to green the CAP further. For example, if a larger share of the semi-natural pastures are made eligible for payments, which has been suggested, it may increase agricultural employment further. In addition, the subsidy is not specific for Sweden, so the results may be relevant for other European countries as well. Specific for Sweden, is that the grassland subsidy is relatively high in relation to the arable support.

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Tables and figures

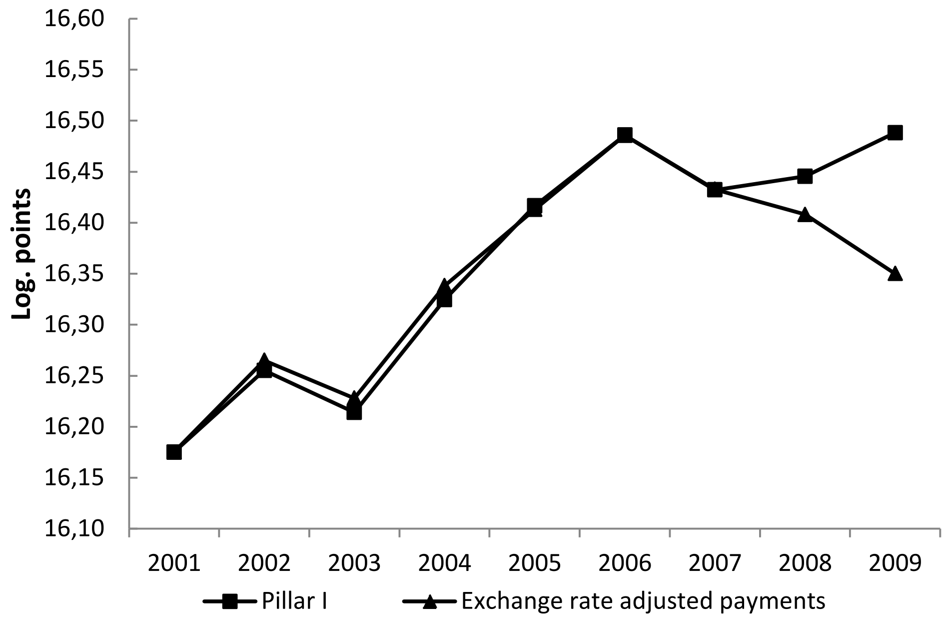

Figure 1. The mean direct payments to the Swedish municipalities (log. points). 2001-2009

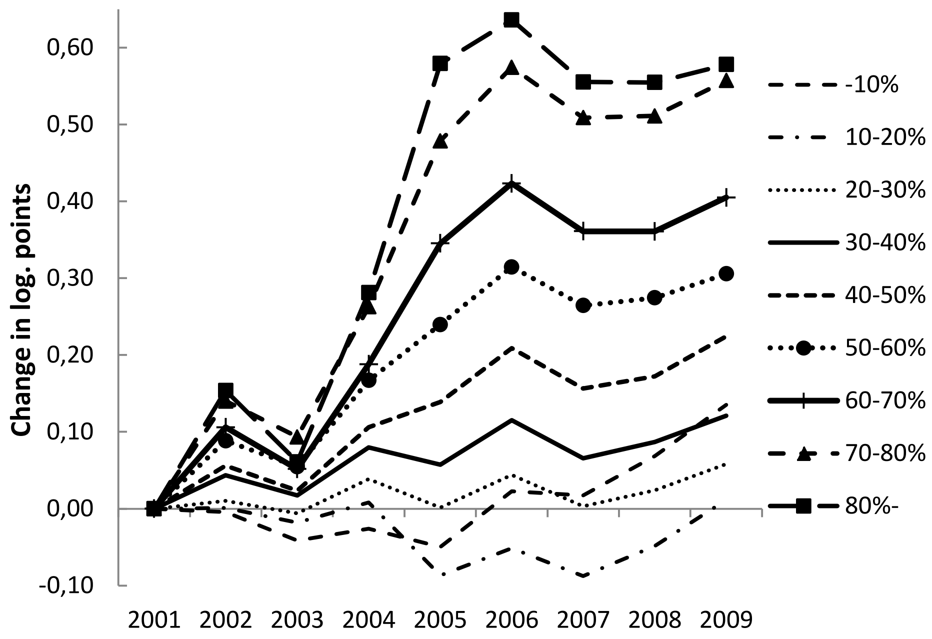

Figure 2. The change in the direct payments for different regional groups (log. points). 2001-2009

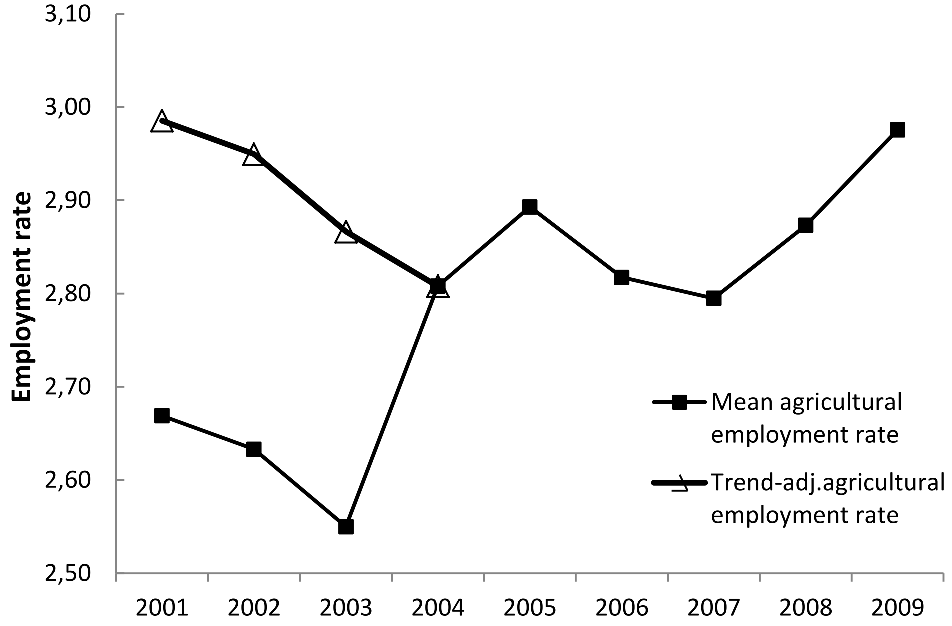

Figure 3. Mean and trend-adjusted agricultural employment rate in the Swedish municipalities. 2001-2009

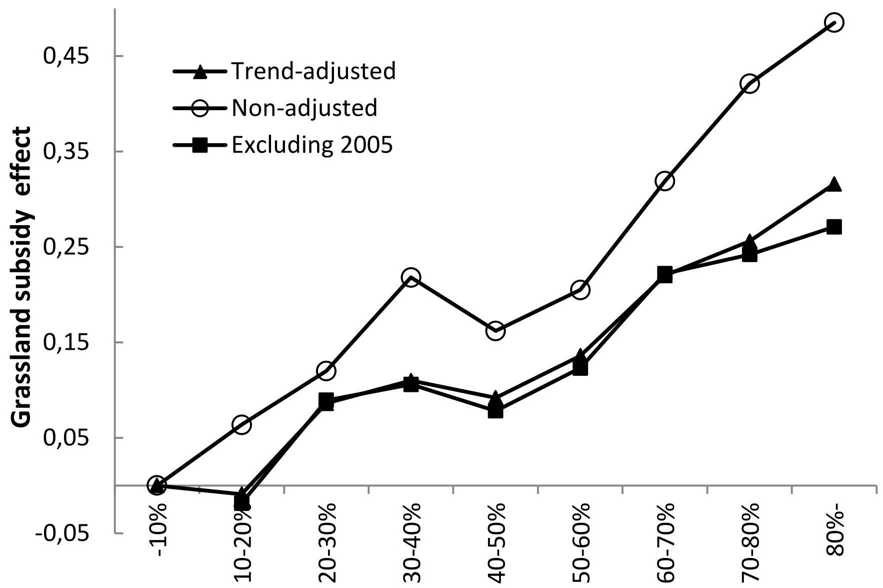

Figure 4. Illustrating the relationship between the employment change after 2005, and the grassland share. 2001-2009

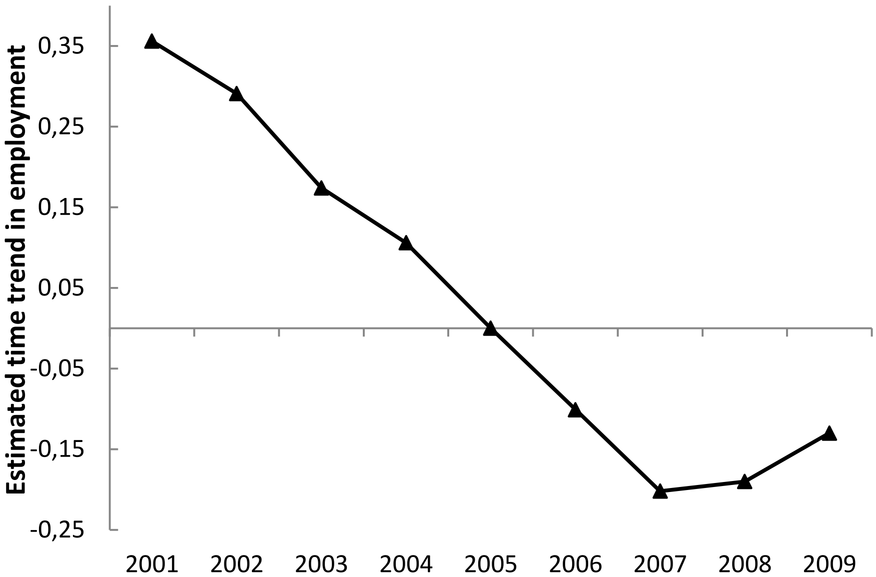

Figure 5. Illustrating the estimated time-trend when including the full set of independent variables. 2001-2009

Table 1
Descriptive Statistics for the different grassland regions. 2001-2009

	Grassland region:								
	1	2	3	4	5	6	7	8	9
Municipalities	14	21	24	25	31	32	37	53	24
Share of grassland	6.1%	15.4%	24.7%	34.9%	45.2%	55,0%	64.4%	75.1%	83.5%
	(.02)	(.03)	(.02)	(.03)	(.03)	(.03)	(.03)	(.03)	(.02)
Agricultural employment (rate)	2.01	2.42	2.36	2.62	2.49	2.46	2.97	3.28	3.54
	(1.45)	(1.59)	(1.8)	(1.43)	(1.51)	(1.41)	(1.83)	(1.94)	(1.65)
Direct payments	17.21	17.29	17.65	17.05	16.69	16.48	15.87	15.70	14.65
	(1.09)	(.74)	(.64)	(.69)	(1.06)	(.75)	(1.06)	(1.17)	(1.24)

Note: Standard deviations in parenthesis.

Table 2
Difference-in difference results of the grassland subsidy effect on agricultural employment. 2001 - 2009

	(1) Trend-adjusted	(2) Non-adjusted	(3) Excluding 2005	(4) Including DP
Grassland share:				
10-20%	-0.009	0.064	-0.019	-0.009
	(0.083)	(0.091)	(0.097)	(0.084)
20-30%	0.086	0.120*	0.089	0.087
	(0.071)	(0.070)	(0.083)	(0.071)
30-40%	0.110	0.218**	0.106	0.111
	(0.083)	(0.085)	(0.101)	(0.082)
40-50%	0.092	0.162**	0.078	0.094
	(0.075)	(0.077)	(0.090)	(0.075)
50-60%	0.136*	0.205***	0.123	0.138*
	(0.071)	(0.075)	(0.088)	(0.0734)
60-70%	0.220***	0.319***	0.222**	0.224***
	(0.076)	(0.090)	(0.096)	(0.081)
70-80%	0.256***	0.421***	0.242***	0.260***
	(0.074)	(0.080)	(0.090)	(0.077)
80%-	0.316***	0.485***	0.271**	0.320***
	(0.103)	(0.113)	(0.122)	(0.102)
Direct payment to farmers				-0.011
				(0.108)
Milk cow quartile 2 (coupled)	0.004	0.073	0.001	0.004
	(0.045)	(0.060)	(0.043)	(0.044)
Milk cow quartile 3 (coupled)	-0.028	0.049	-0.024	-0.028
	(0.042)	(0.053)	(0.042)	(0.042)
Milk cow quartile 4 (coupled)	-0.147***	-0.147***	-0.145***	-0.147***
	(0.047)	(0.057)	(0.046)	(0.047)
Milk cow quartile 2 (decoupled)	0.071	0.115*	0.067	0.072
	(0.065)	(0.070)	(0.065)	(0.065)
Milk cow quartile 3 (decoupled)	0.022	0.066	0.013	0.022
	(0.062)	(0.062)	(0.063)	(0.061)
Milk cow quartile 4 (decoupled)	-0.054	-0.097	-0.060	-0.054
	(0.069)	(0.068)	(0.071)	(0.068)
Enviromental subsidy	0.221**	0.137	0.250**	0.222**
	(0.095)	(0.085)	(0.106)	(0.094)
Firm subsidies	0.005	0.007	0.007	0.005
	(0.007)	(0.007)	(0.007)	(0.007)
Other rural subsidies	0.001	-0.003	0.002	0.001
	(0.006)	(0.006)	(0.006)	(0.006)
Northern subsidy	0.007	-0.001	0.0100	0.006
	(0.021)	(0.022)	(0.022)	(0.021)
Observations	2,349	2,349	2,088	2,349
R-squared	0.985	0.985	0.985	0.985

Notes: The dependent variable is the agricultural employment rate (percent) at the municipality level. Year- and municipality fixed effects, the price controls and the covariates reported in Table A1 are added in every specification. Dummy variables for zero payments of the firm, other rural and northern subsidies are also included. Robust clustered standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 3
Instrumental variable results of the grassland subsidy effect on agricultural employment. 2001-2009

Second stage	*Employment rate*	*Number employed*
Grassland subsidy effect	0.602***	60.05***
	(0.114)	(10.08)
Observations	2,349	2,349
R-squared	0.984	0.990
First stage		
Share of grassland	0.614***	
	(0.051)	
Share of small farms	0.789***	
	(0.301)	
Milk cow quartile 2 (coupled)	0.029	
	(0.028)	
Milk cow quartile 3 (coupled)	0.035	
	(0.023)	
Milk cow quartile 4 (coupled)	0.079***	
	(0.026)	
Milk cow quartile 2 (decoupled)	0.035	
	(0.036)	
Milk cow quartile 3 (decoupled)	0.034	
	(0.030)	
Milk cow quartile 4 (decoupled)	0.084**	
	(0.035)	
Enviromental subsidy	0.106	
	(0.070)	
Firm subsidies	-0.000	
	(0.003)	
Other rural subsidies	-0.002	
	(0.002)	
Northern subsidy	-0.028*	
	(0.015)	
Weak IV-test	144.467	
R-squared	0.995	

Notes: In the second-stage regression the dependent variable is the agricultural employment rate (percent) at the municipality level. In the first-stage regression the dependent variable is the logarithm of the Pillar I payments. Year- and municipality fixed effects, the price controls and the covariates reported in Table A1 are added in every specification. Dummy variables for zero payments of the firm, other rural and northern subsidies are also included. Robust clustered standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table A1
Desciptive Statistics

	Mean	Standard Deviation	Source
Agricultural employment	2.779	1.732	Statistics Sweden
Milk cow quartile 2 (coupled)	0.084	0.278	Swedish Board of Agriculture
Milk cow quartile 3 (coupled)	0.082	0.274	Swedish Board of Agriculture
Milk cow quartile 4 (coupled)	0.084	0.278	Swedish Board of Agriculture
Milk cow quartile 2 (decoupled)	0.084	0.278	Swedish Board of Agriculture
Milk cow quartile 3 (decoupled)	0.082	0.274	Swedish Board of Agriculture
Milk cow quartile 4 (decoupled)	0.084	0.278	Swedish Board of Agriculture
Enviromental subsidy	15.772	1.026	Swedish Board of Agriculture
Firm subsidies	11.029	5.468	Swedish Board of Agriculture
Other rural subsidies	8.834	6.172	Swedish Board of Agriculture
Northern subsidy	4.169	6.413	Swedish Board of Agriculture
Firm subsidies (zeros)	0.191	0.393	Swedish Board of Agriculture
Other rural subsidies (zeros)	0.315	0.464	Swedish Board of Agriculture
Northern subsidy (zeros)	0.695	0.46	Swedish Board of Agriculture
Beef price	11.28	12.322	Swedish Board of Agriculture
Veal price	11.703	12.574	Swedish Board of Agriculture
Pork price	31.749	65.169	Swedish Board of Agriculture
Lamb price	9.638	11.186	Swedish Board of Agriculture
Poultry price	173.997	586.666	Swedish Board of Agriculture
Milk price	8.808	10.914	Swedish Board of Agriculture
Egg price	28.166	114.311	Swedish Board of Agriculture
Wheat price	10.593	14.037	Swedish Board of Agriculture
Grain price	13.918	9.823	Swedish Board of Agriculture
Oat price	8.878	7.843	Swedish Board of Agriculture
Rye price	2.117	2.712	Swedish Board of Agriculture
Oilseed prices	2.045	3.237	Swedish Board of Agriculture
Sugar beat price	0.969	3.115	Swedish Board of Agriculture
Foddet price	1.876	1.786	Swedish Board of Agriculture
Food potatoe pricer	1.138	2.388	Swedish Board of Agriculture
Other potatoe price	0.276	1.851	Swedish Board of Agriculture
Ln. of income	5.22	0.091	Swedish Board of Agriculture
Share with university education	10.15	3.836	Statistics Sweden
Share with high school education	19.039	2.108	Statistics Sweden
Ln. population size	9.726	0.845	Statistics Sweden
Ln. of exp. on educ.	9.476	0.102	Statistics Sweden
Ln. of exp. on soc. aid	7.599	0.326	Statistics Sweden
Ln. of exp. on cult. and leis.	7.517	0.261	Statistics Sweden
Share 00-14	17.035	1.858	Statistics Sweden
Share 15-19	6.954	0.643	Statistics Sweden
Share 20-24	4.985	1.087	Statistics Sweden
Share 25-34	10.097	1.692	Statistics Sweden
Share 35-44	13.226	1.176	Statistics Sweden
Share 45-54	13.433	0.747	Statistics Sweden
Share 55-64	14.142	1.28	Statistics Sweden
Share 65-74	10.008	1.528	Statistics Sweden
Share 75-84	7.288	1.432	Statistics Sweden
Share 85-94	2.66	0.616	Statistics Sweden
In and outflow	93.163	19.9	Statistics Sweden
Ln. population density	43.032	70.086	Statistics Sweden
Share of men	50.212	0.727	Statistics Sweden
Share with a for. backgrd.	10.705	5.998	Statistics Sweden