Deriving a measure of gender role attitudes using data from the European Values Study

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Claire Shepherd[2] and Mark Elliot[2]

Abstract

Gender role attitudes inform sociological debates concerning gender inequalities, women's position in the labour market, declining fertility rates and family breakdown, and naturally feed into the discourse surrounding welfare state and policy decision making. As such developing an appropriate measure of gender role attitudes would be useful to explore how attitudes have changed over time and enable further analyses to contribute to our understanding of the above debates.

Using data from three waves of the European Values Study (EVS) two data classification techniques are implemented to derive a measure of gender role attitudes comprised of three components: 'Maternal employment', 'Job fulfilment' and 'Economic independence'. It is determined that the interpretation of the derived measure is sufficiently stable over time and across the selected 19 European countries to be used as a valid measure of gender role attitudes to assess their change over time and enable wider contributions to be drawn from further analyses.

1. Introduction

This paper uses two data reduction techniques: Principal Components Analysis (PCA) and Confirmatory Factor Analysis (CFA) to ascertain if a measure of gender role attitudes can be derived using data from three waves of the European Values Study (EVS). The solutions produced are compared both across techniques and across countries to produce the most appropriate interpretation of the latent factors produced. Using both PCA and CFA enables refinement of the latent measures of gender role attitudes and ensures that the measure is the most appropriate fit for both the data and broader theoretical considerations.

1.1 Background

The term 'attitude' is used extensively by researchers from a broad range of fields, as well as by politicians, social commentators, the media and of course in everyday language yet often the term is used without an explicit discussion of the definition, measurement and interpretation of attitudinal data. As a result, much attitude research launches into analysis of data without due consideration being paid to establishing what definition of the attitude is being adopted; how the selected data can be used to examine a particular set of attitudes and whether the derived measure can be justified in terms of methodological and theoretical considerations.

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Much of the theoretical discussion concerning the formation of attitudes, and how to measure and interpret them emerged in the social psychology literature of the early twentieth century, and this discipline continues to lead the theoretical and methodological discussion.

An early and oft cited definition of attitudes, from social psychology, explains them as:

> '*..a mental and neutral state of readiness, organised through experience, exerting a directive and dynamic influence upon the individual's response to all objects and situations with which it is related'*, (Allport 1935: 810).

Attitudes are shaped by contextual experience and can influence our behavioural responses; Terry and Hogg emphasise the importance of the social in attitude formation and describe them as '*unobservable cognitive constructs that are socially learned, socially changed and socially expressed'* (Terry and Hogg 2000: 1).

In social psychology, the prevailing understanding is that attitudes consist of some combination of three components: the affective, behavioural and cognitive responses towards an attitudinal object. Fabrigar *et al.* (2005) define the three components as follows:

- Affective responses are emotional reactions to situations, objects or individuals.
- Behavioural responses are actions (and intended actions).
- Cognitive responses are based on perceptions and beliefs about specific events or objects.

The relative importance of the three components and the relationship between them remain matters of debate and different theorists place different emphasis on the three components. Here we follow the framework set out by Bohner and Wanke (2002), in operationalising the affective (emotions) and cognitive (beliefs) components only as we agree with those authors that whilst there is a multi-directional relationship between attitudes and behaviour, behaviour itself is not an intrinsic part of the attitude.

2. Data and methods

2.1 The European Values Study - EVS

The European Values Study is a Europe-wide survey. The number of countries that participate in this EVS survey has increased from 16 in the first wave of the study in 1980, (which also included the USA and Canada), to 47 in the most recent wave in 2008, of which all 47 were European countries.

The EVS is administered by separate teams in each country using a common questionnaire and either a representative multi-stage stratified random sample or quota sample of the adult population aged 18 years and older[3]. The questionnaire was designed by a Steering Committee, in consultation with national research teams and representatives of fieldwork agencies, and was revised at each wave when new modules of the survey were added. The

[3] Within each country harmonised methods of sampling are used although there were some differences across countries.

same questionnaire was administered in each country, although in certain cases some questionnaire items were omitted for some countries. Appropriate translations were implemented from the original English language questionnaire by means of the questionnaire translation system 'WebTrans' a web-based translation platform designed by Gallup Europe. The process of translation was closely monitored and semi-automated, and any minor alterations that had to be made to ensure consistent interpretation were documented (EVS website[4]). The questionnaires were administered in personal face to face interviews using CAPI. The agencies that administer the survey varied between countries but include academic institutions, national research bodies and professional research companies such as Gallup. Three waves of the EVS were selected for this research for both theoretical reasons as they cover an important period of socio-economic change in Europe and for the more practical consideration that each contains the same six attitude variables. The datasets selected are: wave two which took place in 1990 (with data collection continuing in 1991, 1992 and 1993 in some countries); wave three which took place in 1999/2000; and wave four in 2008 (with a few countries continuing data collection into 2009/2010), which is the most recent wave of the study. The first 1980 wave of the EVS could not be used because it did not include the gender role attitude variables needed for this study.

The selected variables of interest measure aspects of social attitudes concerning men and women's roles within the family, through a focus on the implications of women's employment for her, her children and the economic well-being of the family. They are as follows:

People talk about the changing roles of men and women today. For each of the following statements I read out can you tell me how much you agree with each:

> *V159 A working mother can establish just as warm and secure a relationship with her children as a mother who does not work*
>
> *V160 A pre-school child is likely to suffer if his or her mother works*
>
> *V161 A job is alright but what most women really want is a home and children*
>
> *V162 Being a housewife is just as fulfilling as working for pay*
>
> *V163 Having a job is the best way for a woman to be an independent person*
>
> *V164 Both the husband and wife should contribute to household income*

Each of these six items had four potential answers: strongly agree, agree, disagree or strongly disagree with coding options for 'don't know' responses. In the dataset there are five coded responses for missing values including: 'not asked in the survey', 'no answer', 'don't know', 'no answer or don't know', and 'not applicable'. Of these the response 'don't know' has been recoded as a non-missing item to allow the analysis to include unsure responses to the attitude questions, and is recoded as the central item of the Likert scale for all of the analyses.

[4] Source: data catalogue ZA4759 EVS 2008: http://info1.gesis.org/dbksearch/sdesc2.asp?no=4759&db=e&doi=10.4232/1.10156http://info1.gesis.org/dbksearch/sdesc2.asp?no=4759&db=e&doi=10.4232/1.10156 accessed 19th July 2015

2.2 Methods

Two methods of data reduction have been selected to derive a stable measure of gender role attitudes: principal components analysis (PCA) and confirmatory factor analysis (CFA). PCA is chosen because it is the most appropriate approach for exploring variable correlations over different time points at the pan-European level for each time point as well as within each country/time point. CFA is carried out to provide a statistical analysis that tests the coherence of the component structure. This is needed in order to assess the stability of the model over time and its success in measuring gender role attitudes.

Principal Components Analysis (PCA)

PCA is a multivariate data analysis technique and is one of the most popular methods of data reduction. It reduces a chosen set of variables down to a smaller more manageable sub-set whilst simultaneously retaining the greatest amount of variance possible (Conway and Huffcutt 2003). The approach produces principal components that are linear combinations of the original variables in order to consolidate data into a simpler form. The number of components that are extracted varies (depending on the variables inputted) but the first extracted component always captures the highest proportion of variance and the variables that provide the most explanatory power for each component will have the highest loaded component scores (Abdi and Williams 2010: 4). The components produced take into consideration both the common and unique sources of variance and '*achieves parsimony by explaining the maximum amount of common variance in a correlation matrix using the smallest number of explanatory constructs'* (Field 2009: 629).

PCA implements an R-matrix to compare the correlation coefficients for each pair of variables and the objective is to reduce the R-matrix to its underlying dimensions by isolating variables that appear to cluster together with other variables in a meaningful way. Data reduction is successful when variables that appear to correlate highly with a group of variables can be identified as not correlating with variables that are outside of this group (Field 2009: 629). The linear components of the matrix are calculated by determining the Eigen values of the matrix. The greatest Eigen value associated with each Eigen vector provides a single indicator of the fundamental importance of each component. Components with higher Eigen values are the ones of interest in PCA and as such are the components that are retained in the components analysis, whilst those with relatively small Eigen values are removed. Eigen values in turn allow Eigen vectors to be calculated which are the elements that provide the loading of an individual variable on a particular component and a factor or component loading can be considered as the Pearson correlation between a component and a variable. It is important to note that as PCA is an exploratory technique, it provides conclusions that are restricted to the sample collected and further generalisation of the results to allow inference to a wider population is only possible if further analysis uncovers the same structure of factors or components (Field 2009).

As with all multivariate data analysis certain basic assumptions must be fulfilled in order to produce the most accurate and reliable results. Firstly sample size is an important

consideration because correlation coefficients can vary considerably more between smaller samples than between larger ones. The exact benchmark of cases which is recommended by statisticians varies. Field (2009) supports the position of Comrey and Lee (1992) who state that a sample of 100 is poor, 300 as good and 1000 or more as excellent, while Conway and Huffcut (2003) suggest that any sample over 400 cases is sufficient for an accurate PCA. Overall, the larger the sample size the more accurate the results will be, for as in any data analysis the larger the sample the smaller the standard errors and hence higher accuracy (Floyd and Widaman 1995, Conway and Huffcut 2003, Field 2009). However, factor loadings also come into play in the discussion of optimal sample sizes. Floyd and Widaman (1995) imply that when factor loadings are low, i.e. less than 0.4, larger samples of at least 400 cases are necessary. In addition to a healthy sample size an appropriate number of variables must be inputted into the model in order to achieve the theoretically hypothesised number of components in order to produce a stable component solution (Field 2009). The EVS pan-European level data have a minimum of 23,271 cases[5] and at the country level the smallest sample size is found in Finland with 588 cases so this is still above the threshold set out by Floyd and Widaman (1995). As a result of these healthy sample sizes, the number of variables to be included and alongside theoretical considerations, it is anticipated that two or three component solutions will be produced and thus should fulfil the different elements of this assumption.

Another assumption that must be considered before carrying out PCA is the type of data under analysis. Classic factor analysis and PCA both require data that is measured on a continuous scale; namely interval level or quasi-interval level variables. The six gender role attitude variables that are being included from the EVS are categorical so it may initially appear inappropriate to pursue a PCA or factor analysis approach. However, since all six variables are measured using a five-point Likert scale this is considered acceptable owing to the interval level nature of Likert scales. Floyd and Widaman (1995) suggest that any ordinal variables with five categories are acceptable as variables for PCA analysis. A further test for assessing the suitability of Likert scale data for factor analysis has been suggested by Caroll et al (1970) who discuss the appropriate uses of different correlation coefficients. They suggest that if the Pearson's correlation assumptions are met by the selected data then using a secondary type of correlation to 'test' the appropriateness of the data can be considered as a test of robustness. For example if there is no considerable difference between the Pearson correlation matrix and a Spearman's correlation matrix then this indicates that no major assumptions are being broken and thus it is justifiable to base the analysis of these data on Pearson's correlation coefficients[6].

A further consideration is determining the appropriate number of components to be extracted from the initial analyses. One common technique to inform this decision is the Kaiser-Guttman rule (K1). This relies on Eigenvalues and suggests that only the components

[5] This is the sample size for the 1999 dataset, for 1990 it is 26,290 and for 2008 it is 32,953.

[6] The matrix tables for each year show very similar values for both Pearson and Spearman correlation matrices see Appendix.

that have an Eigen value greater than 1.0 can be extracted. Each component has an Eigen value which accounts for the total variance of that component, and the sum of all the Eigen values is equal to the total number of variables in the component analysis. The Kaiser-Guttman rule states that components with Eigen values greater than 1.0 account for at least the equivalent variability that can be explained by one individual variable.

Another way of determining the optimum number of components to retain is to examine the scree plot which plots the Eigen values of the different components onto a scatterplot and joins them with a line. Cattell (1966) suggests that the cut-off point for selecting components should be at the sharp descent of the curve of the scree plot so that all components above this inflexion should be included and those after should be excluded. The components above this inflexion point will have larger Eigen values and the ones below this point have lower Eigen values. This ensures that the model will reduce the volume of data being analysed but at the same time retain the most amount of variation as possible. There is some debate over whether the component at the point of inflexion should be included in the subsequent analysis. Cattell opts to include it as an 'error factor' however Thurstone (1947 cited in Field 2009) argues that it is better to retain too few components than too many.

A more thorough and statistical method for determining appropriate component retention is parallel analysis which many statisticians argue is the most accurate method to ensure the correct number of factors are retained (Hayton et al 2004). Parallel analysis extracts Eigen values from randomized datasets that are specifically produced in order to have the same characteristics as the data under examination i.e. the random data contain the same number of variables and cases as the real data. Subsequently, a comparison is made between the Eigen values found from the random data and from the original 'real' data; those components that have higher Eigen values in the real data than in the randomized data are the components that are retained on the basis that these components can be interpreted as accounting for more variance than those extracted by chance (Hayton *et al.* 2004). As such this research will utilise K1, scree plots and parallel analysis as approaches for determining component retention as they have been established as the most accurate.

Another element of PCA that requires careful consideration is that of rotation. The rotation of components can be implemented in order to improve the overall interpretability of the component solution. Field (2009) describes rotation as a method of altering the absolute values of the given variables whilst maintaining their differential values constant in order to achieve a simple structure. This simple structure is defined as a components solution where each variable loads highly onto as few components as possible and ideally each individual variable will have only one primary loading or high value loading on one component (Floyd and Widaman 1995). The type of rotation that is suitable for the data and the hypothesis that is being tested must also be considered. If it is anticipated that the underlying factors will be correlated then oblique rotation is considered the more appropriate approach to choose, whereas orthogonal rotation constrains the components so that they are uncorrelated. It is more common for oblique rotation to be selected because when 'real life' social data are being analysed it is very unlikely that the underlying or latent elements that are being

explored will be unrelated (Conway and Huffcutt 2003). It is anticipated that oblique rotation may well be the best option for ensuring the simplest, interpretable components solution is produced for the selected EVS variables as it is to be expected that any sub-components of gender role attitudes will be correlated.

By carrying out a comprehensive principal component analyses at both the pan-European level for all 19 selected countries, and at the individual country level this will produce an understanding and analysis of the interpretation of the variables both temporally as well as cross-nationally.

Confirmatory Factor Analysis (CFA)

In order to confirm the robustness of the factor structure solution uncovered in the PCA and determine whether these variables can be confidently used to generate a measure for gender role attitudes, a second type of factor analysis was carried out. CFA is a technique that evaluates the 'goodness- of-fit' of a measurement model by measuring the amount of variance left over once the factors have been taken into account, highlighting whether any significant variance residual remains (Floyd and Widaman 1995). There are several software applications that enable CFA to be carried out; for this research AMOS, an SPSS add-on, was used. CFA is used to explore an a priori measurement model and in this instance the proposed model being tested consists of the three factors uncovered in the PCA results, as '*successful confirmation is more likely when exploratory factor analysis is used in the development of the instrument and its measurement structure'* (Floyd and Widaman 1995: 293).

CFA utilises a 'Maximum Likelihood Estimation' method (which is set as the default setting in AMOS) which requires data to contain no missing responses otherwise estimates will be calculated through imputation by AMOS which could potentially introduce bias. Furthermore, this could make a comparison with the PCA findings, which utilised list-wise deletion of cases as is the standard approach in SPSS, inaccurate. As a result the small number of missing cases from the three datasets (less than 3% of total cases), have been removed for this analysis.

In order to carry out CFA certain assumptions concerning the intended data must be met prior to analysis. Firstly, it is important that data are measured using interval or quasi-interval scales which is fulfilled by these sets of data as the variables selected utilise a Likert scale which is the equivalent of a quasi-interval scale. A further assumption concerns the Maximum Likelihood method that is used in CFA. This method requires variables to have a multivariate normal distribution and if this assumption is violated then the chi-square statistic, which was previously perceived as the central goodness-of-fit tool, may contain bias in the form of a type I error which would result in the rejection of a model that should not be rejected. In addition, if the variables do not have multivariate normal distributions then standard errors can be underestimated, leading to inaccurate conclusions being drawn (for more discussion on this see Floyd and Widaman 1995).

There are several different types of measurement indicators used for determining the most appropriate model solution produced by CFA. *Absolute* fit indices which establish how well an

a priori model fits the chosen data. Hooper et al (2008) explain that absolute fit indices differ from other indicators because they do not offer a comparison to a baseline model but merely determine how well the model fits the data compared to no model at all. The two key absolute fit indices are the chi-square and the RMSEA:

Chi² is a traditional measure of overall model fit which works by identifying the variation between the sample and the fitted covariance matrices. A value close to zero indicates that there is little difference between the expected and observed covariance matrices (Hu and Bentler, 1999). A significant chi^2 value, (usually measured as $p < 0.05$), indicates that the model is *not* a good fit to the data. However, large sample sizes tend to return a significant chi^2 value and hence encourage model rejection. This has led commentators to discount the efficacy of the chi^2 test for CFA and it will not be used here.

RMSEA describes how well the model, with unknown but optimally chosen parameter estimates, would fit the population's covariance matrix (Byrne1998). Diamantopoulos and Siguaw (2000 cited in Hooper et al 2008) regard it a 'one of the most informative fit indices' due to its sensitivity to the number of estimated parameters in the model. The RMSEA tends to favour simpler models.

Relative fit indices are a group of indices that do not use the chi^2 in its raw form but compare the chi^2 value to a baseline model. For these models the null hypothesis is that all variables are uncorrelated (McDonald and Ho, 2002). The two key relative fit indices are:

CFI, The Bentler Comparative Fit Index evaluates the model against an independent model where the latent variables are assumed to be uncorrelated. The CFI compares the correlation matrix predicted by the model to the observed covariance matrix to assess the lack of fit, which is accounted for from the null to the specified model. The range of values can be between 0 and 1 with those closest to one said to have the best model fit. The CFI should have a value greater than 0.9 to be considered an indicator of a good model fit. The CFI is also said to take into account sample size making it a better indicator for this type of large scale, large sample data (Hooper et al 2008).

TLI (Rho2), The Tucker-Lewis Index, produces a statistic that is similar to the CFI as it is determined by how far the proposed model improves fit compared to the independent model. Values tend to range between 1 and 0 (though this is not guaranteed) and again those closest to 1 have the best fit. It has been suggested that a value of TLI ≥ 0.90 or 0.95 should be recognised as indicative of a good fit (i.e. see Hooper et al 2008 and Garson 2009).

The RMSEA absolute fit statistic and the two relative fit indicators of the CFI and the TLI (Rho2) were selected as the most appropriate indicators to test the validity of the model found in the PCA based on their relative strengths outlined above and on the recommendation of statistical scholars (e.g. see Hooper et al 2008).

3. Results: Pan-European Level PCA

In order to explore the gender role attitude structures and their stability across time, the initial PCA analysed the data at a pan-European level at each wave is presented.

Subsequently, the results of the PCA for individual countries at each of the three time waves of 1990, 1999 and 2008 will be discussed.

Table 1: Communalities for EVS waves: 1990, 1999 and 2008

	1990		1999		2008	
Variables	Initial	Extraction	Initial	Extraction	Initial	Extraction
working mother can have just as warm a relationship as non-working mother	1.000	.750	1.00	.767	1.00	.779
preschool child suffers with a working mother	1.000	.695	1.00	.702	1.00	.703
women really want a family and home	1.000	.706	1.00	.680	1.00	.684
being a housewife is as fulfilling as paid work	1.000	.729	1.00	.751	1.00	.758
job is the best way for women to be independent	1.000	.651	1.00	.657	1.00	.653
husband + wife both contribute to household income	1.000	.672	1.00	.667	1.00	.675

Extraction Method: Principal Component Analysis

Table 1 shows the communalities for each wave. A communality of a variable is the proportion of common variance present in that variable (Field 2009). Communalities therefore can be interpreted as measuring the reliability of an indicator (Floyd and Widaman 1995). The 'initial' column records 1.0 for each variable for each wave as this is prior to extraction and assumes total shared variance. The 'extraction' value records proportion of common variance found within each variable (Field 2009: 661). All communalities are over 0.6 which is relatively high (as is anything above 0.5) by Kaiser's Criterion, which suggests that the extracted solution captures a high proportion of variability; thus all should be retained.

Table 2 shows the variance accounted for by the extractions; the first component at each time point has an Eigen value of around 1.8 and accounts for between 29.95% and 31.23% of variance over the three time periods. The second component returns an Eigen value around 1.35 for 2008, accounting for 22% of total variance. The third component is the final one extracted. The Eigen value threshold was set to the default 1.0 for this analysis and thus only extracts those factors that account for more variance that is present in one of the original variables. The third factor has Eigen values just above the threshold[7]. The subsequent components all had Eigen values considerably lower than 1.0.

[7] As this last factor is close to the threshold of 1.0 Eigen value this means that random variation risks causing the extraction to drop to a two factor solution. This is unlikely to happen at this stage of the analysis due to the

Two checks that the correct number of components have been retained are the examination of the scree plots and parallel analysis. The three waves are displayed on the one scree plot in Figure 1; it is clear that they reveal a very consistent pattern with the main inflexion of the line dropping after three plots of Eigen values; this supports the above analysis of Table 2. Finally, parallel analysis was implemented whereby the Eigen values are used to calculate standard deviations and means, of which the 95th percentile is used as a standard to compare against the Eigen values in the actual data. If these are higher than those found in the random data then they are considered statistically significant because the variation obtained is greater than the variance found from the random data[8]. This parallel analysis has been carried out for all three principal component solutions and the results produced the same pattern of three clear components produced by the variance explained and the below scree plot. Therefore, three components were retained within the components matrix and subsequent rotation.

Table 2: Variance Explained Initial Eigenvalues for EVS waves: 1990, 1999 and 2008

Component	1990			1999			2008		
	Total	% of Variance	Cum %	Total	% of Variance	Cum %	Total	% of Variance	Cum %
1	1.853	30.890	30.890	1.797	29.950	29.950	1.874	31.229	31.229
2	1.321	22.016	52.906	1.369	22.823	52.773	1.344	22.407	53.636
3	1.028	17.126	70.032	1.057	17.617	70.390	1.035	17.250	70.886
4	.677	11.286	81.319	.648	10.801	81.191	.630	10.496	81.382
5	.590	9.834	91.152	.581	9.677	90.868	.580	9.669	91.051
6	.531	8.848	100.000	.548	9.132	100.000	.537	8.949	100.000

Extraction Method: Principal Component Analysis

sample size of the cross-European data but could become a factor later on in the analysis at the individual country level.

[8] The output of the parallel analysis is included in Appendix.

Figure 1: Scree Plot displaying the Eigen values for each component 1990-2008

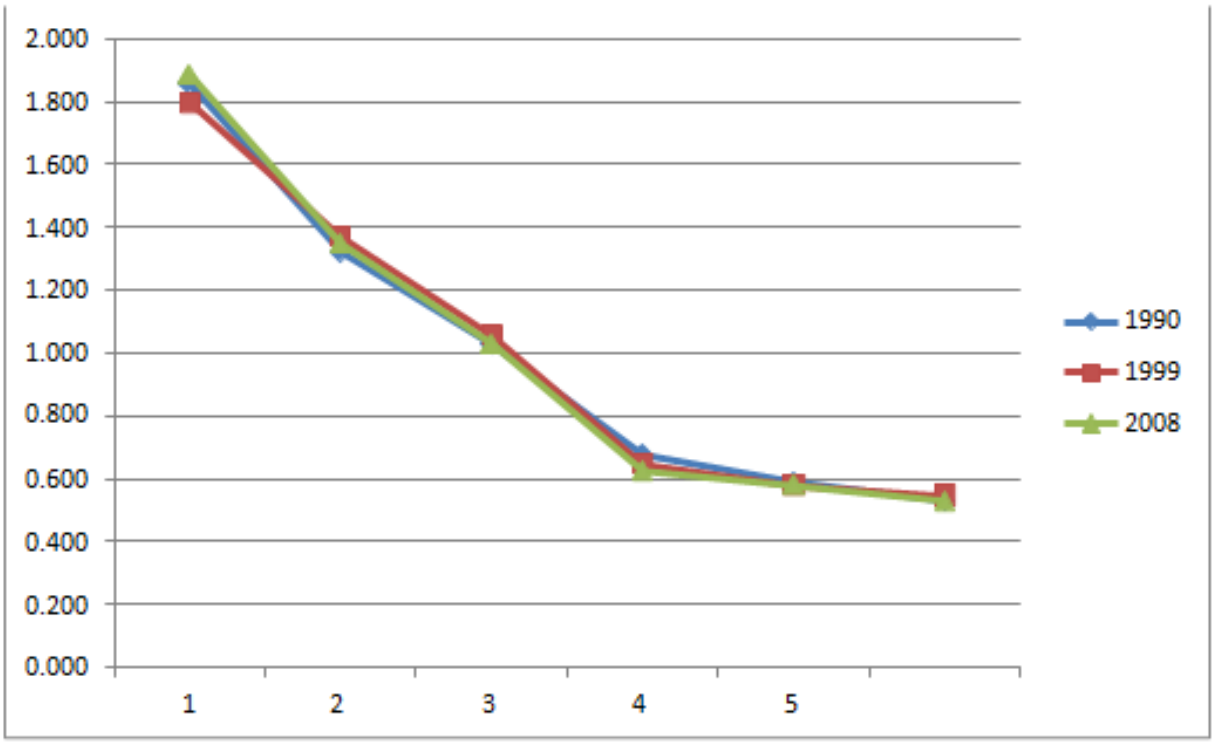

Table 3 combines the component matrix results for each of the initial component solutions and displays the variable loadings for each component for all three waves of the EVS; 1990, 1999 and 2008. Four of the variables are highly loaded onto the first component in all three waves. The first variable *'A working mother can establish just as warm and secure a relationship with her children as a mother who does not work'* is the only variable to have a high negative loading value, (ranging from -.575 to -.588 on the first component)[9].

The variables *'Having a job is the best way for a woman to be an independent person'* and *'A husband and wife should both contribute to household income'* both have high loadings, .673 and .757 respectively for the 1999 solution, on only the second component with the latter variable having the highest loading value of any variable for any component of the three solutions. In contrast that same variable, *'A husband and wife should both contribute to household income'* variable has the lowest loading values on the other components, in all three solutions, showing itself to have the most variance concentrated on one component of the six variables.

The component matrix shows that the first two components contain all six variables as highly loaded, with four being loaded on the first component and two on the second. The third component also has two of the same loaded variables as the first component; namely *'A working mother can establish just as warm and secure a relationship with her children as a mother who does not work'.* This means that interpretability can be somewhat confused and as described earlier in the paper a method to assist in simplifying the interpretation of the component solution is that of rotation. Since this component solution contains six variables

[9]This means that it is at the opposite end of the spectrum, in terms of interpretability, compared to those variables with a similar positive value loading on those components.

with some correlation between variables and are substantively and theoretically likely to share some over-lapping variance in terms of the underlying concepts that they are describing, it is more appropriate to utilise an 'oblique' rather than an 'orthogonal' rotation approach because this will allow for correlation between variables. As discussed previously it will also allow variable independence.

The component solution was rotated obliquely using the *direct oblimin* technique and Tables 4 and 5 show the pattern matrix and the structure matrix rotated component solutions. The pattern matrix displays the component matrix that can be compared to what an orthogonally rotated solution would produce; whereas the structure matrix is the result of combining the pattern matrix and the matrix containing the correlation coefficients between the components. The pattern matrix (Table 4) clearly shows that the rotated solutions for all three time points are much easier to interpret as each variable is highly loaded onto only one component and three distinct components have been extracted for each time point. There is debate over what constitutes a high loading component score with some social statisticians suggesting that only loadings of above 0.7 should be considered, however Garson (2009) suggests that loadings should always be considered in conjunction with theory and that variables with lower loadings should not be dismissed purely on arbitrary measures. In this case the high loading scores and substantive considerations seem to converge and the rotated solutions, for each time point, make both numerical and theoretical sense.

Table 3: Component Matrix for EVS waves: 1990, 1999 and 2008

	1990			**1999**			**2008**		
	1	2	3	1	2	3	1	2	3
working mother can have just as warm a relationship as non-working mother	-.575	.216	.610	-.578	.168	.636	-.588	.074	.654
preschool child suffers with a working mother	.648	.260	-.456	.686	.306	-.371	.677	.377	-.322
women really want a home and children	.665	.452	.242	.652	.445	.237	.613	.500	.243
being a housewife is as fulfilling as working for pay	.633	.213	.531	.570	.151	.635	.569	.116	.649
job is the best way for women to be independent	-.414	.613	-.322	-.389	.673	-.230	-.465	.645	-.145
husband + wife both contribute to household income	-.298	.762	-.051	-.300	.757	-.052	-.394	.720	-.043

The first extracted component has high loading values for the variables *'A job is alright but what most women really want is a home and children'* and *'Being a housewife is just as fulfilling as working for pay*' with loadings of between .723 and .783 for the first variable and loadings of between .842 and .859 respectively for the second. This component therefore

appears to be describing an underlying set of attitudes advocating women's traditional role of homemaker and asserts that the stay-at-home motherhood role remains fulfilling, and will be referred to as a **Domestic Fulfilment** component. The attitudes that are represented within this **Domestic Fulfilment** component draw on more traditional perspectives towards women's role within the home and family and the consistency of the loadings over time allows for an understanding of how attitudes to this more traditional perspective of male breadwinner model have altered over time.

The second component extracted has the same high loading variables *'a job is the best way for a woman to be independent person' and 'a husband and wife should both contribute to household income'* as were found in the pre-rotated component solutions but post rotation the variables now have higher loading values of .783 to .796 and for the second variable between .793 and .816 respectively, and lower loadings for the other variables. This component can be considered as representing attitudes concerning the **Economic Independence** of women. High scorers on this component recognise and support women's engagement in the labour market. The strength and consistency of the relationships between these two variables that make up the economic independence role component provides a useful tool for assessing attitude change over time towards women's role in the labour market.

The third and final extracted component also has two clearly loaded variables in all three of the rotated solutions for the variables '*a working mother can establish just as warm and secure a relationship with her children as a mother who does not work'* and *'a pre-school child is likely to suffer with a working mother'*. As with the un-rotated solution the former has a high loading but negative value which suggests that it explores the same underlying concept but from an opposite perspective to the latter. Theoretically, this makes sense as this component can be seen to capture attitudes about whether or not women are able to combine their maternal responsibilities with employment. Overall this component represents a complex set of attitudes relating to maternal employment and the impact of employment on their ability to parent successfully and will be referred to as '**Maternal Employment'**. This component will provide a useful tool for measuring change over time in attitude variation towards women's reconciliation of paid employment and mothering.

The structure matrix, whilst considered less important for interpretation of the components (Field 2009 661), is still useful to examine to check that the same variables load onto the same components. It is clear from the structure matrix, Table 5, that the variable loadings follow very closely the same pairings as those in the pattern matrix, Table 4.

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Table 4: Pattern Matrix: 1990, 1999 and 2008

	1990			1999			2008		
	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	.130	.203	.840	.170	.206	.853	.181	.206	.861
A pre-school child is likely to suffer with a working mother	.232	.156	-.757	.267	.136	-.745	.298	.113	-.731
A job is alright but what most women really want is a home and children	.786	.117	-.176	.736	.140	-.246	.730	.163	-.259
Being a housewife is just as fulfilling as working for pay.	.846	-.173	.092	.860	-.191	.150	.851	-.227	.168
A job is the best way for a woman to be an independent person	-.196	.783	-.050	-.145	.798	-.004	-.111	.794	.033
A husband and wife should both contribute to household income	.123	.799	.113	.069	.807	.079	.035	.817	.059

Table 5: Structure Matrix: 1990, 1999 and 2008

	1990			1999			2008		
	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	-.028	.268	.832	.026	.249	.834	.018	.253	.840
A pre-school child is likely to suffer with a working mother	.368	.091	-.787	.393	.099	-.783	.428	.060	-.779
A job is alright but what most women really want is a home and children	.816	.087	-.311	.777	.128	-.364	.773	.126	-.383
Being a housewife is just as fulfilling as working for pay.	.833	-.183	-.078	.834	-.183	-.005	.827	-.242	-.001
A job is the best way for a woman to be an independent person	-.203	.783	.049	-.144	.798	.060	-.140	.799	.101
A husband and wife should both contribute to household income	.086	.806	.155	.056	.811	.107	.000	.819	.102

Summary

In this section six Likert scale variables were analysed using PCA. The solutions were obliquely rotated using a *direct oblimin* technique, employing a delta score of 0, which produced a very distinct pattern of alignment of the variable loadings. The analysis of the pan-European data reveals a high level of consistency across three time points; each producing three latent gender role attitudes. We have labelled these three attitudes: a 'Domestic Fulfilment' dimension, which represents attitudes that align with the more traditional male breadwinner model that women seek fulfilment through a full-time home making role for women. An 'Economic Independence' dimension, which represents attitudes that support more progressive views that women should engage in employment and finally a 'Maternal Employment' dimension which explore attitudes towards employment for women when they are raising young children. In combination these three elements will provide a useful tool in measuring attitudes towards key aspects of gender roles in the family in order to assess change over time across Europe and compare the trends across countries.

4.Results: Individual Country PCA

The previous section has revealed that, at the pan-European level, the chosen EVS variables can provide evidence of latent gender role attitudes and these variables have been proven to retain a consistent interpretability over time, thus validating their usage as a potential measure of attitude change over time. Having uncovered such a clear pattern in the data at the pan-European level this section will now explore whether the same consistency of attitude measurement can be found at the individual country level or if diverse country contexts lead to different component structures.

This section analyses the results of 57 individual principal component analyses, exploring the variation uncovered amongst the 19 countries at each of the three waves of the EVS. The same approach was taken for each individual country PCA as that used with the pan-European level PCA: the same six variables were selected and an oblique, direct oblimin rotated solution was chosen. Differing delta scores were tested but as the overall component structures remained constant the default 0 delta score was used (the same value that was used for the pan-European level analysis). A three factor solution was also specified for each individual PCA, this was the result of examining each set of Eigen values produced in the 'variance explained tables' which in all cases presented the third component close to 1.0, and so a three factor solution was forced in each case to avoid arbitrary structural variation. A further justification for this decision is to ensure consistency; in order to enable a more direct comparison with the pan-European level data a three component solution was specified in order to match the component structure found at pan-European level.

The findings of the individual PCA reveal three different patterns across the selected 19 countries. Firstly, there are those countries that follow the same consistent pattern uncovered at the pan-European level and which provides support to the substantive theoretical

arguments revealing a three factor solution with variable loadings that indicate the same three latent dimensions of **Economic Independence**, **Domestic Fulfilment** and **Maternal Employment**. Secondly, there are some countries which follow an adjusted form of this pan-European pattern whereby they follow the pan-European pattern in two out of the three waves with the same component structure and same variable pairings with high loadings; but a slightly different component structure is produced in one of the waves often with varying variable pairings. Thirdly, there are several countries that have a completely different pattern for one year of the data, more pronounced than those countries in the adjusted pan-European grouping. Finally, there is one country, Finland that does not follow the full pan-European component structure for any of the waves. Example countries highlighting the different patterns uncovered are presented below.

Overall 52% of the countries (10 out of the 19) followed the same consistent solution as the pan-European data for all three time points with two high loading variables on each of the three extracted components. These countries are listed in Table 6.

Table 6: Countries with stable component structures following the pan-European pattern

Stable component structures for 1990; 1999; 2008	
Belgium	Netherlands
Bulgaria	Poland
Czech Republic	Spain
France	East Germany
Hungary	Great Britain

These variable pairings were the same as the consistent pattern found at the pan- European level, as exemplified in Table 7 which shows pattern matrix component structure for Belgium. The highlighted values clearly show that there is one component representing the **Economic independence** role; with the variables of *'a job is the best way for a woman to be an independent person'* and *'a husband and wife should both contribute to household income'*; one component representing the **Domestic Fulfilment** role with variables *'being a housewife is just as fulfilling as working for pay'* and *'a job is alright but what most women really want is a home and children'* and finally one component representing **Maternal Employment** with the variables *'a working mother can establish just as warm and secure a relationship with her children as a mother who does not work*' and *'a pre-school child is likely to suffer with a working mother'*. The consistency of these pairings and their high loadings onto separate components reaffirms the pan-European level findings that these variables appear to have successfully extracted latent constructs of gender role attitudes that may be used as a measure of attitude change over time in different country contexts.

However, not all countries followed this consistent pattern of variable pairings and component loadings that both follow the pan-European level pattern. The remaining nine countries have varying levels of inconsistencies with either component structures or variable pairings and loading scores at each wave. However, there was still an overarching similarity amongst the

countries and that is that the **Economic Independence** component was universally clear-cut across the countries and waves with the two variables *'a job is the best way for a woman to be an independent person'* and *'a husband and wife should both contribute to household income'* being consistently highly loaded onto one of the three components extracted from the rotated solution. This strong relationship between these two variables mirrors the partnership found in the pan-European level results.

4.1 The adjusted pan-European pattern for five countries: Slovenia, the Slovak Republic, West Germany and Portugal

This adjusted pan-European pattern describes two sets of countries for which that the data indicates what might be termed a transference of the variance for one variable in one wave of the data.

Slovenia and the Slovak Republic for 1999

The first set comprises Slovenian and Slovakia (named the Slovak Republic in 1990). Both countries followed the pan-European factor solution in two of the three waves however in the 1999 wave a slightly different pattern of variable loading was revealed. Table 8 shows, for Slovakia, the adjusted pan- European pattern that is found for both countries. For Slovakia and Slovenia the pan- European pattern component structure is closely followed for both the 1990 and 2008 waves of data. However, the results vary in the 1999 structure with the variable *'a pre-school child suffers with a working mother'* loading highly onto two of the components, the **Maternal Employment** component that is delineated in the pan-European pattern but it also has a similarly high loading on the **Domestic Fulfilment** component.

Referring back to the pan-European data, a similar pattern can be seen when comparing the component structure before and after rotation. The pan-European pattern for 1990 (which is mirrored almost identically by the other two waves) can be seen below in Tables 9 and 10. Table 9 shows the component structure prior to rotation and Table 10 shows the component structure after rotation has been implemented. The variable *'a pre-school child is likely to suffer with a working mother'* has a high loading on the first component in the pre-rotated solution along with three other variables, in the subsequent rotated solution it can be seen that the majority of the variance of this variable shifts from the first component of **Domestic Fulfilment** over to the third component **Maternal Employment**. This pattern is very similar to the one uncovered in the 'odd' year for the adjusted pan-European pattern countries, such as the 1999 Slovakia example above, and can be seen to a lesser extent in all three waves of the data as the *'pre-school child is likely to suffer with a working mother'* variable does have a fairly high loading on the **Domestic Fulfilment** component but it is almost half the value of the other two very highly loaded variables. This minor adjustment from the pan-European pattern does not amend the overall component structure very much at all and as demonstrated follows a very similar pattern to the pre-rotated solution in the pan-European results. As such both countries in this group, Slovakia and Slovenia, appear to successfully repeat the latent factor extractions as those found in the pan-European findings that derive a measure of gender role attitudes.

Table 7: Pattern Matrix for 1990; 1999; 2008 - Example country: Belgium

	1990			1999			2008		
	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	.145	.174	.856	-.825	.185	.096	-.881	.086	.142
A pre-school child is likely to suffer with a working mother	.229	.141	-.726	.787	.105	.156	.760	.023	.212
A job is alright but what most women really want is a home and children	.755	.107	-.173	.250	.153	.709	.198	.159	.730
Being a housewife is just as fulfilling as working for pay.	.853	-.164	.123	-.131	-.181	.850	-.132	-.180	.821
A job is the best way for a woman to be an independent person	-.088	.805	-.044	.083	.793	-.118	-.060	.783	.044
A husband and wife should both contribute to household income	.027	.803	.097	-.163	.760	.062	-.002	.763	-.073

Table 8: Pattern Matrix for 1990; 1999; 2008 - Example Slovakia[10]

	1990			1999			2008		
	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment	Domestic Fulfilment	Economic Independence	Maternal Employment
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	.179	.131	.839	.110	.124	-.898	.124	.142	.907
A pre-school child is likely to suffer with a working mother	.394	.103	-.678	.563	.073	.551	.433	.088	-.598
A job is alright but what most women really want is a home and children	.801	.066	-.108	.835	.034	.073	.780	.159	-.150
Being a housewife is just as fulfilling as working for pay.	.784	-.107	.098	.839	-.119	-.200	.855	-.194	.185
A job is the best way for a woman to be an independent person	-.131	.829	-.101	-.112	.810	.066	.055	.803	.145
A husband and wife should both contribute to household income	.089	.711	.166	.076	.781	-.133	-.087	.829	-.045

[10] Or 'Slovak Republic' as it is named in the 1990 dataset.

Table 9: Component Structure (pre-rotation) 1990

	Components		
	1	2	3
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	-.545	.266	.625
A pre-school child is likely to suffer with a working mother	.655	.245	-.441
A job is alright but what most women really want is a home and children	.679	.445	.203
Being a housewife is just as fulfilling as working for pay.	.643	.227	.506
A job is the best way for a woman to be an independent person	-.417	.596	-.354
A husband and wife should both contribute to household income	-.282	.765	-.068

Table 10: Pattern Matrix 1990

	Components		
	Domestic Fulfilment	Economic Independence	Maternal Employment
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	.144	.200	.845
A pre-school child is likely to suffer with a working mother	.280	.157	-.727
A job is alright but what most women really want is a home and children	.783	.110	-.177
Being a housewife is just as fulfilling as working for pay.	.842	-.174	.095
A job is the best way for a woman to be an independent person	-.213	.783	-.055
A husband and wife should both contribute to household income	.130	.793	.124

West Germany and Portugal for 1999

Another two countries, West Germany and Portugal, have a similar adjusted pan- European pattern but with loadings that vary slightly from the pan-European pattern for the 1999 wave. Instead of differences revolving around the *'a pre-school is likely to suffer with a working mother'* variable these two countries have some transferred variance for the *'a working mother can establish just as warm and secure a relationship with children as a mother who does not work'*, in both cases this variable loads onto both the **Maternal Employment** component and the **Economic Independence** component.

Table 11: Pattern Matrix 1999: Example West Germany

	Components		
	1	2	3
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	.476	.138	-.659
A pre-school child is likely to suffer with a working mother	.096	.156	.890
A job is alright but what most women really want is a home and children	.135	.850	.199
Being a housewife is just as fulfilling as working for pay.	-.302	.786	-.141
A job is the best way for a woman to be an independent person	.849	-.045	.073
A husband and wife should both contribute to household income	.733	-.069	-.107
Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.			
a. Rotation converged in 7 iterations.			

Table 11 presents the example of West Germany for 1999, and shows that the transferred variance is quite minimal and as such is only slightly divergent from the pan-European pattern. A similar pattern was found for Portugal. The variable *'a working mother can establish just as warm and secure a relationship as a mother who does not work'* can be seen to deviate from the original pan-European pattern by loading on both the **Economic Independence** component and the usual **Maternal Employment** component. The explanation might be that both of these components connect with ideas about more progressive gender roles in the labour market and in the family. The higher loading for the variable remains on the **Maternal Employment** component and as the adjusted pattern remains very similar to the pan-European pattern it again highlights the complexity concerning these constructs but does on the whole support the pan-European and theoretical interpretation of the components.

4.3 Odd Year Countries: Denmark (1999), Iceland (2008), Romania (2008)

The next group of countries display the same component structure pattern for two of the three waves, similar to the adjusted pan-European pattern group, but their third 'odd' year has a much more pronounced variation from the cross-European and proposed theoretical pattern. This group contains: Denmark, Iceland and Romania. For Denmark, the odd year is 1999 and for Iceland and Romania it is 2008. Examining the example of Romania (Table 12) reveals a split amongst the variables between those that appear to represent more traditional attitudes versus those that support more egalitarian ones. The first component houses the **Domestic Fulfilment** variables alongside the *'a pre-school child is likely to suffer'* variable that implies more traditional home maker and mothering roles for women; whereas the second component tends towards greater liberalism as the '*working mother can establish just as warm a relationship as a mother that does not work*' is loaded along with the '*a husband and wife should both contribute to household income'* which implies attitudes that support women's participation in the workforce and an equal distribution of roles between men and women.

This interpretation does not follow the exact pattern uncovered in the pan-European PCA findings. However, the different variable pairings uncovered in this example (and this is also true of the patterns for the other countries in this group) do engage with the three elements of **Domestic fulfilment**, **Maternal Employment** and **Economic Independence** and as the other two waves of the data do follow the same pattern as the pan-European results these countries are not considered completely divergent from those that do follow the pattern. Instead, these examples reveal the complexities of the connections between the latent constructs and allows acknowledgement of the fact that overlapping and interconnectedness are inevitable when trying to model such complex ideas.

Table 12: Pattern matrix 1990 – Example Romania

	Components		
	1	2	3
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	.029	.825	-.162
A pre-school child is likely to suffer with a working mother	.723	-.133	.218
A job is alright but what most women really want is a home and children	.778	-.007	-.038
Being a housewife is just as fulfilling as working for pay.	605	.230	-.256
A job is the best way for a woman to be an independent person	.026	.018	883
A husband and wife should both contribute to household income	-.058	.656	.421
Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser			
a. Rotation converged in 23 iterations.			

4.4 The case of Finland

Finally Finland is the only country that appears to have a different component structure to the pan-European pattern or the other selected countries. It is the only country that displays a different component structure for each year. One strong similarity with the other countries however, is the component factor – **Economic Independence** – that was found at the pan-European level does remain as a clear-cut component across all three waves of the Finnish data, with the two variables *'a job is the best way for a woman to be an independent person'* and *'a husband and wife should both contribute to household income'* both loading strongly onto one of the three extracted components.

The other two extracted components however do not follow the pan-European pattern and neither do they follow the same pattern consistently. In the 1990 structure the first component, similarly to the Romania example above, appears to load the more 'traditional' variables but the same pattern is not repeated for the 1999 or 2008 first components. The third component for the 1999 and 2008 structures do align with one another with the two variables *'a working mother can establish just as warm a relationship as a mother who does not work'* and *'being a housewife is just as fulfilling as working for pay'* both loading quite highly, which could be interpreted as representing a latent construct that concerns women's choices and advocates that either a more traditional home maker role or the decision to combine working with motherhood is an acceptable choice for women. Whilst these patterns are somewhat inconsistent and do not align with the broader pattern from the Europe-wide data (or most of the individual level trends) due to the interconnected nature of these variables different attitudinal patterns can still make sense as with the example above. Furthermore taking into consideration the context of Finnish family policies, which align with the broad egalitarian tradition of the Nordic model but at the same have their own nuances, which for example are supportive of maternal employment with generous childcare provisions. However policies also encourage mothers with young children to remain at home to care for them, as such support for women's choices to either balance working and caring for children or just caring for children are both likely to find support. Finland does display quite considerable differences compared to the pan-European pattern findings but the **Economic independence** component remains stable throughout and the variable pairings are replicated in some of the component structures between the years. In addition the variations in patterns can perhaps be understood better with some insight into Finnish family policies and their broader cultural caring discourses (see Finnish Ministry of Social Affairs and Health 2013, for more discussion of this).

Summary

The patterns revealed by the individual country PCAs show strong similarity to the pan-European level results and the majority of countries closely follow the constructs illustrated in the pan-European results with the three attitudinal dimensions of **Maternal Employment**, **Domestic Fulfilment** and **Economic Independence** emerging.

The countries appear to fall into four groups; those that follow the pan-European pattern completely, those that display a very minor variation of the pan-European pattern, those that have one 'odd' component structure out of the three years and Finland which produces a different component structure for each year. The **Economic independence** construct has two variables that consistently have high loadings on one component at both the pan-European level and the individual country level. The other two component elements of the **Domestic Fulfilment** and the **Maternal Employment** dimensions clearly divide onto separate components at the pan-European level, whilst at the individual country level these are less clear-cut which serves to highlight the interrelated and complex nature of these constructs.

Ultimately, this analysis indicates that the model uncovered at the pan-European level has been found consistently across 10 out of the 19 countries, whilst a further eight follow the same pan-European pattern for two out of the three waves with some variation found in the pattern for the remaining wave and finally Finland has further deviations. As a result the three pronged model may be seen as a very reliable indicator of gender role attitudes at the pan- European level and it is still useful for assessing gender role attitude change between countries albeit with some acknowledgement that there are some minor disparities for some countries and that something different appears to be happening in Finland which could be the result of contextual policy based change. The analysis now moves onto testing how statistically valid the components structure is for deriving a measure of gender role attitudes.

Table 13: Pattern Matrix for 1990; 1999; 2008 – Example of Finland

Finland	1990			1999			2008		
	Fulfil	Eco	Bal	Fulfil	Eco	Bal	Fulfil	Eco	Bal
working mother can have just as warm a relationship as non-working mother	-.054	.134	.940	-.385	.226	.726	.556	.223	.626
Pre-school child suffers with a working mother	.730	.079	-.280	.763	.026	-.155	.845	.025	-.108
women really want a family and home	.842	.157	-.039	.796	.110	.113	.801	.094	.284
being a housewife is as fulfilling as paid work	.738	-.309	.249	.460	-.237	.702	.332	-.268	.729
job is the best way for women to be independent	.038	.816	.043	.087	.836	-.089	.089	.802	-.176
husband + wife both contribute to household income	-.001	.805	.064	.039	.780	.096	.010	.810	.120

4. Results: Confirmatory Factor Analysis

As discussed in the data and method section confirmatory factor analysis was implemented to test the three factor model derived from the PCA and establish whether it is the best fit for the data compared to other model options without relying on too complex a model.

To assess the relative goodness-of-fit of the proposed three factor model, derived from the PCA findings, a two factor model and a one factor model were also produced. The two factor model was derived by carrying out three further PCA models and forcing SPSS to select only two factors for extraction, whilst the one factor model simply loads all six variables onto the one latent construct. The three factor model contains the first factor which has the two loaded variables: *'a job is best way for a woman to be an independent person'* and *'a husband and wife should both contribute to household income'*, the second factor also has two loaded variables namely, *'a working mother can establish just as a warm and secure a relationship with her child as mother who does not work'* and *'a pre-school child is likely to suffer with a working mother'*, the third and final factor loads the two remaining variables of analysis: *'a job is alright but what most women really want is a home and family'* and *'being a housewife is just as fulfilling as working for pay'.*

Tables 14, 15 and 16, present the results of the CFA models for each of the three years that are being analysed.

Table 14: Indicator values for a three factor solutions for 1990; 1999; 2008

Three Factor Solution	1990	1999	2008
TLI (Rho2)	0.579	0.552	0.653
CFI	0.880	0.872	0.861
RMSEA	0.108	0.111	0.126

Table 15: Indicator values for a two factor solution for 1990; 1999; 2008

Two Factor Solution	1990	1999	2008
TLI (Rho2)	0.332	0.321	0.419
CFI	0.745	0.741	0.779
RMSEA	0.137	0.137	0.132

Table 16: Indicator values for a one factor solution for 1990; 1999; 2008

One Factor Solution	1990	1999	2008
TLI (Rho2)	0.078	0.033	0
CFI	0.605	0.557	0
RMSEA	0.161	0.169	0.179

The results of the TLI, CFI and RMSEA statistical tests presented in Tables 14, 15 and 16 reveal that these models do not provide a good fit for the data. This is because for each test the

suggested threshold has not been met. Both the TFI and CFI statistics fall short of the minimum 0.9 or 0.95 that would be required to indicate a good fit, whilst the RMSEA values are too high and exceed the 0.06 threshold. However, it is interesting to note that the indicator values are very consistent across the dataset waves and in addition the models that are closest to meeting the thresholds of a 'good' model fit are those derived from the three factor solution that was the original priori model generated from the PCA findings. Therefore the three factor solution using the PCA results is the 'best fit' out of these three models and would provide the best measure of gender role attitudes.

CFA enables "model trimming" or model modification, which can suggest alterations in proposed factor structures. Thus, confirmatory procedures can be used to revise and refine instruments and their factorial structure (Floyd and Widaman 1995: 2). In order to assess whether an improvement to the fit of the model can be made; a close examination of the 'modification indices' output can be carried out to explore potential links that could be added or altered in order to improve the fit of the overall model. Local links are often said to improve the fit of the model however, Hooper et al (2008) comment that relying heavily on modification indices to improve a goodness-of-fit is not recommended unless there is a good substantive reasoning to help guide any adjustments in the model. In this instance a closer examination of the modification indices alongside a re-examination of the factor loadings from the PCA analysis enables some minor model adjustments to be made to improve the model fit.

The modification indices for each of the three factor CFA models (one for each wave of 1990, 1999 and 2008) were examined and several additional links were suggested by the output. Each new link was run consecutively for each of the three datasets in order to find a model that had the optimum fit across each of the models. In addition the original PCA variable loadings were examined in order to ensure that any additional links that were added did not alter the overall structure of the model as extensive modifications are not advised. It is important to note here that the original PCA model did include minor cross linkages i.e. each variable did report some loading value for each component albeit often a small value but those under 0.5 were not included in the interpretation of the model (as is suggested by Floyd and Widaman 1995). Furthermore any adjustment requires justification because the PCA model has already been established as having considerable theoretical underpinning.

Table 17 shows the pan-European PCA factor loadings for the factor **Economic Independence** and the loaded variables occupying the final two rows of the table. The top row of values highlight the variables with the next highest factor loadings. Consistently these are shown to be the variables '*a working mother can establish just as warm and secure a relationship as a mother who does not work'* and '*being a housewife is just as fulfilling as working for pay'*. The latter is always a negative value which indicates that it represents a value at the opposite end of the scale to those other variables with a positive loading on that factor. In this instance it makes sense theoretically because the ' *a working mother can establish just as warm and secure a relationship as a mother who does not work'* variable

aligns with the two predominantly loaded variables of '*a job is the best way for a woman to be an independent person'* and *'a husband and wife should both contribute to household income'* as a factor that supports more egalitarian ways of living and advocating more positive connotations surrounding women's position in the workplace. Whilst the '*being a housewife is just as fulfilling as working for pay'* variable posits a positive attitude to women's choices it is one of a more traditional role as a home maker rather than participation in the workforce or a dual role. These additional insights into this '**Economic Independence'** factor allow sufficient justification for including the links to this factor as suggested by the modification indices.

Table 17: Economic Independence Component: 1990; 1999; 2008

	Economic Independence		
	1990	1999	2008
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	.203	.206	.206
A pre-school child is likely to suffer with a working mother	.156	.136	.113
A job is alright but what most women really want is a home and children	.117	.140	.163
Being a housewife is just as fulfilling as working for pay.	-.173	-.191	-.227
A job is the best way for a woman to be an independent person	.783	.798	.794
A husband and wife should both contribute to household income	.799	.807	.817

Table 17 presents the results of the re-run CFA models after considering the modification indices and those lower variable loadings for the pan-European PCA. The three factors of the original priori model derived from the PCA solution were retained alongside the addition of an extra two links between the **Economic Independence** latent concept and the variable *'being a housewife is just as fulfilling as working for pay'* and again between the **Economic Independence** latent concept and the variable *'a working mother can establish just as warm a and secure a relationship with her child as a mother who does not work'*.

Table 18: Modified three factor CFA model for 1990; 1999; 2008

	1990	1999	2008
TLI (Rho2)	.833	.808	.896
CFI	.955	.963	.972
RMSEA	.081	.073	.069

As Table 18 shows, the results across the three models using the modified three factor CFA do produce results that are much closer to the thresholds proposed by the three indicators of model fit. The CFI statistics are over 0.95 which is indicative of a very good

model fit. The TLI and RMSEA whilst considerably improved are not at the exact threshold that suggests a good fit, however they are very close to them. The TLI falls short of the 0.90 threshold for the 1990 and 1999 models. The RMSEA again falls short for 1990 but is very close for both 1999 and 2008 to the 0.06 limit suggested by statistics researchers. On the **Maternal Employment** the 2008 model has the best overall fit with each of the three indicators suggesting that it is a good fit to the data.

Table 19: Standardized Estimates (Group number 1 - Default model)

Variables	Factor	1990	1999	2008
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	Maternal Employment	.372	.379	.375
A pre-school child is likely to suffer with a working mother	Maternal Employment	-.854	-.922	-.968
A job is alright but what most women really want is a home and children	Economic Independence	.530	.621	.617
Being a housewife is just as fulfilling as working for pay.	Economic Independence	.559	.546	.574
A job is the best way for a woman to be an independent person	Domestic Fulfilment	.859	.840	.834
A husband and wife should both contribute to household income	Domestic Fulfilment	.448	.396	.385
A working mother can have just as warm and secure a relationship with her child as a mother who does not work	Economic Independence	-.202	-.221	-.246
A pre-school child is likely to suffer with a working mother	Economic Independence	.249	.214	.211

The standardised estimates of the CFA model, which are equivalent to the factor loadings in the PCA output, are displayed in Table 4.20. It is clear that results across the three points in time remain very consistent. Comrey and Lee (1992) state that loadings greater than 0.70 are excellent; 0.63 are very good; 0.55 are good; 0.45 are fair and 0.32 are poor. Whilst these guidelines were initially set out as guidelines for PCA Comrey and Lee (1992) have suggested that they can be used as an approximate guide for interpreting CFA. On this basis the results displayed in Table 4.20 show that the majority of the variable loadings are either 'good', 'very good' or 'excellent'. The exceptions are found with the variables that have attained the additional links to a secondary latent factor. The variable *'a working mother*

can establish just as warm a relationship with her child as a mother who does not work' and *'being a housewife is just as fulfilling as working for pay'* both have loadings considered 'fair' for their original, dominant factor but 'poor' loadings for their additional factor. This is unsurprising considering the variance contained within the variables is split across two factors. Overall this largely mirrors the findings of the original PCA model as all had 'good' loadings or better and the changes in the CFA model were derived for both statistical purpose and theoretical reasoning because 'CFA is a confirmatory technique – it is theory driven' (Schreiber et al 2006).

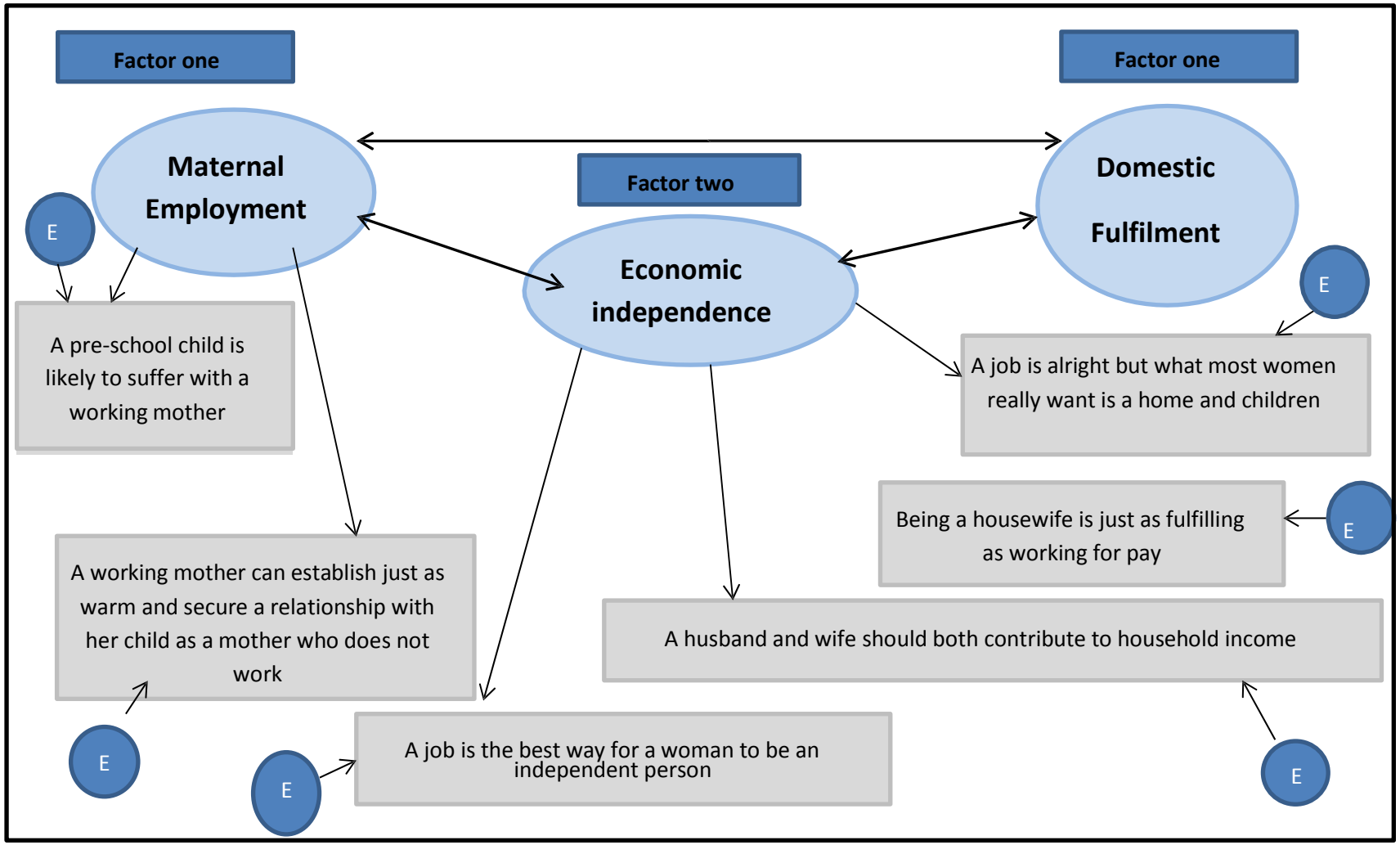
Unfortunately the AMOS software does not enable the extraction of the coefficients which would be required if this adjusted model were to be used as the basis of a measure of gender role attitudes[11]. As such the original three cluster solution based on the variable pairings of the PCA results, which performed the best compared to a one or two factor solution, is the model basis of the attitude measure to be used in future analyses.

This compromised model is still broadly similar to the pattern of the optimised CFA model as was shown with the comparisons to the original PCA variable loadings. In addition given that this is a pan-European model and (as observed in the country level PCA findings) there are some countries that don't quite follow the pattern and as such the fit indices are not considered to be too bad. Taking into account the model fit indices and the theoretical underpinnings this model is proposed as the most feasible fit for the data whilst having sound theoretical reasoning behind the three constructs.

Figure 2 presents a diagram of the resultant model and the three latent factors as follows: **Maternal Employment**, **Economic Independence** and **Domestic Fulfilment** with each comprised of the pairs of variables from the EVS data.

[11] The analysis was also attempted using a more sophisticated software (MPlus) but due to the simple nature of the model with only the six variables the model could not be run.

Figure 2: CFA model solution for EVS 1990; 1999; 2008



A further justification for using the simpler, less statistically robust model as the basis for the attitude measures is that, the **Maternal Employment** element is originally composed of two variables that represent arguably opposite perspectives. *'A working mother can have just as warm and secure a relationship with her child as a mother who does not work'* and '*A pre-school child is likely to suffer with a working mother'* capture two different attitudes concerning whether or not mothers' employment has a detrimental effect on the relationship with their children/ pre-school children. If the coefficients had been extracted for the more complex model it would have been difficult to interpret the attitude dimension of **Maternal Employment.** As such the coding has been reversed for the *'A pre-school child is likely to suffer with a working mother'* variable so that now a high score on the **Maternal Employment** dimension represents attitudes that support the idea that it is possible for mothers to reconcile employment with their parental responsibilities to pre-school children. The coding has also been reversed for both variables on the **Domestic Fulfilment** dimension so that instead of representing attitudes that are in support of a more traditional perspective on women's roles as homemakers, now this dimension represents attitudes that support women's **Job Fulfilment** supporting the idea that women are likely to be most fulfilled if they are employed rather than pursuing a traditional role focussed solely on being a home maker. The **Economic Independence** factor remains the same.

5. Conclusion

This paper has described how a measure for gender role attitudes has been derived in order to analyse European trends and compare 19 European countries using the European Values Study.

Two data classification techniques - principal components analysis and confirmatory factor analysis - were employed to derive the best fitting model for the six attitude variables. PCA was run using the same six variables from each of the three datasets (1990, 1998 and 2008) using the pan-European level data. The results showed a consistent component structure across all three waves of the data with three components each having two highly loaded variables. The three components were labelled **Maternal Employment**, **Domestic Fulfilment** and **Economic Independence**, with the variables pairing as anticipated. This coherence across time allows a consistent interpretation of the gender role attitude variables over the three time points of 1990, 1999 and 2008 and indicates that these three factors can provide a useful tool for assessing gender role attitude change over time at the pan-European level.

Next the individual country level data were examined using PCA to ascertain whether the same component structure was found in each of the selected 19 countries. The findings revealed that there was at least some similarity with the pan-European PCA pattern in all of the 19 countries analysed. There were 10 out of the 19 countries that followed the exact same pattern of the component structure and very similar variable loading scores as the pan-European data. The results for the other nine countries were a little more variable, with eight of the nine countries following the pan-European pattern in two out of three of the waves with alterations to the factor structure in just one year. The Economic Independence dimension was universally highly loaded onto one component for all of the component structures highlighting the consistency of that latent factor. This step in the analysis shows that the model is useful for interpreting gender role change across the countries but it may not be the best model for all individual countries.

Confirmatory Factor Analysis was then carried out on the pan-European level data for each of the three datasets in order to confirm the robustness of the structure and to ensure that the most appropriate model fit was found for the data and the underlining theoretical considerations. The findings of the initial model revealed that the simple component structure without any cross loadings did not reach the strict thresholds for the three model fit indicators, however in comparison to a two factor or one factor solution it did provide the best model out of the three nested models. Next, in order to improve the fit of the model, the modification indices were examined for each of the three models (from each year's model output) in combination with re-examining the PCA component loadings. Links added connections between the '**Economic independence'** factor to the variables '*A working mother can establish just as warm and secure a relationship with her child as a mother who does not work'* and '*Being a housewife is just as fulfilling as working for pay'*. These additions improved the model fit however the software did not allow the coefficients to be extracted to form a measure to be used for the analysis of attitude change.

As such the original three factor solution from the PCA findings was selected as the measure with the six variable forming pairs to construct the three attitude elements. It is also important to note that the results of the country level analysis were more varied than those found at the pan-European level and as such it is likely that there are better individual model fits for specific countries and so care must be exercised in using this model to analyse gender role attitude change at the country level.

In sum, the findings from this paper reveal that a measure of gender role attitudes has been uncovered at the pan-European level. The three distinct, yet connected, latent factors of **Maternal Employment**, **Job Fulfilment** and **Economic Independence** can be used to explore attitude change across time at the European level, and with caution at the individual country level, allowing for greater understanding of how attitudes vary over time and across different country contexts.

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Appendix

Table A1: 1990 Spearman's correlation for the six attitude variables

		working mother just as warm as non-working mother	preschool child suffers with working mother	women really want a home and children	being a housewife is as fulfilling as working for pay	a job is the best way for women to be independent	a husband and wife should both contribute to household income
working mother just as warm as non-working mother	Correlation Coefficient	1.000	-.310**	-.133**	-.067**	.158**	.199**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	30518	30470	29295	30296	30188	30325
preschool child suffers with working mother	Correlation Coefficient	-.310**	1.000	.328**	.212**	-.034**	-.001
	Sig. (2-tailed)	.000		.000	.000	.000	.853
	N	30470	30548	29319	30321	30207	30347
women really want a home and children	Correlation Coefficient	-.133**	.328**	1.000	.408**	-.093**	.083**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	29295	29319	29367	29174	29073	29191
being a housewife is as fulfilling as working for pay	Correlation Coefficient	-.067**	.212**	.408**	1.000	-.163**	-.063**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	30296	30321	29174	30363	30101	30207
a job is the best way for women to be independent	Correlation Coefficient	.158**	-.034**	-.093**	-.163**	1.000	.304**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	30188	30207	29073	30101	30252	30113
a husband and wife should both contributed o household income	Correlation Coefficient	.199**	-.001	.083**	-.063**	.304**	1.000
	Sig. (2-tailed)	.000	.853	.000	.000	.000	
	N	30325	30347	29191	30207	30113	30404

Table A2: Pearson's 1990 correlation for the six attitude variables

		working mother just as warm as non-working mother	preschool child suffers with working mother	women really want a home and children	being a housewife is as fulfilling as working for pay	a job is the best way for women to be independent	a husband and wife should both contributed o household income
working mother just as warm as non-working mother	Pearson Correlation	1.000	-.342**	-.168**	-.091**	.145**	.181**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	30518	30470	29291	30293	30185	30321
preschool child suffers with working mother	Pearson Correlation	-.342**	1.000	.319**	.194**	-.047**	-.036**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	30470	30549	29316	30319	30204	30344
women really want a home and children	Pearson Correlation	-.168**	.319**	1.000	.395**	-.112**	.045**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	29291	29316	29364	29170	29068	29186
being a housewife is as fulfilling as working for pay	Pearson Correlation	-.091**	.194**	.395**	1.000	-.181**	-.104**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	30293	30319	29170	30361	30097	30202
a job is the best way for women to be independent	Pearson Correlation	.145**	-.047**	-.112**	-.181**	1.000	.291**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	30185	30204	29068	30097	30249	30111
a husband and wife should both contributed o household income	Pearson Correlation	.181**	-.036**	.045**	-.104**	.291**	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	30321	30344	29186	30202	30111	30401

Table A3: Spearman's 1999 correlation for the six attitude variables

			a working mother can have just as warm and secure relationship as non-working mother	a preschool child is likely to suffer with a working mother	a job is alright but what women really want is a home and children	being a housewife is just as fulfilling as working for pay	a job is the best way for a woman to be an independent person	both a husband and wife should contribute to household income
Spearman's rho	a working mother can have just as warm and secure relationship as non-working mother	Correlation Coefficient	1.000	-.349**	-.139**	-.029**	.182**	.187**
		Sig. (2-tailed)		.000	.000	.000	.000	.000
		N	28927	28879	28815	28770	28795	28818
	a preschool child is likely to suffer with a working mother	Correlation Coefficient	-.349**	1.000	.339**	.186**	-.035**	-.019**
		Sig. (2-tailed)	.000		.000	.000	.000	.002
		N	28879	28898	28796	28756	28775	28794
	a job is alright but what women really want is a home and children	Correlation Coefficient	-.139**	.339**	1.000	.345**	-.039**	.051**
		Sig. (2-tailed)	.000	.000		.000	.000	.000
		N	28815	28796	28838	28723	28731	28742
	being a housewife is just as fulfilling as working for pay	Correlation Coefficient	-.029**	.186**	.345**	1.000	-.155**	-.080**
		Sig. (2-tailed)	.000	.000	.000		.000	.000
		N	28770	28756	28723	28790	28699	28700
	a job is the best way for a woman to be an independent person	Correlation Coefficient	.182**	-.035**	-.039**	-.155**	1.000	.358**
		Sig. (2-tailed)	.000	.000	.000	.000		.000
		N	28795	28775	28731	28699	28817	28732
	both a husband and wife should contribute to household income	Correlation Coefficient	.187**	-.019**	.051**	-.080**	.358**	1.000
		Sig. (2-tailed)	.000	.002	.000	.000	.000	
		N	28818	28794	28742	28700	28732	28841
**. Correlation is significant at the 0.01 level (2-tailed).								

Table A4: Pearson 1999 correlation for the six attitude variables

		a working mother can have just as warm and secure relationship as non-working mother	a preschool child is likely to suffer with a working mother	a job is alright but what women really want is a home and children	being a housewife is just as fulfilling as working for pay	a job is the best way for a woman to be an independent person	both a husband and wife should contribute to household income
a working mother can have just as warm and secure relationship as non-working mother	Pearson Correlation	1.000	-.362**	-.156**	-.050**	.147**	.157**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	28243	28195	28131	28082	28106	28134
a preschool child is likely to suffer with a working mother	Pearson Correlation	-.362**	1.000	.335**	.177**	-.042**	-.027**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	28195	28216	28112	28067	28086	28112
a job is alright but what women really want is a home and children	Pearson Correlation	-.156**	.335**	1.000	.342**	-.054**	.032**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	28131	28112	28156	28035	28043	28059
being a housewife is just as fulfilling as working for pay	Pearson Correlation	-.050**	.177**	.342**	1.000	-.171**	-.107**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	28082	28067	28035	28103	28008	28013
a job is the best way for a woman to be an independent person	Pearson Correlation	.147**	-.042**	-.054**	-.171**	1.000	.329**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	28106	28086	28043	28008	28129	28044
both a husband and wife should contribute to household income	Pearson Correlation	.157**	-.027**	.032**	-.107**	.329**	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	28134	28112	28059	28013	28044	28159
**. Correlation is significant at the 0.01 level (2-tailed).							

Table A5: 2008 Spearman's correlation for the six attitude variables

		Working mother just as warm	pre-school child suffers	women really want home and children	being a housewife is just as fulfilling	a job is the best way for women to be independent	a husband and wife should both contribute to household income
Working mother just as warm	Correlation Coefficient	1.000	-.374	-.156	-.040	.201	.205
	Sig. (2-tailed)	.	.000	.000	.000	.000	.000
	N	35803	35724	35643	35641	35639	35664
pre-school child suffers	Correlation Coefficient	-.374	1.000	.367	.192	-.058	-.041
	Sig. (2-tailed)	.000	.	.000	.000	.000	.000
	N	35724	35756	35607	35601	35607	35628
women really want home and children	Correlation Coefficient	-.156	.367	1.000	.327	-.041	.035
	Sig. (2-tailed)	.000	.000	.	.000	.000	.000
	N	35643	35607	35684	35546	35545	35560
being a housewife is just as fulfilling	Correlation Coefficient	-.040	.192	.327	1.000	-.171	-.128
	Sig. (2-tailed)	.000	.000	.000	.	.000	.000
	N	35641	35601	35546	35682	35549	35558
a job is the best way for women to be independent	Correlation Coefficient	.201	-.058	-.041	-.171	1.000	.389
	Sig. (2-tailed)	.000	.000	.000	.000	.	.000
	N	35639	35607	35545	35549	35685	35577
a husband and wife should both contribute to household income	Correlation Coefficient	.205	-.041	.035	-.128	.389	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.
	N	35664	35628	35560	35558	35577	35710

Tale A6: 2008 Pearson's correlation for the six attitude variables

		working mother just as warm	pre-school child suffers	women really want home and children	being a housewife is just as fulfilling	a job is the best way for women to be independent	a husband and wife should both contribute to household income
working mother just as warm	Pearson Correlation	1	-.374	-.161	-.048	.149	.150
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	33928	33850	33779	33772	33774	33795
pre-school child suffers	Pearson Correlation	-.374	1	.364	.186	-.042	-.030
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	33850	33879	33741	33730	33741	33758
women really want home and children	Pearson Correlation	-.161	.364	1	.325	-.042	.028
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	33779	33741	33815	33683	33686	33696
being a housewife is just as fulfilling	Pearson Correlation	-.048	.186	.325	1	-.180	-.142
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	33772	33730	33683	33809	33685	33691
a job is the best way for women to be independent	Pearson Correlation	.149	-.042	-.042	-.180	1	.344
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	33774	33741	33686	33685	33816	33713
a husband and wife should both contribute to household income	Pearson Correlation	.150	-.030	.028	-.142	.344	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	33795	33758	33696	33691	33713	33836

The above Tables A1 to A6 display the Spearman's and Pearson's correlations between the six attitudes variables that are the focus of the research, over the three datasets 1990-2008. In order to carry out certain analyses data must be interval or categorical. This data has been recoded so that it has a Likert scale which can be used as a proxy for categorical data when a typically interval type analysis is required. As such these six tables are presented here to show that there are fairly similar patterns when comparing the Spearman's and Pearson's results (of the same year) and as such provide evidence that the two methods of factor analysis – principal components analysis and cluster analysis can be carried out on this data as the similarities of the Pearson's and Spearman's indicate that the categorical data is similar enough to interval level data to be appropriate.

Table A7: Parallel analysis using Raw Data EigenValues 1990-2008

Root	1990	1999	2008
1	1.841754	1.812285	1.867114
2	1.328678	1.36294	1.316835
3	1.030066	1.055592	1.028357
4	0.6774	0.644102	0.652402
5	0.590836	0.57577	0.596671
6	0.531267	0.549312	0.538621

Parallel analysis was carried out on each wave of data to provide a more robust and statistical method of determining the retention of clusters. The results corroborate the scree plots and three components appear to be the appropriate number to extract for all three waves of data.