OCCUPATIONAL STATUS MEASURES FOR THE NEW INTERNATIONAL STANDARD CLASSIFICATION OF OCCUPATIONS ISCO-08; WITH A DISCUSSION OF THE NEW CLASSIFICATION

Harry B.G. Ganzeboom, VUA

(Donald J. Treiman, UCLA)

Last revised: May 24, 2010 [HG]

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INTRODUCTION

Recently, the International Labour Association [ILO] has released the 2008 revision of the International Standard Classification of Occupations [ISCO]. ISCO-08 has been formally <vastgesteld> by the International Conference of Labour Statisticians on December 6th 2007, but draft definitions of the new ISCO-08 have been made available on the ILO website only in July 2009. A formal manual (of which these definitions will be part) has to be published as of yet, but is due soon, as one of the stated aims of the ISCO revision is to inform the 2010/2011 round of population censuses. Moreover, as of October 29th 2009, the European Union Commission (2009) recommends that (A) "Member States should use ISCO-08 for the Structure of Earnings Survey 2010", and (B) "EU Member States should use ISCO-08 from 2011 as reference year in all statistical domains providing statistics broken down by occupations". Together with this decision the EU has published translations of ISCO-08 in 23 European languages, including Maltese and Gaelic, so nothing seems to stop users from a swift adoption of the new classification.

To the social research community, ISCO is not only the backbone of comparative official statistics, but also the major instrument of classification and coding in comparative surveys. Indeed, large-scale international projects such as PISA and PIAAC have already decided to adopt ISCO-08 as the occupational classification for their upcoming rounds, and there is no doubt that other leading comparative projects such as ESS and ISSP will follow suit. However, social researchers are usually not interested in occupational classification *per se*. Occupations most often enter social research in one or other form of occupational *status*. Such status measures exist in various flavors. We find it useful to distinguish (A) socio-economic status scores, (B) occupational prestige scores and (C) socio-economic class categories. In connection with ISCO-88, the predecessor to ISCO-08, much use has been made of ISEI [International Socio-Economic Index of occupational status], SIOPS [Standard International Occupational Prestige Scale] and EGP [the class schema proposed by Erikson, Goldthorpe and Portocarero (1979), also known as the Goldthorpe categories], all of which were initially generated in connection with ISCO-68, the 'grandfather' classification of ISCO-08, but have become most frequently applied in social research in their derivations from ISCO-88, its immediate predecessor. The revision that ISCO-08 represents puts the comparative researcher who applies this classification in the awkward position that no such status measures have been derived yet for the new classification, while an easy upgrade from

the earlier measures is not possible. As we will see, the new classification makes distinctions that were not available in its predecessor (and this is the very reason of its existence). In as far as the construction or validation of such measures requires the presence of data coded in detailed ISCO-08, we find ourselves in a stalemate. As long as there are no occupational status measures available, it in impractical to use the new occupational classification on new data, and as long as these data are not available it is not possible to construct and/or validate such new status measures.

In this paper we present an attempt to breach this stalemate by providing a socio-economic status score, a prestige score and a socio-economic class scheme for detailed ISCO-08. We do this using a large-scale international data set (taken from the International Social Survey Project) originally coded in ISCO-88 that is *converted* into ISCO-08 using a simple (many-to-one) crosswalk. Obviously, this procedure involves loss of information, but as we will show this loss is relatively small. We validate our procedures by estimating the loss as revealed by aggregation statistics and the association with criterion variables, on fresh data. Our results remain provisional in that we do not have large-scale comparative data available that were freshly coded in ISCO-08, or double coded in ISCO-08 and earlier ISCO's. Conclusive validation procedures will have to wait until large-scale double-coded international data sets become available.

The plan of the paper is as follows. First, we give an elaborate introduction of the new classification. We point out that there is much similarity between ISCO-08 and its predecessor ISCO-88, but that there are also some surprising relapses to its grandfather classification, ISCO-68. We create and use conversion tools between all three classifications, using information presently available at the ILO website. Second, we derive the three status measures for the new classification, using a large international ISSP dataset that was converted from ISCO-88 codes. These status measures are baptized ISEI-08, SIOPS-08 and ISEC-08. We discuss the relationships among these three status measures, as well as their counterparts as initially developed for ISCO-88 and ISCO-68. Finally we examine the validity of the proposed measures using a fresh large-scale international data-set, the ESS R1-4 data, as well as a small double-coded national dataset (ESS R4 data for the Netherlands, which is admittedly of limited size and coverage. Both validation exercises provide strong evidence that the newly proposed status measures work well and constitute (at least minor) improvements relative to their predecessors.

HISTORICAL AND CONCEPTUAL BACKGROUNDS OF ISCO-08

ISCO-08 is the fourth version of International Standard Classification of Occupations: earlier versions appeared as ISCO-58, ISCO-68 and ISCO-88. The full details of all these classifications are available on the website of ILO, which has been the custodian of these classifications on behalf of the International Conference of Labour Statisticians. Among the three earlier versions, ISCO-58 has received little application in survey research and it is in practice only interesting for historical reasons. This is quite different for its successor, ISCO-68, that became the classification tool in important comparative surveys such as the Political Action project (1974-1979) and the International Social Justice Project (1991). ISCO-68 also gained popularity by the work of Treiman (1975, 1977) who constructed the Standard International Occupational Prestige Score [SIOPS] by using ISCO-68 as a backbone to harmonize over 60 national occupational prestige scales. The version of ISCO-68 in Treiman (1975, 1977) effectively even became the short-hand tool that researchers used to code their occupation data. Also, some countries (Netherlands, Germany) adopted versions of ISCO-68 as their national classifications. Acknowledging the international impact of ISCO-68, Ganzeboom, Luijkx & Treiman (1989) used it to construct a standard socio-economic class scheme after Erikson, Goldthorpe & Portocarero (1979), which has become a popular tool in comparative stratification and mobility research. ISCO-68 also became the backbone of the first version of the International Socio-Economic Index [ISEI] of occupational status that was constructed by Ganzeboom, De Graaf & Treiman (1992).

In 1990 ILO released ISCO-88, which constituted a major revision of ISCO-68, both in logic and actual classification. Broadly speaking, like many national occupational classifications ISCO-68 mixed three different ingredients: skill level of work, product/industry and status-in-employment (managerial, supervisory, self-employed, irregular contract etc). ISCO-88 departed radically from this mix by purging the status-in-employment dimension. While ISCO-68 still had separate codes for working proprietors, independent workers and workgroup supervisors, for ISCO-88 it was argued that such characteristics could be combined with any content of work and should therefore be secured in separate variables, if researchers are interested in it. Instead, as the Introduction to the ISCO-88 manual (ILO, 1990) argued, occupations should be primarily classified by their skill level, which were defined by reference to the International Standard Classification of Education [ISCED]. As a

result, it can be argued that the 1988 revision the ISCO classification became less sociologically informed than its predecessor and also harder to use for the survey researcher, who has to code actual data and is frequently faced with responses like “shop owner”, “factory worker” and “foreman” that have no direct classification in ISCO-88. In many other respects ISCO-88 was an improvement, in particular by its greater detail, practical hierarchical digit system (see below) and informative manual. But whether in balance progress or not, the newer classification came into use in international survey research, and projects such as ISSP, and later PISA, IALS and ESS adopted it as their standard coding frame. Ganzeboom & Treiman (1996) renewed their earlier work by re-estimating an ISEI index on an international dataset that mostly contained detailed occupations codes in national classifications that were converted into ISCO-88. Note that at the time very few datasets already used ISCO-88 or ISCO-68 as their initial coding frame and that we were facing a different transition than we are now. Ganzeboom & Treiman (1996) circumvented the problem (like in the previous version) by converting national classifications into ISCO-88. Ganzeboom & Treiman (1996, 2003) also produced a derivation of SIOPS (which was a result of simple conversion) and of the EGP class categories. All three occupational status measures have been frequently used in comparative research with ISCO-88 coded datasets, not only in sociology, but also in epidemiology and education research. Later contributions adapted in particular the EGP socio-economic class scheme to local situations. Leijufsrud & Bison (XXREF) adapted the EGP construction for ESS data, and recently Rose & Harrison (2006, 2009) have proposed a European Socio-Economic Classification [ESEC] that is essentially a scaled-downed version of the EGP categories for European data coded in ISCO(com), which is a close relative to original ISCO-88.

The present article is aimed at adapting and improving the earlier work of Ganzeboom et al. (1992, 1996, 2003) for the two previous ISCO’s to the new ISCO-08. We present three status measures related to detailed ISCO-08:

- ISEI-08: A socio-economic status index, that is built on the same conceptual logic and methodological procedures as the original ISEI and national SEI scales: SEI scales tap social and economic resources that expedite status attainment in society.
- SIOPS-08: A standard international occupational prestige measure that is generated using a simple crosswalk from the original scale proposed by Treiman (1977) for ISCO-68.

- ISEC-08: A generalized 13-category socio-economic class scheme that contains EGP and ESEC as special cases.

COMPARISON OF ISCO-88 and ISCO-08

It is useful to introduce ISCO-08 in connection with its predecessor, ISCO-88. This is so because the classifications broadly use the same logic of classification, share about 50% identical (or renumbered) codes and of course also because researchers have become <vertrouwd> with ISCO-88. Like its predecessor, ISCO-08 is organized in a consistent hierarchical system of major, sub-major, minor and unit groups that correspond to the number of informative digits used to code an occupation or occupation group. A simple count of groups at these four levels of aggregation illustrates the changes numerically:

	ISCO-88	ISCO-08
Major	9	10
Sub-major	38	44
Minor	115	120
Unit	363	403
	520	570

In sum, at all levels the classification has become more detailed. However, the added detail is more pronounced at the minor and unit level than at the two more aggregated levels. If we assume that both classifications are somehow capable of coding all occupations (i.e. no new occupations have arisen), the transition can also be described in terms of mergers and splits. A *split* occurs when an ISCO-88 category is subdivided into two or more subcategories, a *merger* when one or more ISCO-88 categories are combined into one ISCO-08 category. However, the actual changes are more complicated than can be described by mergers and splits, as groups may also shift aggregation level (e.g. a minor group becomes a sub-major group), and mergers and splits may be combined in one category. With some reservations, the revision can be mapped like in Table 1a/b that show that there are more splits than mergers. There is a simple but important implication: when we try to create double coded datasets, it is easier to start coding ISCO-08 and then downgrade to ISCO-88 than the other way around!

Because there are both mergers and splits, there is no such thing as a simple conversion from one classification into the other, from neither side. We have still constructed such conversions, using the information on the ILO website, by choosing a *dominant* destination when a category was split. This choice of destination may involve a numerically most prevalent category, but sometimes a change of aggregation level was felt to be a better alternative.

The full ISCO-08 classification is reproduced in Appendix A, together with scores for the three[1] new status scales (to be introduced below). Before explaining how these scores were created, we discuss features of the new classification itself. The points of discussion are marked (red) in the Appendix. It is useful to organized the discussion by level of detail: major (1 digit) groups, sub-major (2 digit) groups, minor (3 digit) groups and unit (four-digit) groups.

Major groups

In order to understand and implement ISCO-08, the most important thing to do is to study the ten major groups, that are virtually identical to ISCO-88. The changes refer to the precise naming of categories 1000 and 5000, whereas category 0000 (Military) was not formally included (and rather: differentiated) in the previous version of ISCO. The major groups are the main way in which ISCO is aligned with level of education (there is no such alignment *within* these major groups!), but this refers only to groups 2000, 3000, 4000, 7000, 8000 and 9000. The alignment is less clear for group 5000, and does not apply at all to 1000 and 6000, that are distinguished on other grounds than typical skill level. In classifying and coding occupations it is of ultimate importance to get this first digit right, and this is what coding and classification should concentrate on (Ganzeboom, 2010).

Despite its nominal stability, there is still underlying change in the major group system. This occurs because sub-major groups, but in particular minor and unit groups have been partly swapped between major groups. The most dramatic instance of this is that Shop Keepers and Shop Supervisors are now classified in 5000, whereas they used to be with 1000. Another swap has been that farmers are now consistently grouped in major group 6000, whereas the

[1] For the time being, the Appendix only show the scores for ISEI.

previous classification allowed[2] to group independent farmers with 1000. Other swaps have occurred, but affect less numerous groups and will be less influential.

Sub-major groups

At the sub-major (two-digit) level the changes are more overt, as about 50% of them is affected by a change of name, a change of code or a change of contents. Some sub-major groups are upgraded from formerly minor groups; this is most conspicuously the case for 2500 (ICT professionals) and 3500 (Information and communications technicians). These two upgrades are <opgelegd> testimony to the tendency of ISCO-08 to reserve more space for all occupations that are somehow associated with information and communication technology. While this should be interpreted as a way of accommodating the classification to the changed division of labor in information / knowledge societies (a stated aim of the revision), the significance of this change should not be overestimated. In fact, corresponding minor groups did not only exist in ISCO-88, but also 40 years ago in ISCO-68 and the upgrade of these to a major group has little consequence for the applicability of the classification.

Rather more challenging changes of the sub-major group system occur inside major group 9000, where the major groups 9400 (Food preparation assistants), 9500 (Street and related sales and service workers) and 9600 (Refuse workers and other elementary workers) are new. None of these contain occupations that are in any sense new to the modern world. They are only new relative to the 1988 classification that was much broader in the definition of elementary occupations. This creates one major problem for our aims here, as one of these new sub-major groups is truly new and does not contain any minor or unit occupations that were distinguished as such in 1988: 9400 ((Food preparation assistants)). Consequently, we cannot estimate a plausible ISEI score for this sub-major group using ISCO-88 conversions. However, it turns out that these same occupations were explicitly distinguished in ISCO-68 and we will take recourse to the results from 40 years ago to come up with status measures for this category.

[2] In ISCO-88 self-employed farmers could be coded alternatively as 1311 (with General Managers) as 6100 (Skilled Agricultural Workers) and coding practices varied widely in this respect. The particular choice could be very influential, in particular when users restricted themselves to 2-digit coding.

A third important change in the sub-major group system refers to the management categories 1200 (Administrative and commercial managers), 1300 (Production and specialized services managers) and 1400 (Hospitality, retail and other services managers). To understand the changes, it is important to recall the differentiation in management categories that ISCO-88 defined. The 1988 classification distinguished first of all between managers (this includes working proprietors and entrepreneurs) who run a small organization (these were confusingly labeled '*General* Managers') and those who run a large organization ('*Corporate*' Managers), or a department in a large organization. The department managers were then distinguished into those who run a 'operation or production' department, i.e. are responsible for the core business of the organization, and those who run 'other' (=support) departments, such as sales, research & development, transport or finance. Conceptually, these distinctions were rather clear, but unfortunately the ISCO-88 manual specified that the distinction between large and small organizations was to be made by *number of managers*, which is rather impractical, since survey data never include this characteristic of organizations. It was hard in practice to distinguish, between say, transport department managers in large enterprises and operations managers in transport firms.

ISCO-08 has given up these distinctions altogether and has now resorted to a threefold distinction that appears to be more closely related to skill and authority level of the activity. Moreover, as already noted two large groups of mostly working proprietors have been explicitly relegated to other parts of the classification: the major group 1000 does no longer contain farming occupations (other than very large-scale agricultural entrepreneurs) nor shop-owners. In empirical data, these groups can be numerically very large, which implies that these changes can affect the major group system.

Minor groups

Changes relative to 1988 become even more visible at the minor group level, but we will only highlight them in as far as they are likely of sociological interest. Most of these changes involve renaming and/or a somewhat different ordering of unit groups with respect to minor groups. However, taken together this makes that a straight conversion of ISCO-88 into ISCO-08 cannot be done at the minor group level.

First, one of the most important modifications in ISCO-08 occurs at the minor group level, this is the definition of a new minor group 3120 (Engineering Production Supervisors) inside the major group 3000 Associate Professionals. This group would cover the familiar industrial foremen that were identified as Production Supervisors and General Foremen in ISCO-68, but were not explicitly referred to in ISCO-88. From a sociological point of view, the revival of this group after forty years is certainly a welcome move, but its place in 3000 Associate Professionals is somewhat odd, as their main status claim is not in professional expertise, but in authority. Note also that in other classifications (such as ISCO-68, but also EGP), this group is assigned to manual workers. The ISCO-08 conversion tables at the ILO website indeed stipulate that Production Supervisors must be split off from various skilled and semi-skilled manual occupations with which they were merged in ISCO-88. In practice, this definition is an invitation to take supervising status into account, when coding occupations into this category.

A related and potentially even more problematic insertion in 3000 Associate Professionals is the new minor group of 3130 Process Control Technicians that are further detailed into eight unit groups of Plant Controllers. The ILO description stipulates that these need to be split from Stationary Plant Operators who used to be classified in the 8000 major group and would then have been regarded as semi-skilled workers. At the same time, ISCO-08 maintains a category of Stationary Plant and Machine Operators (8100). The new distinction is thus between "machine *controllers*" and "machine *operators*", which suggest a difference both in expertise and authority. We fear that the distinction will be hard to make in practice. Note that ISCO-08 also contains a minor group 8210 Assemblers, which should be phrased Assembly Line Workers. However, these are again hard to distinguish from 9320 Manufacturing Laborers.

Unit groups

Finally, at the unit group level the changes are numerous. To begin with, some occupations are no longer distinguished. This includes Charcoal Burners, School Inspectors, Faith Healers and many detailed distinctions among industrial workers. Then there are many (more) newcomers, and these include next to a sizable number of ICT related occupations (such as Web Technicians and ICT Trainers), a rather surprising amount of occupations that have certainly not newly emerged. Some examples are Chef (a 'Culinary Associate Professional'), Service Station Attendant, Office Supervisor, Payroll Clerks, Pet Groomers, Bicycle Repairers, Kitchen Helpers, Shelf Fillers, and Water & Firewood Collectors. It is again rather

striking that many of these occupations did occur in some form in ISCO-68 and had disappeared in ISCO-88. While none of the introductory ILO documents says this, it is clear that the revision of ISCO has also been used to repair problems with ISCO-88 and the way around these problems has often been to relapse to the classification of 40 years ago!

From a sociological point of view this restoration tendency is more than welcome, not only because it will make the classification more flexible to code older data (e.g. data on parents), but also because it allows us to use results on databases with ISCO-68 occupations to estimate status scores for the 2008 classification.

CONSTRUCTING THE THREE OCCUPATIONAL STATUS MEASURES

ISEI-08

An SEI scale of occupational status can be defined as an optimal scaling of occupations in the context of a status attainment process, i.e. the how education, occupation and earnings are obtained. Various procedures have been used to obtain such a scaling. Ganzeboom et al. (1992) implemented a scaling procedure within a MIMIC model:

(MIMIC model)

In this procedure occupations arise as detailed categories that are scaled in such a way that the *direct* effect of education on earnings is minimal, and consequently the *indirect* effect, via occupation, becomes maximal. In other words, occupational status is conceptualized and measured as the mechanism that converts educational credentials into earnings. De Leeuw (1992) adapted a simple alternating least-squares algorithm to obtain the optimal scale values for this model. Ganzeboom et al. (1992) applied this to an international dataset of 71.000 working men in 17 countries using 2xx different occupational unit groups. In their validation excercises these authors showed that for American data the ISEI scale was essentially identical to the familiar Duncan SEI scale and outperformed local SEI scales in four other countries. Similar results were obtained in the 1996 repeat for ISCO-88 (Ganzeboom & Treiman, 1996).

The dataset we use to estimate the ISEI scores is taken from the combined 2002-2007 rounds of the International Social Survey Programme [ISSP] and brings together detailed occupation data with education and earnings data from 198000 men and women in over 42 countries (see Table 2). This dataset was preferred over the datasets used by Ganzeboom et al. (1992, 1996) for a number of reasons. First, the ISSP dataset is larger and refers to fairly recent data. Second, the ISSP dataset is more varied with respect to global coverage and therefore better representative in a conceptual sense. Third, most ISSP data were coded directly into the ISCO classification, whereas the ISMF database required a conversion of national codes into ISCO. While we will not discuss results separately for countries and/or rounds, we have been sensitive throughout our analysis to diagnose problems in the variables in the underlying national files, but have not found a major one. The only minor problem we encountered that not all ISSP countries have coded the ISCO occupations to the same level of detail, but that does not affect our results, because we estimate the ISEI values first at the most detailed unit and minor group levels, then at the less detailed levels. Like Ganzeboom et al. (1992), we choose N=21 as the lower cut-off point to estimate a separate ISEI-value at the group level. If a group was represented by less than 21 persons, we assigned the score of the next hierarchical level or merged with a neighboring category.

A major difference in design with the existing constructions is that we include men and women, while the previous authors used only data on men. Some users of ISEI have expressed concerns about applying a 'male' scale to women, like Ganzeboom et al. (1992) recommend. Ganzeboom et al.'s argument was that an ISEI scale estimated on men and women combined would have a tendency to downplay the earnings differences between men and women, as in combined data these become built into the occupational status score. We think this argument is still valid, but have chosen to include women for different reasons. First, it simply enlarges the available data, which is important to obtain stable estimates. Second, excluding women makes it particularly hard to estimate ISEI scores for female dominated occupations -- such as nurses and pre-primary teachers -- as the values then refer to the rare men who work in these occupations and maybe atypical for the category to begin with. Of course, it needs to be acknowledged that this choice has changed the nature of ISEI: some female dominated occupations have now lower scores than in 1988, which derives partly from the fact that women receive less remuneration for the same occupation as men. We will show that this hardly affects the capability of the measure to detect pay differentials between men and women.

Education in the ISSP is measured by two cross-national comparable indicators: the level of education (DEGREE) and its duration (EDUYRS). In some ISSP studies, the duration measure is not obtained by independent measurement, but is a recode from a country-specific education variable. We combined the two measures after standardizing them within each country/round combination.

Personal incomes in ISSP are in local currency. We made these comparable between files by dividing by the mean within each country/round combination (which expresses each income as a ratio) and than take the natural log (to revert to an additive metric). If personal income was missing, we replaced it by log of household income relative to its mean. We then corrected for hours worked by regressing log-earnings on HOURS and taking the residual. The result was Z-standardized within each separate study, like the education measure.

The actual estimation was done using the same simple algorithm described by De Leeuw (1992). This involves finding a relative weight for (standardized) education and earning, such that the direct effect of education on earnings in minimized. This minimum was found at the .38/.62 weight for education and income respectively. The resulting index was then projected onto a 10..90 range using linear transformation. The resulting variable has almost the same mean and standard deviation as the ISEI scores that were derived by Ganzeboom et al. (1996) and correlates 0.92 with them in the ISSP dataset. Note that we can calculate this correlation because the new ISEI is also a new version of an ISEI measure developed for ISCO-88 codes.

SIOPS-08

The ISEI scale has the advantage of being a detailed and a simple one-dimensional hierarchy that has shown great predictive power in a range of diverse situations. Conceptually, the MIMIC model provides a lucid interpretation of what occupational status is. Nevertheless, users have sometimes been skeptical about the conceptual circularity that arises when ISEI is used to analyze status attainment patterns and prefer status measures that are generated by procedures that are independent of the status attainment process. This need is satisfied by prestige measures, that refer to judgments by the general population and socio-economic class categories that are derived on a priori grounds.

While similar to SEI scales as being a continuous measure of occupational status, prestige scales refer to the popular evaluation of the general attractiveness of occupations. Typically, in prestige research a representative or selected panel is asked to judge a large number of occupations involving some ranking or rating procedures. Such scales are in existence for a large number of countries and relatively easy to generate, as a small number of judges suffices to produce a reliable scale. Some 60 of such national scales were integrated into SIOPS by Treiman (1977). Despite early criticisms this scale has been much applied in comparative research. The criticism can best be summarized by Hodge's (1981) conclusion that XX "prestige is great concept, but it does not work well in practice". In order to generalize Treiman's SIOPS scale for ISCO-08, we use a straight conversion from the 1968 (!) classification into ISCO-08. Note that the construction of SIOPS-08 is not as data-dependent as the construction of ISEI. In principle, transferring SIOPS-68 codes to the new classification is an analytical operation at the most detailed level. However, to generate codes at more aggregated levels, we need weights and these have to come from a representative dataset. We used for this the original dataset used by Ganzeboom, de Graaf & Treiman (1992) to construct the first ISEI measure to derive these weights as it was organized the ISCO-68 classification.

The resulting scores are also displayed in Appendix A. In the ISSP 2002-2007 dataset, the two measures correlate 0.82. To explore differences it may be more useful relate the differences in scalings by sub-major groups as they are portrayed in Figure 3 and Table 4. The relationships should be familiar to the student of stratification versed in occupational measurement. SIOPS differs in particular from ISEI in the placement of farmers, who enjoy moderate prestige, but very low socio-economic status, as well as some female-dominated groups that have the same combinations. We will assess the consequences of these differences between SIOPS and ISEI further in the validation section below.

ISEC-08

Finally, we present a generalized version of the EGP class categories, newly baptized as the International Socio-Economic Class [ISEC-08] categories. ISEC-08 distinguishes 13 categories:

ISEC

XXX TO BE FINISHED

Constructing a socio-economic class measure is exclusively an analytical procedure. Empirical data are not used to inform the categories, although such data can be used to test the validity of the scheme. Furthermore, it is important to understand, that unlike ISEI and SIOPS, ISEC does not only use occupational categories to define the class scheme, but combines these with a status-in-employment measure. Like EGP / ESEC, the status in employment measures needed to construct ISEC should be able to distinguish (A) between self-employed and salaried workers, and (B) between workers with no, lower and higher supervisory status, which is in practice defined by the number of subordinates: lower supervisors supervise between 2 and 10 subordinates, while someone who supervised 10 subordinates or more, is a high level supervisor.

The newly proposed ISEC scheme is a generalization of the earlier schemes and contains both ESEC (nine categories) and EGP (11 categories) as special cases, as well as the various aggregations to fewer categories that are in fact more often used than the original schemes. Relative to both EGP and ESEC, we introduce the distinction between managerial and professional work in the two highest ranked categories, which broadly coincides with occupation in major groups 1000 and 2000 in ISCO-08. We feel that making this distinction is long overdue, as research has amply shown (and we will further illustrate below) that professionals and managers are separate groups in terms of social mobility and status attainment, as well as work conditions and political orientation. In addition, it has been a problem in the past that class I and II in the EGP scheme are hard to separate and together constitute a very large fraction of the labor force.

Relative to ESEC, ISEC reintroduces Farm Workers as a separate category and does not merge these with Unskilled Workers. As we will show, farm workers are very different from other Unskilled Workers, as well as from Self-Employed Farmers with whom they have also

been merged in previous research. We feel that the importance of these distinctions is rather self-evident[3], but will illustrate them further below.

The actual construction of ISEC-08 categories from ISCO-08 codes follows the same logic as used by Ganzeboom et al. (1992, 1996) for the EGP scheme. The occupation are first sorted into a initial group (also displayed in Appendix A), which is then cross-classified with an employment status variable, that makes the following five distinction:

Salaried workers, no supervising task
Salaried workers, small-scale supervision task
Self-employed workers, no employees
Self-employed workers, few employees
Salaried of self-employed workers, many subordinates

Employment status is then taken into account to adjust the initial groups into the final class scheme. This implies that workers can end up in some ISEC categories in two ways, either by the initial recode, or by the upgrading step. E.g. manual supervisors may have been directly classified in ISCO-08, or be persons who were originally classified as manual workers, but are regarded as manual supervisors because they claim supervising task. Similar procedures are responsible for defining self-employed farmers versus farm workers, small-self employed (and their differentiation in own account workers and small employers), etc.

The validity of the ISEC socio-economic class scheme is thus very dependent upon the quality of the employment status variables in the data at hand. If these variables are imperfectly measured or partly omitted, as scaled down version of ISEC still is generated, but the research should be careful in using a detailed version of the scheme. We also not that like EGP en ESEC, ISEC is a non-linear combination of the underlying variables, which makes measurement error in the underlying variables hard to trace.

[3] It is odd that ESEC does not distinguish farm laborers as a separate group. In some European countries, both farmers and farm laborers are rather small groups, but this is certainly not the case in all European countries. We note that a similar problem gave rise to the revision of Goldthorpe's (1980) British class scheme into the EGP class scheme by Erikson, Goldthorpe & Portocarero (1979).

VALIDATION ON CONVERTED DATA

Are the new measures of occupational status valid representation of occupational stratification? In order to test their validity, we make a comparison with each other and earlier measures. Again, we need to stress that we do not have an optimal test database at hand. Ideally, this should be a large and internationally representative database, in which occupations are coded in both ISCO-88 and ISCO-08 (and for testing SIOPS-08: ISCO-68). Lacking such a database, we take recourse to another large and high-quality database that is coded in ISCO-88: the combined European Social Surveys of Round 1, 2, 3 and 4 (2002-2008). While the ESS naturally restricts itself to European space, it covers a large number of countries with very different social systems. Not only the size and quality of the ESS make it a good test case to compare old and new status measures, another particular advantage of this database is that it contains two independently measured occupations: that of respondent and spouse. While it is no doubt reasonable to take other criteria into account for the test (and we will), the most obvious way to test the validity of an occupational variable is of course with *another* occupation, such as arises in studies of intergenerational occupational mobility, or in this case occupational homogamy. We take an explicit comparative point of view: validity cannot be determined as a stand-alone issue, but is best by decided by comparing alternative status indicators of the same occupation.

For ISEI, we estimate an elementary status attainment model (Figure 5) that analyzes the relationship between the education of the two spouses, their occupations and their common household income[4]. We estimate structural relationships between the variables using a simultaneous equation model, as this will provide us immediately with a comparative indicator of measurement quality. We compare the newly derived measure ISEI-08 after converting the ISCO-88 codes into ISCO-08, with a measure that derived the existing ISEI-88 directly from ISCO-88. Education and income are treated in much the same way as we did with ISSP. For education we used the international standard variables EDULVL and EDULVLP that classify all educations by ISCED in seven categories; a comparative measure of household income was calculated as log of incomes (expressed in local currency) divided by their within sample means. We restrict the analysis to couples with two working spouse. While this design severely restricts the N of available cases, it makes for a model that is fully

[4] ESS does not contain a direct measure of personal income.

symmetric between spouses: we can therefore use equality constraints to obtain more powerful estimates. In effect, what we loose by dropping respondents with valid occupations but no employed spouse, we gain by taking spouse's data into account without consuming any degrees of freedom.

Table 6 gives the correlation matrix generated under this design. Before going to a model it is worthwhile to study the plain correlations and observe that the new ISEI does certainly just as well as the old one. In general, we see higher correlation with the other variables, and most conspicuously this is the case for the homogamy correlation. The obvious explanation for this pattern is that the new ISEI is a (slightly) better measure of occupational status than the old one. A LISREL model (Table 7) brings out directly the difference in its measurement loadings that turn out to be 0.971 for ISEI-08 and 0.941 for ISEI-88. If tested (using constraints), it turns out that the difference is statistically significant, but also that the measurement coefficient for ISEI-08 is significantly different from 1.00. There is an important interpretation to this latter finding. As our ISCO-08 codes are recodes from ISCO-88 and in this sense cannot contain any new information, the better measurement quality results from improvement of the ISEI scale itself. This being so, the difference of the measurement coefficient from 1.0 can be interpreted as generated by the loss of information incurred when converting detailed ISCO-88 into detailed ISCO-08. While statistically significant, a 3% loss seems rather small.

A validation of SIOPS-08 proceeds along similar lines. SIOPS-08 is derived from ISCO-08 that is converted from the ISCO-88 codes. A most proper comparison would be with data coded in ISCO-68, but this is not available. However, we can compare with the SIOPS version proposed by Ganzeboom et al. for ISCO-88. Note that these two measures are not identical, because the SIOPS score for 2008 were derived by comparing ISCO-08 directly to ISCO-68 and thus profits of some of the occupations revived in the new classification (XX). Table X-b gives the correlation matrix implied by these measures. Again we see that the new SIOPS correlates more strongly with criterion variables than the old measure, and is thus a slightly better measure. However, we also see that the correlations are generally weaker than for ISEI, also between the spouses' occupations, which confirms conclusions from much other research that occupational prestige measures are weaker indicators of occupational stratification than SEI scores.

Finally, we use the ESS data again for studying the validity of the new ISEC classification, which we compare to the ESEC measure proposed by Rose and Harrison (2006, 2009) as well as the EGP derivation as given by Ganzeboom et al. (1996). We now concentrate on the occupational homogamy patterns, which are modeled with the often-used Goodman row-column association model II with equal scalings. There are two issues at stake here: one is whether the new classification performs better or worse than the old ones, and another whether the newly added differentiation between managers and professionals adds to our understanding of occupational homogamy patterns. Table XX gives first the marginal distributions of the three measures, that we have averaged over the two spouses. The next part gives the scalings and diagonal coefficients obtained under the RC-II model with fitted diagonals. As the association is expressed in multiple parameters, the comparison between representations is complex and may not go unequivocally in the same direction. The patterns to look for are: (A) separated scaling parameters, (B) a higher scaled association coefficient, and (C) higher diagonal coefficients.

XXX

VALIDATION ON DOUBLE CODED DATA (XX NOT FINISHED XX)

In this section we present a similar validation exercise as before on data that were double coded, in ISCO-88 and ISCO-08. The data refer to Round 4 of the ESS as they were collected in the Netherlands. Having access to the original strings that describe the occupations, we first ran the conversion from ISCO-88 to ISCO-08 and then reviewed all occupations from the perspective of the new classification, in particular by concentrating on all the possible splits. The original ISCO-88 coding was created by the agency (GfK) that fields the ESS in the Netherlands and are identical to the codes available from the ESS data archive. As the data are restricted to the Netherlands, we are able to take into account also father's and mother's occupations – the ISCO-88 coding is a country-specific variable in ESS. Altogether we have reviewed over 6000 occupations, of which about half are affected by possible splits. The comparison in Table X.x is between ISEI-88 and ISEI-08, now taking into account respondents, spouses, fathers, mothers, as well as the education of all these actors, and the household income produced by respondent and spouse. The SEM model has two parallel indicators for each occupation, of which the relative size is of our primary interest. Furthermore, we are interesting in correlated residuals among similar indicators across

occupation, which would indicate systematic bias. The relevant correlations are reproduced in Table XX.x and the model parameters given in Table XX.b. The results are very similar to the validation exercise for the Europe-wide converted data: ISEI-08 is a somewhat sharper measurement tool than its predecessor and there is little to no indication that either ISEI-08 and ISEI-88 have a unique content that is correlated across occupations.

Interestingly, the double coded Dutch sample offers an opportunity to separate the differences in measurement quality into a component that refers to increase quality of coding, which includes but is not identical to using ISCO-08 rather than ISCO-88, and a component that refers to the use of the ISEI-08 versus ISEI-88. To make this comparison, we include a third indicator of ISEI, one that applies ISEI-08 to ISCO-88 codes. Note that the difference in measurement quality is not only due to the use of a newer occupational status scale, but also to the quality of coding procedures that were used to generate the ISCO-88 codes for the ESS-NL file and the coding procedures that were used to generate the ISCO-08 codes. Whatever the source of the differences, they speak in favor of the new measures, as the measurement loadings for ISEI-08 are again marginally larger than for ISEI-88. The result for ISEI-08 as applied to ISCO-88 codes are closer to the old measure than to the new measure, which suggests that the major source of improvement is either in the use of the new classification, or in the use of better coding procedures.

Validation for SIOPS-08: XX

Validation for ISEC-08: XX.

CONCLUSIONS

The major conclusions from our review of the new ISCO-08 classification and the derivation of the three new status measures ISEI-08, SIOPS-08 and ISEC-08 can be summarized as follows:

- While conceptually the transition from ISCO-88 to ISCO-08 may be a minor one -- as intended by the International Conference of Labour Statisticians and the ILO --, there are a few major changes and many smaller ones. The sociologically most important changes

refer to the differences of coding farmers and shop-keepers, as well as the reintroduction of production supervisors in the classification.

- While ISCO-08 has been announced as a revision to upkeep with modern technological developments, it is in fact more adequate to characterize the revision as a repair of problems that occurred in ISCO-88 and the solution has in many instances been to relapse to the grandfather of the new classification, ISCO-68.
- There is no simple conversion (cross-walk) possible between ISCO-88 and ISCO-08. The impossibility of this conversion is the very reason why a new classification needs to be introduced. While such conversions (and double coding) can ultimately not been accomplished without recurring to the origin verbatim descriptions, we have created and used tools that do the job without much loss of information. These tools are available to other users.
- It is important to note that conversion works better if it is done at a more detailed level. This runs counter to impressions that novice users may have that there is much more similarity between ISCO-88 and ISCO-08 at the major and sub-major level than at the detailed levels.
- We have created three status measures for the new classification using conversion and have shown that these new measures work adequately, of not better than their existing counterparts for ISCO-88. In a SEM model with double indicators, ISEI-08 outperforms its predecessor by about 3%. A similar increase in measurement quality does not arise for SIOPS-08, and at the same time we find that SIOPS is inferior to ISEI in representing the status attainment process. Finally, we have introduced a socio-economic class scheme that generalizes EGP and ESEC, but provides more detailed distinctions, in particular by separating managerial and professional work (which largely corresponds to a major group division in ISCO). ISEC-08 performed better than it counterparts in the validation procedures.

The tools used in our procedures are available online to other users. We believe that until large scale detailed and international occupational data with appropriate criterion variables will become available, these status measures will be adequate for social research.

Table 1a: Splits that occurred to occupation codes when transferring ISCO-88 into ISCO-08, by number of digits of ISCO-88

	SPLITS						Total
DIGIT88	1	2	3	4	5	5+	
1	10						10
2	24	1	3				28
3	92	14	7	1		1	115
4	274	56	21	4	1	7	363
Total	400	71	31	5	1	8	516

Table 1b: Splits that occurred to occupation codes when transferring ISCO-88 into ISCO-08, by number of digits of ISCO-88

	SPLITS						Total
DIGIT88	1	2	3	4	5	5+	
1	10						10
2	24	1	3				28
3	92	14	7	1		1	115
4	274	56	21	4	1	7	363
Total	400	71	31	5	1	8	516

Table 2: Representation of countries in ISSP Rounds 2002-2007. Men and women with valid education, occupation and income data.

	2002	2003	2004	2005	2006	2007	2002
1 ARG						1299	1299
2 AUS	867	1853	1651	1691	2380	2305	10747
3 AUT	803	719	719			715	2956
4 BEF	936		1167	1135		1054	4292
5 BRA	781		793				1574
6 BUL	847	771	801	801		572	3792
7 CAN	0	750	750	708	708		2916
8 CHL	790	695	991		1059	1022	4557
9 CRO					710	710	1420
10 CYP	752		722	693		790	2957
11 CZR	969	864	1172	854	835	743	5437
12 DEN	1151	1196	1079	1258	1208		5892
13 DOM				1226	1645	1491	4362
14 ENG	1783	777	759	812	804	786	5721
15 FIN	835	1010	928	988	924	1028	5713
16 FRA	1595	838	1151	1079	1489	1717	7869
17 GER	1065	1034	1075	1284	1254	1317	7029
18 HUN	821	769	792	672	793	752	4599
19 IRE	587	831	831	805	804	1011	4869
20 ISR	878	855	832	821	923	923	5232
21 JAP	537	490	633	404	638	633	3335
22 KOR		1005	1109	1368	1406	1229	6117
23 LAT	568	568	775	866	722	722	4221
24 MEX	622		608	694		687	2611
25 NET	879		1543	748	866	742	4778
26 NIR	579						579
27 NOR	1269	1257	1195	1086	1148	959	6914
28 NZE	616	661	892	1013	816	822	4820
29 PHI	800	878	798	840	903	874	5093
30 POL	1048	1015	1015		1044	1044	5166
31 POR	714	1143	1143	1113	1113		5226
32 RUS	711	2033	802	1239	2017	1754	8556
33 SAF		733	1000	827		1327	3887
34 SLN	665	681	633	442	539	551	3511
35 SLO	927	702	545			872	3046
36 SPA	1305	606	1314	595	1655		5475
37 SWE	848	922	1051	1141	1028	1105	6095
38 SWI	668	830	899	899	773	773	4842
39 TAI	1393	1528	1332	1571	1705	1480	9009
40 URU		1004	1004		895	1260	4163
41 USA	1056	1083	1277	1257	1257	1359	7289
42 VEN		503	503		656		1662
	30665	30604	36284	30930	34717	36428	199628

Figure 3: SIOPS-08 by ISEI-08. sub-major groups in ISCO-08

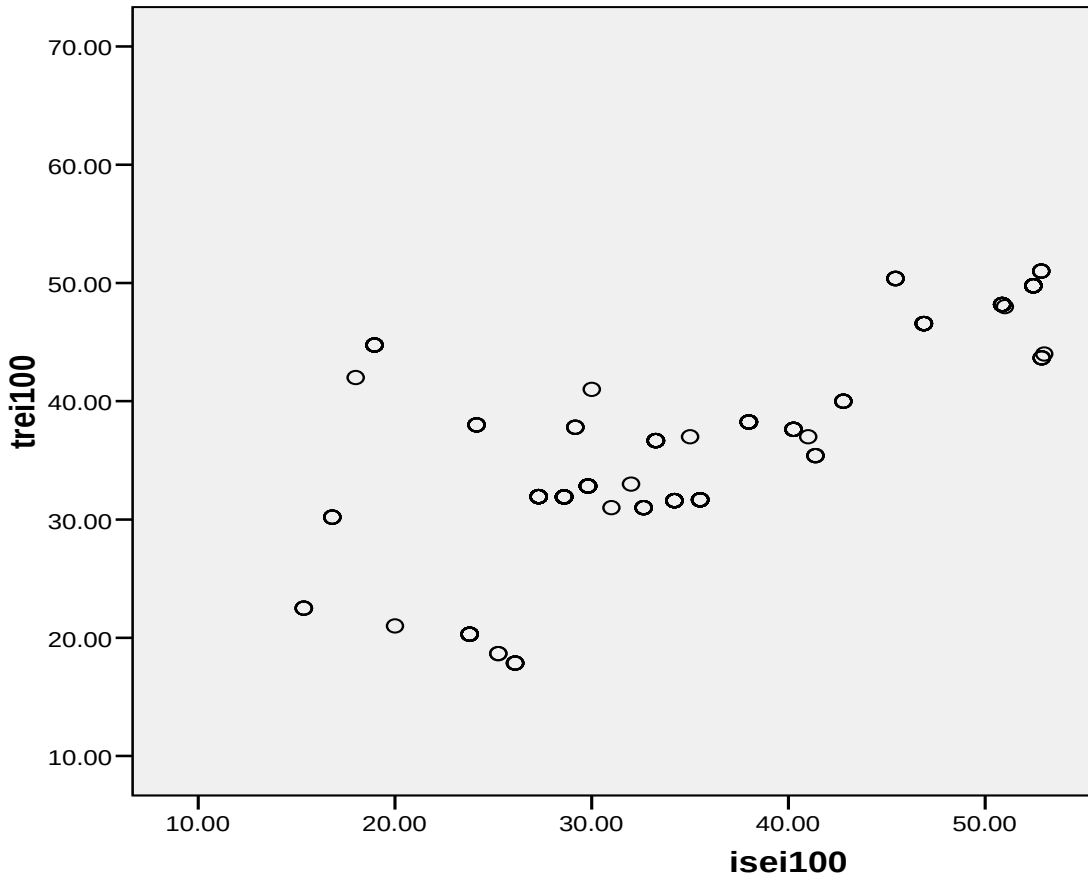

Table 4: ISEI-08 and SIOPS-08 for sub-major groups in ISCO-08

		ISEI-08	SIOPS-08
0100	Commissioned armed forces officers	65	41
0200	Non-commissioned armed forces officers	53	44
0300	Armed forces occupations, other ranks	30	41
1000	Managers	62	51
1100	Chief executives, senior officials and legislators	69	64
1200	Administrative and commercial managers	68	56
1300	Production and specialized services managers	60	60
1400	Hospitality, retail and other services managers	53	44
2000	Professionals	65	63
2100	Science and engineering professionals	70	63
2200	Health professionals	66	63
2300	Teaching professionals	63	62
2400	Business and administration professionals	64	58
2500	ICT professionals	69	51
2600	Legal, social and cultural professionals	66	60
3000	Technicians and associate professionals	51	48

3100	Science and engineering associate professionals	51	47
3200	Health associate professionals	47	45
3300	Business and administration associate professionals	52	48
3400	Legal, social, cultural and related associate professionals	45	53
3500	Information and communications technicians	53	53
4000	Clerical support workers	41	37
4100	General and keyboard clerks	41	35
4200	Customer services clerks	40	38
4300	Numerical and material recording clerks	43	37
4400	Other clerical support workers	39	37
5000	Service and sales workers	31	31
5100	Personal service workers	30	35
5200	Sales workers	33	32
5300	Personal care workers	26	32
5400	Protective services workers	39	32
6000	Skilled agricultural, forestry and fishery workers	18	42
6100	Market-oriented skilled agricultural workers	19	46
6200	Market-oriented skilled forestry, fishery, hunting wrkrs	24	38
6300	Subsistence farmers, fishers, hunters and gatherers	10	42
7000	Craft ar trades wrkrs	35	37
7100	Building ar trades wrkrs, excluding electricians	34	34
7200	Metal, machinery ar trades wrkrs	38	39
7300	Handicraft and printing workers	33	38
7400	Electrical and electronic trades workers	43	41
7500	Food processing, wood working, garment ar craft-trades wrks	27	33
8000	Plant and machine operators, and assemblers	32	33
8100	Stationary plant and machine operators	29	32
8200	Assemblers	29	37
8300	Drivers and mobile plant operators	36	31
9000	Elementary occupations	20	21
9100	Cleaners and helpers	17	24
9200	Agricultural, forestry and fishery labourers	15	22
9300	Labourers mining, construction, manufactur & transport	24	20
9400		lsei68	siops68
9500	Street and related sales and service workers	25	20
9600	Refuse workers and other elementary workers	26	20

Figure 5: Validation model

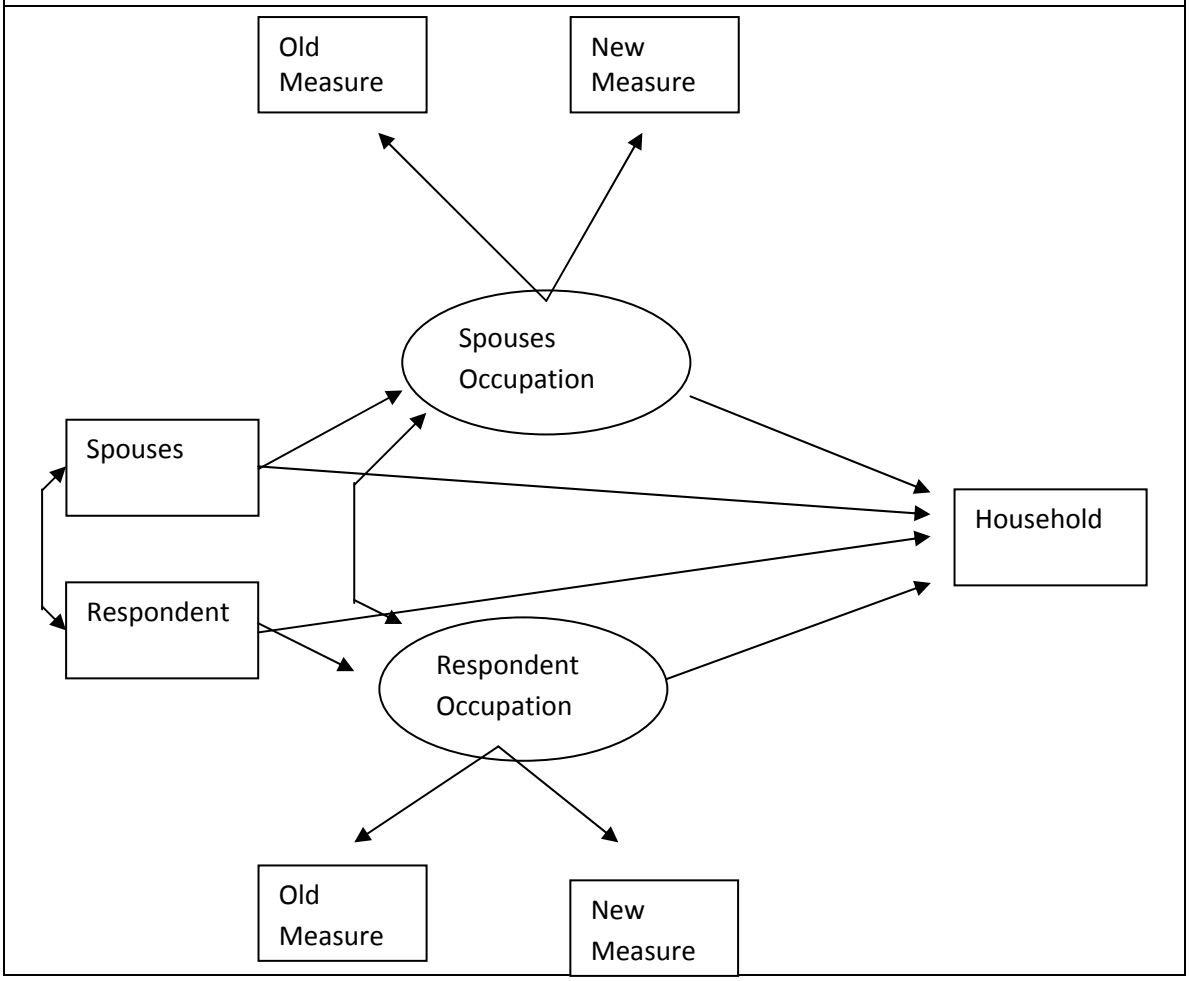

Table 6: Correlation matrix analyzed in the validation model, ESS Rounds 1 2 3 4, N=51145, listwise deletion of missing values.

REDUC	SEDUC	RISEI1	RISEI2	RISEI3	SISEI1	SISEI2	SISEI3	HHINC
1.0000	0.5689	0.5768	0.6069	0.6008	0.4097	0.4277	0.4253	0.3134
0.5689	1.0000	0.3996	0.4248	0.4225	0.5810	0.6031	0.5958	0.2922
0.5768	0.3996	1.0000	0.9114	0.9104	0.4100	0.4143	0.4125	0.3234
0.6069	0.4248	0.9114	1.0000	0.9858	0.4228	0.4283	0.4234	0.3435
0.6008	0.4225	0.9104	0.9858	1.0000	0.4202	0.4224	0.4207	0.3451
0.4097	0.5810	0.4100	0.4228	0.4202	1.0000	0.9176	0.9167	0.3211
0.4277	0.6031	0.4143	0.4283	0.4224	0.9176	1.0000	0.9867	0.3258
0.4253	0.5958	0.4125	0.4234	0.4207	0.9167	0.9867	1.0000	0.3269
0.3134	0.2922	0.3234	0.3435	0.3451	0.3211	0.3258	0.3269	1.0000

RISEI1 and SISEI1 are measured in ISEI-88
RISEI2 and SISEI2 are measured in ISEI-08 applied to ISCO-88
RISEI3 and SISEI3 are measured in ISEI-08 applied to ISCO-08

Table 7: Structural and measurement coefficients in the validation model, ESS R1234. N=51117. Two measures of occupational status.

	ISEI	**SIOPS**		
	SOCC	**SOCC**		
REDUC	0.129	0.112		
SEDUC	0.541	0.521		
R2	38.9%	35.1%		
	ROCC	**ROCC**		
REDUC	0.550	0.534		
SEDUC	0.120	0.104		
R2	39.1%	36.0%		
	HINC	**HINC**		
REDUC	0.086	0.118		
SEDUC	0.046	0.072		
ROCC	0.196	0.155		
SOCC	0.184	0.164		
R2	17.1%	15.5%		
Old measure	0.941	0.964		
New measure	0.971	0.933		
ROCC-SOCC	0.452	0.412		

References

De Leeuw, Jan (1992) “Appendix”.

Erikson, Robert, Goldthorpe, John H. and Portocarero, Lucienne. 1979. “Intergenerational Class Mobility in Three Western European Societies: England, France and Sweden” *British Journal of Sociology 30 (3): 415-441*.

Ganzeboom, Harry B.G.; De Graaf, Paul; Treiman, Donald J.; (with De Leeuw, Jan) (1992). "A Standard International Socio-Economic Index of Occupational Status", *Social Science Research* (21-1), pp. 1-56.

Ganzeboom, Harry B.G., Luijkx, Ruud; Treiman, Donald J. (1989). "Intergenerational Class Mobility in Comparative Perspective", *Research in Social Stratification and Mobility* (8), pp. 3-79.

Ganzeboom, Harry B.G.; Treiman, Donald J. (1996). "Internationally Comparable Measures of Occupational Status for the 1988 International Standard Classification of Occupations". *Social Science Research* (25), pp. 201-239.

Ganzeboom, Harry B.G.; Luijkx, R. (2004). “More Recent Trends in Intergenerational Occupational Class Reproduction in the Netherlands 1970-2004. Evidence from an Expanded Database.” *Netherlands Journal of Social Sciences* (40,2) pp. 114-142.

Ganzeboom, Harry B.G.; Treiman, Donald J. (2003). "Three Internationally Standardised Measures for Comparative Research on Occupational Status." Pp. 159-193 in Jürgen H.P. Hoffmeyer-Zlotnik & Christof Wolf (Eds.), *Advances in Cross-National Comparison. A European Working Book for Demographic and Socio-Economic Variables.* New York: Kluwer Academic Press.

Goldthorpe, John H. 1980. *Social Mobility and Class Structure in Modern Britain.* (with the assistance of Llewellyn, C. and Payne, C.) Oxford: Clarendon Press.

Güveli, Ayse. 2006. *New Social Classes within the Service Class in the Netherlands and Britain: Adjusting the EGP Class Schema for the Technocrats and the Social and Cultural Specialists*. Nijmegen: PhD Dissertation Radboud University.

Harrison, Eric & David Rose (2006). *“The European Socio-economic Classification (ESeC) User Guide.”* Colchester UK: Institute for Social and Economic Research.

Hodge, R. W. (1981). "The measurement of occupational status." *Social Science Research* **10**: 396-415.

Rose, David & Eric Harrison (Eds.) (2010). *“Social Class in Europe. An introduction to the European Socio-economic Classification.”* Oxford: Routledge.

Treas, J. and A. Tyree (1979). "Prestige versus socioeconomic status in the attainment processes of American men and women." *Social Science Research* **8**(3): 201-221.

Treiman, D. J. (1975). "Problems of concept and measurement in the comparative study of occupational mobility." *Social Science Research* **4**(3): 183-230.

Treiman, D. J. (1977). *Occupational prestige in comparative perspective.* New York, Academic Press.

Internet links

Ganzeboom, Harry B.G. (2010) “Do’s and Don’ts of Occupation Coding”. ***link***

Ganzeboom, Harry (2010). “Tools for deriving occupational status measures from ISCO-08 with interpretative notes to ISCO-08.” ***link***

ILO (International Labour Organization). “ISCO. International Standard Classification of Occupation).” ***link***

EU Commission, (2009). “Recommendation of 29 October 2009 on the use of the International Standard Classification of Occupations (ISCO-08). [with translations of ISCO-08 in 23 EU languages].” *Official Journal of the European Union*, Vol. 52/L292, November 10 2009. ***link***