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Latent class models for cross-national comparisons: the association between individual and national-level fertility and partnership characteristics

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Abstract: Multilevel modelling techniques such as random models or fixed effect are increasingly used in social sciences and demography to both account for clustering within higher level aggregations and evaluate the interaction between individual and contextual information. While this is justifiable in some studies, the extension of multilevel models to national level analysis — and particularly cross-national comparative analysis — is problematic and can hamper the understanding of the interplay between individual and country level characteristics. This paper proposes an alternative approach, which allocates countries to classes based on economic, labour market and policy characteristics. Classes influence the profiles of three key demographic behaviours at a sub-national level: marriage, cohabitation and first birth timing. Woman level data are drawn from a subset of the Harmonized Histories dataset, and national level information from the GGP contextual database. In this example, three country classes are extracted reflecting two Western patterns and an Eastern pattern, divided approximately along the Hajnal line. While Western countries tend to exhibit higher levels of family allowances albeit accounting for a lower share of spending which is associated with lower marriage and later fertility, Eastern countries generally show a higher share of spending but at lower absolute levels with lower cohabitation rates and early fertility.

Keywords: multilevel models, latent class analysis, cross-national, marriage, cohabitation, fertility

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1. Introduction

Multilevel modelling is increasingly popular within both general social science and demography. The importance of the interaction between macro and micro level is recognised within demographic literature (*e.g.*, Neels, Theunynck, and Wood, 2013; Billingsley and Farrini, 2014; Perelli-Harris and Sánchez-Gassen, 2012). Multilevel models seem a natural method to be applied for this research *prima facie*, due to their ability to partition variation in demographic outcomes between individual and contextual influences, and explicitly model the relationship between individual and macro level (*e.g.*, national policies) characteristics.

Within the longitudinal context, multilevel models have been frequently applied to examining the effect of national level policies on life course events, such as fertility or partnership transitions, or the effect of some other exogenous factor (*e.g*. Neels, Theunynck**,** and Wood, 2013; Billingsley and Farrini, 2014). The major advantage of this approach is that it allows the integration of policy indicators as contextual variables with more general clustering parameters to capture unobserved or unspecified country level characteristics (*e.g*., cultural variation). Country level variation is also of interest in many other research areas, such as politics or sociology (Hox, van de Schoot, and Matthijsse, 2012).

Unfortunately, standard multilevel or random effects models, and the aim of examining micro-macro interactions are not coherent when the higher level clusters are countries. Specifically, the model can complicate the interpretation of country specific variation, small numbers of countries can complicate model estimation, and the fundamental assumptions of the multilevel model are not compatible with national level data. Random effects multilevel modelling is therefore not an appropriate solution when examining the effect of national level characteristics on individual demographic behaviour. Unfortunately, fixed effects models provide little by way of alternative, due to their limited ability to provide inference and statistical inefficiency. Fixed effects also exhibit other issues such as potentially inefficient estimation for large numbers of countries (since each country within the dataset requires a new parameter within a regression model) and, critically where country level policies are of research interest, the inability to include covariate information at the cluster level (since the country specific parameter now confounds the national level policy information).

Some authors have attempted to overcome the limitations of a purely data driven approach by using *a priori* specifications of country typologies. Esping-Andersen (1990 and 1999) provided an attempt at these classifying countries as belonging to different social welfare regimes within Western Europe; countries belonging to either liberal, corporatist-statist or social democratic welfare regimes, extended by Blossfeld and Drobnic (2001) to incorporate former socialist countries. Further attempts at linking welfare regimes to demographic behaviour have been made by Blossfeld (2006) characterising countries as being conservative (Germany and the Netherlands), southern (Italy and Spain), liberal (UK and US), social democratic (Sweden, Norway, Denmark) and post- socialist (Czech Republic, Estonia, Hungary), as well as other demographic examples (Korpi, Ferrarini, and Englund, 2013; Korpi, 2000; Kalwij, 2010). There are considerable advantages to the typology driven approach. The typologies derived show few of the disadvantages of a purely empirical based approach, since typologies can be derived from a small sample of countries and by their nature are interpretable. Additionally, the grouping derived will be conceptually valid and consistent with existing theoretical understandings; this potentially may not occur in a purely empirical approach. That said, the major drawback of the typology based approach is that typologies have to be specified *a priori* by the researcher, and the ability to validate these groupings can often be neglected when linking typologies to the variable of interest.

In this paper an alternative means for the analysis of individual and national interactions is proposed, through the use of two level latent class growth models. These models provide the ability to generate clusters at the national level, but based on observed characteristics, rather than the distributional characterisation of random effects models. The observed characteristics used to define the class provide a substantive interpretation. This has the additional advantage of being a means by which theoretically derived country level typologies (Esping-Andersen, 1990; Esping-Andersen, 1999; Blossfeld, 2006) can be validated empirically. I apply this model to data from the Harmonized Histories dataset and GGP contextual database, which captures individual level demographic and country level welfare data in the European context. Individual level demographic behaviour is measured through the three processes of the timing of first marriage, the timing of first cohabitation and the timing of first birth. I classify countries based on relevant socio-economic (family allowance, social support) and legal (recognition of cohabitation within the legal framework) characteristics, and allow the timing of demographic behaviour to vary by class. This provides results which explicitly model micro-macro level interactions, without the loss of information associated with traditional multilevel models, and countries clustered within classes which afford a substantive interpretation.

2. Methodological Discussion

Random effects models are a form of regression, which in their most basic form function by capturing deviations in clusters from the overall regression equation by partitioning error terms. Deviations from the overall population line due to country/cluster level variation are captured by the cluster level random effect, which is a draw from a normal (or similar) distribution. Deviation is assumed to be due to a sampling process with an approximately normal sampling distribution — the stochastic nature of this model leads to the term random effects models. Residuals (cluster level deviations) will typically be shrunk or precision weighted, to take account of the fact that *j* level units with few individuals (*i* level observations) will be unreliably estimated (Efron and Morris, 1973).

This model is attractive to social scientists wishing to investigate the interaction between individual and higher order clusters. The random effects model will correct for standard error overestimation due to clustering, provides estimates of the relative size of individual and cluster level correlations and allow for more complex models such as random slopes models or cross level interaction which allow effects of interest to vary between clusters.

That said, random effects models have some limitations which means that they may not be methodologically germane to research questions which specify certain types of cluster, for example, countries. Many analyses will typically be limited in the number of countries analysed (for example Neels *et al*. (2013) analysed only 14 countries, Billingsley and Farrini (2014) used 21). This is problematic when trying to obtain estimates for country level random effects, due to a lack of precision and since many iterative methods (such as IGLS) will assume normality, which is difficult to verify with such a small sample. Small sample sizes can typically result in underpowered analysis; Hox *et al*. (2012) find that at least 20 higher order units is required for the accurate interpretation of regression coefficients, and a sample size of at least 50 higher order units is required for sufficiently powered analysis of variance parameters. The use of Bayesian estimation techniques can produce more reliable estimates for a far lower number of higher level units (Hox, van de Schoot, and Matthijsse, 2012). However, the small number of *j* units can mean that reliable estimates require exceptionally long model runs (when using MCMC; Browne, 2014) or the use of informative priors.

Interpretation can also be difficult when trying to establish cluster-specific effects. Interpreting the deviation for a particular country requires interpretation of posterior or empirical Bayes residuals, and is not intuitive. Where the model is more complicated, for example through the addition of random slopes, country specific estimates can become increasingly obtuse.

Finally, it is questionable whether this model is conceptually valid. The fundamental assumption of the random effects model is that the random effect approximates variation that is characteristic of a sampling process, where the countries in the observed dataset were drawn at random from a larger population. For many researchers, the selection of countries within a dataset may often be purposive. At best, it is unclear what the population of countries to which inference is being made actually is, since enumeration of higher order units will tend to be complete or approaching the finite population from which they are drawn (Stegmueller, 2013). Further, it is assumed that the cluster level deviations from the population line can be well approximated by a draw from an *i.i.d.* normal distribution. Evidence in demographic literature of the existence of country typologies (Korpi, Ferrarini, and Englund, 2013; Korpi, 2000; Kalwij, 2010) or ‘clumpy’ groupings of higher order units within multilevel models (Billingsley and Farrini, 2014) would indicate that this assumption is shaky when countries are specified as the level 2 unit.

2.1 Fixed Effects

In fixed effects models deviation from the overall population line, rather than being captured by a random effect are now captured by dummy variables which index each cluster (save for one omitted cluster to identify the model).

This has some advantages over and can overcome some of the conceptual limitation of random effects models. The model makes no distributional assumptions for cluster level variance and hence is protected against misspecification. This also allows deviation from the overall population line to exhibit the clumpy characteristics expected under circumstances where regime typologies exist (*e.g.*, Elzinga and Liefbroer, 2007). Moreover, since the model will remove via differencing both observed and unobserved *j* level variation, the fixed effects model is commonly applied under circumstances where causal inferences are required.

That said, there are drawbacks to this approach. Firstly the dummy variables identifying clusters refer only to the sample under analysis; hence, it is impossible to make inference beyond the observed data. Secondly, where there are relatively few observations within cluster then the estimated fixed effects will tend to be unreliable. Indeed, the random effects model in general will tend to be more efficient, since the deviations from the population line are captured by one parameter, while the fixed effects model requires the estimation of $\boldsymbol{J}-1$ dummy variables (for a model with *J* clusters). Finally, the use of fixed effects models can preclude the use of country or cluster level covariates since these are confounded with their own fixed effect. This is a distinct disadvantage when seeking to understand the effect of country level information, such as national level policy.

2.2 Latent Class Analysis

To overcome the limitations highlighted, the use of Two-level Latent Class models is proposed, which will be demonstrated go some way to overcoming the limitations of both random and fixed effects models for longitudinal data analysis. Latent class models use country level information to create classes, allocate countries to classes and produce woman level information within that class. There are a number of advantages to this approach. Firstly, the fact that the cluster level effect is described by classes means that specifying a Normal (or indeed any other distribution) is no longer required, and hence 'clumpiness' can be accurately captured. Moreover, the fact that the country level of analysis is now generated from policy indicators means that the class can be ascribed qualitative meaning for interpretation purposes, either by generating empirical groupings or validating theoretically derived groupings *as per* Elzinga and Liefbroer (2007) or Esping-Andersen (1990 and 1999). The grouping variable is a categorical variable represented in Figure 1 by the class indicator C. The model has the advantage over the fixed effects model that since C is a 'random' effect, it is possible to make inferences beyond the data within the sample at cluster level. Forming classes based on variables of interest explicitly includes contextual (country level) information in the model, and interactions between cluster and individual level information can be included by allowing individual level covariates to depend on class membership. The disadvantage of this lack of confounding of the latent class approach is that residual confounding may exist due to variables omitted from those used in class formation; hence, it is harder to make causal claims from latent class compared to fixed effects models.

Figure 1 represents the structural form of the latent class model. Within the figure, we observe the response variable $\boldsymbol{y}$ at a series of timepoints $\boldsymbol{t}=1, \boldsymbol{t}=2, \cdots, \boldsymbol{t}=\boldsymbol{T}$ observed at the level of the individual. The level of the response variable at each time point is determined by an intercept ($\boldsymbol{i}$) and slope ($\boldsymbol{s}$). The shape of the slope trajectory can take a variety of forms (quadratic, cubic).The values of the intercept and slope are allowed to vary according to membership of a higher level class, C, which is determined at the cluster/country level. In this instance, class membership is determined by a set of relevant cluster level variables here denoted by the vector x.

2.3 Number of Classes

A disadvantage of the latent class approach is that the researcher needs some means by which to

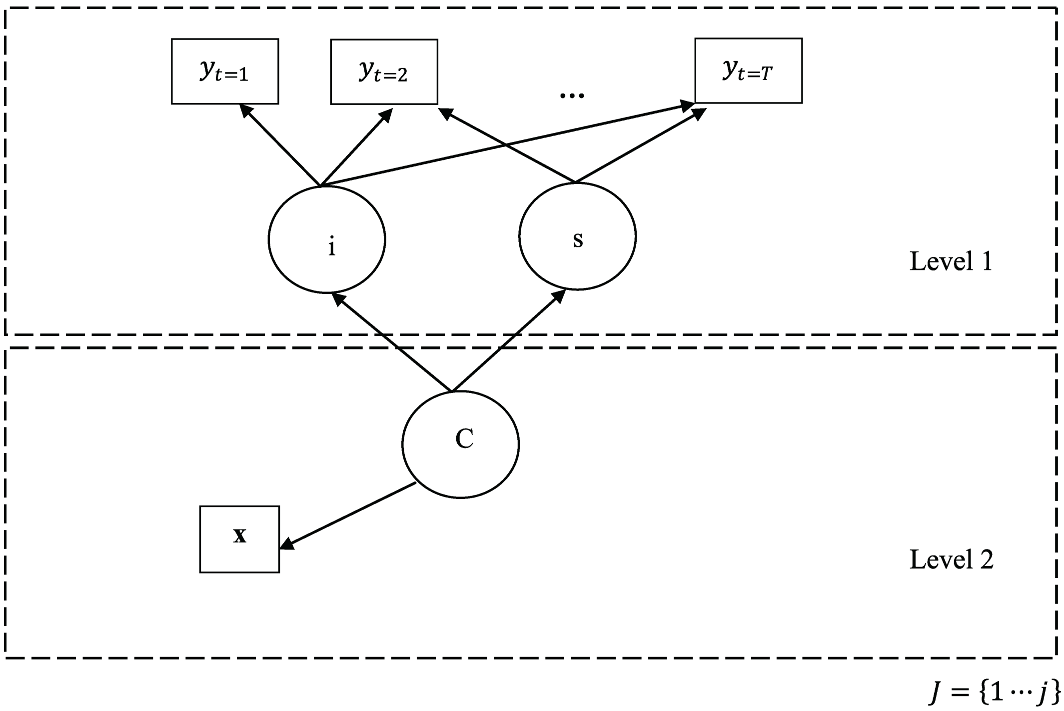


Figure 1. Structural equation representation of two level latent class models employed.

decide on the number of classes. One approach is to specify classes *a priori* according to typologies identified from theoretical literature (*e.g.*, Esping-Andersen, 1990; Blossfeld and Drobnic, 2001; Blossfeld, 2006; Korpi, Ferrarini, and Englund, 2013; Korpi, 2000; Kalwij, 2010). However, a data driven approach which will provide an overall best fitting solution, consistent with empirical validation of theoretical clusters is preferred. A variety of statistics are available based on overall goodness of fit: The AIC, BIC, and Sample-size adjusted BIC are used.

3. Data and Model

Country level data are drawn from two sources. Economic and social data from the GGP contextual database using most recent values are taken. While there is some missing information for some of the economic variables in the GGP contextual dataset, an advantage of the Two-level latent class approach is that estimation can be performed even when there is some missing data at either level via FIML (Full Information Maximum Likelihood).

Country level information is obtained from the GGP contextual database available from http://www.ggp-i.org/data/ggp-contextual-database. Three indicators designed to capture the generosity of the welfare state with regard to childrearing are included. The indicators selected are consistent with Kalwij (2010) but are not economic indicators and are included for one time point only (Neels, Theunynck, and Wood, 2013). The absolute value of child allowances provided by the state is included as an indicator of welfare provision (2005 US$ PPP adjusted). The proportion of GDP devoted to family allowances and the proportion of GDP devoted to state funded childcare indicate the prioritisation of family behaviours within the welfare system, while the proportion of GDP devoted to social support in general captures the degree of support for the welfare system within the country context. These mirror the indicators to represent childcare subsidies in Kalwij (2010).

Expenditure data is unlikely to entirely adequately capture the design of welfare policies, and is particularly inadequate in the context of fertility variation which is strongly related to gender equality (Billingsley and Farrini, 2014; Kühner, 2007).The female labour force participation rate is included as a measure of the extent to which women are integrated into the workplace. The age at starting school is also included as a measure of how easy it is to combine childbearing with work, due to rising female employment and increased difficulty in fulfilling multiple roles influencing fertility outcomes (Mason, 1998; McDonald, 2000; Mills, 2010). The effect of the interaction between leave provision (as well as other indicators of the integration of women into the labour market post childbearing) and fertility and partnership behaviour is widely documented (Adserà, 2004; Ahn and Mira, 2002; Chesnais, 1996; Neyer, 2003) as well as the broader social contexts within which both demographic behaviour and policy formation occur (McDonald, 2000).

Measures on the legal status of cohabitation is also included (Perelli-Harris and Sánchez-Gassen, 2012). Specifically, the proportion of policies in which cohabitation was mentioned and the proportion of policies in which marriage and cohabitation were afforded equal status are used. Finally, a binary indicator of whether the country in question has a legally recognised cohabiting state distinct from marriage is included (*e.g.*, PACS).

Individual level data for this analysis are drawn from the Harmonized Histories (Perelli-Harris, Kreyenfeld, and Kubisch, 2010, and see www.nonmarital.org where the data can also be requested). The Harmonized Histories is a dataset containing consistent retrospective demographic histories from 16 countries across Europe based largely on GGP surveys (as well as some other national surveys).

A subset of 10 countries from the full Harmonized Histories dataset is extracted to ensure that each country in the dataset has at least some contextual level information available. Therefore, respondents from Austria, Bulgaria, Estonia, France, the Netherlands, Norway, Romania, Russia, Spain, and the United Kingdom are selected since these countries have at least some information available either from the GGP contextual database (or comparable source) or the study by Perelli-Harris and Sánchez-Gassen (2012). The sample size within each country is presented in Table 1. Only women within the sample are retained consistent with the study by Perelli-Harris and Lyons-Amos (2015) and Perelli-Harris and Lyons-Amos (2016).

Three individual level processes are used in this analysis, capturing the processes of marriage formation, the formation of non-marital cohabitating unions and becoming a mother (first birth). The processes are modelled accurate to the nearest year consistent with Perelli-Harris and Lyons-Amos (2015) and Perelli-Harris and Lyons-Amos (2016). I model these processes between the ages of 16 and 45, delimiting the effective exposure to the three processes modelled (women cannot marry before the age of 16 in the selected countries, and are generally speaking post-menopausal by the age of 45).

Marriage and cohabitation processes are represented by response variables $\boldsymbol{y_{tj}^{M}}$ and $\boldsymbol{y_{tj}^{C}}$ take the value 0 for years t when the respondent is not in a marital or cohabitating relationship respectively, and 1 where they are. These are not cumulative rates: women can exit both marriage and cohabiting relationships reflected in the falling probability of being in either of these states reflecting

Table 1. Sample size within each country

Country and original survey	Number of women
Austria GGS	1505
Bulgaria GGS	5236
Estonia GGS	4252
France GGS	4556
Netherlands FFS	3476
Norway GGS	5922
Romania GGS	5176
Russia GGS	5836
Spain SFS	7300
UK BHPS	5890

trends such as divorce/union dissolution or the transition of cohabitation into marriage. In contrast, entry into motherhood y_{tj}^{F} is modelled as a cumulative growth curve (consistent with Dariotis, Pleck, Astone, *et al.*, 2011). This is reflected in Equation 1. The probability of being married, in a cohabiting relationship and having ever had a first birth is a function of a third order polynomial of the age of the respondent dependent on membership of class *J*.

$$\begin{cases} logit\left(y_{tj}^{M}\right) = \beta^{M} age_{tj} + \beta^{M} age_{t}^{2} + \beta^{M} age_{t}^{3} \\ logit\left(y_{tj}^{C}\right) = \beta^{M} age_{t} + \beta^{C} age_{t}^{2} + \beta^{C} age_{t}^{3} \\ logit\left(y_{tj}^{M}\right) = \beta^{F} age_{t} + \beta^{M} age_{t}^{2,F} + \beta^{M} age_{t}^{3} \end{cases} \quad (1)$$

$$J = \{1 \cdots j\}$$

4. Results

4.1 Class Characteristics

Table 2 presents fit statistics for models with differing numbers of latent classes. The addition of a fourth class increased the value of all fit statistics only marginally, indicating that best model fit was afforded by a three class model.

The allocation of countries to classes is presented in Figure 2. Broadly speaking, there is an East-West divide, with the Hajnal line (Hajnal, 1965) demarking the geographic clustering of Eastern European countries (Bulgaria, Estonia, Romania and Russia) which are all members of class 1, and clustering of Western countries (classes 2 and 3). The Netherlands and Spain are members of class 2, while Austria, France, Norway and the United Kingdom are members of class 3.

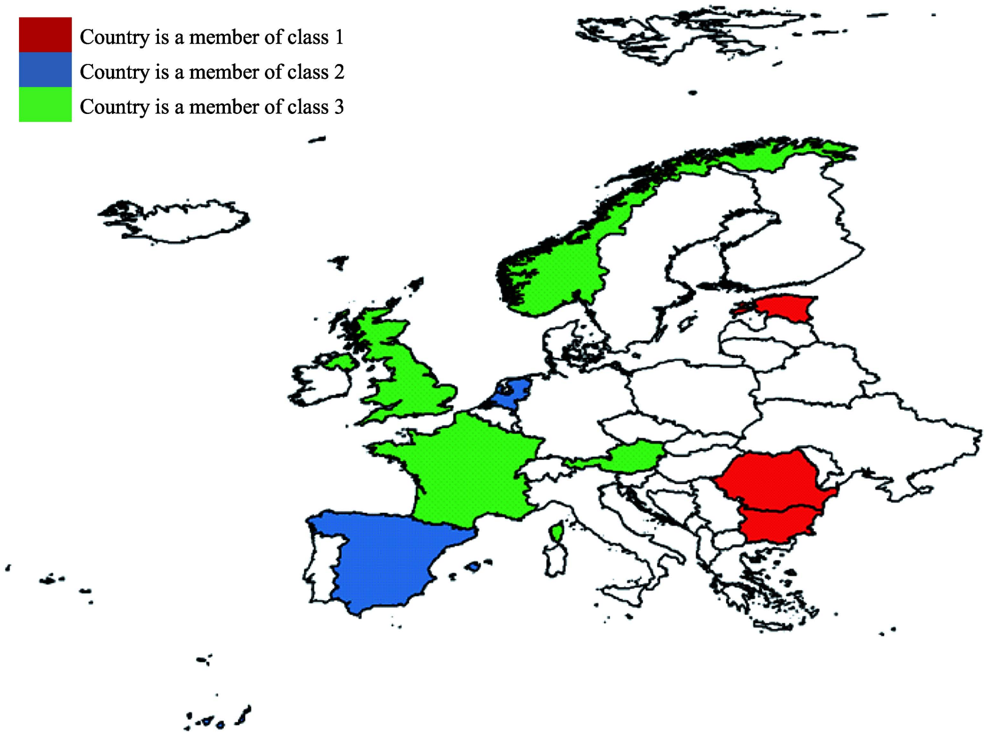
Table 3 presents the estimated characteristics for the latent classes. Class 1 (Eastern pean class) is characterised by a low level of family support, with the lowest absolute value of family remittances, and relatively low level of support for family as a proportion of GDP in terms of both family allowance, social expenditure and public expenditure on childcare. This cluster can roughly be seen to incorporate the post-Socialist typology of Blossfeld (2006).

In terms of the ease of childcare domain, the female labour force participation is rather lower in this class than the other two, while the school entry age is somewhat comparable. There is little support for cohabitation in the legal frameworks of these countries, with cohabitation mentioned in only 26.7% of legislation, and equivalent in only 30% of legislations (lower than the other two classes). There is no legal recognition of cohabitation as a partnership form within this class.

Class 2 presents a somewhat intermediate picture and incorporates countries included in Conservative (Netherlands) and Southern (Spain) welfare regimes (Blossfeld 2006). The absolute value of family allowances is higher than in class 1 but lower than in class 3 (by a considerable margin). The proportion of GDP devoted to family allowances is the lowest of all classes. In contrast, the value of social expenditure is high, and the level of public expenditure on childcare is the highest of all classes. This pattern therefore reflects a family support regime which is focussed on in-kind benefits; the value of family allowances is moderate, but women can expect to receive a relatively high degree of support through subsidised childcare for example.

Table 2. Fit statistics for latent class models

	AIC	BIC	Sample size adjusted BIC
1	1581496.061	1581751.337	1581659.174
2	1552354.465	1552803.398	1552641.319
3	1534286.142	1534928.733	1534696.738
4	1534330.274	1535166.522	1534864.611



Russia not shown in full for visual clarity.

Figure 2. Allocation of countries to latent classes.

Table 3. Estimated mean levels of country level indicators by latent class

Indicator (Number of country members)	Class 1: Eastern Europe (4)	Class 2: Western Europe lesser support (2)	Class 3: Western Europe higher support (4)
Family support			
Value of family allowance (PPP adjusted 2005 $)	82.21	92.26	133.0
Family allowance (% of GDP)	1.38	0.11	1.78
Social expenditure (% of GDP)	13.16	26.8	26.13
Public expenditure on childcare (% of GDP)	0.38	0.64	0.38
Ease of childcare			
Female labour force participation (%)	64.40	73.40	70.46
School entry age	3.25	4.00	3.00
Legal status of cohabitation			
Cohabitation mentioned (%)	26.7	26.0	29.7
Legal equivalence (%)	30.7	37.5	34.5
Legally recognised (prob)	0.00	0.50	0.99

Female labour force participation is high in this class at over 73%. This is considerably higher than in the Eastern European class (class 1) and comparable to class 3. The school entry age is rather higher than other classes. The legal status of cohabitation is rather mixed in this class. Cohabitation is mentioned in 16% of legislations, and legally equivalent to marriage in 38% of these — the highest in all classes. However, the existence of legally distinct non-marital unions is somewhat mixed, with a 50% probability.

Class 3 is characterised by the highest level of family support incorporating both liberal (UK) and socio-democratic welfare regimes (Blossfeld, 2006). The absolute value of remittances are considerably higher than in either class 1 or class 2, and are similarly higher in terms of proportion of

GDP. General social expenditure is high, although the support for childcare as a proportion of GDP is somewhat lower than in class 2 and consistent with Eastern European levels. Female labour force participation is in excess of 70%, albeit slightly lower than in class 2. The school entry is the lowest seen in all classes.

In general this class demonstrates a high degree of support for cohabitation within the legal frameworks of countries. Cohabitation is mentioned in nearly one third of relevant laws, and legally equivalent in nearly 35% of these. The existence of a legally recognised cohabiting relationship is highly prevalent for countries in this class, with a near universal existence of a formal non-marital union within the law.

4.2 Individual Characteristics

Growth curves for three demographic processes were extracted, with the growth curve varying by class. The growth curves for the probability of marriage are presented in Figure 3. Broadly speaking, the overall pattern of marriage is consistent across all classes, increasing from relatively low levels at early ages, and peaking around the early 30s. Thereafter, there is some evidence of the decline of the probability of being married, due in the most part to the dissolution of marital unions. There are some differences in the overall levels of marriage between classes, as well as marriage timing. Class 1 (Eastern European pattern) shows the overall highest propensity for women to have a marital union, with the highest probability of marriage at all ages. Class 2 (Western Europe – limited support) presents a more mixed progression. The probability of marriage is low at younger ages; 10% points lower than in class 1 at age 16. However, the rate of increase across ages is rapid and increases to the extent that the probability of marriage is nearly at the level seen in class 1 by age 36.

Class 3 (Western European – extensive support) shows the overall lowest propensity for marriage, which is consistent across the life course. The overall probability is low at early ages, consistent with the levels seen in class 2. However, in class 3 the increase in the probability of marriage is not as dramatic, and the peak in the probability of marriage is slightly below 70%, in comparison to classes 1 and 2 which are both in excess of 85%. Overall then, class 3 is associated with the lowest prevalence of marital behaviours, while classes 1 and 2 show greater recourse to the institution of marriage. That said, class 2 is associated with some postponement of entry into marriage, while class 1 is characterised by high levels of marriage at early ages.

The estimated growth curves for cohabitation are presented in Figure 4. The probabilities of cohabitation are somewhat lower than they were for marriage (Figure 3) reflecting the preponderance of

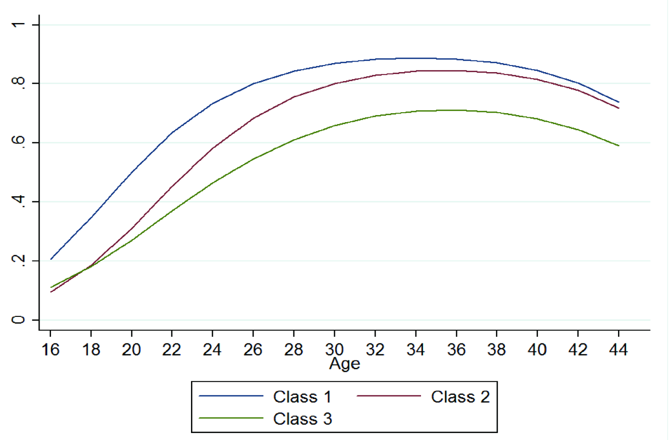


Figure 3. Predicted growth curves for probability of marriage for Western extensive and limited and Eastern classes.

Figure 4. Predicted growth curves for probability of cohabitation for Western extensive and limited classes.

formalised unions across all classes. The probability of living in a cohabiting relationship follows a similar trajectory for both class 1 (Eastern European) and class 2 (Western European — limited support). There is a gentle increase in the probability of cohabitation, reaching a peak around age 30 at approximately 5%. Thereafter, there is a fall in the probability of being in a cohabiting union, to just over 1% in class 2, while the probability remains above 3% in class 1. This reflects that in Eastern Europe and Western regimes with limited social support the probability of being in a non-marital union is still low.

In contrast the probability of cohabitation is considerably higher in class 3 (Western European – extensive support), increasing to peak at age 30 at around 11% (more than double the other classes). Thereafter the probability of cohabitation decreases rapidly, falling to around 3% by the age of 45. This is indicative that the Western European regimes with high levels of social support are more characterised by non-marital partnership behaviour.

Figure 5 presents predicted growth curves for the cumulative probability of birth. Class 1 reflects a pattern of a rapid transition into motherhood, with the incidence of first birth rising rapidly. For instance, 50% of women have experienced their first birth before the age of 22 and 80% by the age of 26. However, this pattern reflects the persistence of historic trends in socialist countries toward early birth (Sobotka, 2003), since there is little increase in the proportion of women who have a first birth after the age of 30, reflected in the flattening of the curve toward the end of the reproductive life course.

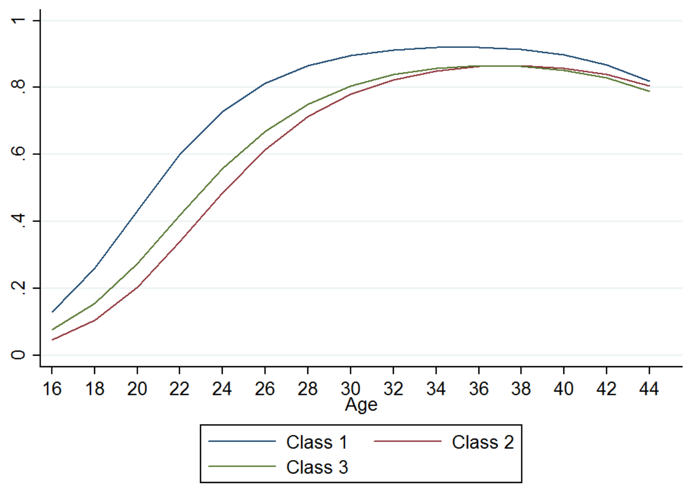


Figure 5. Predicted growth curves for probability of birth for Western extensive and limited and Eastern classes.

In contrast classes 2 and 3 (Western Europe – limited support, Western Europe – extensive support) show a rather later transition to motherhood. In class 2 the median age at motherhood is 25, and in class 3 slightly earlier at age 24. It is worth noting that the increase in cumulative fertility for these classes persists to rather later ages than in class 1 resulting in a fall in the gap between the proportion of women who have had first birth, which amounted to nearly 20% points at age 22, falling to 10% points by age 28 and 5% points by age 36. This is indicative of the increasing postponement of fertility in Western settings, and a persistence of entry into motherhood even toward the end of the reproductive life course.

5. Discussion and Conclusion

This paper considered different strategies for incorporating higher level information into longitudinal modelling. The specific focus in this context was the use of countries as higher level units: country context is of wide interest to the demographic and social science community. However the usual multilevel modelling techniques (random and fixed effects) will often be severely limited where countries are a higher unit, either due to the characteristics of the methods themselves or due to the sampling structure at the country level. The implementation of latent classes at the country level is an attempt to overcome the limitation of both of these methods. The additional advantage of the latent class based approach is that in forming clusters based on empirical data, it provides the opportunity to validate *a priori* theoretical clusters or typologies (*e.g*., Esping-Andersen, 1990; Esping-Andersen, 1999; Blossfeld, 2006).

That said there are a number of limitations to this analysis and a number of areas that could be expanded. Firstly, the selection of the most recent variable information for policy indicators precludes causal inferences. The use of policy data from a point in time either contemporary or following the life course processes under study introduces an ambiguity into the causal direction of the variables under consideration: policies may influence life course behaviour; both the life course processes and the policies pertaining to them may be endogenous with respect to broader cultural trends within the country of study (McDonald, 2000), or policies may be derived to reflect social pressure within the country (Perelli-Harris and Sánchez-Gassen, 2012). While it might at first seem plausible to overcome this problem relatively simply by selecting historic indicators, the causal relationship is likely to be more complicated since policy will reflect underlying behavioural trends to a certain extent (Perelli-Harris and Sánchez Gassen, 2012). However, similar to Neels *et al.* (2013), it is not the aim of this paper to make causal statements about the particular economic variables included; rather the indicators are taken as manifest representations of the generosity of the welfare system in a country. It may be possible for researchers to apply this method to construct more robust indicators and thus make causal statements, but this is beyond the scope of the current analysis. Secondly, the small number of countries can be considered a limitation in terms of power to extract classes of behaviour, and is somewhat less detailed than many conceptual typologies (Esping-Andersen, 1990; Esping-Andersen, 1999). That said, this 'limitation' is somewhat deliberate, as much of the literature relies on a small country level sample. The fact that this article can produce some meaningful interpretation despite this is still an advantage. Finally, the restriction of partnership and fertility pattern to depend solely on the class allocation of the country is likely to be overly simplified. Indeed, similar techniques have found multiple classes at an individual (sub-national) level (Dariotis, Pleck, Astone, *et al*., 2011; Perelli-Harris and Lyons-Amos, 2015; Perelli-Harris and Lyons-Amos, 2016). The production of sub-national level classes and their cross classification with national level policy classes is a natural extension of this paper.

The advantages of this approach are demonstrated by evaluating the association between fertility and partnership behaviour and country clusters represented by a set of policy relevant indicators. This analysis extracted three distinct country level clusters in the European settings. Firstly, Eastern European countries were distinct exhibiting relatively low welfare support in both absolute and relative terms, but with a fair degree of child support. There was no protection for cohabitation as a childbearing union. Unions tended to be marital in these settings, with an early incidence of fertility behaviour. The uniqueness of the Eastern fertility pattern and extraction as a discrete cluster distinct from Western fertility regimes has been remarked upon in demographic literature and links to theoretical understanding of fertility patterns (Blossfeld and Drobnic, 2001).

Western Europe was characterised by two classes: lesser and greater support. The lesser port class (The Netherlands and Spain) comprised countries in Conservative and Southern welfare state typologies; both characterised by welfare systems designed to either support the family institution or rely on familial support (Blossfeld, 2006). The uniqueness of the Netherlands as a hybrid welfare state model has been noted elsewhere (Kammer, Niehues, and Peichl, 2012) and seems to be replicated by this analysis. This class had relatively low financial support for childbearing and welfare in general, but relatively high levels of female labour market engagement. There was some limited legal protection for cohabiting unions. Again, in terms of partnership behaviour, unions are predominately marital, with little evidence of cohabitation, but with fertility behaviour somewhat delayed. The final class captures generous European welfare states, which afford considerable welfare provision as well as a high degree of support for childcare and legal protection for cohabitation. These legal frameworks coincide with more common cohabitation and fertility behaviour relatively late in the life course. Countries in this class belong to either Liberal or Social Democratic welfare regimes (Blossfeld, 2006).

These findings demonstrate the major advantages of the latent class approach. By relaxing the assumption of a Normal/continuous distribution among higher order units, I am able to identify clusters of similar higher level units, which is informative in itself due to the neat division along the Hajnal line. Another major advantage is that the higher level groups are formed using contextual information, which can provide an additional point of interpretation. It should be noted that this is also a limitation of the study: the requirement for contextual information is now greater than for either random or fixed effects multilevel models. Additionally, a more cautious approach should be applied for a researcher wishing to make causal statements: the fact that much country level information is relatively recent means that some of these indicators are likely to be endogenous with fertility and partnerships behaviour (Perelli-Harris and Sánchez-Gassen, 2012; McDonald, 2000). The final advantage is that this approach allows straightforward comparison of individual level behaviour between clusters: the lateness of fertility behaviour in Western European higher support settings compared to Eastern Europe is intuitive and straightforward and links with existing understanding of different fertility norms in Western and post-Socialist countries (Sobotka, 2003; Blossfeld and Drobnic, 2001). The divisions also link to previous typologies of welfare states, reinforcing the advantage of this approach for the validation of theoretical models. In terms of the groupings revealed, the contrast between the class containing the Netherlands and the other Western class is similar in nature to the cluster analysis of Kammer *et al*. (2012) who empirically derive a 'hybrid' class of welfare provision. This reinforces the idea of a more limited welfare class (Class 2), which is characterised by a Western looking structure but with restrictions compared to the most generous welfare regime. One source of departure is the lack of variation in terms of Western patterns within Class 3: indeed this class includes a number of countries with differing welfare patterns such as the United Kingdom (Liberal), Norway (Sociodemocratic) and France (Christian Democratic) within the same grouping (Esping-Andersen, 1999). That said, the range of countries included in this analysis differs compared to both the original and revised Esping-Andersen analytic samples: indeed the reason for excluding Eastern European and post-Soviet countries was due to the fact they were deemed to be transitional and thus qualitatively different from the capitalist welfare systems, which was reinforced by Blossfeld (2006). This analysis reinforces this point: Eastern European demographic and welfare trends interact to produce a unique pattern distinct from Western Europe.

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