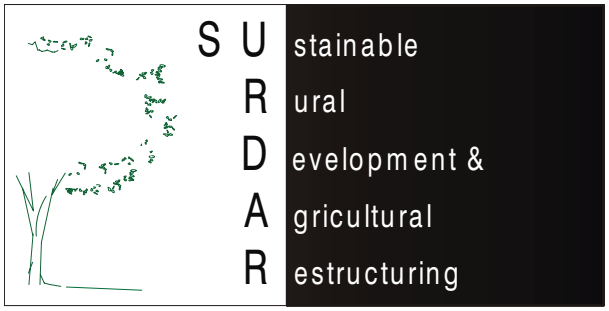

WORKER MOBILITY IN POLISH AGRICULTURE

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Hilary Ingham and Mike Ingham

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Address for correspondence:

Department of Economics
Lancaster University
Lancaster LA1 4YX

e-mail: h.ingham@lancaster.ac.uk

Abstract

Poland's recent entry into the EU and attendant commitment to the achievement of a range of ambitious labour market and social targets has served merely to re-emphasise the ongoing need for the rationalisation of perhaps its most conspicuous socialist paradox; namely, a private agricultural sector that on one count employs over one quarter of the country's workers. Using multinomial estimation on an annual panel of individual data from the Labour Force Survey, this paper confirms the impression of stagnation conveyed by the gross movements computable from published statistics and underlines the severity of the challenge posed by the necessary restructuring. The inescapable conclusion points to the need for radical policy innovation.

Keywords: Poland, Agricultural Restructuring, Worker Flows, EU Accession

JEL Classification: J43, J62, O13, P23, Q12, R58

1. Introduction

Although hailed as an event that would enhance the world standing of the EU (Kok, 2003), the recent enlargement imposes severe strains on many of its ambitions and policies. One notable case in point is provided by the European Employment Strategy (EES), which is a key tool underpinning the agenda set at the Lisbon Council of 2000 to create 'the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion' within the ensuing decade (EC, 2000). The ambition encompasses a return to full employment in the context of high employment rates, enhanced labour market flexibility, increased productivity and a reduction in regional disparities (CEC, 2003). With one eye cast towards the new member states, the European Commission recently recognised the need to ensure an 'orderly flow from agriculture and industry to services' if the goals espoused in the EES are to be achieved (CEC, 2003a).

Most notably in the case of Poland, by far the largest but by no means the most advanced of the new entrants with a purchasing power standard per capita GDP of just 40.5 per cent of the EU average, all of this is problematic. That country's official statistics report that agriculture's share of total employment has remained almost unchanged since 1989 at over a quarter of the workforce, while its contribution to national output fell from twelve per cent to four per cent in the years from 1989 to 2003 (Czyżewski *et al*., 1999; GUS, 2004: 666). At the same time, economic growth has slowed, the national unemployment hovers around 20 per cent (GUS, 2005), employment rates lag well below EES targets (*ibid.*: 40) and the World Economic Forum's Global Competitiveness Report recently ranked Poland below all other EU-25 Member States, but also lower than Bulgaria and emerging economies such as Mexico and Costa Rica (WEF, 2005).[1] Furthermore, notwithstanding efforts to

reform the Common Agricultural Policy (EU, 2003), the country's terms of accession include significant concessions to its farming sector (Wilkin, 2003).

Against this background, the current paper sets out to determine the size and direction of the gross flows out of Polish agricultural employment and the factors that might underpin them. The next section provides basic evidence on the labour market adjustment that has occurred within Poland since 1989 and highlights the limitations of the net flow rates that are typically available from the official statistics as mobility indicators. Greater insights can be gained from the analysis of individual flow data derived from the Labour Force Survey (LFS), which is described in section three, and these constitute the primary focus of attention in the remainder of the work. Section four introduces the state transition matrices to be analysed and summarises the flows contained within them. The model specifications and estimator are discussed in section five, section six presents the results obtained from them and section seven considers certain simulations based upon the findings. A summary discussion concludes the paper.

2. Restructuring in the Polish Economy

The Polish economy exhibited some rather peculiar characteristics at the close of the communist era. While the high degree of employment concentration was typical, its location and contractual form was not. In particular, almost sixty per cent of jobs were to be found in agriculture and industry, with the former dominated by private sector undertakings and the latter by state owned enterprises. It was anticipated that the liberalisation, stabilisation and restructuring package embodied in the Balerowicz Plan would have significant repercussions for the labour market, particularly as over-employment was believed to be of the order of 25 per cent (Góra, 1993, Rutowski,

1990). In the event, real GDP declined by 13.1 per cent and employment fell by 15.1 per cent between 1989 and 1993, although not all sectors suffered equally. In particular, agriculture and industry still accounted for more than fifty per cent of total employment in 1993 (Ingham and Ingham, 2003).

While '[t]he large-scale movement of labour from agriculture and manufacturing industry into the service sector is evidently one of the major tasks of economic restructuring' (Jackman and Pauna, 1977: 373), private sector agricultural employment failed to change radically in the early transition years. The actual number of agricultural job lost in the state and the private sectors between 1989 and 1993 were not of dissimilar magnitudes – 414,223 *vis-á-vis* 517,703 (GUS, 1994, 1997). However, while these losses accounted for almost seventy per cent of the initial jobs in state farming, the corresponding figure for the private sector was only twelve per cent. In effect, the state sector collapsed while private sector farming survived relatively unscathed, not least because it offered some work opportunities for individuals laid off from other sectors of the economy. The fact that industrial employment did not fall by more than the 28 per cent actually observed has been attributed to the power of the Works' Councils and the delay in the large-scale privatisation programme. Private sector services such as trade, telecommunications and finance and insurance did expand, but their combined employment share in 1993 still lagged behind far those of both agriculture and industry (Ingham and Ingham, *op. cit.*).

The period from 1994 began with real GDP climbing above its 1990 figure and thereafter increasing by 46 per cent in the years to 2003.[2] However, the growth was jobless, with more than 160, 000 posts lost over the period GUS (1995, 2004) and there was no shift of agricultural workers into higher value added activities.

Notwithstanding the fact that state farms shed more than one hundred thousand jobs over the period, private sector agricultural employment actually increased by nine per cent and still accounted for almost thirty per cent of all jobs in the economy in 2002 (GUS, 2004; Ingham and Ingham, *op. cit.*).[3] Nevertheless, some rather more predictable labour reallocation did occur, with manufacturing, mining, construction, the utilities and transport suffering significant job losses, while hotels and restaurants, real estate, renting and business activities evidenced strong gains, albeit from low bases. More surprising, perhaps, was the growth in employment shares registered by some public sector service activities.

That almost 75 per cent of Poland's workforce was employed in the private sector in 2003 (GUS, *op. cit.*) might appear to indicate a satisfactory transition, but agriculture accounted for almost forty per cent of the total.[4] This, along with the absolute numbers involved, serves to distinguish the country's employment distribution from those of both the original EU-15 countries that it joined in 2004 and the other new member states. In addition, in a recent ranking of agricultural reform, Poland lags behind all of the other new EU entrants except Lithuania, which receives the same score, and these two countries are adjudged to be on a par with Bulgaria (EBRD, 2002). This begs two important questions. First, why have such high levels of employment in agriculture persisted even as the economy has been subjected to strong market forces? Second, what are the prospects for change in the future?

The first question has been addressed by a number of authors and a variety of explanations have been advanced. Political factors have clearly been important, with various minority governments reliant on the support of farmers' parties that, in general, are fiercely protective of the rights of rural individuals to pursue their traditional livelihoods. Also, allowing the sector to absorb individuals who might

otherwise have flowed into unemployment has proved politically expedient; an important consideration in an economy in which the open unemployment rate has recently exceeded twenty per cent (GUS, 2005). In addition, the generous provisions of the agricultural pension scheme (KRUS) have enabled many to continue operating as nominal or 'hobby' farmers, with the transfer payment being their main source of financial support (Gomulka, 2000; Orłowski, 2002). This has fuelled some debate about whether such individuals should be reclassified as economically inactive, although any such change would militate against the EU's European Employment Strategy target of an employment rate of seventy per cent by 2010. Mobility has also been hampered both by the low human capital levels of agricultural workers (Ingham and Ingham, 2002) and the acute housing shortages in the urban areas of Poland (Juraś and Marzał, 1998). Furthermore, property rights that remain ill defined, coupled with a general resistance to sell land for a variety of reasons, continue to hamper large-scale farm reform (Zawojska, 2004; EU, 2003a; Pouliquen, 2001; Swinnen, 1999).

In the medium to long term, it is inconceivable that the current configuration of the sector can be preserved, notwithstanding the fact that the concessions granted to Poland during the accession negotiations will tend to ossify existing farming practices at the expense of rural diversification and development (Ingham and Ingham, 2004; Pelkmans, 2002). With Poland's competitiveness depending in no small part on the reallocation of labour out of agriculture and into higher value added activities, this is clearly counter-productive. The analysis to follow therefore seeks to identify those factors that might promote recent successful exits from farming in an attempt to inform future policy formulation in an area that represents Poland's highest outstanding transition hurdle. This necessitates that the focus shifts from the official

establishment survey statistics, which provide the longest time series of largely comparable data on Polish employment, but do not provide information about individuals, to the Labour Force Survey, which is described in the next section.

3. The Polish Labour Force Survey

The sampling procedure adopted generates both a quarterly and an annual panel. Attention here focuses on the latter for two reasons. First, yearly panels are more suitable when people change their labour market status infrequently. Second, the use of a quarterly panel to investigate flows into and out of agricultural employment introduces seasonal distortions. For example, there were more than three hundred and fifty thousand fewer workers on private agricultural holdings in the rural areas of Poland in the first quarter of 2001 than there were in the third quarter of that year (GUS, 2001: 18; 2001a: 18). On the other hand, yearly panels are susceptible to round tripping, since individuals who leave their origin state only to return to it by the end of the year are recorded as non-movers. Using the constant sample available for the first four Surveys, Góra and Lehmann (1995) were able to estimate the significance of this problem. Their results indicated substantial round tripping by the unemployed, with almost one-quarter of those who were originally without a job and who found work at some point during the year returned to unemployment by the end of the twelve month period. However, they detected no evidence of significant round tripping by those in other labour market states.

The period chosen for analysis runs from February 2001 to February 2002, which was the last LFS prior to the introduction of continuous sampling.[5] The earlier of these exercises interviewed 47.2 thousand individuals living in 18.6 thousand households and the annual panel produced 21,837 usable responses, implying an

attrition rate of approximately eight per cent (GUS, 2001). In the Survey, an individual is enumerated as being in employment according to the standard International Labour Organisation convention; that is, if they either worked for at least one hour during the reference week or they formally held a job, even if they did not work.[6] Also, an individual is recorded as being employed in agriculture if this is the sector in which they held their 'primary' job, which is the job from which they derive the largest part of their income. Adopting this rule gave Poland an agricultural workforce of 2.7 million in February 2001 (GUS, 2001: 98), suggesting that the official employment count (GUS, 2002) identified approximately 1.6 million farmers for whom agriculture is a secondary source of income.

4. The Transition Matrix and Descriptive Data

This section provides the building blocks for the analysis to follow. It first describes the transition matrix employed and then summarises the data.

Transition Rates

Four mutually exclusive, exhaustive labour market states form the focus of the analysis:

- working in agriculture (EA)
- working in a non-agricultural sector (E)
- unemployment (U)
- economic inactivity (N).

The transition probabilities for movement between these states are based on the standard Markovian process described by Toikka (1976), which records labour market flows between times t_0 and t_1 in the following manner:

$$\begin{pmatrix} EA_{t0}EA_{t1} & EA_{t0}E_{t1} & EA_{t0}U_{t1} & EA_{t0}N_{t1} \\ E_{t0}EA_{t1} & E_{t0}E_{t1} & E_{t0}U_{t1} & E_{t0}N_{t1} \\ U_{t0}EA_{t1} & U_{t0}E_{t1} & U_{t0}U_{t1} & U_{t0}N_{t1} \\ N_{t0}EA_{t1} & N_{t0}E_{t1} & N_{t0}U_{t1} & N_{t0}N_{t1} \end{pmatrix}$$

Each cell in the matrix represents the number of people moving from one state to another.

The probability of making any particular transition is defined as the number of individuals in the flow divided by the number in the origin state of interest. For example, $EA_{t0}E_{t1}/EA_{t0} = ea_{to}e_{t1}$ is the probability of moving from a job in agriculture to a job in another sector between t_0 and t_1. The transition probability matrix is therefore:

$$\begin{pmatrix} ea_{t0}ea_{t1} & ea_{t0}e_{t1} & ea_{t0}u_{t1} & ea_{t0}n_{t1} \\ e_{t0}ea_{t1} & e_{t0}e_{t1} & e_{t0}u_{t1} & e_{t0}n_{t1} \\ u_{t0}ea_{t1} & u_{t0}e_{t1} & u_{t0}u_{t1} & u_{t0}n_{t1} \\ n_{t0}ea_{t1} & n_{t0}e_{t1} & n_{t0}u_{t1} & n_{t0}n_{t1} \end{pmatrix}$$

In this framework, the possible outcomes (labour market transitions) remain the same from trial to trial, are finite in number and have probabilities that depend only on the outcome of the previous trial.

Summary Flows

Basic information on the panel analysed here is given in Table 1. The data indicate an activity rate of 54.8 per cent, which compares with the full Survey figure of 56.7 per cent (GUS, 2001: XXXV), meaning that those who are out of the labour force are slightly over-represented in the panel. Agricultural employment is also overstated at 23.6 per cent, compared with 19.1 per cent overall (*ibid*: 22). The panel and aggregate unemployment rates were similar; 19.3 and 18.4 per cent, respectively (*ibid*: 21). It might be noted at this juncture that the annual average LFS unemployment rate reached its lowest ever recorded level in 1998 (10.2%), but that figure had risen above

18 per cent by 2001 (*ibid*: XXXV) and stood at approximately 20 per cent the following year (GUS, 2004a: XLII).

Table 1 about here

Table 1 presents the probabilities of an individual being in a particular labour market state in 2002, contingent upon their status in 2001. Over this period, the recorded status of the majority of the sample did not change, with approximately ninety per cent of the employed, either in agriculture or elsewhere, and the economically inactive in 2001 to be found in the same state twelve months later. The unemployed were the most mobile individuals, with thirty per cent experiencing a move, over one-third of whom left the labour force. These aggregate findings are broadly in line with those reported in Góra and Lehmann (*op*. *cit*.) for Poland and the results for Britain in the 1980s found by Wadsworth (1989). However, they differ significantly from the findings of Bellmann *et al*. (1995) for the East German labour market. The latter authors found considerably higher transition probabilities, although their period of analysis coincided with a major shake-out of labour, primarily from the state-owned industries, and the difference in the results is therefore unsurprising.[7]

The terminal locations of those originally employed in agriculture are given in the first row of the Table. As Góra and Lehmann (*op*. *cit*.) found that approximately 83 per cent of farm workers in the two panels they analysed did not move, the current results suggest that mobility out of the sector declined somewhat during the nineteen-nineties. Just over 1.5 per cent of agricultural workers secured employment in another sector of the economy, almost four per cent withdrew from the labour force and less than one per cent became unemployed. The last of these findings should be interpreted in the context of the unemployment benefit regulations prevailing under the provisions of the 1994 Act on Employment and Counteract[ing] Unemployment.

These determine that any individual who either owns agricultural real estate or is working on a family holding in excess of two hectares, albeit without receiving an explicit wage, is ineligible for unemployment benefit (GUS, 2002a).

In contrast to the findings reported here, Bellmann *et al*. (*op*. *cit*.) found that 45 per cent of agricultural workers in the former East Germany left farming during 1990-91. Of these, approximately half found jobs elsewhere, 27 per cent left the labour force, 18 per cent became unemployed and approximately six per cent joined a government-funded programme. The magnitude of this exodus is explained by the collapse of the state farms that dominated agricultural production. As noted above, the same fate also befell Poland's state sector, but its impact was much smaller than in Germany, given the importance of private sector farming.

5. Modelling labour market transitions in Poland

This section seeks to model outflows from Polish agriculture via the estimation of an unordered multinomial discrete choice model that controls for a variety of personal and locational characteristics. To the extent that systematic relationships are apparent, they may serve to inform the policy design process. Individuals still recorded as working in agriculture in 2002, having been similarly enumerated in 2001, form the base group in the analysis.

Most of the exogenous variables are self explanatory, with precise specifications provided in the Data Appendix, although some require elaboration. The first are the employment status measures. Two dummy variables are included in the empirical specification; *Selfemp*, which identifies individuals working on their own account, and *Emp*, which identifies persons working for a public or private employer and receiving remuneration. This means that the base group is composed of unpaid

family workers, defined in the LFS as people working without pay in an economic enterprise operated by a related person living in the same household. In the panel utilised, almost twenty-eight per cent of the sample working in agriculture in 2001 were in this category.[8] Furthermore, while the allocation of individuals to labour market states can be problematic in transition economies (Dutz *et al*., 2001); with almost one-quarter of these family workers devoting more than forty hours a week to farming, it would seem perverse to categorise them as inactive.

Given that the LFS contains information on additional employment, the binary variable *Addjob* identifies those in the sample who had a second job outside agriculture, with the expectation being that these individuals may be better equipped to make the transition out of the sector. The variable *Time*, which measures the duration of individuals in their current labour market state, captures the possibility that the longer people have been in any particular state, the less likely they might be to leave. Finally, educational effects are captured by the binary variable *Bvoc+*, which identifies those individuals who had at least basic vocational education. The choice of this measure was necessitated by the exceptionally low educational achievements of the agricultural workers in the sample.

It would have been desirable to have used a full set of dummy variables representing the countries' voivodships as regional indicators. However, this resulted in a large number of zero cells, meaning that some form of aggregation was necessary in order for the model to be estimable. To achieve this, a cluster analysis of the voivodships on a number of major economic indicators was undertaken using the SAS FASTCLUS procedure, which identified a seven cluster solution as optimal. As such, six dummy variables (*Tier1*, …. , *Tier6*) were included in the model, with the

remaining cluster taken as base. The indicators used to construct the clusters and their resulting memberships are given in the Data Appendix.

Of the seven clusters, two, Tiers 3 and 4, were clearly disadvantaged, albeit in different respects. The former, which consisted of the three most eastern voivodships, along with Świętokrzyskie, had the lowest concentrations of employment in both industry and market services and the lowest average GDPs per capita. Tier 4 had only a single member – Warmińsko Mazurskie – a region that suffered the highest unemployment rate and job loss, in addition to having the second lowest per capita GDP, all of which reflect the enduring impact on the area of the collapse of state farming. Of the two clusters that fared well, Tier 1 also had only a single member, Mazowieckie, which houses the capital. This voivodship ranked highest on all of the included measures. The two voivodships in Tier 2 – Śląskie and Wielkopolskie – had the heaviest concentration of employment in industry, but enjoyed high levels of per capita GDP and low unemployment rates.

Given that the labour market transitions identified in this paper are represented by one of four mutually exclusive states, a multinomial response model is employed wherein the probability of alternative *j* on trial *i* is given by:

$$p_{ij} = \Pr\left(y_{ij} = 1\right). \tag{1}$$

It is assumed that the p_{ij} are related to a set of explanatory variables through the model:

$$p_{ij}\left(\beta\right) \equiv \Pr\left(y_{ij} = 1 \middle| x_i, \beta\right) = G(x_i^{'} \beta_j) > 0 \tag{2}$$

for $i = 1,2, \ldots, N$ and $j = 1,2, \ldots, J$

in which β_j is a (Kx1) vector of unknown parameters, $x_i' = (x_{i1}, x_{i2}, \ldots, x_{ik})$ is a (1xK) vector of covariates, and $G(.)$ is a function that links the probabilities, p_{ij} with the linear structure $x_i'\beta_j$. With noisy data the model becomes:

$$y_{ij} = G(x_i', \beta_j) + e_{ij} = p_{ij} + e_{ij} \tag{3}$$

where the e_{ij} are the error components contained within the interval [-1,1]. In order to recover the unknown, unobservable p_{ij} and e_{ij}, indirect empirical measures on the noisy, but observable, y_{ij} and the known covariates x_i must be used.

Using the maximum likelihood approach, the multinomial logit model results from choosing $G(.)$ to be the logistic cumulative density function (cdf), whereas if the standard Gaussian cdf is chosen, the result is the multinomial probit. In this application, however, an alternative procedure was adopted based on the entropy formulation, which measures uncertainty (state of knowledge) about a particular event. Thus, if x is a random variable with j outcomes (j = 1,2, …, J), with each outcome having a probability p_j such that $\sum_j p_j = 1$, the entropy of the distribution of p_j is:

$$H \equiv -\sum_j p_j \log_e p_j \tag{4}$$

In order to recover the individual p_j, the entropy is maximised subject to the available sample moments and the adding up constraints on the probabilities. Here, the generalized maximum entropy (GME) approach to multinomial response data proposed by Golan *et al.* (1996) was adopted. This choice was based on the fact that GME is more efficient than maximum likelihood and also avoids any strong parametric assumptions. Furthermore, the GME formulation works well even when the sample is small, the covariates are correlated or the design matrix is ill-

conditioned. Further details of the GME approach are provided in the Technical Appendix.

6. Exits from Polish Agriculture

In the current application, $j=0,1,2,3$, as described above, and the GME results obtained are reported in Table 2, in which each of the coefficient estimates pertain to the log of the odds ratio. Each of the three of columns relates to one of the possible transitions out of agriculture, with those working in the sector at both ends of the sample period forming the base group. In an attempt to capture the potential impacts of gender differentiation in the assumption of domestic responsibilities on the transition probabilities, interaction terms on the age variables were also included in the specification.[9] The resulting model correctly predicts over ninety per cent of observations and the pseudo R^2 statistic indicates that the model explains over eighty per cent of the variation in the outcome variable.

Table 2 about here

The first column of the Table presents the findings obtained for the log of the odds of moving from agriculture into alternative employment relative to remaining in farming (hereafter, the odds). These indicate the existence of significant differences between the sexes with respect to the terms in age. Thus, for males, the odds of securing non-agricultural employment increased up to the age of 29, but declined thereafter. In the case of females, however, these odds were maximised at the age of 40 and, beyond the age of 49 their chance of exiting to other work exceeded that of otherwise equivalent men.

As might be expected, the odds of an individual making a successful transition out of agriculture into another sector were inversely related to the jobless rate in the

voivodship in which they resided. At the same time, agricultural workers living in the regions in the two most advanced tiers (Tier 1 and Tier 2) were less successful at exiting farming than the base group; presumably because they lacked the skills and/or qualifications necessary to compete successfully for jobs in these areas. The same finding holds for those living in the eastern voivodships in Tier 5 although, as these regions house a large proportion of Poland's small family farms, this result case is likely to reflect the dearth of non-agricultural employment opportunities in the area. Finally, individuals residing in Warmińsko-Mazurskie (Tier 4) were more likely than the base group to leave agriculture for a job elsewhere. As noted earlier, this area previously housed the state farms and although their collapse meant that many former employees became unemployed, a number of private farms were created. Since these were larger and more market oriented than the majority of the small family, semi-subsistence farms to be found in other regions, it is likely that employment in such an enterprise provided a better platform for the switch to an off-farm job.

The odds of moving from agriculture into unemployment were maximised at the age of 36, with no statistically significant difference between the sexes. The results for this transition also show that the longer people had been working in farming, the less likely was it that they would move into the unemployment pool. In addition, the possession of vocational education reduced the odds of someone making the switch. With the unemployment rate for those with no more than primary education being 23.9 per cent in the second quarter of 2001, 26 per cent in the same quarter of 2002 (GUS, 2001b, 2002b) and with more than half of those concerned being out of work for one year or more, this particular move seems unlikely to have been motivated by search considerations. Finally, the results suggest that location played no part in determining outflows from agriculture into unemployment.

The final column of Table 2 relates to the odds of exiting agriculture into inactivity. As might be expected, the young and the old were the more likely to move out of the labour market, with the chances of males making this transition being minimised at age 22. Female farmers were more likely to leave the labour market throughout their working lives. On the other hand, self employed farmers were much less prone to move into inactivity, while employed workers were no more likely to make this transition than were the base group of unpaid family workers. None of the spatial indicators had a statistically significant impact on the flow and, in addition, education proved not to be a determinant of the decision to withdraw from the labour force.

To close this section, because the actual coefficients depend on arbitrary normalisation conventions, it is instructive to look at the effect on entropy of omitting variables from the model. To do this requires the calculation of the entropy values:

$$S(\hat{p}) = \sum_i \sum_j \hat{p}_{ij} \log_e \hat{p}_{ij} \qquad (5)$$

which lie in the [0,1] interval with a zero value indicating no uncertainty and a value of one reflecting perfect uncertainty. The results in Table 3 show that the greatest increases in uncertainty arise from excluding the spatial indicators, *Tier1* to *Tier6*, and the age variables. Conversely, excluding *Addjob* from the empirical specification only causes a very small increase in the entropy value.

Table 3 about here

7. Implied Probabilities

Poland's farms must shed large volumes of labour if genuine economic modernisation is to be achieved. However, social cohesion and the prevention of yet further increases in the country's already large economic dependency rate imply that

this exodus should come about principally through flows into alternative employment. In view of this, the following discussion focuses on the probability that a given individual, with a particular vector of characteristics, would leave agricultural employment to work in another sector of the economy. Such probabilities are calculated as:

$$\hat{p}_{ij} = \frac{\exp\left(x_i' \hat{\beta}_j \right)}{\sum_{ij} \exp\left(x_i' \hat{\beta}_j \right)} \tag{6}$$

with selected results being presented in Table 4.

Table 4 about here

The first group of simulations, reported in rows one to six of the Table, embody two assumptions, with the first being that the unemployment rate is taken to be the average of the LFS unemployment rates for the tier for which the simulation was performed. For example, the relevant rate in row one is the average for the two voivodships of Śląskie and Wielkopolskie. The second is that the individuals concerned are assumed to have worked continuously in agriculture since the age of 17. Under these base conditions, the probability of any individual with the assumed characteristics leaving farming for employment in another sector is found to be exceptionally low, with those most likely to make the transition being 25 year old males residing in Tier 2. Even in this case, however, their chance of` so doing is only slightly above two per cent.

In contrast, rows seven to ten portray a much more optimistic picture. There attention is focused on unpaid family workers who, it is assumed, have only been in their current labour market state for two years, which might not be unreasonable under some plausible scenarios. For example, in the case of a 25 year old, this might reflect a situation in which the individual was working in farming, albeit without

explicit pay, after completing formal education whilst they were at the same time searching for alternative employment. In the case of a 35 year old, such status could describe a woman helping on a family farm after a period of absence from the labour market. Alternatively, a male in this situation might be seeking temporary shelter in farming after being laid off from a previous employment. In any event, the unemployment rates in this group of simulations have been set at the lowest powiat (NUTS 4) rate pertaining at the time in the tier concerned.[10] For Tier 3 regions, the estimated exit probabilities are very high: even a 55 year old male, the individual who was least likely to move from farming into alternative work, has more than a ninety per cent chance of doing so. In Tier 5 regions where, in certain areas, more than fifty per cent of those in employment work in agriculture, the estimated probabilities imply that all but older male farmers should be able to make a purposeful transition out of farming.[11]

The final pair of simulations, reported in the last two rows of the Table, refer to employed agricultural workers living in one of the two Tier 6 voivodships. Although reasonably advanced, both of these regions have concentrations of farming employment that are above the national average. In addition, it is assumed that the individuals under consideration have worked in agriculture for two years and that they reside in the lowest unemployment powiat within the tier. Under this scenario, young and middle aged males would successfully move to other sectors, but their female counterparts would not. Nonetheless, beyond the age of 55 neither sex would succeed in making the transition.

It is most important, however, that the foregoing results be placed in the appropriate context. In particular, only seven per cent of Poland's farmers in 2001 were paid employees (GUS, 2001b), less than five per cent of powiats had

unemployment rates below ten per cent and three-quarters had rates in excess of 15.2 per cent. Furthermore, over half of all farmers were to be found in Tiers 2, 4 and 5 and therefore simulations one to six portray most accurately the situation obtaining in the sector. As such, even though transitions were found to be sensitive to employment status, the prevailing unemployment rate and location, the present findings do not suggest that an imminent increase in mobility between the farm and non-farm sectors is likely without some additional intervention.

8. Concluding discussion

Poland's accession to the EU introduced a labour market of significant size, but one which, on certain counts, lags far behind in terms of its development, with its restructuring falling short of that which could reasonably be expected in the years since 1989. In particular, a significant reform of the archaic agricultural sector and attendant reallocation of its labour force has yet to take place. When this does eventually occur, it will impart severe strains on many of the EU's medium-term aspirations and the associated policy challenges are demanding. Using micro-data from the LFS, this paper has shown that the impression of stagnation within farming that is conveyed by the official statistics does not disguise a more dynamic reality in which counter flows cancel out in the aggregate.

Multinomial estimation of worker flows through a four-way transition matrix revealed very low exit probabilities. Even older workers do not leave the sector on reaching the age of retirement and remain there more or less until death. This leads to the well rehearsed conclusion that the farmers' pension scheme must be reformed, perhaps by enforcing strict eligibility criteria based on the release of land. There may also be a case for policies that discourage self-employment in the sector. This would clearly be discriminatory and fiercely opposed by the farming community and its

powerful political lobbies, but subsistence agriculture is certainly not an activity that the institutions of the EU are attempting to encourage when they call for an expansion in entrepreneurship.

While the results produced no evidence that exits from farming are fostered by the possession of education, this is perhaps not surprising in the face of a scarcity of individuals with schooling that extends beyond vocational secondary level in the sector. As such, longstanding proposals to improve the educational standards of Poland's agricultural and rural populations seem worthy of hastened execution. Finally, the present findings do support the notion that flows from farming are sensitive to the tightness of the labour market, but the country's growth in recent years has been jobless and the EU's Stability Pact is likely to retard policy innovations with otherwise desirable potential consequences.

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Table 1 *Transition probabilities: Outflows*

Status at t_1	***e_A***	***e***	***u***	***n***	***Stock at t_0***
Status at t_0					
e_A	0.9377	0.0162	0.0075	0.0386	2,279
e	0.0087	0.8940	0.0498	0.0475	7,386
u	0.0243	0.1518	0.6911	0.1328	2,305
n	0.0113	0.0202	0.0312	0.9374	9,867

Note: The elements in this table represent the probability that a member of any origin state *i* moved to terminal state *j*. Subject to rounding errors each row of the table sums to 1.

Table 2 Multinomial estimates of outflows from agriculture

	EA→E	***EA→U***	***EA→N***
Constant	7.0475 (1.44)	-12.6616* (1.94)	-0.7725 (0.30)
Age	0.1805 (1.53)	0.3974* (1.86)	-0.0440 (0.96)
Age squared	-0.0031* (1.90)	-0.0055* (1.77)	0.0010** (2.31)
*Female*Age*	-0.1085** (2.48)	-0.0054 (0.07)	0.0385* (1.94)
*Female*Age squared*	0.0022** (2.21)	-0.0004 (0.20)	-0.0005* (1.72)
Urate	-0.6653** (2.98)	0.2099 (0.83)	-0.1256 (1.13)
Emp	-0.4511 (0.54)	0.3640 (0.48)	0.0474 (0.10)
Selfemp	-0.1495 (0.35)	-1.0682 (1.36)	-0.7661** (3.16)
Time	-0.0217 (0.90)	-0.2579** (3.28)	-0.0033 (0.33)
Addjob	0.6297 (0.43)	-7.1608 (0.07)	0.2320 (0.31)
Bvoc+	-0.0314 (0.08)	-1.2877** (2.27)	-0.0400 (0.15)
Tier1	-5.0907** (2.43)	2.6867 (1.05)	-1.3523 (1.22)
Tier2	-2.8440* (1.76)	0.6909 (0.31)	-0.7959 (0.89)
Tier3	1.0984 (0.98)	1.1632 (1.04)	-0.0090 (0.01)
Tier4	5.9955** (2.82)	-10.5374 (0.13)	1.4637 (1.55)
Tier5	-2.4852* (1.68)	-0.3774 (0.19)	-0.9841 (1.24)
Tier6	-2.5845 (1.53)	2.6546 (1.21)	-0.8882 (0.94)
N		2,279	
Pseudo R^2		0.8255	
Correct predictions		93.8%	
Normalised entropy		0.1746	

Notes:

a. * and ** indicate that coefficients are significant at the 10% and 5% levels respectively.

b. The results are based on m=9, as suggested by Golan et al. (op. cit.), which means that the first eight moments of the unknown errors are recovered. This improves the estimates of the unknown probabilities and the coefficients.

Table 3 Changes in normalised entropy values

Omitted variable(s)	$\Delta S(\hat{p})$
Tier 1 →Tier 6	0.0085
*Age, Age^2, Female*Age, Female*Age^2*	0.0070
Urate	0.0025
Emp, Selfemp	0.0023
Time	0.0032
Addjob	0.0001
Bvoc$^+$	0.0008
All except constant terms	0.0342

Table4 Predicted probabilities for outflows from agriculture

Sim. No.	***Age***	***25***	***35***	***45***	***55***
	Characteristics				
1	*Self-employed, male, Tier2, Urate=15.2%*	0.0244	0.0187	0.0077	0.00017
2	*Self-employed, female, Tier2, Urate=15.2%*	0.0066	0.0063	0.0051	0.0034
3	*Self-employed, male, Tier4, Urate=27.5%*	0.0463	0.0356	0.0148	0.0032
4	*Self-employed, female, Tier4, Urate=27.5%*	0.0127	0.0123	0.0099	0.0067
5	*Self-employed, male, Tier5, Urate=16.2%*	0.0190	0.0145	0.0060	0.0013
6	*Self-employed, female, Tier5, Urate=16.2%*	0.0051	0.0049	0.0040	0.0027
7	*UFW, male, Tier3, Time=2, Urate=9%*	0.9898	0.9889	0.9778	0.9181
8	*UFW, female, Tier3, Time=2, Urate=9%*	0.9647	0.9704	0.9710	0.9659
9	*UFW, male, Tier5, Time=2, Urate=8%*	0.8492	0.8406	0.7256	0.4104
10	*UFW, female, Tier5, Time=2, Urate=8%*	0.6035	0.6463	0.6474	0.6060
11	*Employed, male, Time=2, Tier6, Urate=8.2%*	0.7142	0.6785	0.5321	0.2509
12	*Employed, female, Time=2, Tier6, Urate=8.2%*	0.4124	0.4245	0.4660	0.4349

Data Appendix

Covariates:

Age	Age in years
Time	The length of time an individual has been in his/her current labour market state
Unemployment rate	The November 2001 unemployment rate in the individual's voivodship

Binary factors:

Female	1 if female, 0 otherwise – although this binary factor was interacted with all the exogenous variables, significant differences between the sexes were only found to be upheld empirically for the age variables.
Emp	1 if a paid employee, 0 otherwise
Selfemp	1 if self employed, 0 otherwise
Addjob	1 if the individual has an additional job which is not in agriculture, 0 otherwise.
Bvoc+	1 if the individual concerned has attained at least basic vocational education, otherwise
Tier1 →Tier6	A set of binary variables indicating the individual's Area of residence, those residing in the Tier 7 voivodships form the base group.

Voivodship clusters:

Indicators used:

- Percentage of employment in industry, December 2001 (GUS, 2002)
- Percentage of employment in market services, December 2001 (GUS, 2002)

- Percentage change in total employment 1994-2001 GUS (1995, 2002)
- GDP per capita, 2001 (GUS/US, 2004)

Tier 1: Warszawskie

Tier 2: Śląskie, Wielkopolskie

Tier 3: Kujawsko-pomorskie, Łódzkie

Tier 4: Warminskio-Mazurskie

Tier 5: Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie

Tier 6: Małopolskie, Opolskie

Tier 7: Dolnośląskie, Lubuskie, Pomorskie, Zachodniopomorskie

Technical Appendix

The GME approach utilises an ill-posed inverse moment entropy problem which is both linear in **p** and includes noise:[12]

$$\left(I_j \otimes X'\right)\mathbf{y} = \left(I_j \otimes X'\right)\mathbf{p} + \left(I_j \otimes X'\right)\mathbf{e} \qquad \text{(A.1)}$$

A problem that arises is that in order to use the information in the entropy problem requires that **p** and **e** have the properties of probabilities and, although **p** already satisfies this requirement, the elements of **e** can lie anywhere in the [-1,1] interval. The solution to this problem involves reparameterizing the e_{ij} to probabilities whose values lie in the [0,1] interval. In order to accomplish this, define, over the interval [-1,1], a bounded discrete random variable which can only take a finite number of values:

$$v_{ij} = \left(v_{ij1}, v_{ij2}, ..., v_{ijm}\right)' \qquad \text{(A.2)}$$

where $m \geq 2$

together with corresponding, but unknown, weights:

$$w_{ij} = \left(w_{ij1}, w_{ij2}, ..., w_{ijm}\right)' \qquad \text{(A.3)}$$

which have the following properties:

$$\sum_m w_{ijm} = 1 \qquad \text{(A.4)}$$

and:

$$e_{ij} = \sum_m v_{ijm} w_{ijm} \qquad \text{(A.5)}$$

Equation (5) can now be written as:

$$\left(I_j \otimes X'\right)\mathbf{y} = \left(I_j \otimes X'\right)\mathbf{p} + \left(I_j \otimes X'\right)\mathbf{V}\mathbf{w} \qquad \text{(A.6)}$$

and the GME multinomial response problem can be formulated as the following constrained maximisation problem:

$$\max H(\mathbf{p},\mathbf{w}) = \max\{-\mathbf{p}'\log_e\mathbf{p} - \mathbf{w}'\log_e\mathbf{w}\} \qquad \text{(A.7)}$$

subject to (10) and the following normalization constraints:[13]

$[\mathbf{I}_{N1}\ \mathbf{I}_{N2}\ \ldots\ \mathbf{I}_{NJ}]\mathbf{p} = 1$ for $i = 1,2\ \ldots\ ,N$ (A.8)

and

$\mathbf{I}'\mathbf{w}_{ij} = 1$ for $i = 1,2\ \ldots\ ,N$ and $j=1,2,\ \ldots\ ,J$ (A.9)

Solving the first order conditions of the Lagrangean, and noting that $\hat{\beta}_j = -\hat{\lambda}_j$, provides the following estimators:

$$\hat{p}_{ij} = \frac{\exp\left(x_i' \hat{\beta}_j \right)}{\sum_{ij} \exp\left(x_i' \hat{\beta}_j \right)} \tag{A.10}$$

$$\hat{w}_{ijm} = \frac{\exp\left(x_i' \hat{\beta}_j v_j \right)}{\sum_{ij} \exp\left(x_i' \hat{\beta}_j v_j \right)} \tag{A.11}$$

$$\hat{e}_j = v_j \hat{w}_j \tag{A.12}$$

where the recovered $\hat{p}_{ij}$ and $\hat{e}_{ij}$ are based only on the information-moment relations and contain no implicit assumption regarding the form of the function linking the p_{ij} and the $x_i' \beta_j$. Finally, because the Lagrange multipliers, $\hat{\lambda}_j$, are not unique in the GME formulation, the normalisation that $\lambda_1 = -\beta_1 = 0$ is applied.

[1] Zinnes *et al*. (2001) provide an excellent discussion of the possible definitions of competitiveness, of which factor productivity is but one.

[2] The GDP figures are taken from various issues of *Rocznik Statystyczny* published by the Central Statistical Office.

[3] To put the Polish experience into context, Boeri and Terrell (2003: 54) report that the Russian Federation experienced modest growth (+0.04%) in agricultural employment during the period 1989-1998 whereas other transition economies witnessed job contraction in the sector – Czech Republic (-6.2%), Hungary (-9.1%) and Slovakia (-6%).

[4] It would be erroneous to equate movements into the private sector with labour market restructuring as this can involve nothing more than the redefinition of an enterprise's ownership status. For further discussions of this point and the contrast between 'insider' and 'outsider' privatization, see the papers by Aghion and Blanchard (1994) and Aghion and Carlin (1997).

[5] Between May 1992 and February 1999 the Survey was conducted during a reference week that included the 15th day of the middle month of the quarter. The next Survey was not until QIV 1999 and since then interviewing has taken place on a continuous basis with (1/13)th of the sample of dwellings being surveyed in each week of the quarter.

[6] This definition differs from that adopted by the European Community Household Panel (the base survey for its LFS), which only classifies individuals as employed if they work a minimum of 15 hours (Eurostat, 1999).
[7] As Poland's first Labour Force Survey was not conducted until May 1992, by which time the dissolution of the state farms was well advanced and the official employment count had already fallen by some two million (GUS, 1997: 217), it not possible to produce directly comparable evidence.
[8] The true cost of the workers concerned, who worked an average of 31 hours per week, can hardly be assumed to be zero.
[9] The LFS does not provide information on the presence of children in the household.
[10] Registered powiat unemployment rates are used as the LFS rates are only reliable at the voivodship level. The data are from GUS (2003c).
[11] This assertion is based upon Greene's (2003) rule that probabilities of 0.5 and above imply that an individual will make a particular transition.
[12] The GME formulation is ill-posed because there are KJ moment relations (data points) but NJ unknown multinomial parameters to be recovered and N must be greater than K.
[13] These normalisation factors ensure that the estimates of p_{ij} and e_{ij} have the properties of probabilities.