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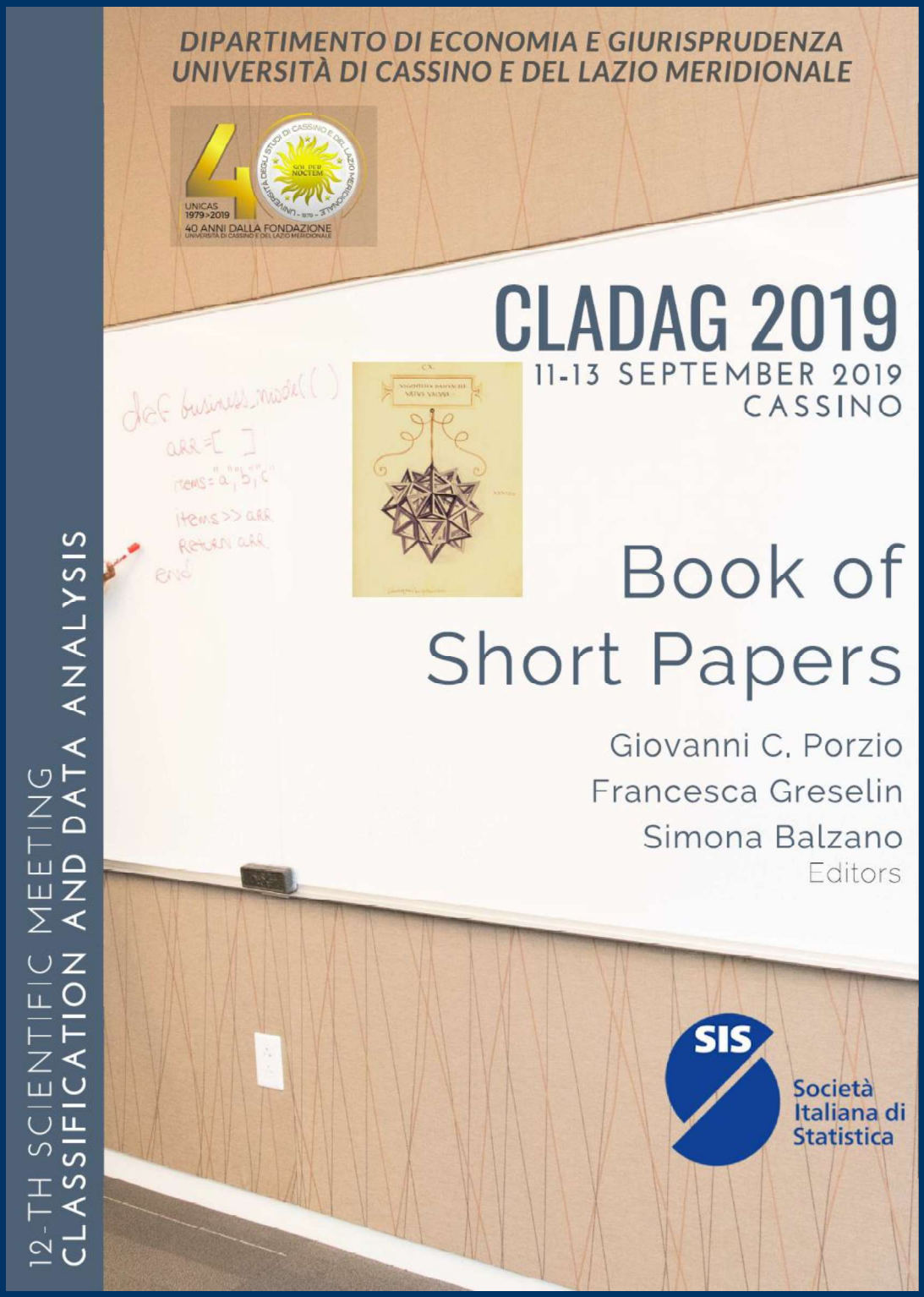

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Giovanni C. Porzio

Francesca Greselin

Simona Balzano

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A NEW PROPOSAL FOR BUILDING IMMIGRANT INTEGRATION COMPOSITE INDICATOR

Venera Tomaselli[1], Mario Fordellone[2] and Maurizio Vichi[2]

[1] Department of Political and Social Sciences, University of Catania,
(e-mail: venera.tomaselli@unict.it)

[2] Department of Statistical Sciences, Sapienza University of Rome,
(e-mail: mario.fordellone@uniroma1.it, maurizio.vichi@uniroma1.it)

ABSTRACT: Integration consists in a multidimensional process, which can take place in different ways and in different times in relation to each single economic, social, cultural, and political dimension. In this paper, we aim at providing a methodological proposal based on PLS-SEM to build a composite immigrant integration indicator.

KEYWORDS: partial least squares, immigrant integration, composite indicator, structural equation modelling.

1 Measuring immigrant integration

Integration consists in a multidimensional process, which can take place in different ways and in different times in relation to each single economic, social, cultural, and political dimension. It aims at pursuing mutual respect of ethno-cultural differences and peaceful coexistence among populations within a historical and social reality. Its goal cannot be reached once for all but must be continuously pursued distinguishing different integration processes at economic, cultural, social, and political level. A high economic integration level may be quickly achieved, indeed, along with scarce or no social or political integration. Each single dimension, diachronically positioned over time, generates different integration levels. Hence, examining each single dimension is important as well as building composite indexes simultaneously comprehensive of all dimensions in order to obtain a full description of a complex phenomenon and to convey a suitable set of information.

According to the literature (Entzinger, 2000), the concept of integration can be broken down into different dimensions. Firstly, the socio-economic dimension refers to housing conditions, work conditions and income. Including mostly the theme of citizenship, also the legal-political dimension takes into account two sub-dimensions. The other sub-dimension concerns the rights of political participation - from the freedom of association to the voting right - which in some countries can be used at local government elections even without having achieved the citizenship status of the host country. Finally, the cultural and social dimension considers

several elements, among which knowledge of the Italian language, free times activities and access to information.

In this paper, we aim at providing a methodological proposal to build a composite immigrant integration indicator, able to measure the different aspects related to integration, such as employment, education, social inclusion, and active citizenship. With this in mind, we analyse the data collected from European Social Survey (ESS), Round 8, on immigration by the Partial Least Squares Path Modelling (PLSPM) approach (Tenenhaus et al., 2005). The PLSPM models are Structural Equation Modelling suitable to estimate interaction and main effects among multiple sets of latent variables. In the present study we use a simultaneous non-hierarchical clustering and Partial Least Squares Modelling, named Partial Least Squares K-Means (PLS-KM), recently proposed by Fordellone and Vichi (2017). In this model, centroids are laying the reduced space of the latent variables, ensuring the optimal partition of the statistical units on the best latent hyperplane. Estimating the measurement relations by the SEM pre-specified model, the latent structure is defined.

2 ESS data

The data from the eighth iteration of the survey for ESS are until now available from 18 of the 24 countries, which undertook fieldwork in 2016. The 18 countries included in this initial release are: Austria, Belgium, Czech Republic, Estonia, Finland, France, Germany, Iceland, Ireland, Israel, Norway, Netherlands, Poland, Russia, Slovenia, Sweden, Switzerland and United Kingdom. The included questions asked in every round since 2002 on topics including crime, democracy and politics, human values, immigration, media consumption, national and ethnic identity, perceived discrimination, religion, social exclusion, social trust/trust in institutions, subjective wellbeing and socio-demographics and public attitudinal data towards welfare, climate change and energy security, personal norms, efficacy and trust and energy preferences. The data must be weighted to adjust for different selection probabilities, for sampling error and non-response bias as well as different selection probabilities. The table 1 shows the topics covered by the survey in the collection of questions, classified into two main parts: a core section and a rotating section. The core module contains items measuring a range of topics of enduring interest to the social sciences as well as the most comprehensive set of socio-structural variables of any cross-national survey. The rotating modules are carried out by multi-national teams of researchers selected to contribute to the design of survey.

Table 1 - *Topics and items of ESS.*

Items	Topics
Core A1-A6	Media use; internet use; social trust
Core B1-B43	Politics, including: political interest, trust, electoral and other forms of participation, party allegiance, socio-political orientations, immigration
Core C1-C44	Subjective wellbeing, social exclusion, crime, religion, perceived discrimination, national and ethnic identity, test questions (sect. I), refugees
Rotating D1-D32	Climate change and energy, including: attitudes, perceptions module and policy preferences
Rotating E1-E42	Welfare, including attitudes towards welfare provision, size of module claimant groups, attitudes towards service delivery and likely future dependence on welfare, vote intention in EU referendum
Core F1-F61	Socio-demographic profile, including household composition, sex, age, marital status, type of area, education and occupation, partner, parents, union membership, income and ancestry
Core Section H	Human values scale
Core Section l	Test questions

Source: www.europeansocialsurvey.org.

The ESS sampling strategy is based on the design and implementation of workable and equivalent sampling plans in all participating countries, following key principles:

- samples must be representative of all persons aged 15 and over (no upper age limit) resident within private households in each country, regardless of their nationality, citizenship or language
- individuals are selected by strict random probability methods at every stage
- sampling frames of individuals, households and addresses may be used
- all countries must aim for a minimum 'effective achieved sample size' of 1,500 or 800 in countries with ESS populations of less than 2 million after discounting for design effects
- quota sampling is not permitted at any stage
- substitution of non-responding households or individuals (whether 'refusals', 'non-contacts' or 'ineligibles') is not permitted at any stage.

In the present paper, we use ESS Multilevel Data resource in order to analyse the ESS-respondents with reference to the context they live in. The resource contains data about:

- individuals (the ESS respondents)
- regions (mainly data collected from EUROSTAT)
- countries (data collected from different sources)

3 Methodology

Given the $n \times J$ data matrix $\mathbf{X}$, the $n \times K$ membership matrix $\mathbf{U}$, the $K \times J$ centroids matrix $\mathbf{C}$, the $J \times P$ loadings matrix $\boldsymbol{\Lambda} = [\boldsymbol{\Lambda}_{\mathrm{H}}, \boldsymbol{\Lambda}_{\mathrm{L}}]$, and the errors matrices $\mathbf{E}$, $\mathbf{Z}$, $\mathbf{D}$, the Partial Least Squares Structural Equation Modelling *K*-Means approach can be written as follows (Fordellone and Vichi, 2017; Fordellone et al., 2018):

$$\begin{aligned}
&\mathbf{H} = \mathbf{H}\mathbf{B}^{\mathrm{T}} + \boldsymbol{\Xi}\boldsymbol{\Gamma}^{\mathrm{T}} + \mathbf{Z}, \\
&\mathbf{X} = \boldsymbol{\Xi}\boldsymbol{\Lambda}_{\mathrm{H}}^{\mathrm{T}} + \mathbf{H}\boldsymbol{\Lambda}_{\mathrm{L}}^{\mathrm{T}} + \mathbf{E}, \\
&\mathbf{X} = \mathbf{U}\mathbf{C}\boldsymbol{\Lambda}\boldsymbol{\Lambda}^{\mathrm{T}} = \mathbf{U}\mathbf{C}\boldsymbol{\Lambda}_{\mathrm{H}}\boldsymbol{\Lambda}_{\mathrm{H}}^{\mathrm{T}} + \mathbf{U}\mathbf{C}\boldsymbol{\Lambda}_{\mathrm{L}}\boldsymbol{\Lambda}_{\mathrm{L}}^{\mathrm{T}} + \mathbf{D},
\end{aligned} \tag{1}$$

under constraints: *(i)* $\boldsymbol{\Lambda}^{\mathrm{T}}\boldsymbol{\Lambda} = \mathbf{I}$; and *(ii)* $\mathbf{U} \in \{0,1\}$, $\mathbf{U}\mathbf{1}_K = \mathbf{1}_n$. Where, H is the n×L matrix of the endogenous LVs with generic element $\eta_{i.l}$, $\boldsymbol{\Xi}$ be the $n \times H$ matrix of the exogenous LVs with generic element $\xi_{i.h}$, $\mathbf{B}$ is the $L \times L$ matrix of the path coefficients $\beta_{l.l}$ associated to the endogenous latent variables, $\boldsymbol{\Gamma}$ is the $L \times H$ matrix of the path coefficients $\gamma_{l.h}$ associated to the exogenous latent variables, $\boldsymbol{\Lambda}_{\mathrm{H}}$ is the $J \times H$ loadings matrix of the exogenous latent constructs with generic element $\lambda_{i.h}$, and $\boldsymbol{\Lambda}_{\mathrm{L}}$is the $J \times L$ loadings matrix of the endogenous latent constructs with generic element $\lambda_{i.l}$. Thus, the PLS-SEM-KM model includes the SEM estimated via Partial Least Squares (PLS) and the clustering equations. The simultaneous estimation of the three sets of equations will produce the estimation of the pre-specified SEM describing relations among variables and the corresponding best partitioning of units

There is a relevant aspect to considerate in the application of PLS-SEM-KM procedure: when we applying PLS-SEM-KM, the number of groups is unknown and the identification of an appropriate number of K clusters is not straightforward. Then, often you need to rely on some statistical criterion. In particular, the PLS-SEM-KM algorithm includes the choice of the number of clusters K classes according the *gap method* criterion (Fordellone and Vichi, 2017).

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