ILHAM-EC

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Computational Data Analysis and Statistics in Agriculture (Part II)

Prof. Konstadinos MATTAS

Dr. Anastasios MICHAILIDIS

Training in Italy

Sassari, 22-24 January 2018

Structure of the presentation

- **Introduction**
- **Definitions**
- **Theory**
- **Methodological framework**
- **Examples**

Welcome to the future …

Aerial seeding

Aerial spraying

Growing accuracy


TeeJet
ALL ON
AUTO
MAN
GPS
GPS
DGPS
6.9 ft
A/B
ESC
CenterLine 230BP


esa


AUTOFARM
You recently sent a help request to your dealer. Please allow the dealer a few more minutes to respond before requesting additional help


Trimble
FIMCO

Definitions

- Opinion leader
- ICT
- Precision farming
- Diffusion
- Social change
- Uncertainty

What are opinion leaders?

- **General definition** → Influential members of a community, group, or society to whom others turn for advice, opinions, and views.
- **Marketing definition** → Minority group (called early adopters) that passes information on new products, techniques or ideas to *less adventuresome or not as well informed segments of the population*.

What is ICT?

- **Information and communications technology** (**ICT**) is often used as an extended synonym for information technology (IT), but is a more specific term that stresses the role of communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary software, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information

What is Precision Agriculture?

- **Precision farming (PA) or satellite farming or site specific crop management (SSCM) is a farming management concept based on observing, measuring and responding to inter and intra-field variability in crops.**
- *Crop variability typically has both a spatial and temporal component which makes statistical/computational treatments quite involved.*

Precision farming issues

Precision agriculture aims to optimize field-level management with regard to:

- crop science: by matching farming practices more closely to crop needs (e.g. fertilizer inputs);
- environmental protection: by reducing environmental risks and footprint of farming (e.g. limiting leaching of nitrogen);
- economics: by boosting competitiveness through more efficient practices (e.g. improved management of fertilizer usage and other inputs).

Precision farming issues

Precision agriculture also provides farmers with a wealth of information to:

- build up a record of their farm;
- improve decision-making;
- foster greater traceability
- enhance marketing of farm products
- improve lease arrangements and relationship with landlords
- enhance the inherent quality of farm products (e.g. protein level in bread-flour wheat)

What is innovative behavior?

- Opinion leader?
- ICTs?
- Precision agriculture?
- or what?

Niccolò Machiavelli

"… there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than a new system or than a creation of a new order of things … Whenever his enemies have occasion to attack the innovator they do so with the passion of partisans, while the others defend him sluggishly so that the innovator and his party alike are vulnerable"

The Prince (1513)

Why there is so much interest?

- … getting a new idea adopted, even when it has obvious advantages, is often very difficult!

What is diffusion?

- … is the process by which an innovation is communicated through certain channels over time among the members of a social system.
- → special type of communication
- → messages are concerned with a new idea
- → two way process
- → share information with one another in order to reach a mutual understanding.

Social change

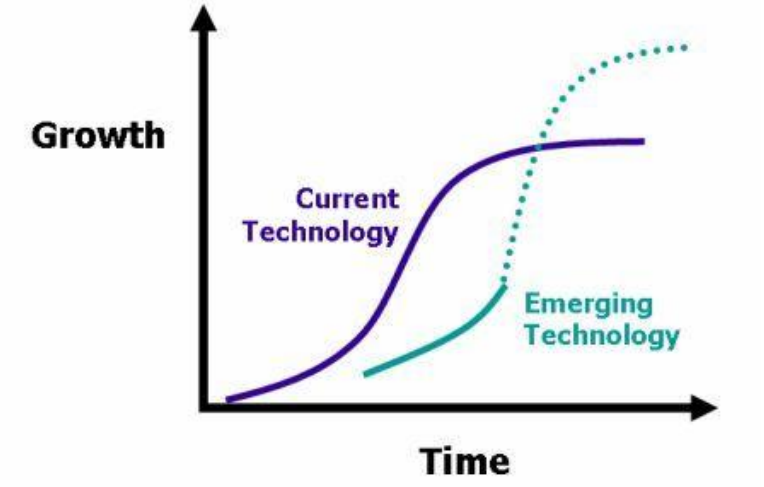
- **… is a kind of social change**
- Defined as the process by which alteration occurs in the structure and functions of a social system
- **When new ideas are invented and diffused → adopted or rejected → social change occurs**
- **Diffusion theory → Change theory**

Uncertainty

- … is the degree to witch a number of alternatives are perceived with respect to the occurrence of an event and the relative probability of these alternatives.
- **→ implies a lack of predictability and information**
- **Information → main mean of reducing uncertainty**

Innovations vs. Investments

Maturity stages …



Final decision …

Potentials

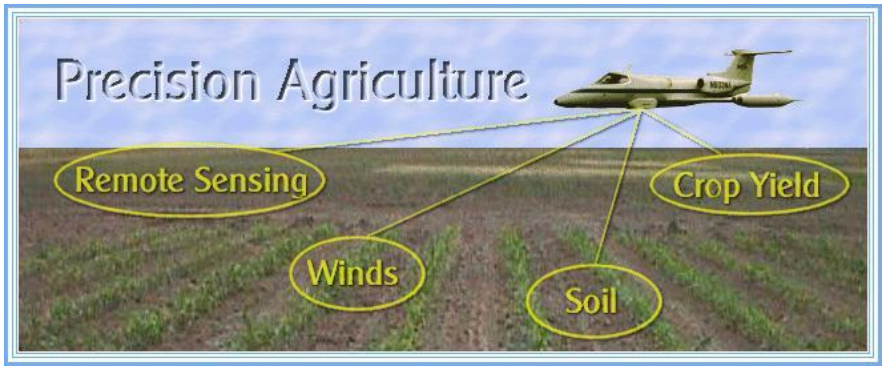
+Time
+Productivity
+Communication
+External conditions (control)
+Production functions (control)
+Management
+Archive analysis
+Production control
+Quality control
+Cost control
+bureaucracy

Pitfalls

-Costs
-Risks
-Familiarity
-Examples
-Dependency

What can Innovations do for me?

- Productivity increase
- Information → betters decision
- Production cost decrease
- Archive (bureaucracy)
- Farmer net profit increase
- Environmental benefits
- Gain time

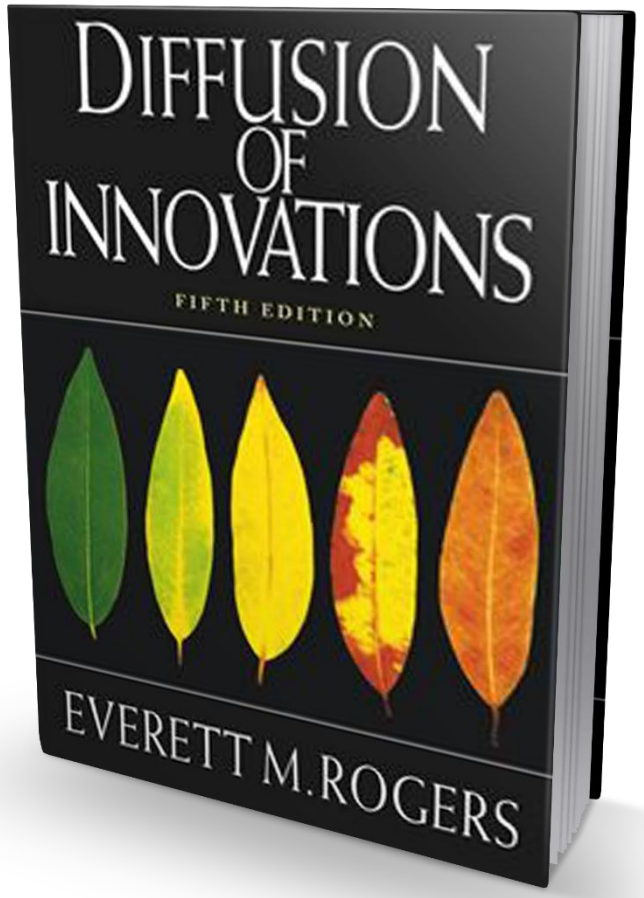


Answer questions like …

- When?
- Where?
- How much?
- How?

Theoretical framework

- Everett Rogers, a professor of communication studies, popularized the theory in his book *Diffusion of Innovations*; the book was first published in 1962, and is now in its fifth edition (2003).



Diffusion of innovations…

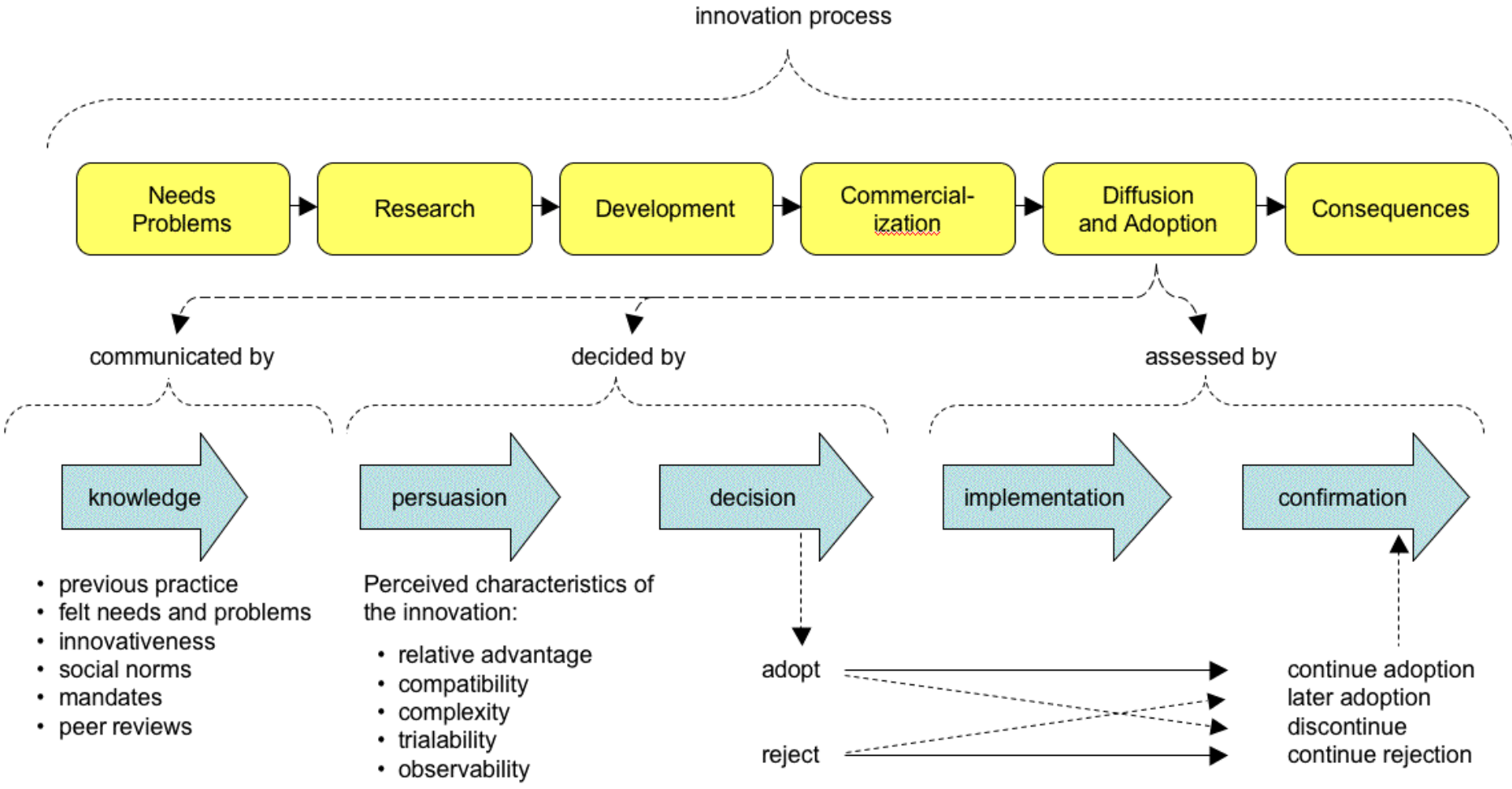
- **… is a theory that seeks to explain how, why, and at what rate new ideas and technology spread through cultures.**
- Diffusion is the process by which an innovation is communicated through certain channels over time among the participants in a social system.
- **Four main elements influence the spread of a new idea: the innovation itself, communication channels, time, and a social system.**
- This process relies heavily on human capital.
- The categories of adopters are: innovators, early adopters, early majority, late majority, and laggards.

Key elements

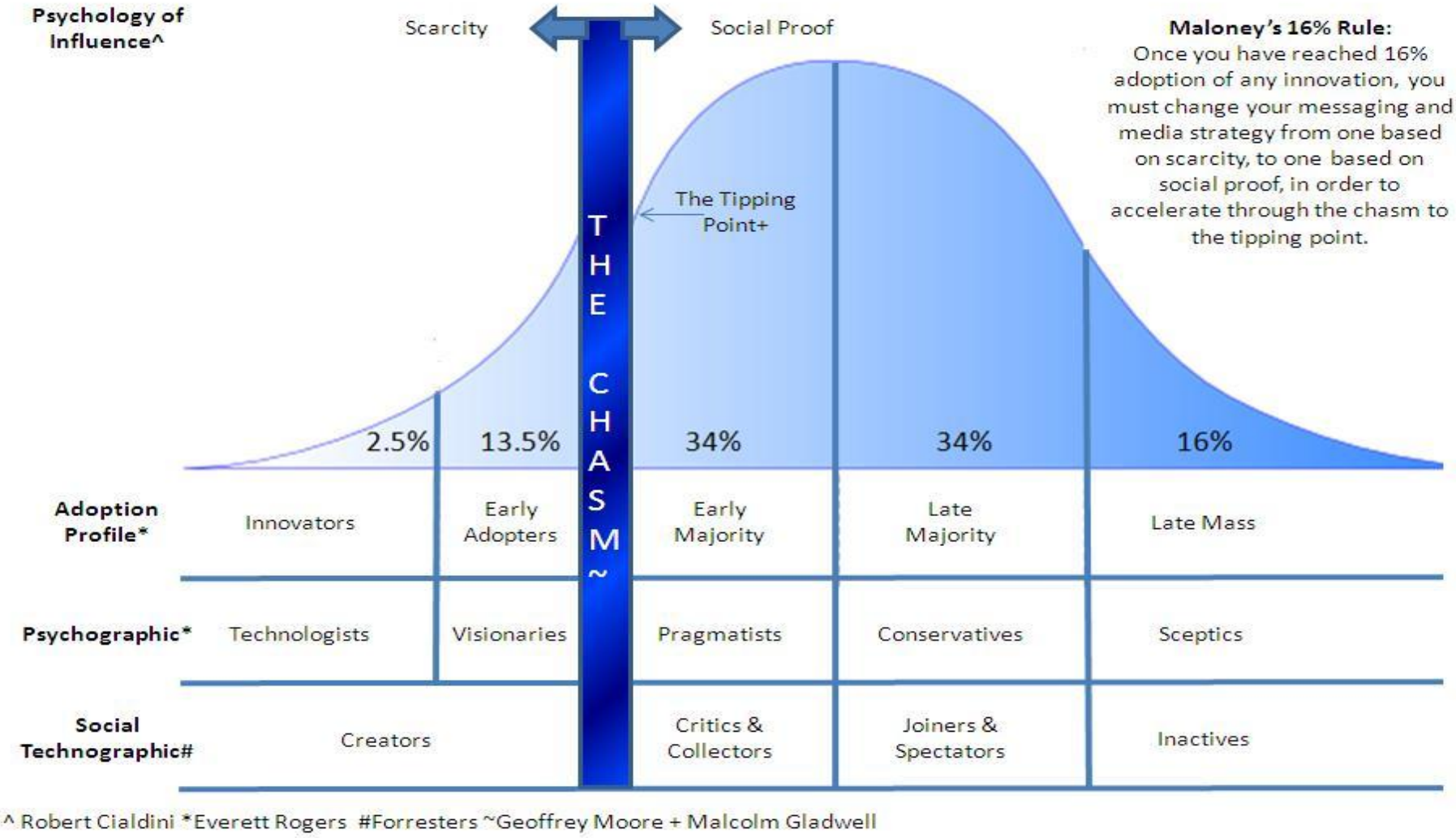
- **Innovation** →an idea, practice, or object that is perceived as new by an individual or other unit of adoption".
- **Communication channels** → the means by which messages get from one individual to another".
- **Time** → The innovation-decision period is the length of time required to pass through the innovation-decision process".
- **Rate of adoption** → the relative speed with which an innovation is adopted by members of a social system".
- **Social system** → a set of interrelated units that are engaged in joint problem solving to accomplish a common goal".

Five stages of the adoption process

- **Knowledge** → The individual is first exposed to an innovation, but lacks information about the innovation. During this stage the individual has not yet been inspired to find out more information about the innovation.
- **Persuasion** → The individual is interested in the innovation and actively seeks related information/details.
- **Decision** → The individual takes the concept of the change and weighs the advantages/disadvantages of using the innovation and decides whether to adopt or reject the innovation. Due to the individualistic nature of this stage, Rogers notes that it is the most difficult stage on which to acquire empirical evidence.
- **Implementation** → The individual employs the innovation to a varying degree depending on the situation. During this stage the individual also determines the usefulness of the innovation and may search for further information about it.
- **Confirmation** → The individual finalizes his/her decision to continue using the innovation. This stage is both intrapersonal (may cause cognitive dissonance) and interpersonal, confirmation the group has made the right decision.


innovation process
Needs Problems
Research
Development
Commercial-ization
Diffusion and Adoption
Consequences
communicated by
decided by
assessed by
knowledge
persuasion
decision
implementation
confirmation
• previous practice
• felt needs and problems
• innovativeness
• social norms
• mandates
• peer reviews
Perceived characteristics of the innovation:
• relative advantage
• compatibility
• complexity
• trialability
• observability
adopt
reject
continue adoption
later adoption
discontinue
continue rejection

Accelerating Diffusion of Innovation: Maloney's 16% Rule©



^ Robert Cialdini *Everett Rogers #Forresters ~Geoffrey Moore + Malcolm Gladwell

Adopter categories

- **Innovators**
- **Early adopters**
- **Early Majority**
- **Late Majority**
- **Laggards**

Innovators

- … are willing to take risks, have the highest social status, have financial liquidity, are social and have closest contact to scientific sources and interaction with other innovators.
- Their risk tolerance allows them to adopt technologies that may ultimately fail.
- Financial resources help absorb these failures.

Early adopters

- These individuals have the highest degree of opinion leadership among the adopter categories.
- Early adopters have a higher social status, financial liquidity, advanced education and are more socially forward than late adopters.
- They are more discreet in adoption choices than innovators.
- The use judicious choice of adoption to help them maintain a central communication position

Early majority

- They adopt an innovation after a varying degree of time that is significantly longer than the innovators and early adopters.
- Early Majority have above average social status, contact with early adopters and seldom hold positions of opinion leadership in a system.

Late majority

- They adopt an innovation after the average participant.
- These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation.
- Late Majority are typically skeptical about an innovation, have below average social status, little financial liquidity, in contact with others in late majority and early majority and little opinion leadership.

Laggards

- **They are the last to adopt an innovation.**
- **Unlike some of the previous categories, individuals in this category show little to no opinion leadership.**
- *These individuals typically have an aversion to change-agents.*
- **Laggards typically tend to be focused on "traditions", lowest social status, lowest financial liquidity, oldest among adopters, and in contact with only family and close friends.**

Methodological framework

- This methodology attempts to reveal the heterogeneity of farmers in rural areas.
- Can rural areas be seen as a homogenous space or do different types of farmers exist?
- Who is really innovator?
- Is it the farmer or other members of the rural family?
- Who is laggard?

Concept

- The basic concept underlying diffusion theory is that adopters of an innovation do not adopt the innovation independently, but instead influence each others' adoption decisions
- The influence of early adopters on later adopters is often called "word of mouth communication", a term referring to a much broader set of phenomena than adopters simply talking to each other.

Survey …

- The survey has to be designed to collect information on several issues related to rural life and innovation adoption → **six levels of information**
- *Part of the survey has to be designed to elicit data on respondents' innovation use and their views on several prospective changes, desirable or undesirable, all drawn from the literature or experience.*
- **To encourage participation and minimize the cognitive burden on respondents, most questions must be framed using *Likert* scale intervals.**

Methodological mix

- both descriptive statistics and multivariate analysis techniques used using the Statistical Package for Social Sciences (SPSS):
  - Two-Step Cluster Analysis (TSCA) and
  - Categorical regression (CATREG).

Why TSCA & CatReg?

- … due to their ability to optimally handle categorical variables.
- Indeed, much of the data that social scientists deal with are qualitative in nature and most other data are at best ordinal.

TSCA

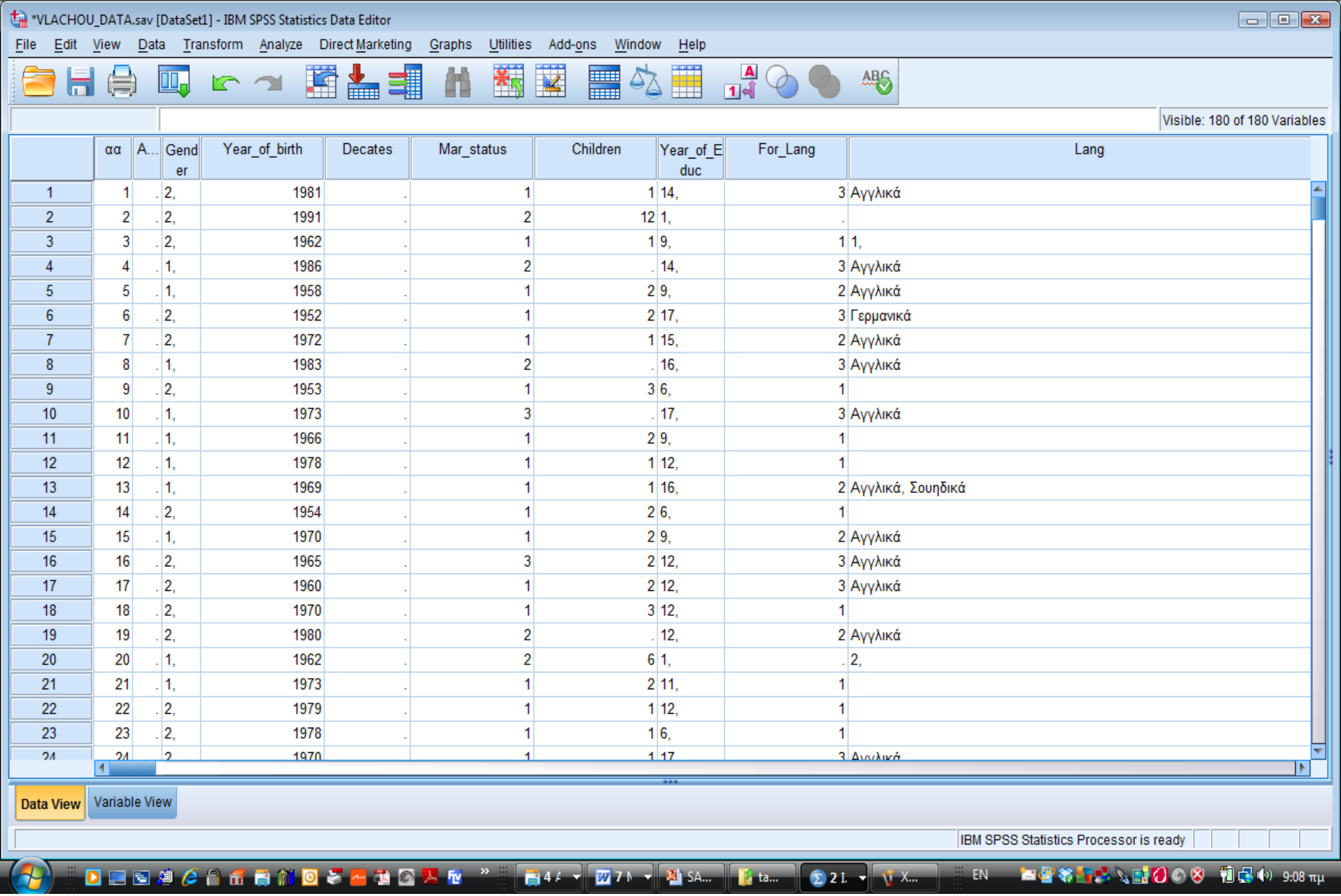
- In order to classify farmers in discernible clusters, with similar adopting behaviour, the TSCA has to be employed as a scalable cluster analysis algorithm designed to handle large data sets, revealing natural groupings within a data set that would otherwise not be apparent.
- Traditional clustering methods are considered effective and accurate on small datasets and usually do not scale up well to large datasets unless these datasets are first reduced into smaller ones.
- Moreover, traditional clustering methods cannot optimally handle categorical variables, as well as attributes most commonly found in sociological research surveys.
- Although TSCA requires only one data set, it follows a two-step procedure: the first step pre-clusters the cases into many small sub-clusters, and the second step clusters the sub-clusters of the first step into the desired number of clusters.

CatReg

- CATREG has to be used in order to highlight possible relations between innovation adoption and a set of other selected independent categorical variables.
- In fact, CATREG is a modern regression technique, much more holistic and effective than the multiple regression analysis and the analysis of multiple regression with categorical variables.
- Actually, the CATREG model can deal more optimally with both qualitative and quantitative data, as it works on two discrete and simple stages: firstly, the nominal and ordinal variables are transformed to interval scales, in order to maximize the relationship between each predictor and the dependent variable, and secondly, multiple regression analysis is applied to the transformed variables.

IBM® SPSS® Statistics

Version 20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αα | A... | Gender | Year_of_birth | Decates | Mar_status | Children | Year_of_Educ | For_Lang | Lang
1 | 1 | . | 2, | 1981 | . | 1 | 1 | 14, | 3 | Αγγλικά
2 | 2 | . | 2, | 1991 | . | 2 | 12 | 1, | . |
3 | 3 | . | 2, | 1962 | . | 1 | 1 | 9, | 1 | 1,
4 | 4 | . | 1, | 1986 | . | 2 | . | 14, | 3 | Αγγλικά
5 | 5 | . | 1, | 1958 | . | 1 | 2 | 9, | 2 | Αγγλικά
6 | 6 | . | 2, | 1952 | . | 1 | 2 | 17, | 3 | Γερμανικά
7 | 7 | . | 2, | 1972 | . | 1 | 1 | 15, | 2 | Αγγλικά
8 | 8 | . | 1, | 1983 | . | 2 | . | 16, | 3 | Αγγλικά
9 | 9 | . | 2, | 1953 | . | 1 | 3 | 6, | 1 |
10 | 10 | . | 1, | 1973 | . | 3 | . | 17, | 3 | Αγγλικά
11 | 11 | . | 1, | 1966 | . | 1 | 2 | 9, | 1 |
12 | 12 | . | 1, | 1978 | . | 1 | 1 | 12, | 1 |
13 | 13 | . | 1, | 1969 | . | 1 | 1 | 16, | 2 | Αγγλικά, Σουηδικά
14 | 14 | . | 2, | 1954 | . | 1 | 2 | 6, | 1 |
15 | 15 | . | 1, | 1970 | . | 1 | 2 | 9, | 2 | Αγγλικά
16 | 16 | . | 2, | 1965 | . | 3 | 2 | 12, | 3 | Αγγλικά
17 | 17 | . | 2, | 1960 | . | 1 | 2 | 12, | 3 | Αγγλικά
18 | 18 | . | 2, | 1970 | . | 1 | 3 | 12, | 1 |
19 | 19 | . | 2, | 1980 | . | 2 | . | 12, | 2 | Αγγλικά
20 | 20 | . | 1, | 1962 | . | 2 | 6 | 1, | . | 2,
21 | 21 | . | 1, | 1973 | . | 1 | 2 | 11, | 1 |
22 | 22 | . | 2, | 1979 | . | 1 | 1 | 12, | 1 |
23 | 23 | . | 2, | 1978 | . | 1 | 1 | 6, | 1 |
Data View
Variable View
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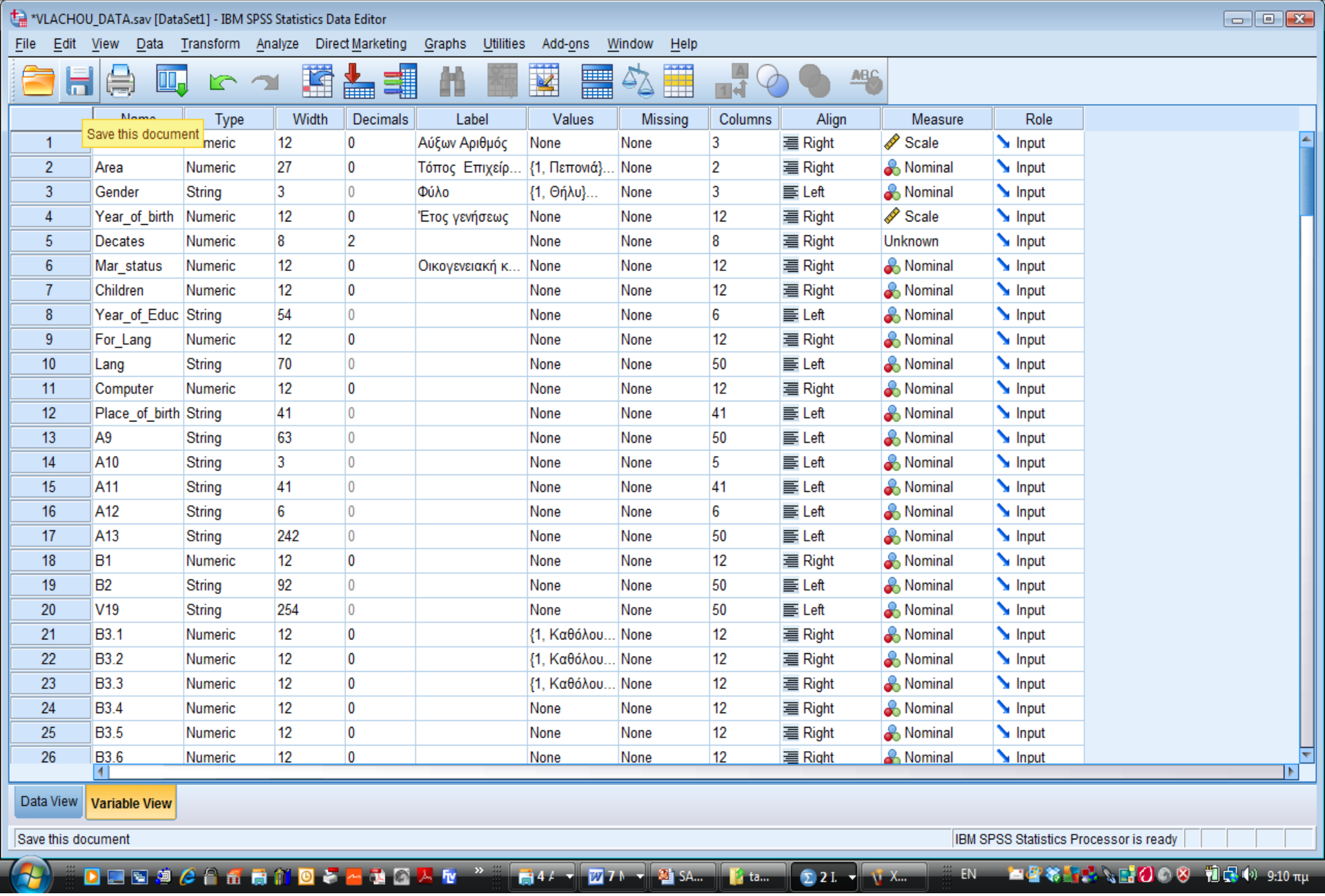
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2 Area Numeric 27 0 Τόπος Επιχείρ... {1, Πεπονιά}... None 2 Right Nominal Input
3 Gender String 3 0 Φύλο {1, Θήλυ}... None 3 Left Nominal Input
4 Year_of_birth Numeric 12 0 Έτος γενήσεως None None 12 Right Scale Input
5 Decates Numeric 8 2 None None 8 Right Unknown Input
6 Mar_status Numeric 12 0 Οικογενειακή κ... None None 12 Right Nominal Input
7 Children Numeric 12 0 None None 12 Right Nominal Input
8 Year_of_Educ String 54 0 None None 6 Left Nominal Input
9 For_Lang Numeric 12 0 None None 12 Right Nominal Input
10 Lang String 70 0 None None 50 Left Nominal Input
11 Computer Numeric 12 0 None None 12 Right Nominal Input
12 Place_of_birth String 41 0 None None 41 Left Nominal Input
13 A9 String 63 0 None None 50 Left Nominal Input
14 A10 String 3 0 None None 5 Left Nominal Input
15 A11 String 41 0 None None 41 Left Nominal Input
16 A12 String 6 0 None None 6 Left Nominal Input
17 A13 String 242 0 None None 50 Left Nominal Input
18 B1 Numeric 12 0 None None 12 Right Nominal Input
19 B2 String 92 0 None None 50 Left Nominal Input
20 V19 String 254 0 None None 50 Left Nominal Input
21 B3.1 Numeric 12 0 {1, Καθόλου... None 12 Right Nominal Input
22 B3.2 Numeric 12 0 {1, Καθόλου... None 12 Right Nominal Input
23 B3.3 Numeric 12 0 {1, Καθόλου... None 12 Right Nominal Input
24 B3.4 Numeric 12 0 None None 12 Right Nominal Input
25 B3.5 Numeric 12 0 None None 12 Right Nominal Input
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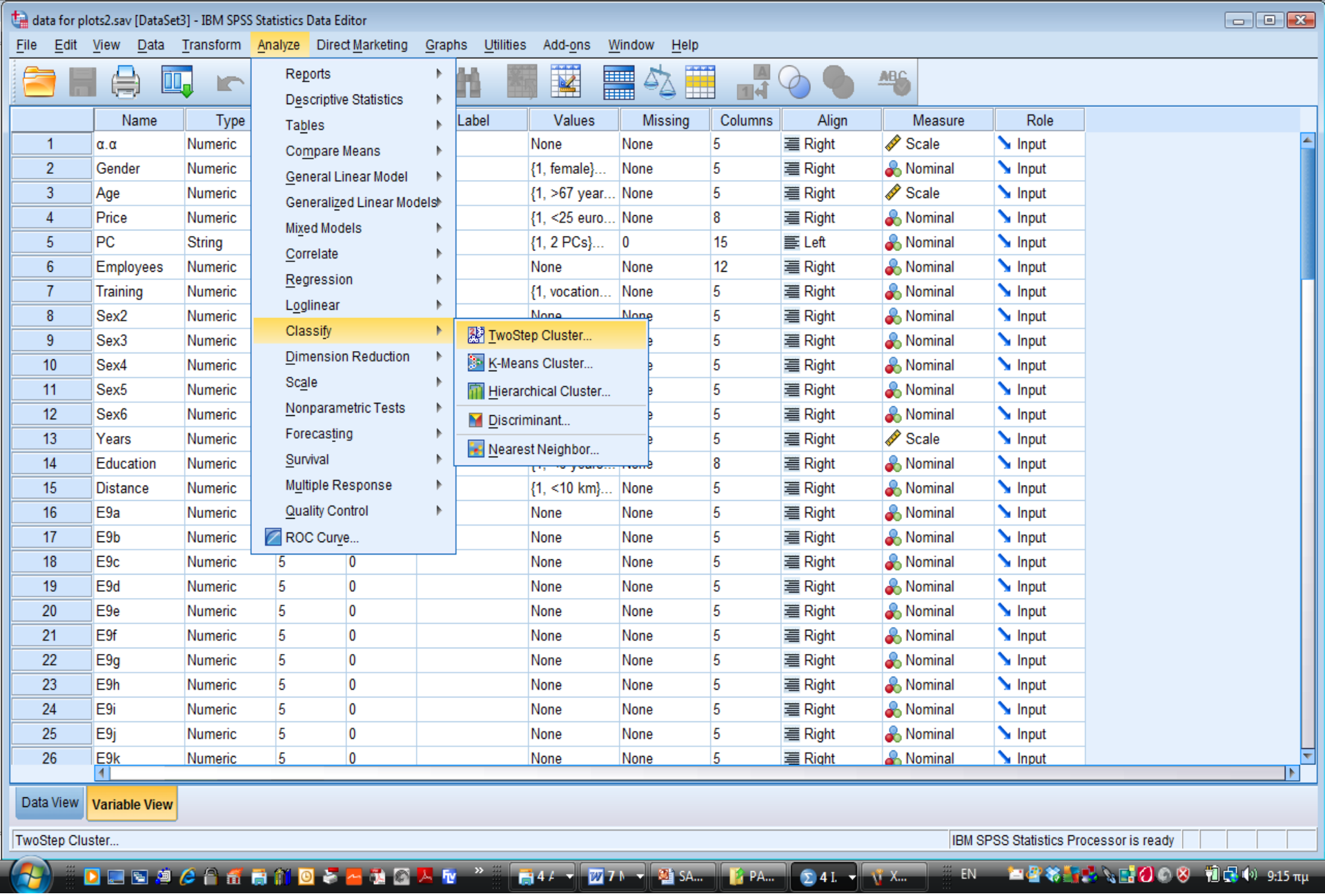
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Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Quality Control
ROC Curve...
TwoStep Cluster...
K-Means Cluster...
Hierarchical Cluster...
Discriminant...
Nearest Neighbor...
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4 Price Numeric {1, <25 euro... None 8 Right Nominal Input
5 PC String {1, 2 PCs}... 0 15 Left Nominal Input
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8 Sex2 Numeric 5 Right Nominal Input
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12 Sex6 Numeric 5 Right Nominal Input
13 Years Numeric 5 Right Scale Input
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15 Distance Numeric {1, <10 km}... None 5 Right Nominal Input
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17 E9b Numeric None None 5 Right Nominal Input
18 E9c Numeric 5 0 None None 5 Right Nominal Input
19 E9d Numeric 5 0 None None 5 Right Nominal Input
20 E9e Numeric 5 0 None None 5 Right Nominal Input
21 E9f Numeric 5 0 None None 5 Right Nominal Input
22 E9g Numeric 5 0 None None 5 Right Nominal Input
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24 E9i Numeric 5 0 None None 5 Right Nominal Input
25 E9j Numeric 5 0 None None 5 Right Nominal Input
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TwoStep Cluster...
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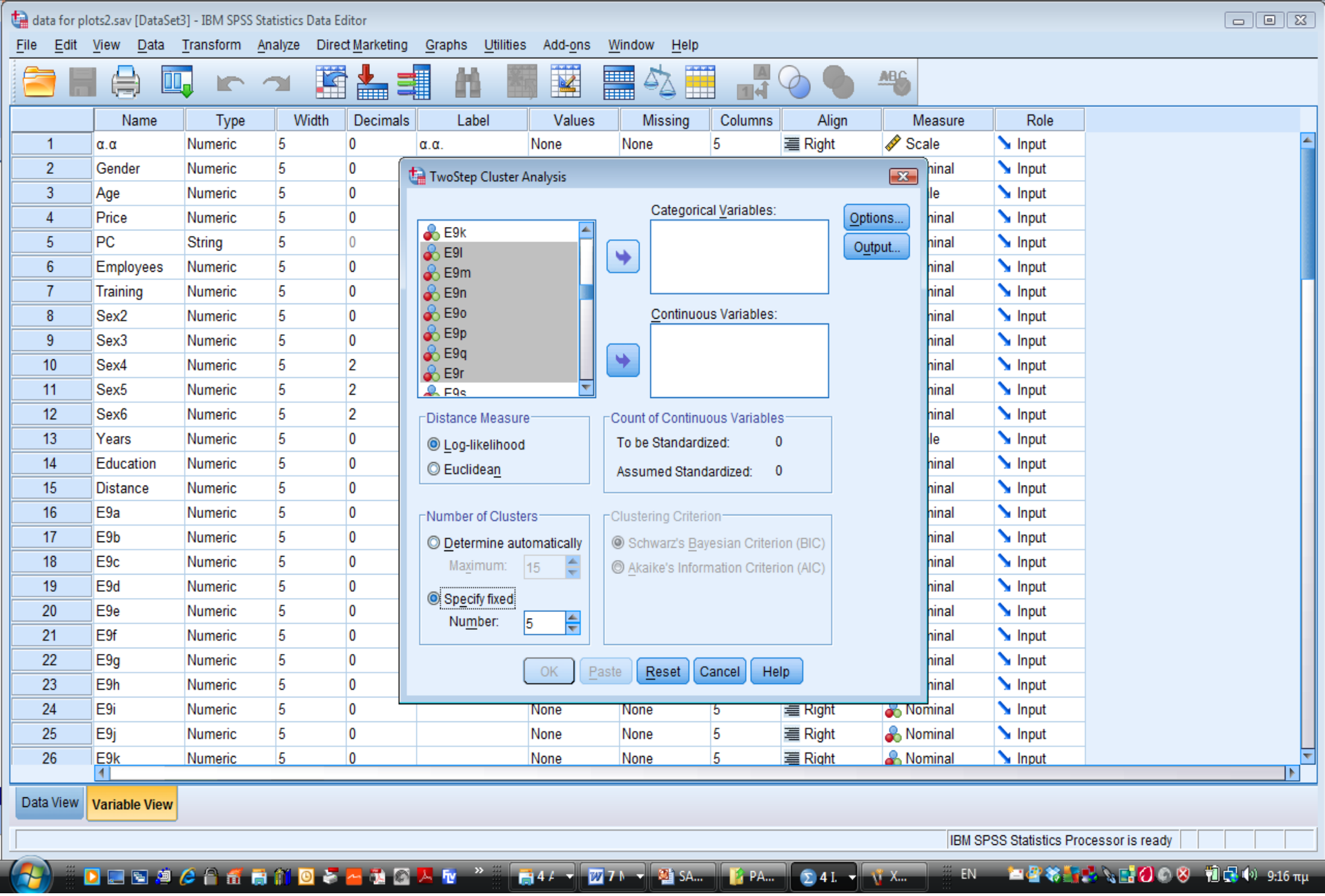

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5	PC	String	5	0							Input
6	Employees	Numeric	5	0							Input
7	Training	Numeric	5	0							Input
8	Sex2	Numeric	5	0							Input
9	Sex3	Numeric	5	0							Input
10	Sex4	Numeric	5	2							Input
11	Sex5	Numeric	5	2							Input
12	Sex6	Numeric	5	2							Input
13	Years	Numeric	5	0							Input
14	Education	Numeric	5	0							Input
15	Distance	Numeric	5	0							Input
16	E9a	Numeric	5	0							Input
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18	E9c	Numeric	5	0							Input
19	E9d	Numeric	5	0							Input
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21	E9f	Numeric	5	0							Input
22	E9g	Numeric	5	0							Input
23	E9h	Numeric	5	0							Input
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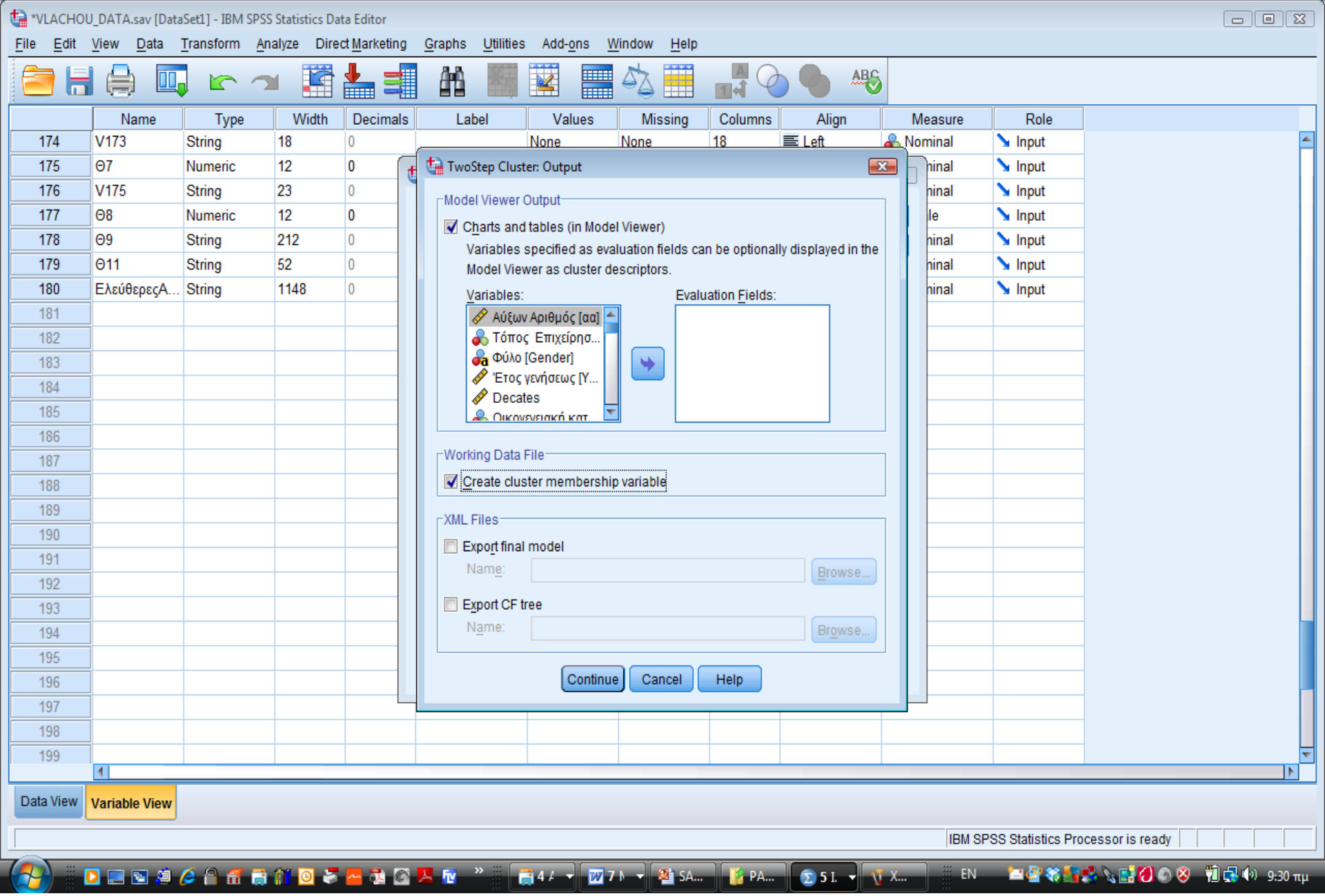
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176 V175 String 23 0 Input
177 Θ8 Numeric 12 0 Input
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180 ΕλεύθερεςΑ... String 1148 0 Input
TwoStep Cluster: Output
Model Viewer Output
Charts and tables (in Model Viewer)
Variables specified as evaluation fields can be optionally displayed in the Model Viewer as cluster descriptors.
Variables:
Αύξων Αριθμός [αα]
Τόπος Επιχείρησ...
Φύλο [Gender]
Έτος γενήσεως [Υ...
Decates
Evaluation Fields:
Working Data File
Create cluster membership variable
XML Files
Export final model
Name:
Browse...
Export CF tree
Name:
Browse...
Continue
Cancel
Help
Data View
Variable View
IBM SPSS Statistics Processor is ready

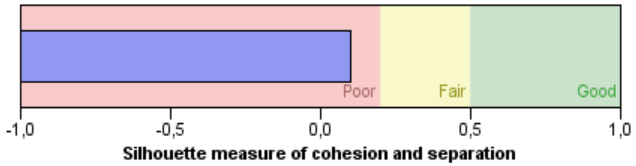
Model Viewer

File Edit Generate View Help

Model Summary

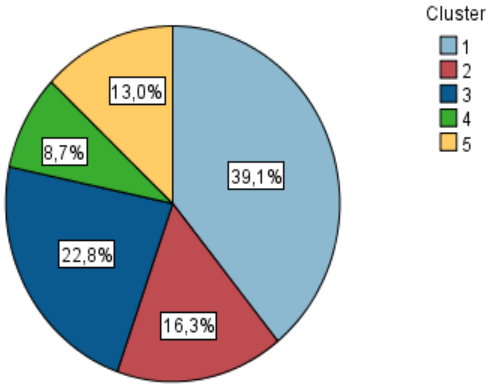
Algorithm	TwoStep
Inputs	35
Clusters	5

Cluster Quality



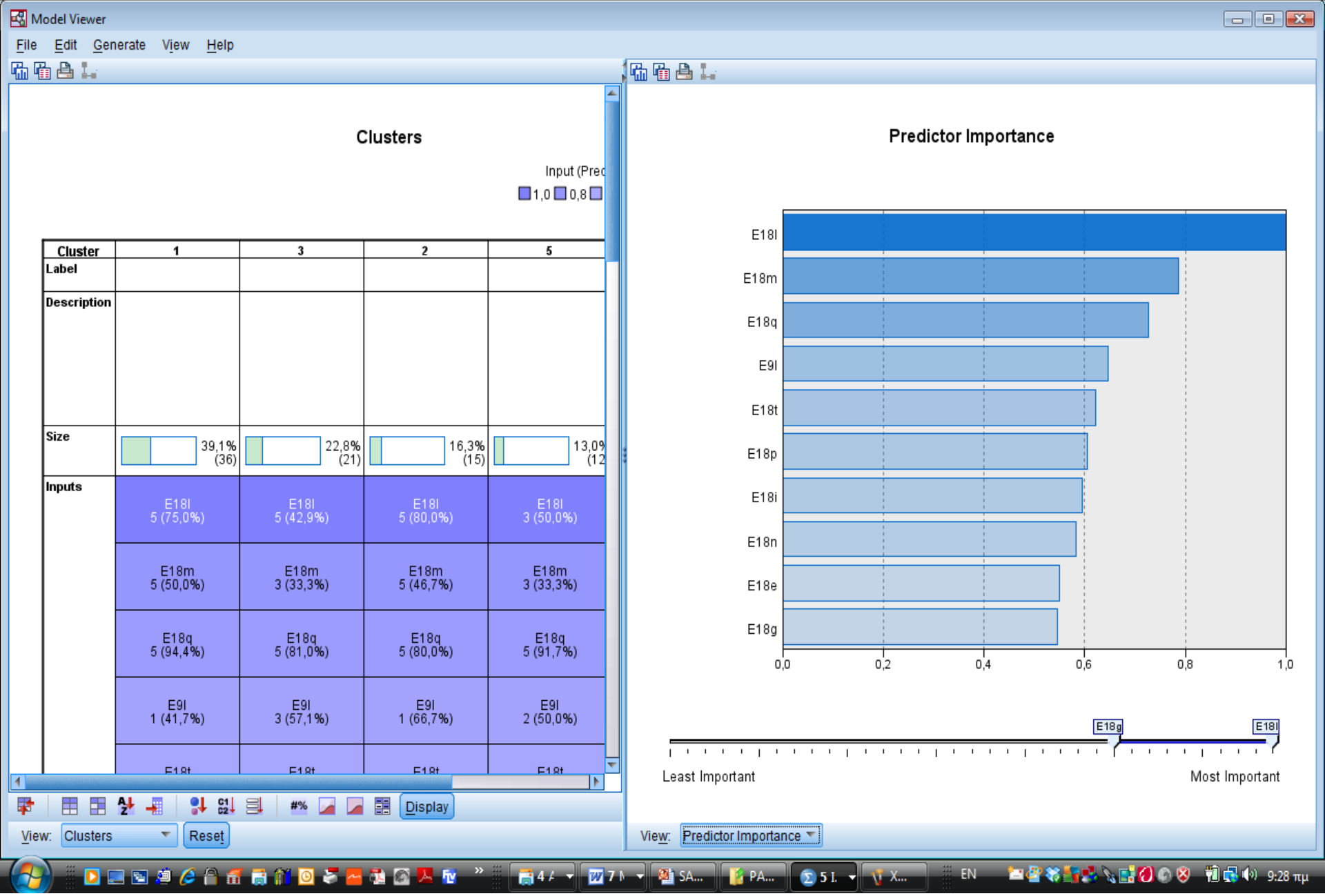
View: Model Summary Reset

Cluster Sizes



Size of Smallest Cluster	8 (8,7%)
Size of Largest Cluster	36 (39,1%)
Ratio of Sizes: Largest Cluster to Smallest Cluster	4,50

View: Cluster Sizes


Model Viewer
File Edit Generate View Help
Clusters
Input (Pred
1,0 0,8
Cluster 1 3 2 5
Label
Description
Size
39,1% (36)
22,8% (21)
16,3% (15)
13,0% (12
Inputs
E18l 5 (75,0%) E18l 5 (42,9%) E18l 5 (80,0%) E18l 3 (50,0%)
E18m 5 (50,0%) E18m 3 (33,3%) E18m 5 (46,7%) E18m 3 (33,3%)
E18q 5 (94,4%) E18q 5 (81,0%) E18q 5 (80,0%) E18q 5 (91,7%)
E9l 1 (41,7%) E9l 3 (57,1%) E9l 1 (66,7%) E9l 2 (50,0%)
Display
View: Clusters Reset
Predictor Importance
E18l
E18m
E18q
E9l
E18t
E18p
E18i
E18n
E18e
E18g
0,0 0,2 0,4 0,6 0,8 1,0
E18g E18l
Least Important
Most Important
View: Predictor Importance
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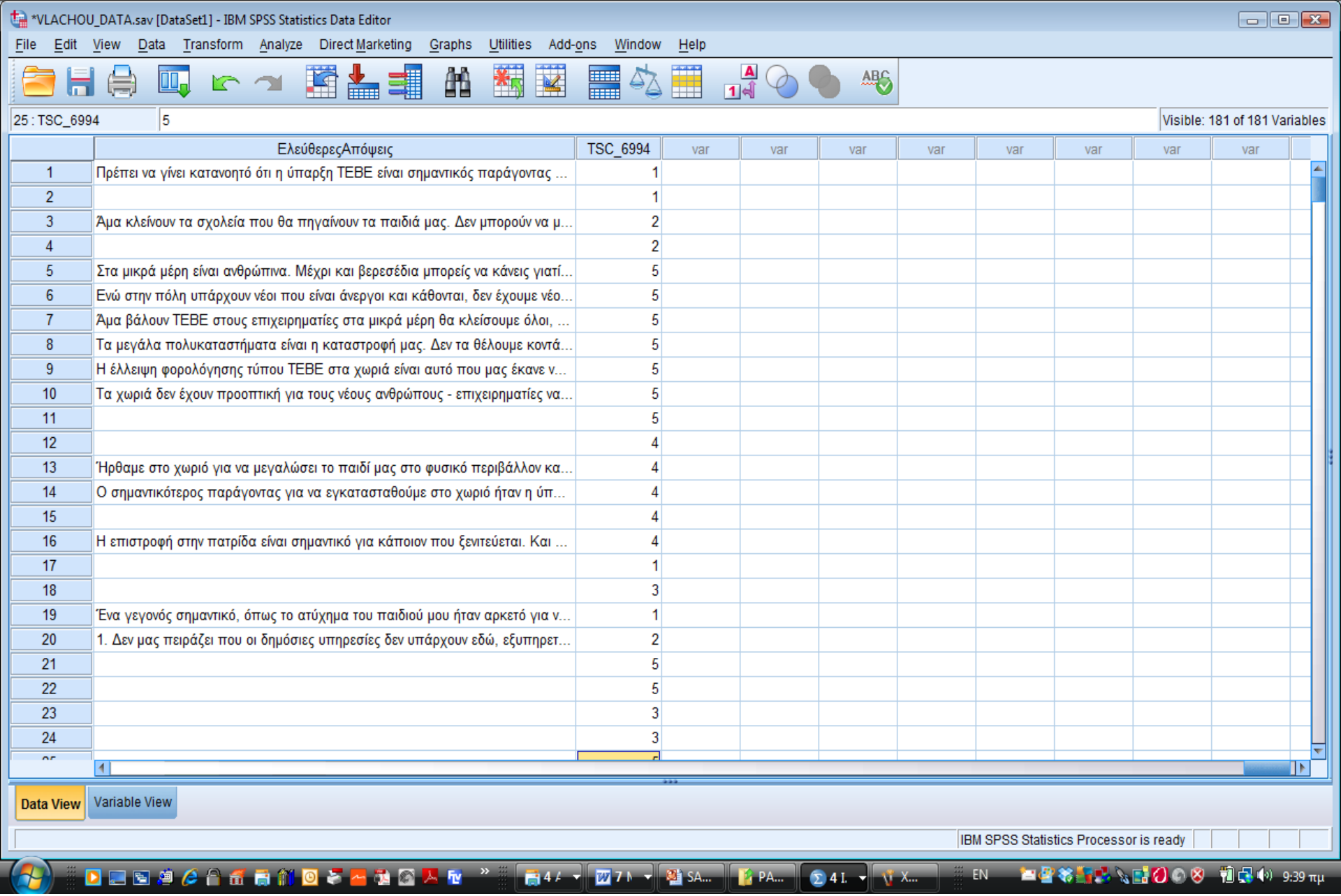
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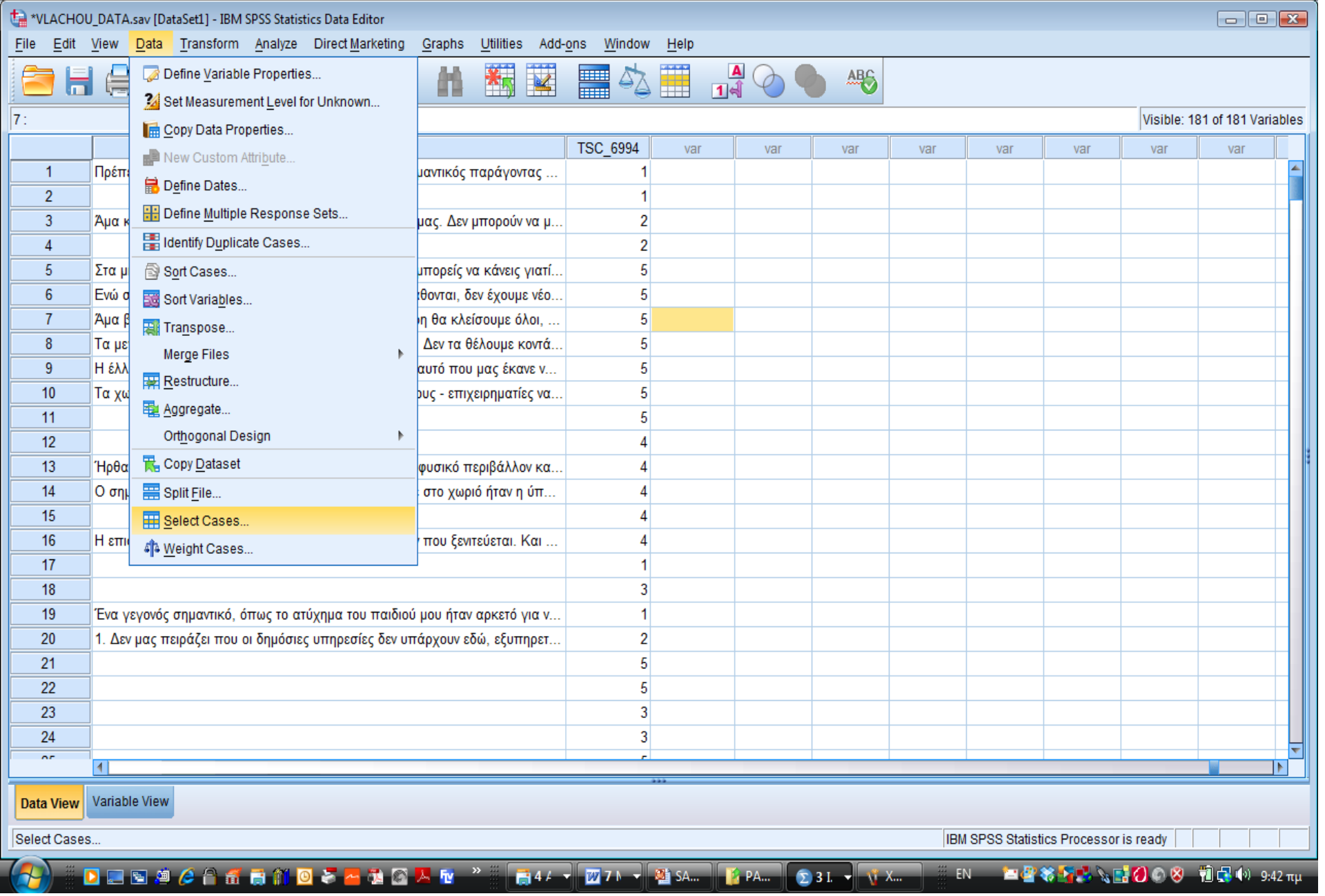
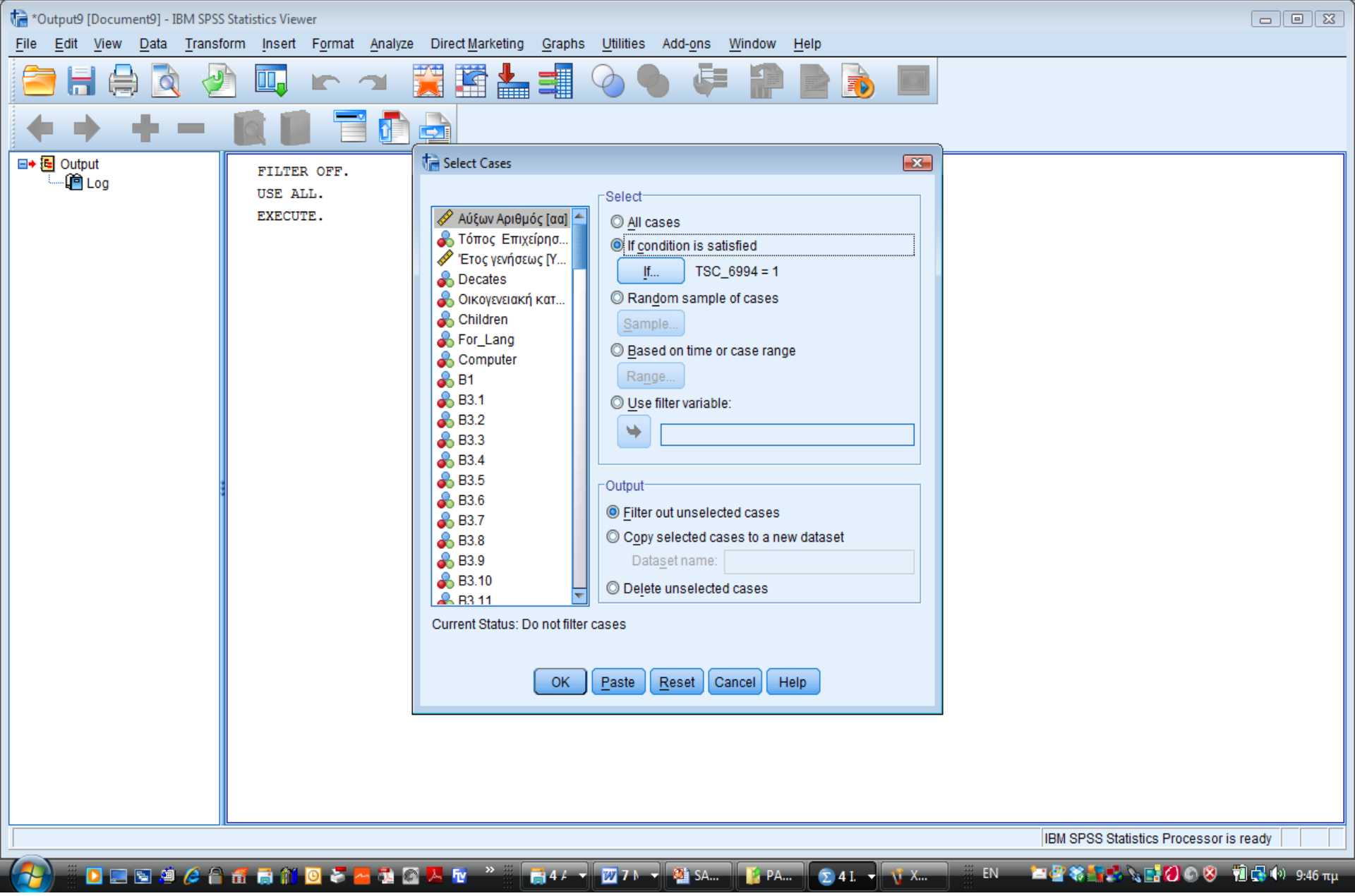
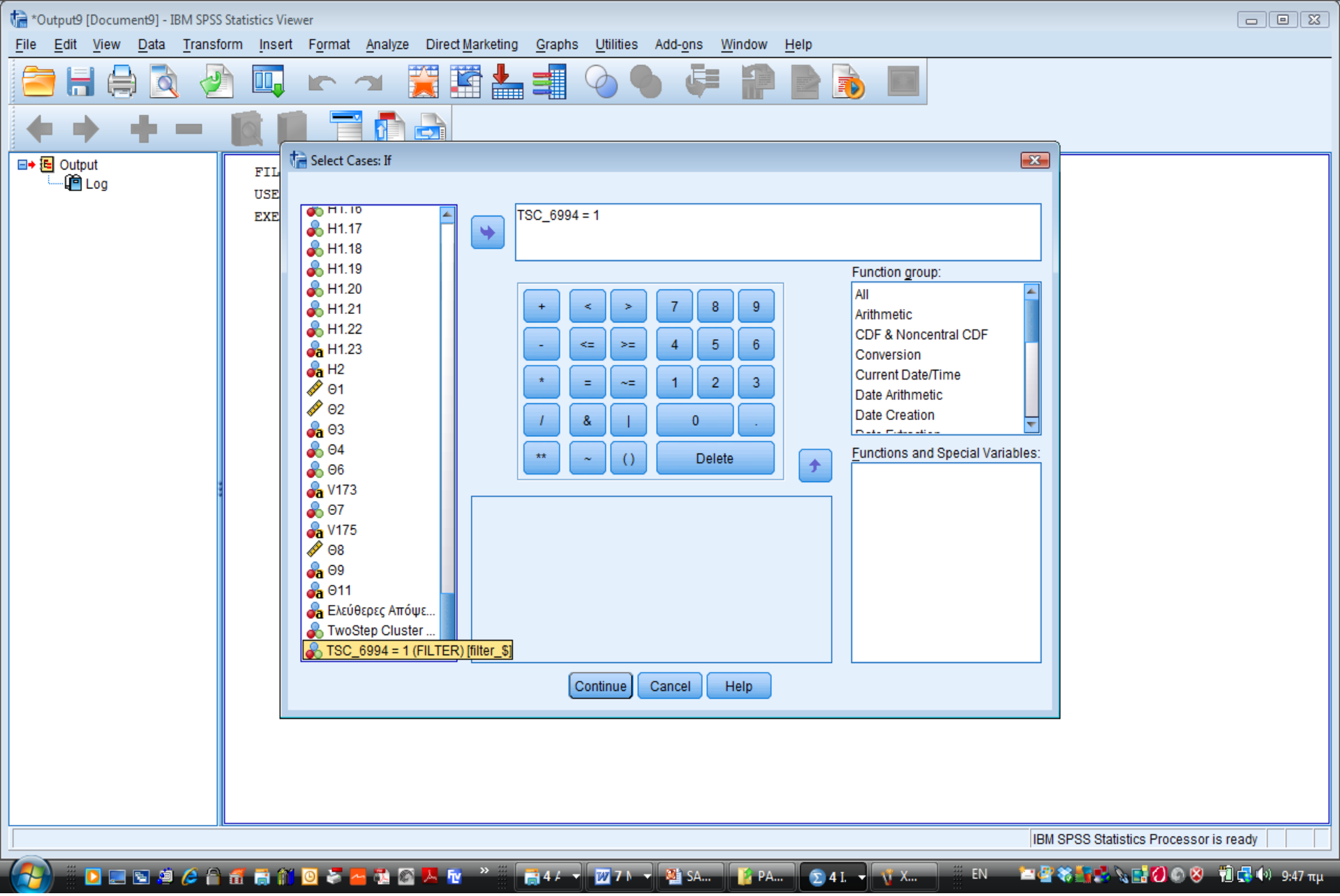
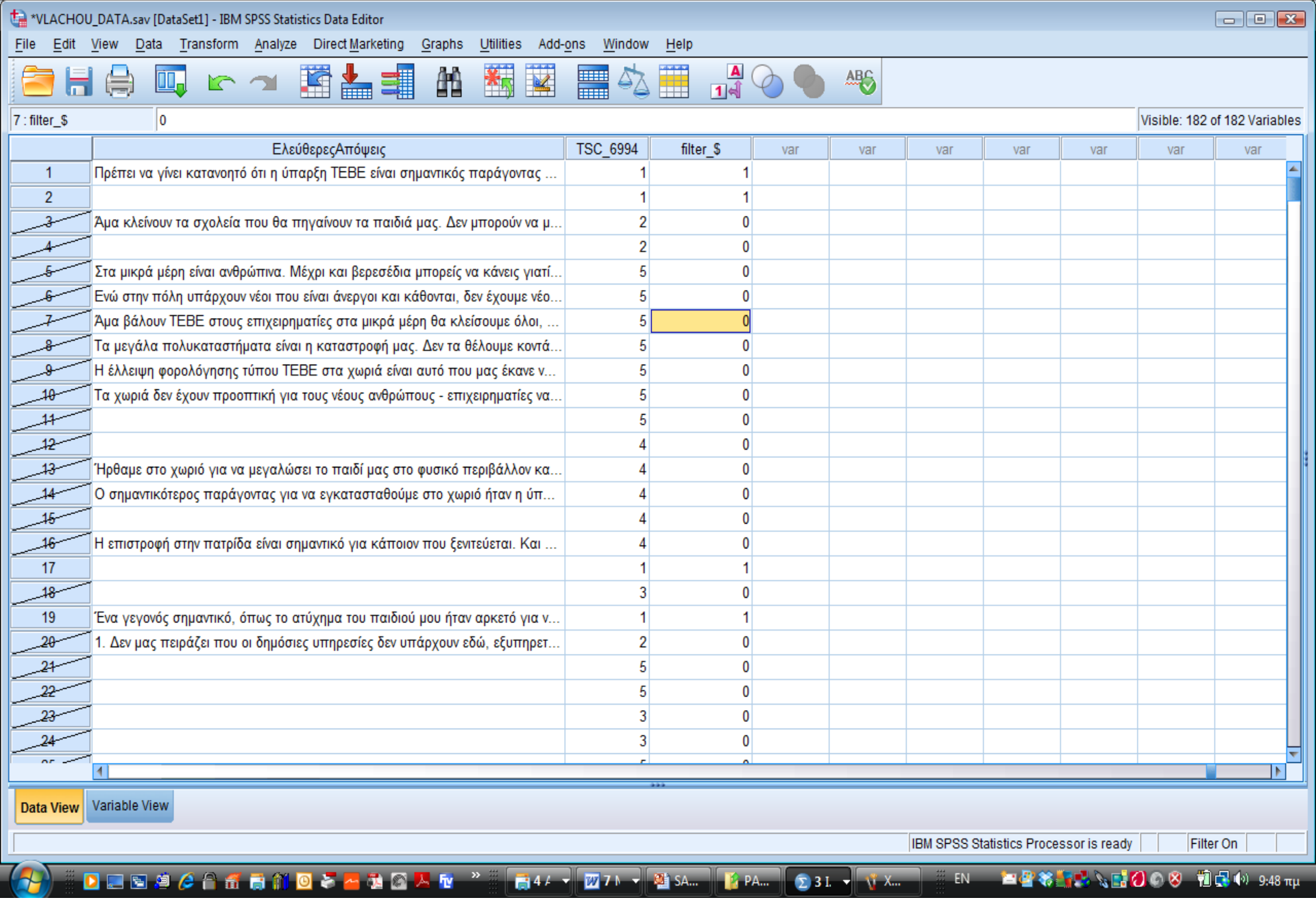
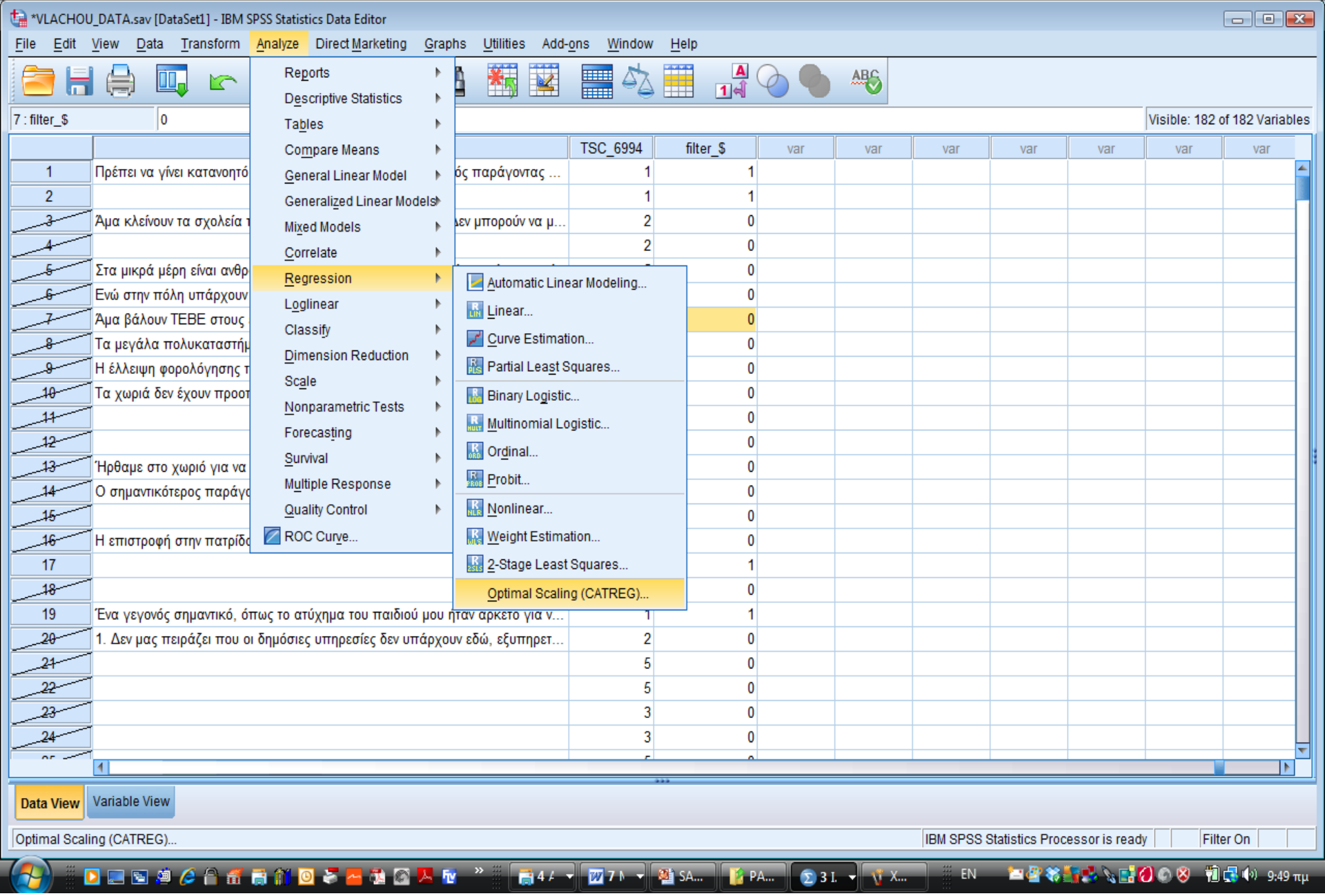
Visible: 181 of 181 Variables
ΕλεύθερεςΑπόψεις
TSC_6994
var
1 Πρέπει να γίνει κατανοητό ότι η ύπαρξη ΤΕΒΕ είναι σημαντικός παράγοντας ... 1
2 1
3 Άμα κλείνουν τα σχολεία που θα πηγαίνουν τα παιδιά μας. Δεν μπορούν να μ... 2
4 2
5 Στα μικρά μέρη είναι ανθρώπινα. Μέχρι και βερεσέδια μπορείς να κάνεις γιατί... 5
6 Ενώ στην πόλη υπάρχουν νέοι που είναι άνεργοι και κάθονται, δεν έχουμε νέο... 5
7 Άμα βάλουν ΤΕΒΕ στους επιχειρηματίες στα μικρά μέρη θα κλείσουμε όλοι, ... 5
8 Τα μεγάλα πολυκαταστήματα είναι η καταστροφή μας. Δεν τα θέλουμε κοντά... 5
9 Η έλλειψη φορολόγησης τύπου ΤΕΒΕ στα χωριά είναι αυτό που μας έκανε ν... 5
10 Τα χωριά δεν έχουν προοπτική για τους νέους ανθρώπους - επιχειρηματίες να... 5
11 5
12 4
13 Ήρθαμε στο χωριό για να μεγαλώσει το παιδί μας στο φυσικό περιβάλλον κα... 4
14 Ο σημαντικότερος παράγοντας για να εγκατασταθούμε στο χωριό ήταν η ύπ... 4
15 4
16 Η επιστροφή στην πατρίδα είναι σημαντικό για κάποιον που ξενιτεύεται. Και ... 4
17 1
18 3
19 Ένα γεγονός σημαντικό, όπως το ατύχημα του παιδιού μου ήταν αρκετό για ν... 1
20 1. Δεν μας πειράζει που οι δημόσιες υπηρεσίες δεν υπάρχουν εδώ, εξυπηρετ... 2
21 5
22 5
23 3
24 3
Data View
Variable View
IBM SPSS Statistics Processor is ready
EN
9:39 πμ

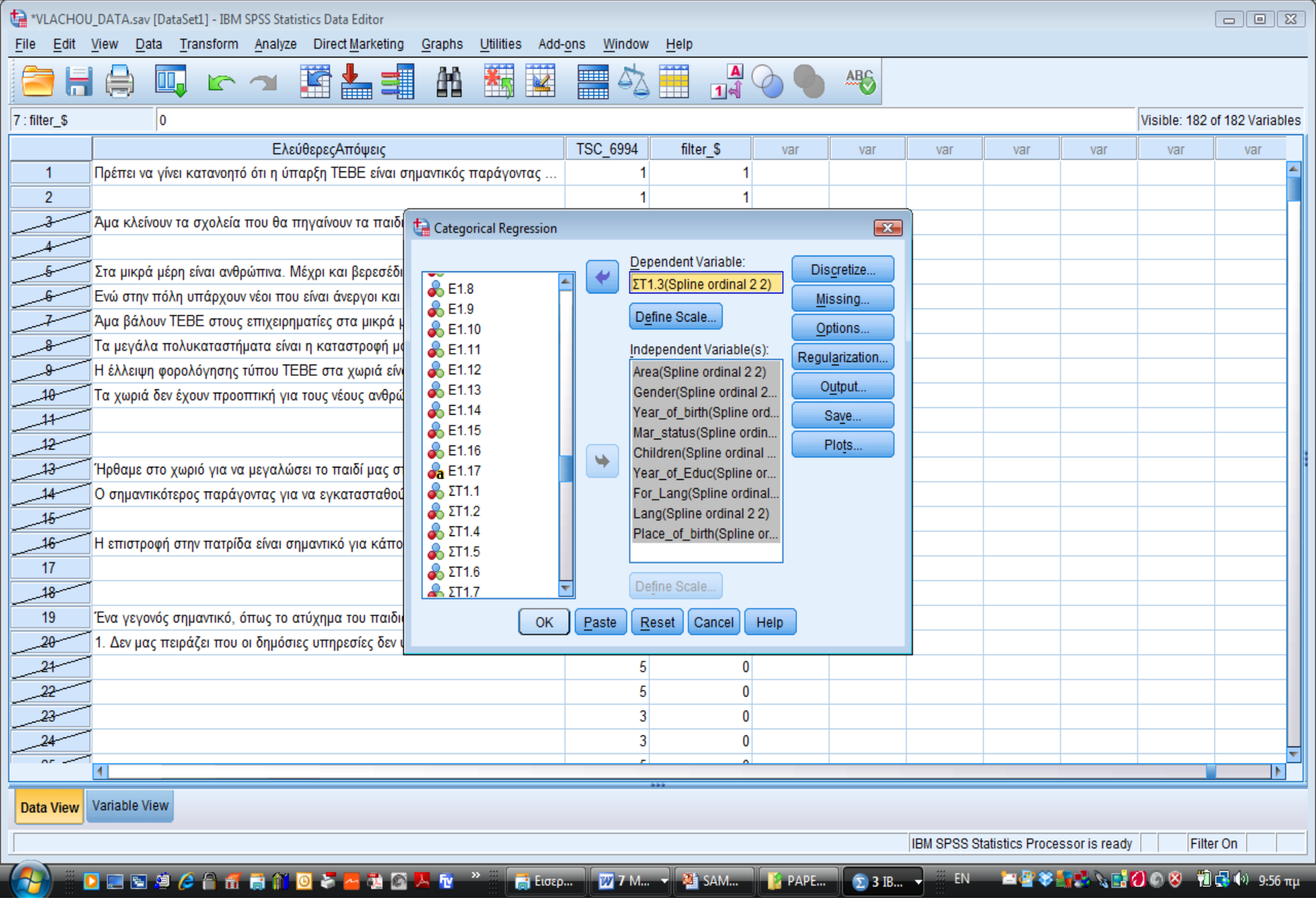

*VLACHOU_DATA.sav [DataSet1] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Define Variable Properties...
Set Measurement Level for Unknown...
Copy Data Properties...
New Custom Attribute...
Define Dates...
Define Multiple Response Sets...
Identify Duplicate Cases...
Sort Cases...
Sort Variables...
Transpose...
Merge Files
Restructure...
Aggregate...
Orthogonal Design
Copy Dataset
Split File...
Select Cases...
Weight Cases...
Visible: 181 of 181 Variables
TSC_6994
var
Data View
Variable View
Select Cases...
IBM SPSS Statistics Processor is ready


*Output9 [Document9] - IBM SPSS Statistics Viewer
File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Output
Log
FILTER OFF.
USE ALL.
EXECUTE.
Select Cases
Αύξων Αριθμός [αα]
Τόπος Επιχείρησ...
Έτος γενήσεως [Υ...
Decates
Οικογενειακή κατ...
Children
For_Lang
Computer
B1
B3.1
B3.2
B3.3
B3.4
B3.5
B3.6
B3.7
B3.8
B3.9
B3.10
B3.11
Select
All cases
If condition is satisfied
If...
TSC_6994 = 1
Random sample of cases
Sample...
Based on time or case range
Range...
Use filter variable:
Output
Filter out unselected cases
Copy selected cases to a new dataset
Dataset name:
Delete unselected cases
Current Status: Do not filter cases
OK
Paste
Reset
Cancel
Help
IBM SPSS Statistics Processor is ready


*Output9 [Document9] - IBM SPSS Statistics Viewer
File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Output
Log
Select Cases: If
TSC_6994 = 1
H1.17
H1.18
H1.19
H1.20
H1.21
H1.22
H1.23
H2
Θ1
Θ2
Θ3
Θ4
Θ6
V173
Θ7
V175
Θ8
Θ9
Θ11
Ελεύθερες Απόψε...
TwoStep Cluster ...
TSC_6994 = 1 (FILTER) [filter_$]
Function group:
All
Arithmetic
CDF & Noncentral CDF
Conversion
Current Date/Time
Date Arithmetic
Date Creation
Functions and Special Variables:
Delete
Continue
Cancel
Help
IBM SPSS Statistics Processor is ready


*VLACHOU_DATA.sav [DataSet1] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
7 : filter_$
0
Visible: 182 of 182 Variables
ΕλεύθερεςΑπόψεις
TSC_6994
filter_$
var
1 Πρέπει να γίνει κατανοητό ότι η ύπαρξη ΤΕΒΕ είναι σημαντικός παράγοντας ... 1 1
2 1 1
3 Άμα κλείνουν τα σχολεία που θα πηγαίνουν τα παιδιά μας. Δεν μπορούν να μ... 2 0
4 2 0
5 Στα μικρά μέρη είναι ανθρώπινα. Μέχρι και βερεσέδια μπορείς να κάνεις γιατί... 5 0
6 Ενώ στην πόλη υπάρχουν νέοι που είναι άνεργοι και κάθονται, δεν έχουμε νέο... 5 0
7 Άμα βάλουν ΤΕΒΕ στους επιχειρηματίες στα μικρά μέρη θα κλείσουμε όλοι, ... 5 0
8 Τα μεγάλα πολυκαταστήματα είναι η καταστροφή μας. Δεν τα θέλουμε κοντά... 5 0
9 Η έλλειψη φορολόγησης τύπου ΤΕΒΕ στα χωριά είναι αυτό που μας έκανε ν... 5 0
10 Τα χωριά δεν έχουν προοπτική για τους νέους ανθρώπους - επιχειρηματίες να... 5 0
11 5 0
12 4 0
13 Ήρθαμε στο χωριό για να μεγαλώσει το παιδί μας στο φυσικό περιβάλλον κα... 4 0
14 Ο σημαντικότερος παράγοντας για να εγκατασταθούμε στο χωριό ήταν η ύπ... 4 0
15 4 0
16 Η επιστροφή στην πατρίδα είναι σημαντικό για κάποιον που ξενιτεύεται. Και ... 4 0
17 1 1
18 3 0
19 Ένα γεγονός σημαντικό, όπως το ατύχημα του παιδιού μου ήταν αρκετό για ν... 1 1
20 1. Δεν μας πειράζει που οι δημόσιες υπηρεσίες δεν υπάρχουν εδώ, εξυπηρετ... 2 0
21 5 0
22 5 0
23 3 0
24 3 0
Data View
Variable View
IBM SPSS Statistics Processor is ready
Filter On
EN
9:48 πμ


*VLACHOU_DATA.sav [DataSet1] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
Reports
Descriptive Statistics
Tables
Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Quality Control
ROC Curve...
Automatic Linear Modeling...
Linear...
Curve Estimation...
Partial Least Squares...
Binary Logistic...
Multinomial Logistic...
Ordinal...
Probit...
Nonlinear...
Weight Estimation...
2-Stage Least Squares...
Optimal Scaling (CATREG)...
7 : filter_$
Visible: 182 of 182 Variables
TSC_6994
filter_$
Data View
Variable View
Optimal Scaling (CATREG)...
IBM SPSS Statistics Processor is ready
Filter On


*VLACHOU_DATA.sav [DataSet1] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
7 : filter_$
0
Visible: 182 of 182 Variables
ΕλεύθερεςΑπόψεις
TSC_6994
filter_$
Πρέπει να γίνει κατανοητό ότι η ύπαρξη ΤΕΒΕ είναι σημαντικός παράγοντας ...
Άμα κλείνουν τα σχολεία που θα πηγαίνουν τα παιδ
Στα μικρά μέρη είναι ανθρώπινα. Μέχρι και βερεσέδ
Ενώ στην πόλη υπάρχουν νέοι που είναι άνεργοι και
Άμα βάλουν ΤΕΒΕ στους επιχειρηματίες στα μικρά μ
Τα μεγάλα πολυκαταστήματα είναι η καταστροφή μ
Η έλλειψη φορολόγησης τύπου ΤΕΒΕ στα χωριά είν
Τα χωριά δεν έχουν προοπτική για τους νέους ανθρώ
Ήρθαμε στο χωριό για να μεγαλώσει το παιδί μας σ
Ο σημαντικότερος παράγοντας για να εγκατασταθού
Η επιστροφή στην πατρίδα είναι σημαντικό για κάπο
Ένα γεγονός σημαντικό, όπως το ατύχημα του παιδ
1. Δεν μας πειράζει που οι δημόσιες υπηρεσίες δεν
Categorical Regression
E1.8
E1.9
E1.10
E1.11
E1.12
E1.13
E1.14
E1.15
E1.16
E1.17
ΣΤ1.1
ΣΤ1.2
ΣΤ1.4
ΣΤ1.5
ΣΤ1.6
ΣΤ1.7
Dependent Variable:
ΣΤ1.3(Spline ordinal 2 2)
Define Scale...
Independent Variable(s):
Area(Spline ordinal 2 2)
Gender(Spline ordinal 2...
Year_of_birth(Spline ord...
Mar_status(Spline ordin...
Children(Spline ordinal ...
Year_of_Educ(Spline or...
For_Lang(Spline ordinal...
Lang(Spline ordinal 2 2)
Place_of_birth(Spline or...
Define Scale...
Discretize...
Missing...
Options...
Regularization...
Output...
Save...
Plots...
OK
Paste
Reset
Cancel
Help
Data View
Variable View
IBM SPSS Statistics Processor is ready
Filter On
9:56 πμ

CatReg Model Summary

Model Summary

Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
,903	,815	,519	,185

Dependent Variable: TwoStep Cluster Number

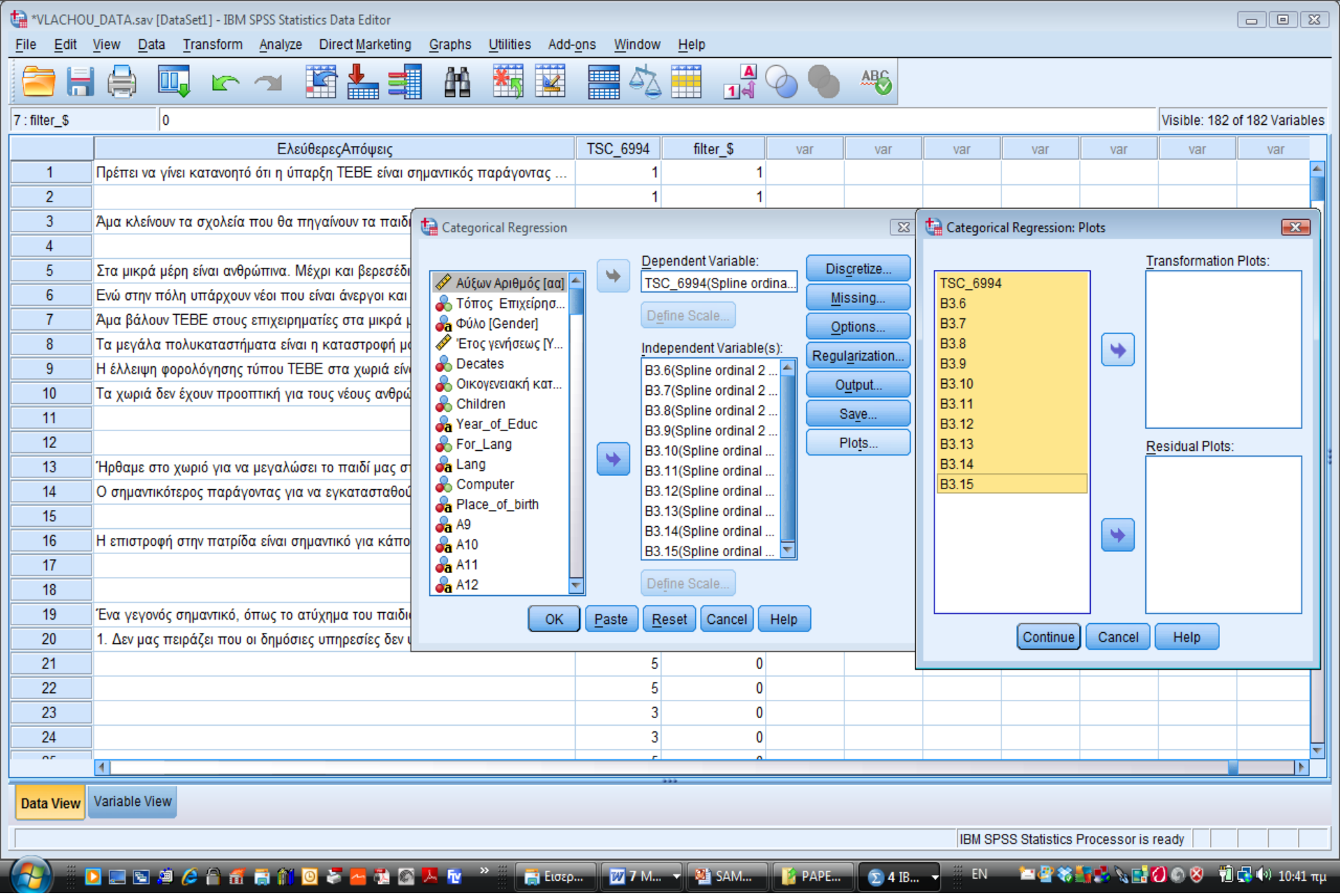
Predictors: B3.6 B3.7 B3.8 B3.9 B3.10 B3.11 B3.12 B3.13 B3.14 B3.15

Relative importance measures

Correlations and Tolerance

	Correlations			Importance	Tolerance	
	Zero-Order	Partial	Part		After Transformation	Before Transformation
B3.6	-,215	-,668	-,386	,145	,496	,473
B3.7	-,604	-,848	-,689	,633	,651	,495
B3.8	-,174	-,595	-,318	,122	,313	,303
B3.9	,268	,506	,252	,093	,793	,641
B3.10	-,094	,755	,495	-,086	,436	,444
B3.11	,011	-,173	-,075	-,001	,514	,588
B3.12	,054	,731	,461	,044	,464	,466
B3.13	-,084	,644	,362	-,051	,543	,468
B3.14	-,229	-,480	-,235	,090	,543	,558
B3.15	-,098	-,159	-,069	,012	,451	,347

Dependent Variable: TwoStep Cluster Number


*VLACHOU_DATA.sav [DataSet1] - IBM SPSS Statistics Data Editor
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help
7 : filter_$
0
Visible: 182 of 182 Variables
ΕλεύθερεςΑπόψεις
TSC_6994
filter_$
Πρέπει να γίνει κατανοητό ότι η ύπαρξη ΤΕΒΕ είναι σημαντικός παράγοντας ...
Άμα κλείνουν τα σχολεία που θα πηγαίνουν τα παιδ
Στα μικρά μέρη είναι ανθρώπινα. Μέχρι και βερεσέδι
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Άμα βάλουν ΤΕΒΕ στους επιχειρηματίες στα μικρά μ
Τα μεγάλα πολυκαταστήματα είναι η καταστροφή μ
Η έλλειψη φορολόγησης τύπου ΤΕΒΕ στα χωριά είν
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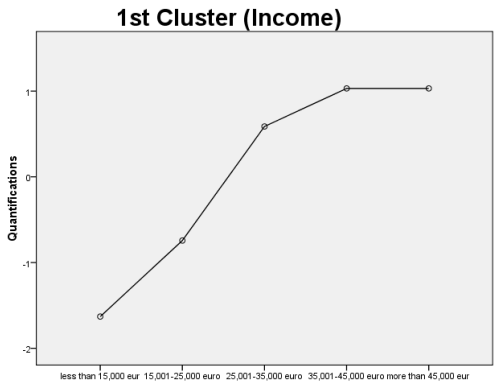
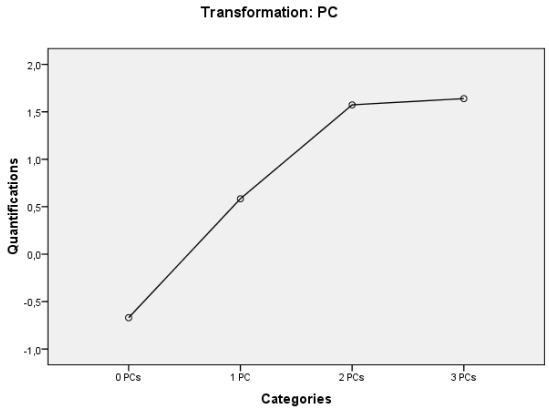
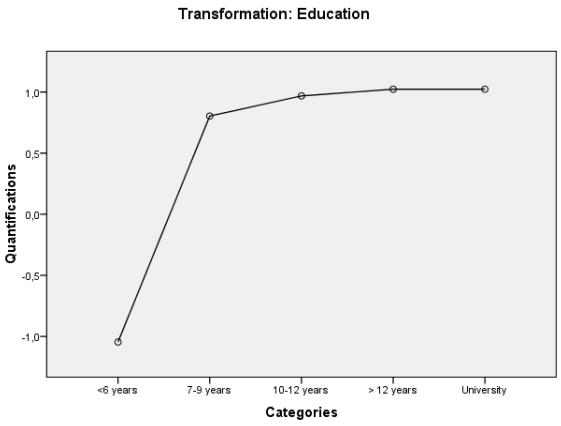
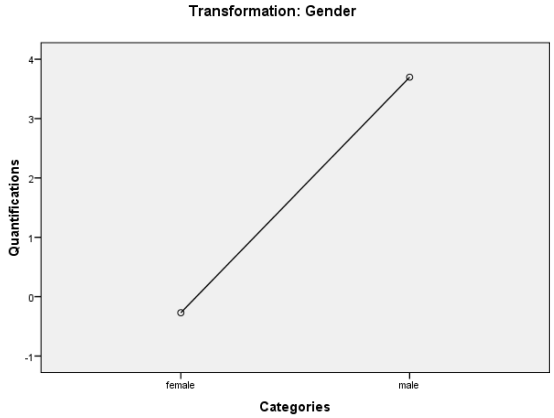
Ήρθαμε στο χωριό για να μεγαλώσει το παιδί μας σ
Ο σημαντικότερος παράγοντας για να εγκατασταθού
Η επιστροφή στην πατρίδα είναι σημαντικό για κάπο
Ένα γεγονός σημαντικό, όπως το ατύχημα του παιδι
1. Δεν μας πειράζει που οι δημόσιες υπηρεσίες δεν
Categorical Regression
Αύξων Αριθμός [αα]
Τόπος Επιχείρησ...
Φύλο [Gender]
Έτος γενήσεως [Υ...
Decates
Οικογενειακή κατ...
Children
Year_of_Educ
For_Lang
Lang
Computer
Place_of_birth
A9
A10
A11
A12
Dependent Variable:
TSC_6994(Spline ordina...
Define Scale...
Independent Variable(s):
B3.6(Spline ordinal 2 ...
B3.7(Spline ordinal 2 ...
B3.8(Spline ordinal 2 ...
B3.9(Spline ordinal 2 ...
B3.10(Spline ordinal ...
B3.11(Spline ordinal ...
B3.12(Spline ordinal ...
B3.13(Spline ordinal ...
B3.14(Spline ordinal ...
B3.15(Spline ordinal ...
Define Scale...
Discretize...
Missing...
Options...
Regularization...
Output...
Save...
Plots...
OK
Paste
Reset
Cancel
Help
Categorical Regression: Plots
TSC_6994
B3.6
B3.7
B3.8
B3.9
B3.10
B3.11
B3.12
B3.13
B3.14
B3.15
Transformation Plots:
Residual Plots:
Continue
Cancel
Help
Data View
Variable View
IBM SPSS Statistics Processor is ready
10:41 πμ

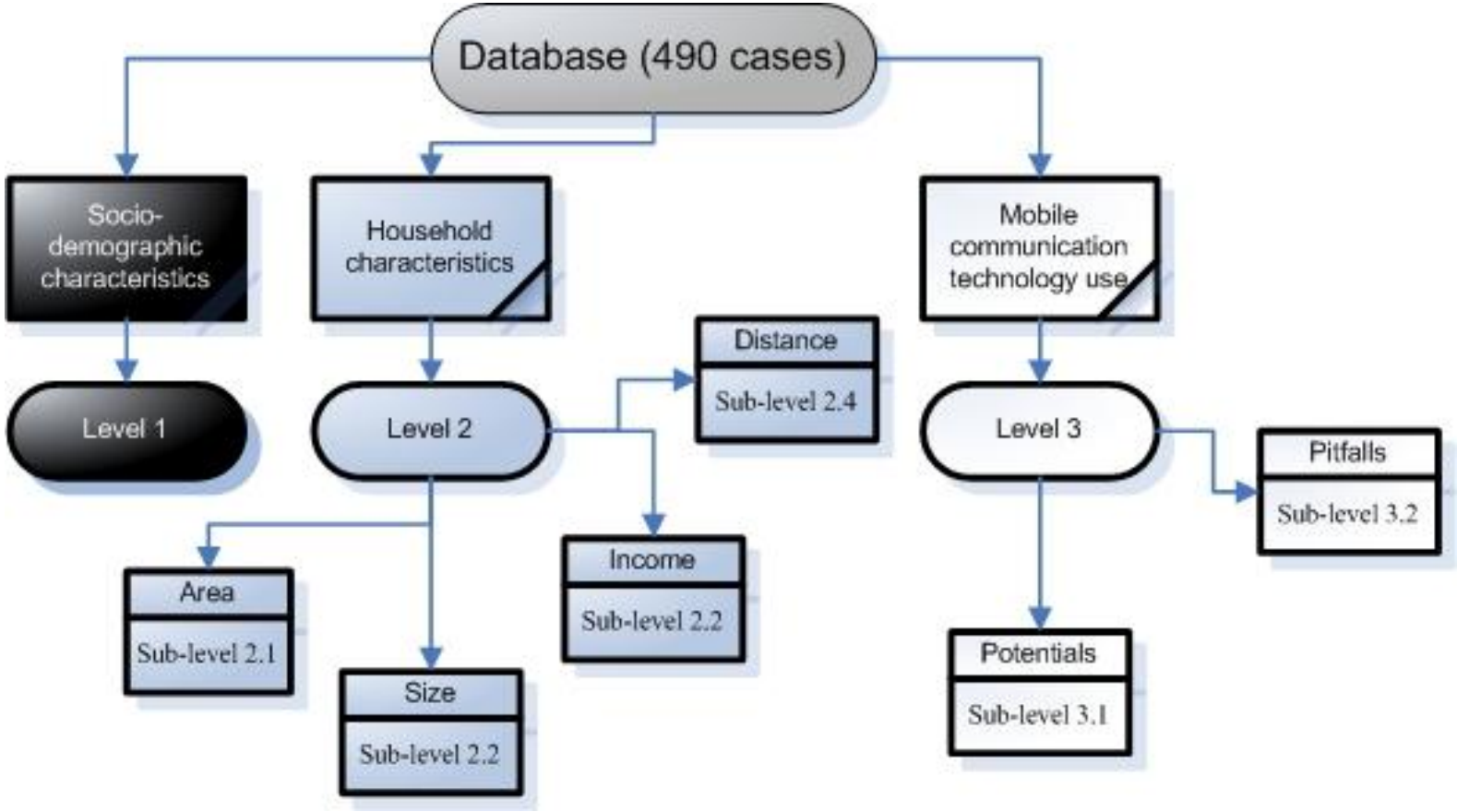

1st Cluster (Income)
Quantifications
1
0
-1
-2
less than 15,000 eur
15,001-25,000 euro
25,001-35,000 euro
35,001-45,000 euro
more than 45,000 eur


Transformation: PC
Quantifications
2,0
1,5
1,0
0,5
0,0
-0,5
-1,0
0 PCs
1 PC
2 PCs
3 PCs
Categories


Transformation: Education
Quantifications
1,0
0,5
0,0
-0,5
-1,0
<6 years
7-9 years
10-12 years
> 12 years
University
Categories


Transformation: Gender
Quantifications
4
3
2
1
0
-1
female
male
Categories

Sample


Database (490 cases)
Socio-demographic characteristics
Household characteristics
Mobile communication technology use
Level 1
Level 2
Level 3
Distance
Sub-level 2.4
Pitfalls
Sub-level 3.2
Area
Sub-level 2.1
Income
Sub-level 2.2
Size
Sub-level 2.2
Potentials
Sub-level 3.1

Example …

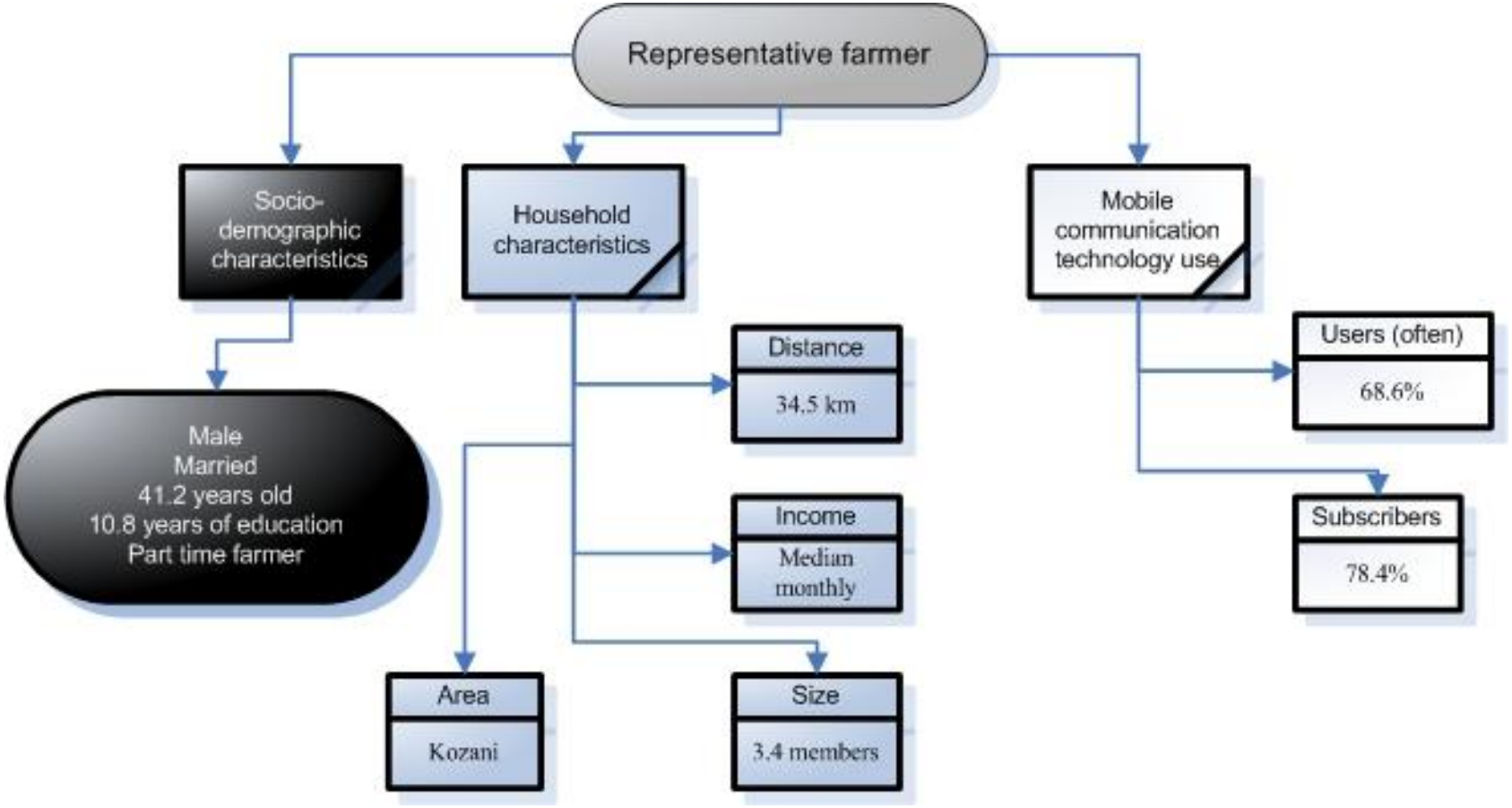

WMR


F.Y.R.O.M.
FLORINA
FLORINA PREFECTURE
Central Macedonia
Mavrovo
ALBANIA
KASTORIA
Ptolemaida
Argos Orestiko
KOZANI PREFECTURE
KASTORIA PREFECTURE
KOZANI
Neapoli
Siatista
Tsotili
Aiani
Servia
GREVENA
Epirus
GREVENA PREFECTURE
Deskati
Thessaly
National Road
Egnatia Motorway
Under construction
Railroad

Aim

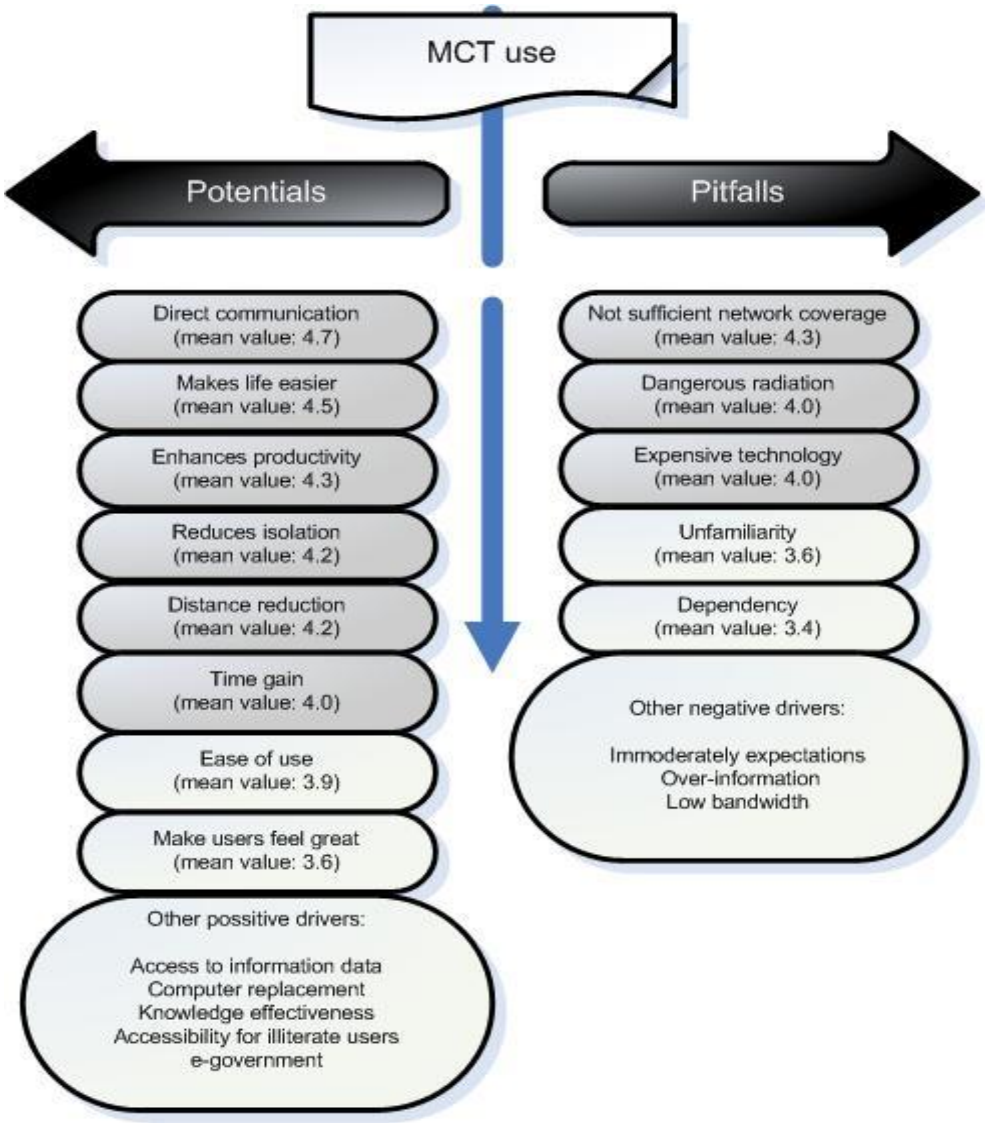
- Innovation → mobile phone → agriculture
- Rural residents → farmers
- Population segmentation in clusters based on the mobile phone use in agriculture

Representative respondent

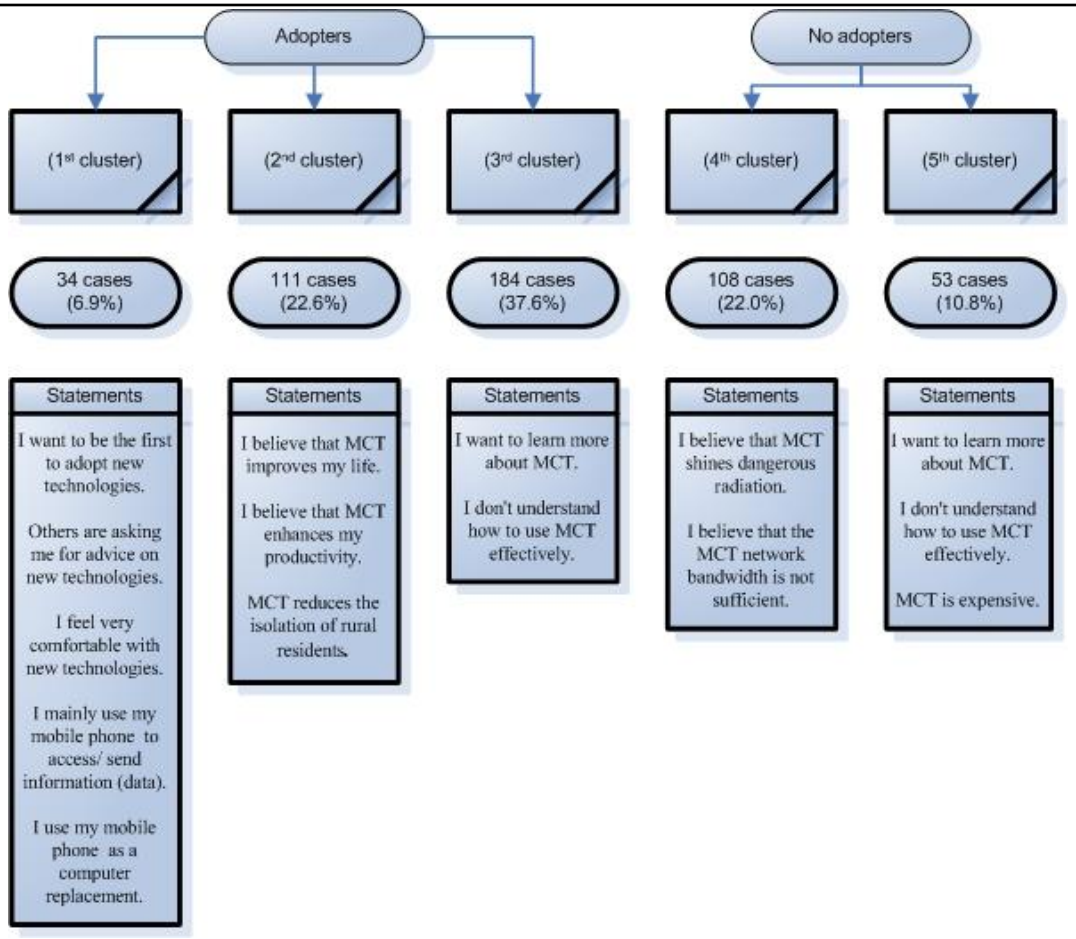


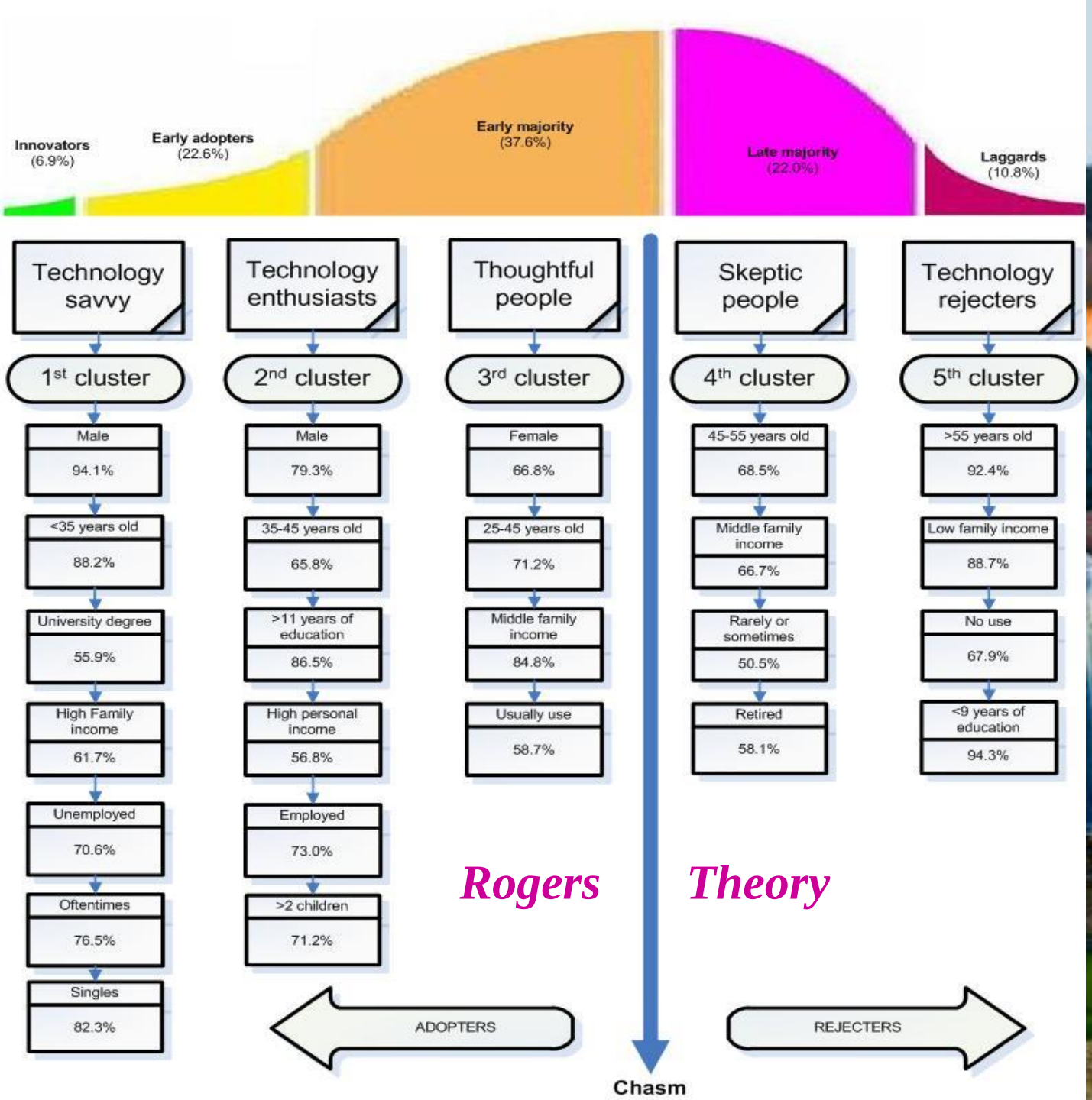
Mobile phone use

		Male (%)	Household monthly income (€)	Average age (years)	Years of education (years)	Distance from the nearest urban area (km)
Never	*(38 cases)*	59.1	950	51.4	9.6	34.1
Rarely	*(24 cases)*	61.2	1,000	43.6	9.9	33.9
Some times	*(92 cases)*	60.2	1,050	42.4	10.2	34.4
Oftentimes	*(212 cases)*	54.9	1,350	41.2	11.0	34.6
Usually	*(124 cases)*	52.7	1,500	36.7	11.4	34.7


MCT use
Potentials
Pitfalls
Direct communication (mean value: 4.7)
Makes life easier (mean value: 4.5)
Enhances productivity (mean value: 4.3)
Reduces isolation (mean value: 4.2)
Distance reduction (mean value: 4.2)
Time gain (mean value: 4.0)
Ease of use (mean value: 3.9)
Make users feel great (mean value: 3.6)
Other possitive drivers:
Access to information data
Computer replacement
Knowledge effectiveness
Accessibility for illiterate users
e-government
Not sufficient network coverage (mean value: 4.3)
Dangerous radiation (mean value: 4.0)
Expensive technology (mean value: 4.0)
Unfamiliarity (mean value: 3.6)
Dependency (mean value: 3.4)
Other negative drivers:
Immoderately expectations
Over-information
Low bandwidth

Clustering model




Innovators
(6.9%)
Early adopters
(22.6%)
Early majority
(37.6%)
Late majority
(22.0%)
Laggards
(10.8%)
Technology savvy
1st cluster
Male
94.1%
<35 years old
88.2%
University degree
55.9%
High Family income
61.7%
Unemployed
70.6%
Oftentimes
76.5%
Singles
82.3%
Technology enthusiasts
2nd cluster
Male
79.3%
35-45 years old
65.8%
>11 years of education
86.5%
High personal income
56.8%
Employed
73.0%
>2 children
71.2%
Thoughtful people
3rd cluster
Female
66.8%
25-45 years old
71.2%
Middle family income
84.8%
Usually use
58.7%
Skeptic people
4th cluster
45-55 years old
68.5%
Middle family income
66.7%
Rarely or sometimes
50.5%
Retired
58.1%
Technology rejecters
5th cluster
>55 years old
92.4%
Low family income
88.7%
No use
67.9%
<9 years of education
94.3%
Rogers
Theory
ADOPTERS
REJECTERS
Chasm

Concluding …

- The basic concept underlying diffusion theory is that adopters of an innovation do not adopt the innovation independently, but instead influence each others' adoption decisions.
- According to Rogers, the influence of early adopters on later adopters is often called "word of mouth communication", a term referring to a much broader set of phenomena than adopters simply talking to each other.

Concluding …

- Innovations are considered, among other things, as rural development and socioeconomic cohesion indicators for a region.
- The EU emphasizes the contribution of innovations to the economy, society and personal quality of life with the framework Digital Agenda 2010, which aims at getting more people online.
- Evidence from Greece shows that this policy challenge will be faced for a long time in rural areas, where more than three quarters of households still do not have Internet access and the majority of population do not have innovative behaviour.

Concluding …

- It is still too early in the diffusion process to estimate the full future potential of innovations like MCT and Internet.
- Further research is needed specifically targeted on non-users in order to fully understand the situation and provide an overall future policy framework.

Concluding …

- The innovative use of non-linear methodologies for decision-making presented here provides a methodological framework suitable for a number of applications.
- Thus, a combinational use of CATREG model with a TSCA can be very practical for future research, in the examination of any human decision where some variables are not linear.

Policy implications

- Policy makers can focus on the specific needs and characteristics of each cluster in order to design policy measures and regulations !!!
- From the side of resource utilization … this is a more sustainable policy process !!!

Related Literature

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Thank you !!!

tassosm@auth.gr

http://rural-lab.agro.auth.gr/ilham-ec2.pdf