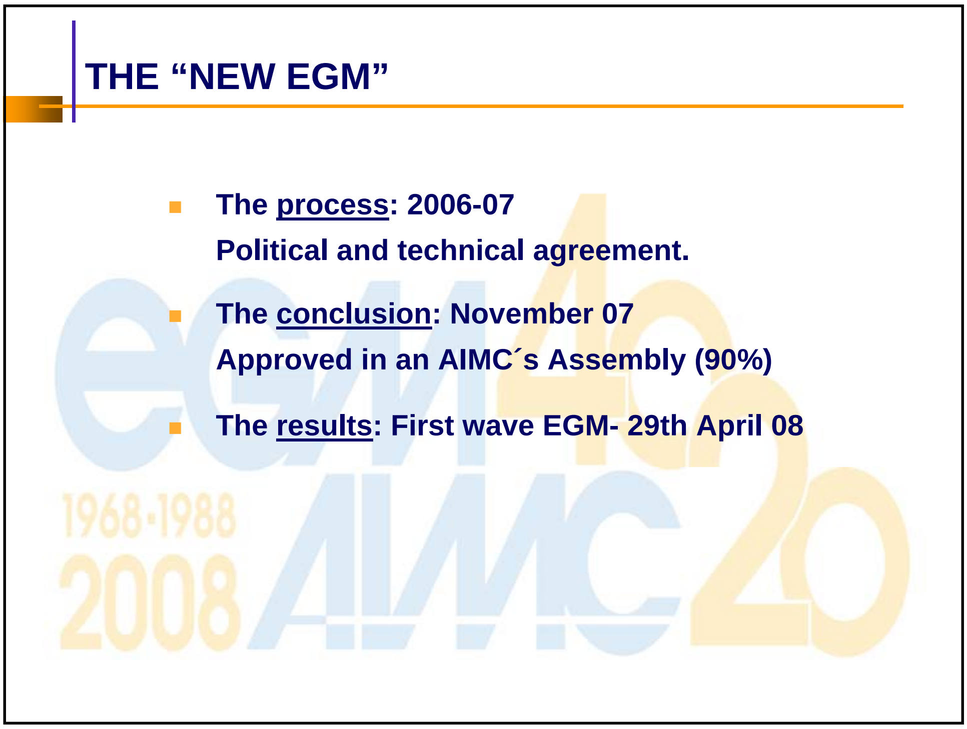
EGM 08: The evolution of the traditional model

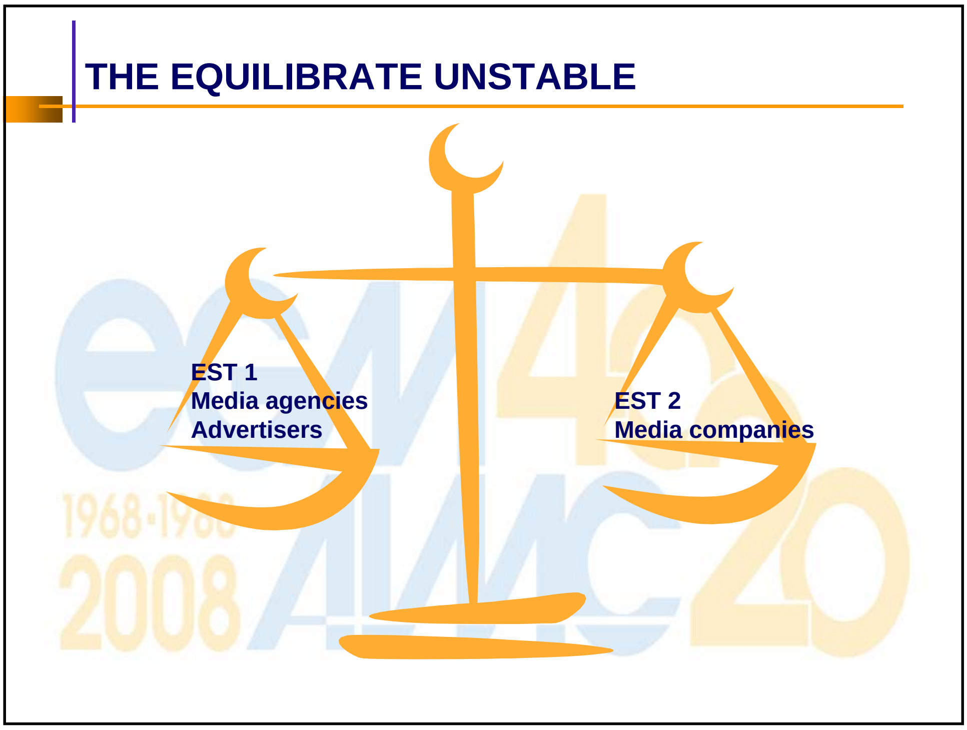
Carlos Lozano (AIMC)
Julián Sánchez (ODEC/QUINAO)

EMRO Conference
Biarritz 24-28 May 2008



THE “NEW EGM”

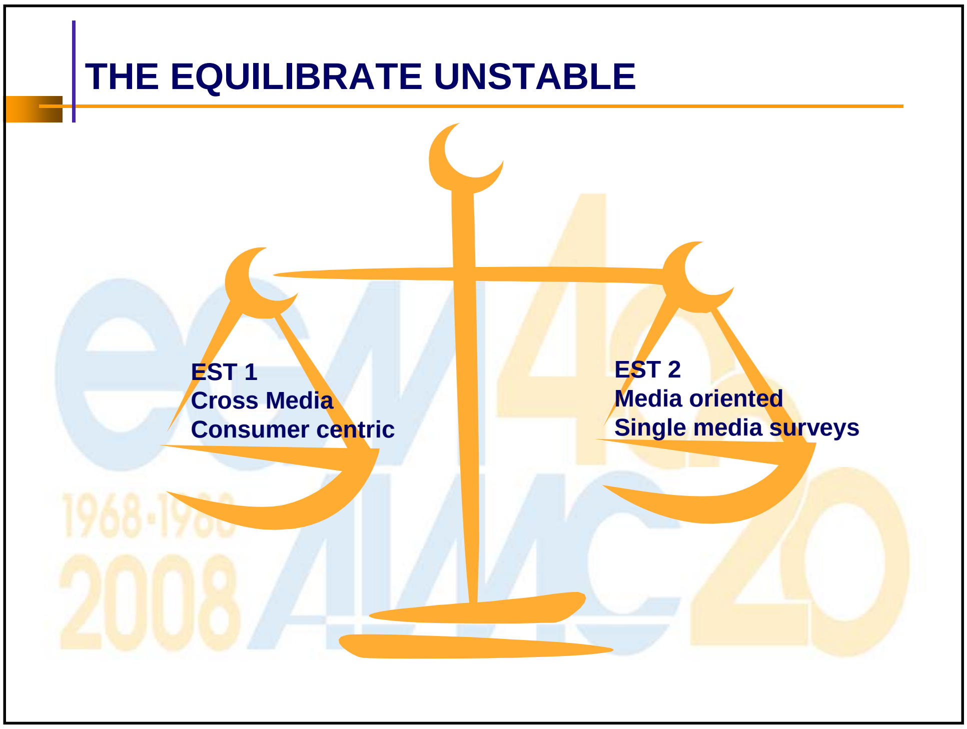
- The process: 2006-07
  Political and technical agreement.
- The conclusion: November 07
  Approved in an AIMC´s Assembly (90%)
- The results: First wave EGM- 29th April 08



THE EQUILIBRATE UNSTABLE

EST 1
Media agencies
Advertisers

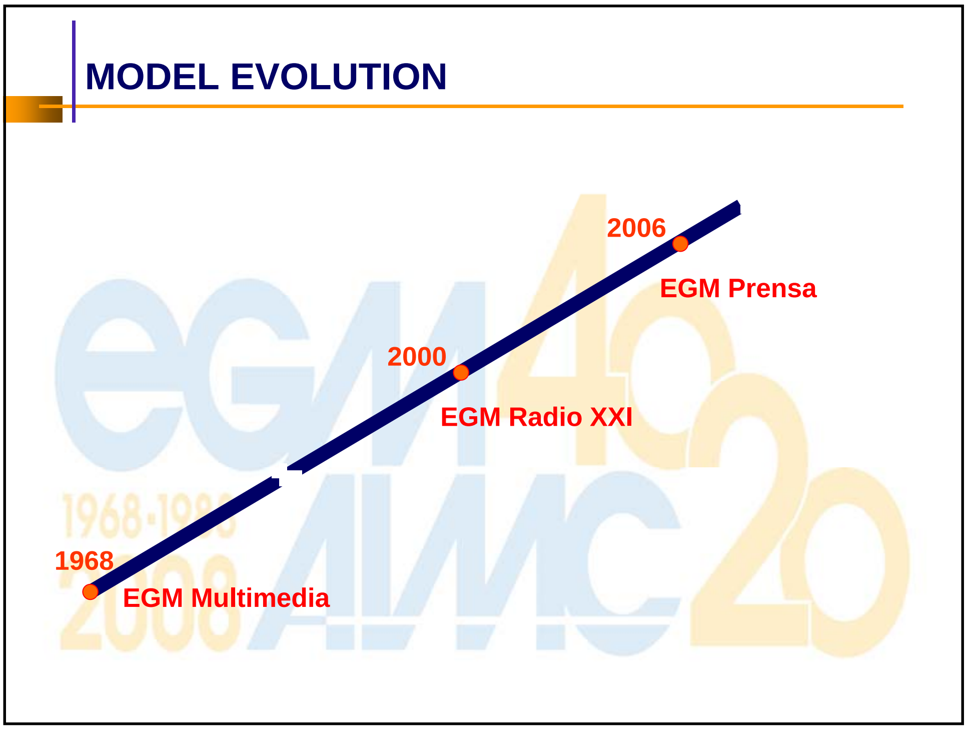
EST 2
Media companies



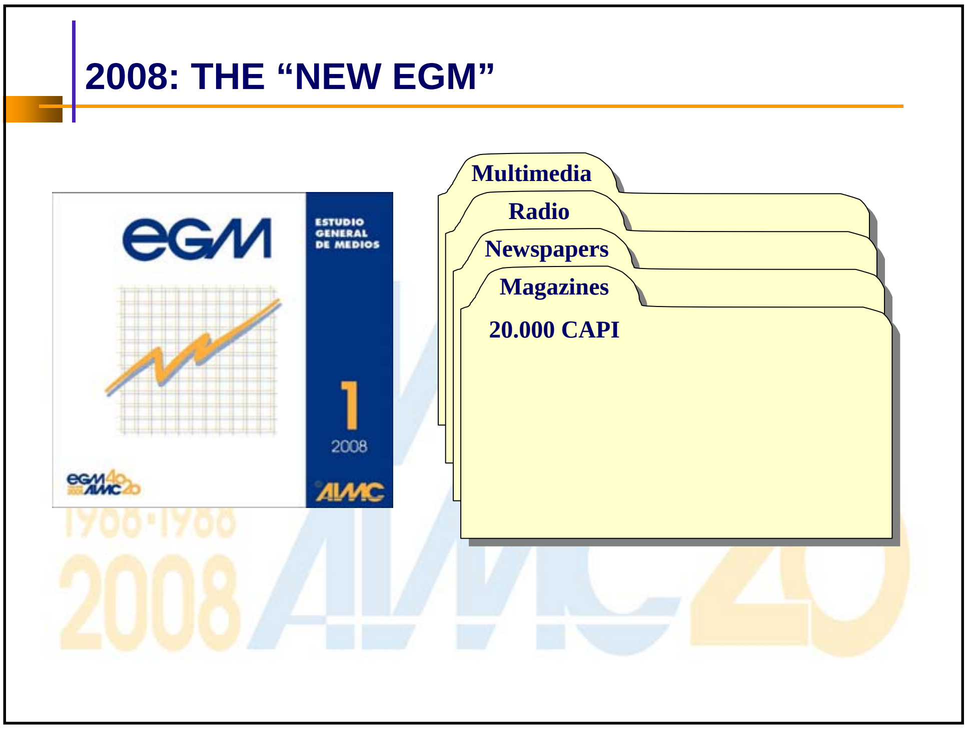
THE EQUILIBRATE UNSTABLE

EST 1
Cross Media
Consumer centric

EST 2
Media oriented
Single media surveys



MODEL EVOLUTION



2008: THE “NEW EGM”

eGM
ESTUDIO GENERAL DE MEDIOS
1
2008
AIMC

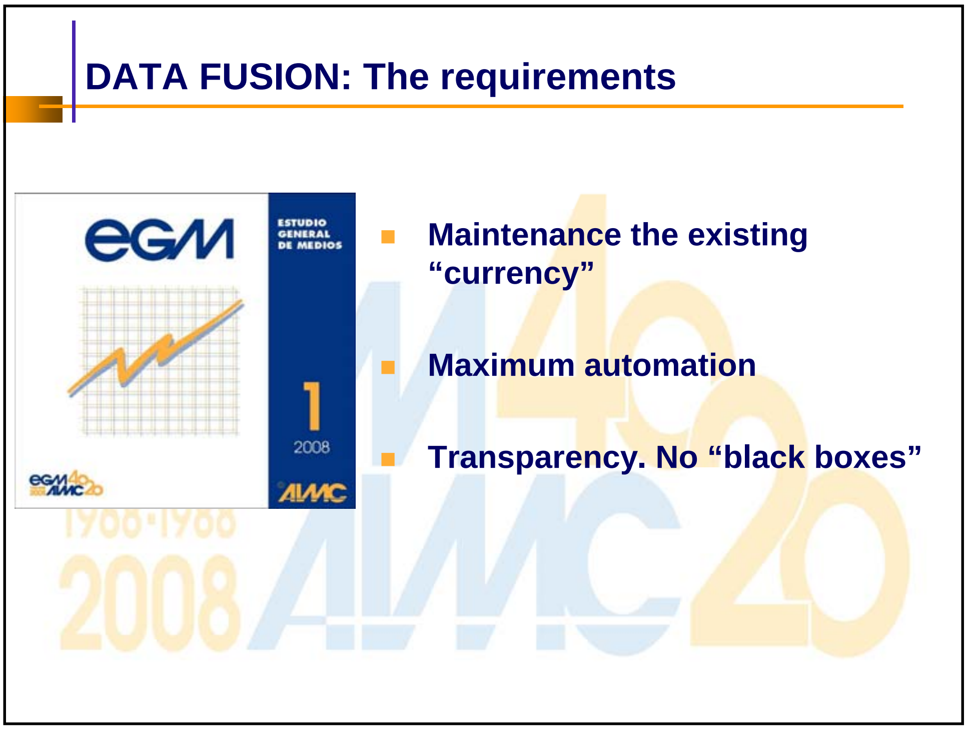
Multimedia

Radio

Newspapers

Magazines

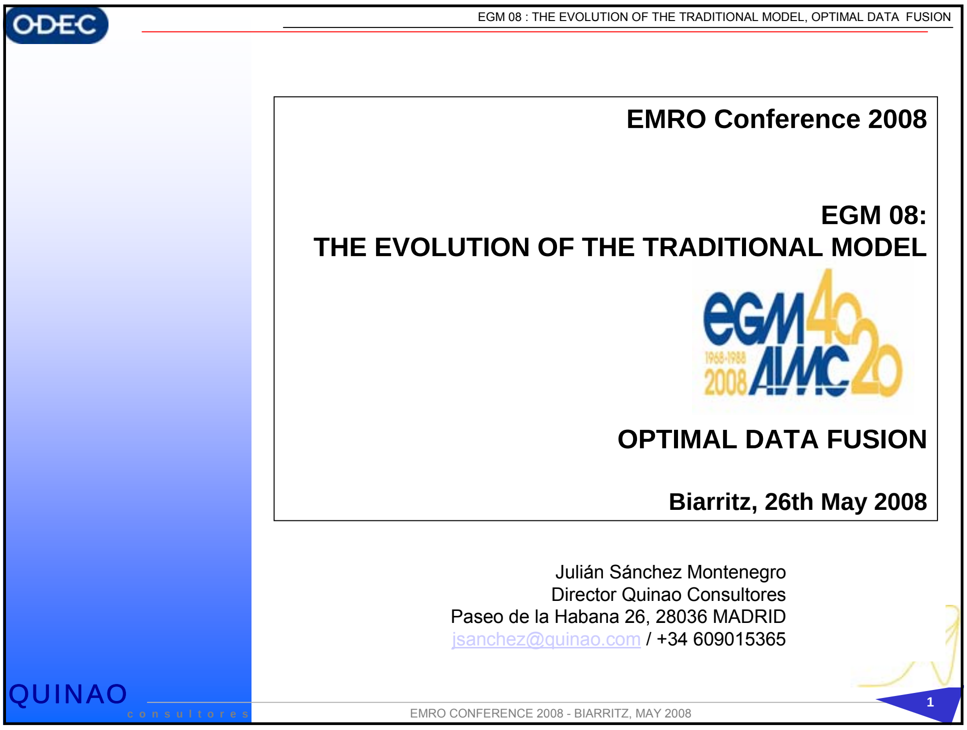
20.000 CAPI



DATA FUSION: The requirements

eGM
ESTUDIO GENERAL DE MEDIOS
1
2008
AIMC

- Maintenance the existing “currency”
- Maximum automation
- Transparency. No “black boxes”



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EGM 08:
THE EVOLUTION OF THE TRADITIONAL MODEL

eGM 40
1968-1988
2008 AIMC 20

OPTIMAL DATA FUSION

Biarritz, 26th May 2008

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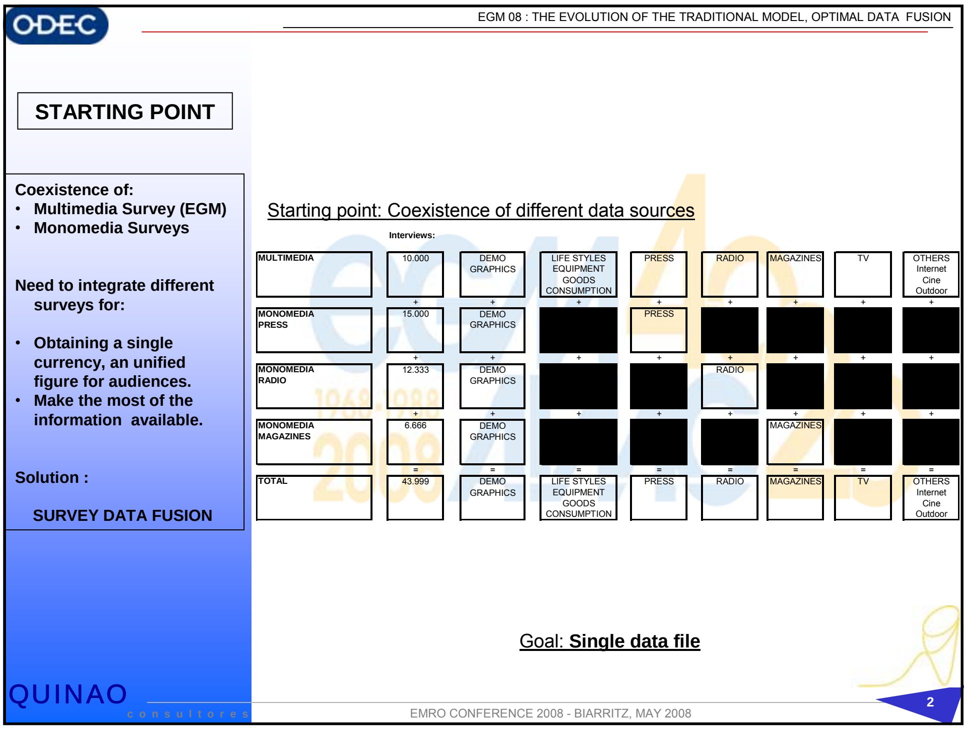


STARTING POINT

Coexistence of:
- **Multimedia Survey (EGM)**
- **Monomedia Surveys**

Need to integrate different surveys for:

- **Obtaining a single currency, an unified figure for audiences.**
- **Make the most of the information available.**

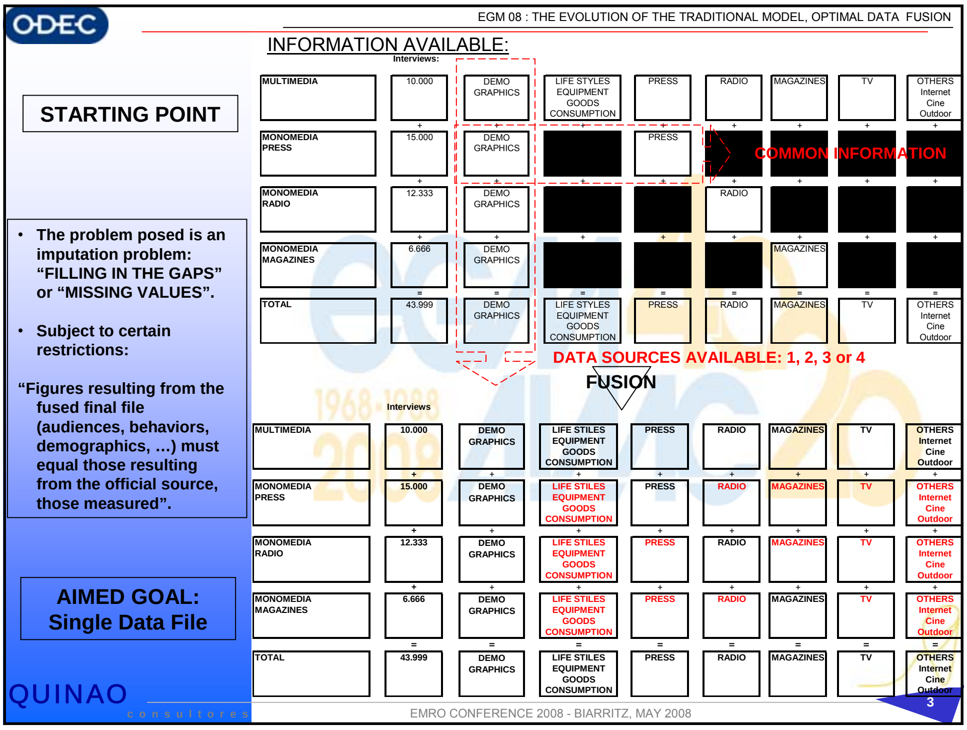
Solution :

SURVEY DATA FUSION

Starting point: Coexistence of different data sources

	Interviews:							
MULTIMEDIA	10.000	DEMO GRAPHICS	LIFE STYLES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
	+	+	+	+	+	+	+	+
MONOMEDIA PRESS	15.000	DEMO GRAPHICS	■	PRESS	■	■	■	■
	+	+	+	+	+	+	+	+
MONOMEDIA RADIO	12.333	DEMO GRAPHICS	■	■	RADIO	■	■	■
	+	+	+	+	+	+	+	+
MONOMEDIA MAGAZINES	6.666	DEMO GRAPHICS	■	■	■	MAGAZINES	■	■
	=	=	=	=	=	=	=	=
TOTAL	43.999	DEMO GRAPHICS	LIFE STYLES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor

Goal: **Single data file**



EGM 08 : THE EVOLUTION OF THE TRADITIONAL MODEL, OPTIMAL DATA FUSION

STARTING POINT

- The problem posed is an imputation problem: "FILLING IN THE GAPS" or "MISSING VALUES".
- Subject to certain restrictions:

"Figures resulting from the fused final file (audiences, behaviors, demographics, …) must equal those resulting from the official source, those measured".

AIMED GOAL: Single Data File

INFORMATION AVAILABLE:

	Interviews:							
MULTIMEDIA	10.000	DEMO GRAPHICS	LIFE STYLES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
MONOMEDIA PRESS	15.000	DEMO GRAPHICS		PRESS				
MONOMEDIA RADIO	12.333	DEMO GRAPHICS			RADIO			
MONOMEDIA MAGAZINES	6.666	DEMO GRAPHICS				MAGAZINES		
TOTAL	43.999	DEMO GRAPHICS	LIFE STYLES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor

COMMON INFORMATION

DATA SOURCES AVAILABLE: 1, 2, 3 or 4

FUSION

	Interviews							
MULTIMEDIA	10.000	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
MONOMEDIA PRESS	15.000	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
MONOMEDIA RADIO	12.333	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
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TOTAL	43.999	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor

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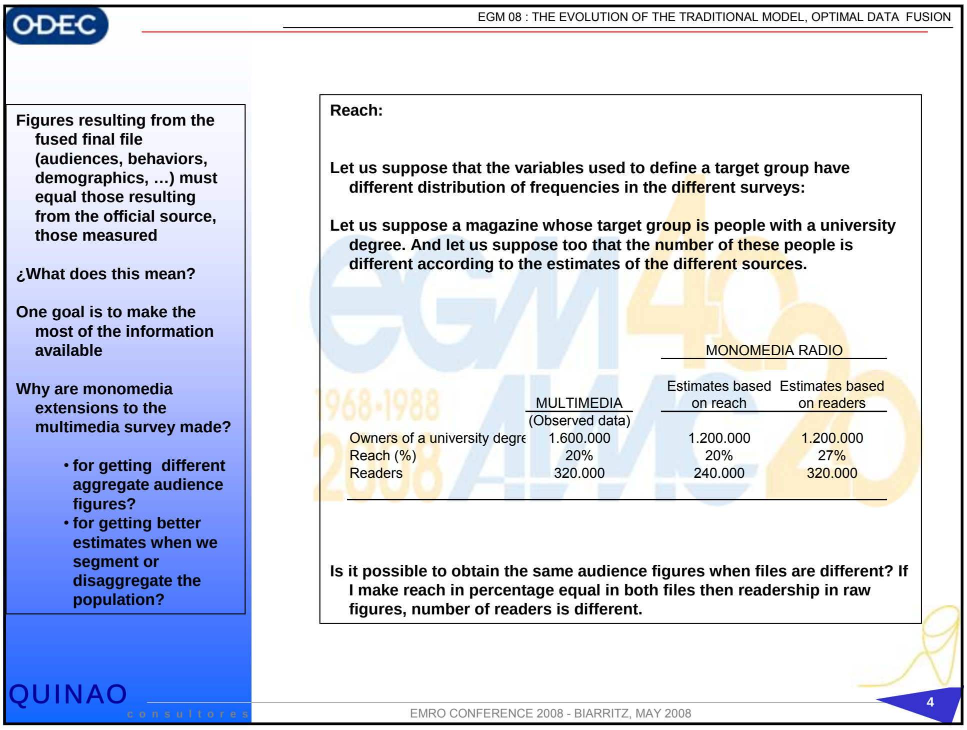

EGM 08 : THE EVOLUTION OF THE TRADITIONAL MODEL, OPTIMAL DATA FUSION

Figures resulting from the fused final file (audiences, behaviors, demographics, …) must equal those resulting from the official source, those measured

¿What does this mean?

One goal is to make the most of the information available

Why are monomedia extensions to the multimedia survey made?

- for getting different aggregate audience figures?
- for getting better estimates when we segment or disaggregate the population?

Reach:

Let us suppose that the variables used to define a target group have different distribution of frequencies in the different surveys:

Let us suppose a magazine whose target group is people with a university degree. And let us suppose too that the number of these people is different according to the estimates of the different sources.

		MONOMEDIA RADIO	
	MULTIMEDIA (Observed data)	Estimates based on reach	Estimates based on readers
Owners of a university degre	1.600.000	1.200.000	1.200.000
Reach (%)	20%	20%	27%
Readers	320.000	240.000	320.000

Is it possible to obtain the same audience figures when files are different? If I make reach in percentage equal in both files then readership in raw figures, number of readers is different.

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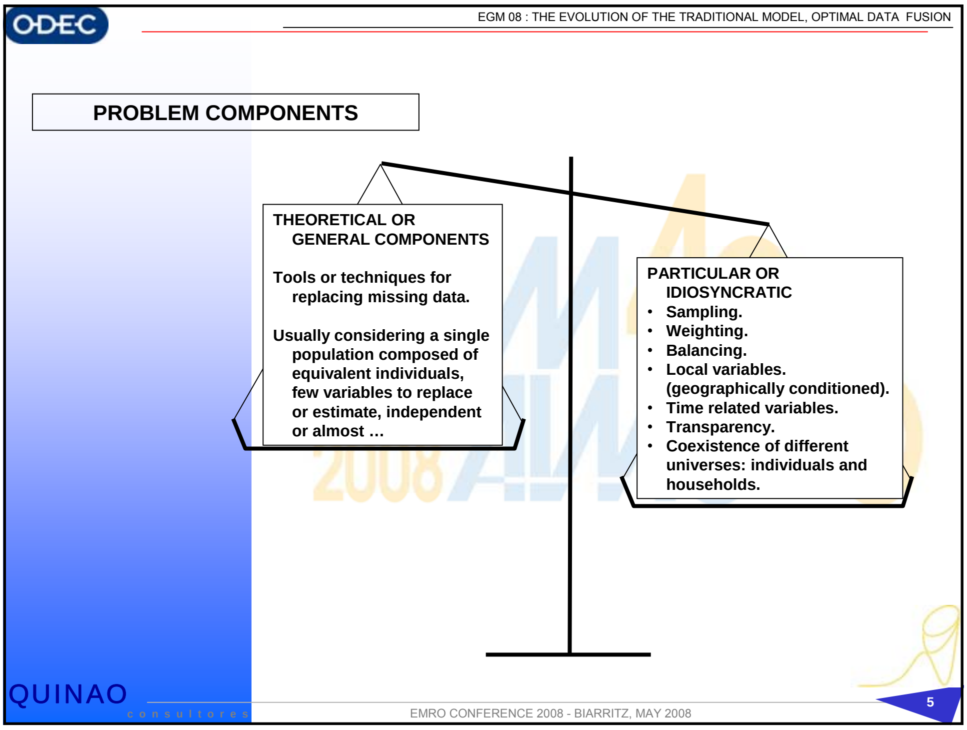

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PROBLEM COMPONENTS

THEORETICAL OR GENERAL COMPONENTS

Tools or techniques for replacing missing data.

Usually considering a single population composed of equivalent individuals, few variables to replace or estimate, independent or almost …

PARTICULAR OR IDIOSYNCRATIC
- Sampling.
- Weighting.
- Balancing.
- Local variables. (geographically conditioned).
- Time related variables.
- Transparency.
- Coexistence of different universes: individuals and households.

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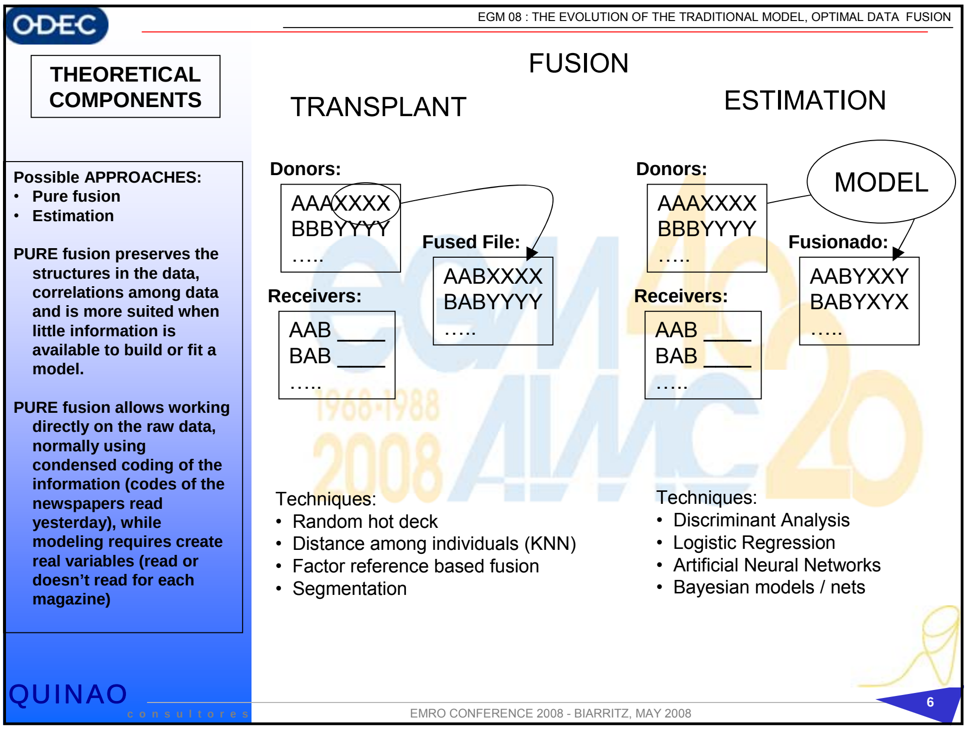

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THEORETICAL COMPONENTS

Possible APPROACHES:
- Pure fusion
- Estimation

PURE fusion preserves the structures in the data, correlations among data and is more suited when little information is available to build or fit a model.

PURE fusion allows working directly on the raw data, normally using condensed coding of the information (codes of the newspapers read yesterday), while modeling requires create real variables (read or doesn't read for each magazine)

FUSION

TRANSPLANT

Donors:

AAAXXXX
BBBYYYY
…..

Receivers:

AAB ____
BAB ____
…..

Fused File:

AABXXXX
BABYYYY
…..

Techniques:
- Random hot deck
- Distance among individuals (KNN)
- Factor reference based fusion
- Segmentation

ESTIMATION

Donors:

AAAXXXX
BBBYYYY
…..

MODEL

Receivers:

AAB ____
BAB ____
…..

Fusionado:

AABYXXY
BABYXYX
…..

Techniques:
- Discriminant Analysis
- Logistic Regression
- Artificial Neural Networks
- Bayesian models / nets

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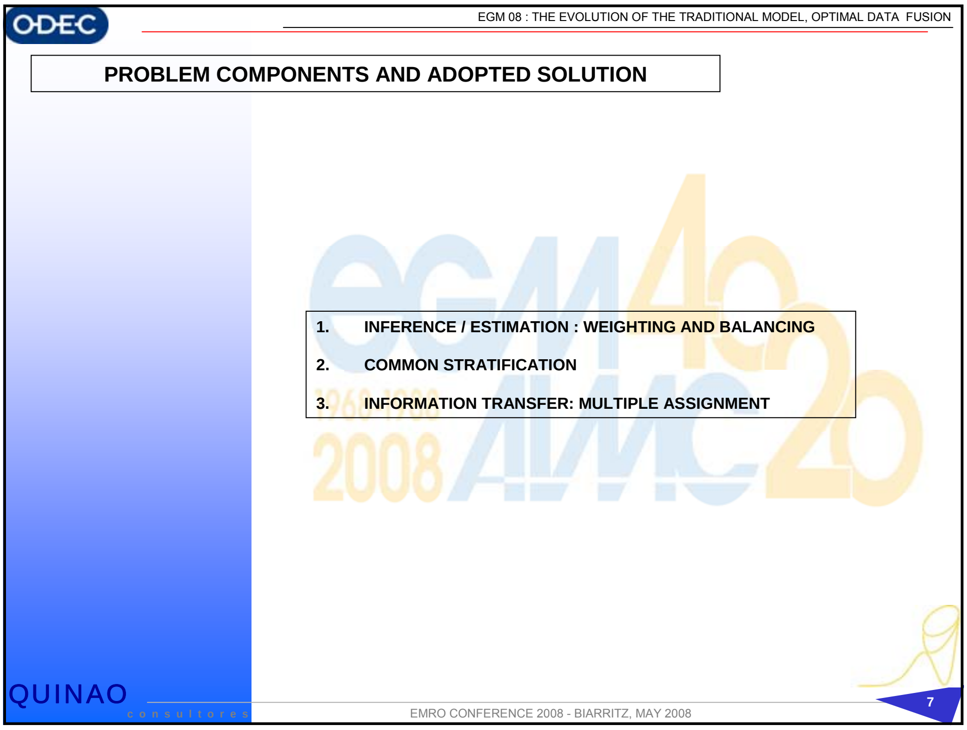
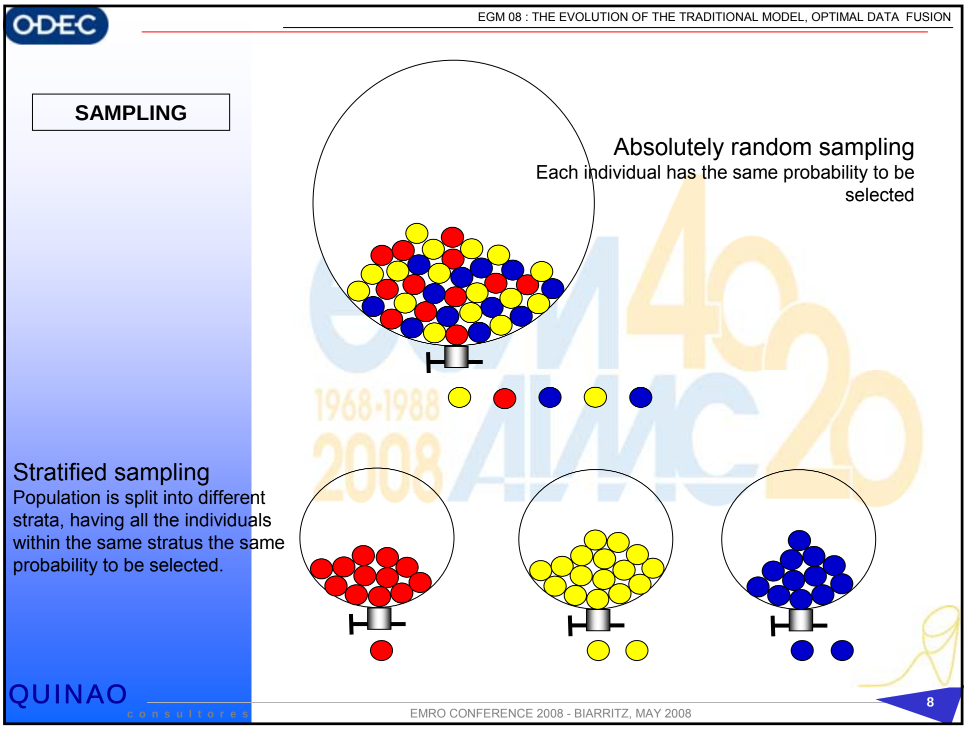


PROBLEM COMPONENTS AND ADOPTED SOLUTION

1. INFERENCE / ESTIMATION : WEIGHTING AND BALANCING
2. COMMON STRATIFICATION
3. INFORMATION TRANSFER: MULTIPLE ASSIGNMENT



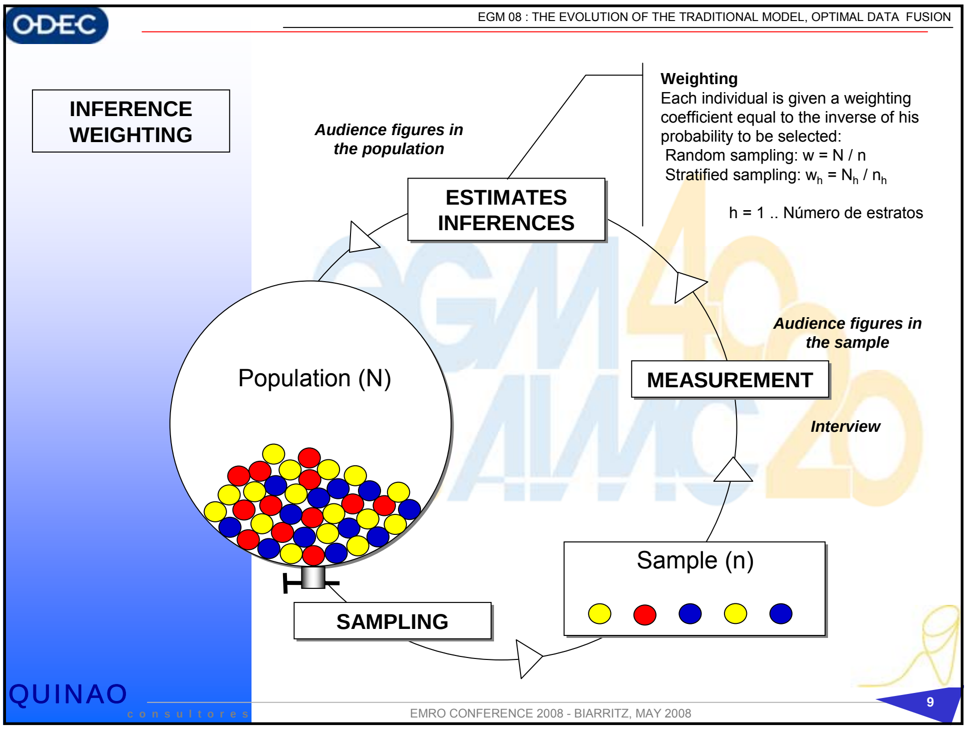
SAMPLING

Absolutely random sampling

Each individual has the same probability to be selected

Stratified sampling

Population is split into different strata, having all the individuals within the same stratus the same probability to be selected.



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INFERENCE WEIGHTING

Weighting

Each individual is given a weighting coefficient equal to the inverse of his probability to be selected:

Random sampling: $w = N / n$

Stratified sampling: $w_h = N_h / n_h$

h = 1 .. Número de estratos

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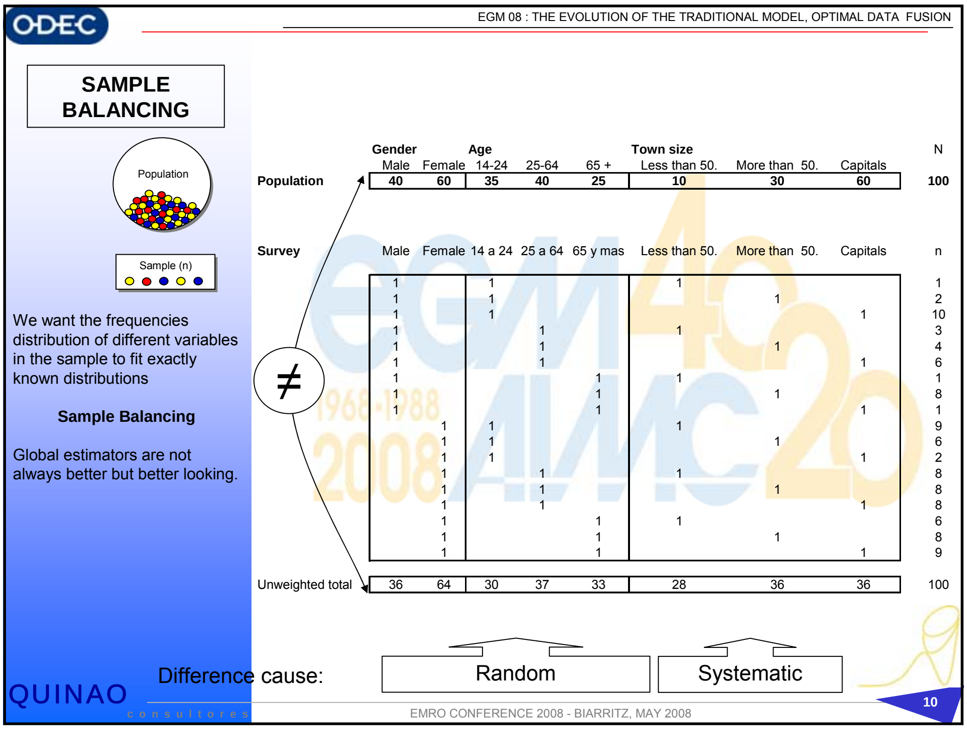

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SAMPLE BALANCING

Population
Sample (n)
≠

We want the frequencies distribution of different variables in the sample to fit exactly known distributions

Sample Balancing

Global estimators are not always better but better looking.

	Gender		Age			Town size			N
	Male	Female	14-24	25-64	65 +	Less than 50.	More than 50.	Capitals	
Population	**40**	**60**	**35**	**40**	**25**	**10**	**30**	**60**	**100**
Survey	Male	Female	14 a 24	25 a 64	65 y mas	Less than 50.	More than 50.	Capitals	n
	1		1			1			1
	1		1				1		2
	1		1					1	10
	1			1		1			3
	1			1			1		4
	1			1				1	6
	1				1	1			1
	1				1		1		8
	1				1			1	1
		1	1			1			9
		1	1				1		6
		1	1					1	2
		1		1		1			8
		1		1			1		8
		1		1				1	8
		1			1	1			6
		1			1		1		8
		1			1			1	9
Unweighted total	36	64	30	37	33	28	36	36	100

Difference cause: Random Systematic

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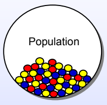
BALANCING



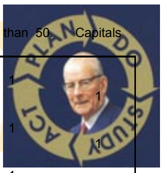
Sample (n)

Balancing is sometimes called:

POST STRATIFICATION, because it creates strata in the sample joined by those individuals with the same values in all the balancing variables and because of this with the same weighting or balancing coefficient.

RAKING, after the algorithm usually applied to turn the sample balanced.

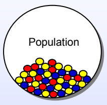
	Gender		Age			Town size			N
	Male	Female	14-24	25-64	65 +	Less than 50.	More than 50.	Capitals	
Population	**40**	**60**	**35**	**40**	**25**	**10**	**30**	**60**	**100**
Survey	Male	Female	14 a 24	25 a 64	65 y mas	Less than 50.	More than 50.	Capitals	n
	1		1			1			1
	1		1				1		2
	1		1					1	10
	1			1		1			3
	1			1			1		4
	1			1				1	6
	1				1	1			1
	1				1		1		8
	1				1			1	1
		1	1			1			9
		1	1				1		6
		1	1					1	2
		1		1		1			8
		1		1			1		8
		1		1				1	8
		1			1	1			6
		1			1		1		8
		1			1			1	9
Unweighted total	36	64	30	37	33	28	36	36	100



W. Edwards DEMING

Difference cause: Random | Systematic

JOINT POST STRATIFICATION



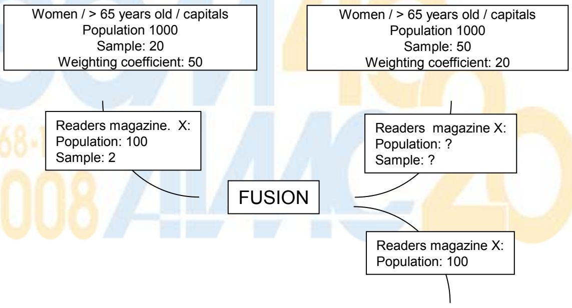
Sample (n)
Sample (n)
Sample (n)

Strata are integrated by individuals absolutely equivalent and being affected equal weighting coefficients and so transfer of the information is done between equivalent individuals.

MULTIMEDIA | MONOMEDIA

Stratus:
.
.
.
h
.
.
.

Sample (n) | Sample (n)



Women / > 65 years old / capitals
Population 1000
Sample: 20
Weighting coefficient: 50

Women / > 65 years old / capitals
Population 1000
Sample: 50
Weighting coefficient: 20

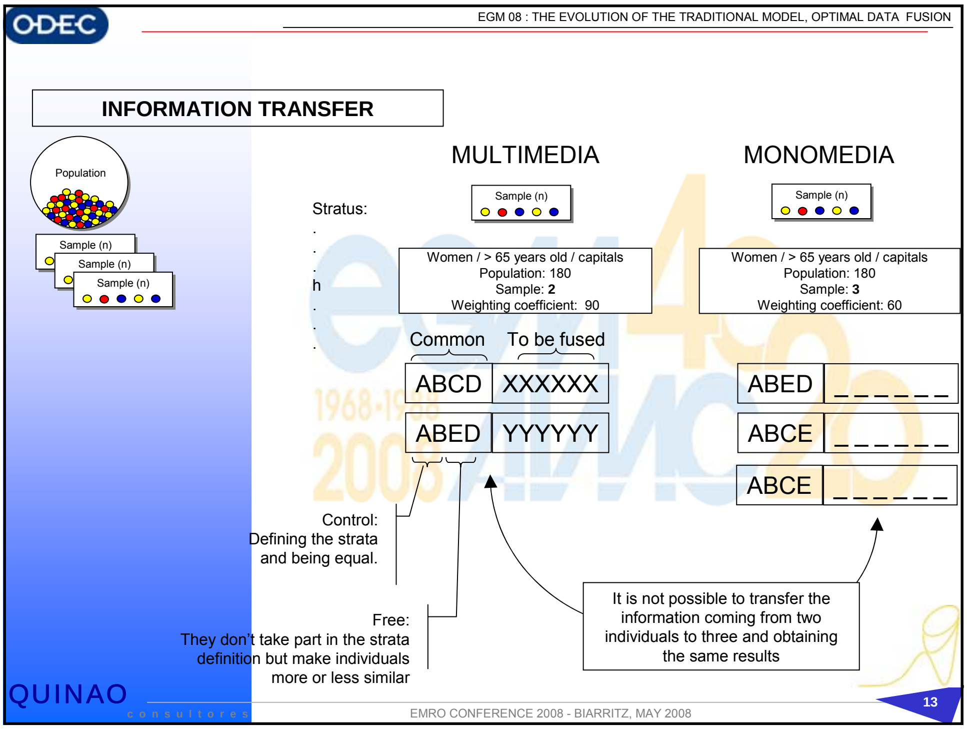
Readers magazine. X:
Population: 100
Sample: 2

Readers magazine X:
Population: ?
Sample: ?

FUSION

Readers magazine X:
Population: 100

If we could make this transfer, put in the receiver file the information we have in the donor file, this information will be same not only for the equivalent strata in both file but for all their possible combinations



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INFORMATION TRANSFER

MULTIMEDIA

MONOMEDIA

Stratus:

Women / > 65 years old / capitals
Population: 180
Sample: **2**
Weighting coefficient: 90

Women / > 65 years old / capitals
Population: 180
Sample: **3**
Weighting coefficient: 60

Common	To be fused
ABCD	XXXXXX
ABED	YYYYYY

ABED	_ _ _ _ _ _
ABCE	_ _ _ _ _ _
ABCE	_ _ _ _ _ _

Control:
Defining the strata
and being equal.

Free:
They don't take part in the strata
definition but make individuals
more or less similar

It is not possible to transfer the information coming from two individuals to three and obtaining the same results

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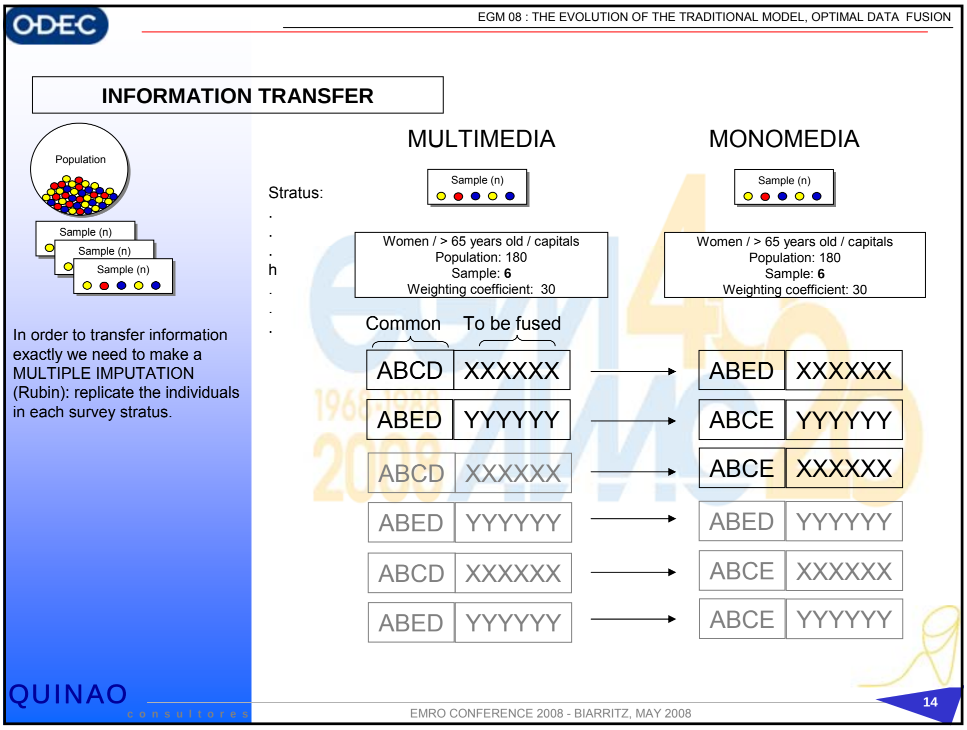

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INFORMATION TRANSFER

In order to transfer information exactly we need to make a MULTIPLE IMPUTATION (Rubin): replicate the individuals in each survey stratus.

MULTIMEDIA

MONOMEDIA

Stratus:

Women / > 65 years old / capitals
Population: 180
Sample: **6**
Weighting coefficient: 30

Women / > 65 years old / capitals
Population: 180
Sample: **6**
Weighting coefficient: 30

Common	To be fused			
ABCD	XXXXXX	→	ABED	XXXXXX
ABED	YYYYYY	→	ABCE	YYYYYY
ABCD	XXXXXX	→	ABCE	XXXXXX
ABED	YYYYYY	→	ABED	YYYYYY
ABCD	XXXXXX	→	ABCE	XXXXXX
ABED	YYYYYY	→	ABCE	YYYYYY

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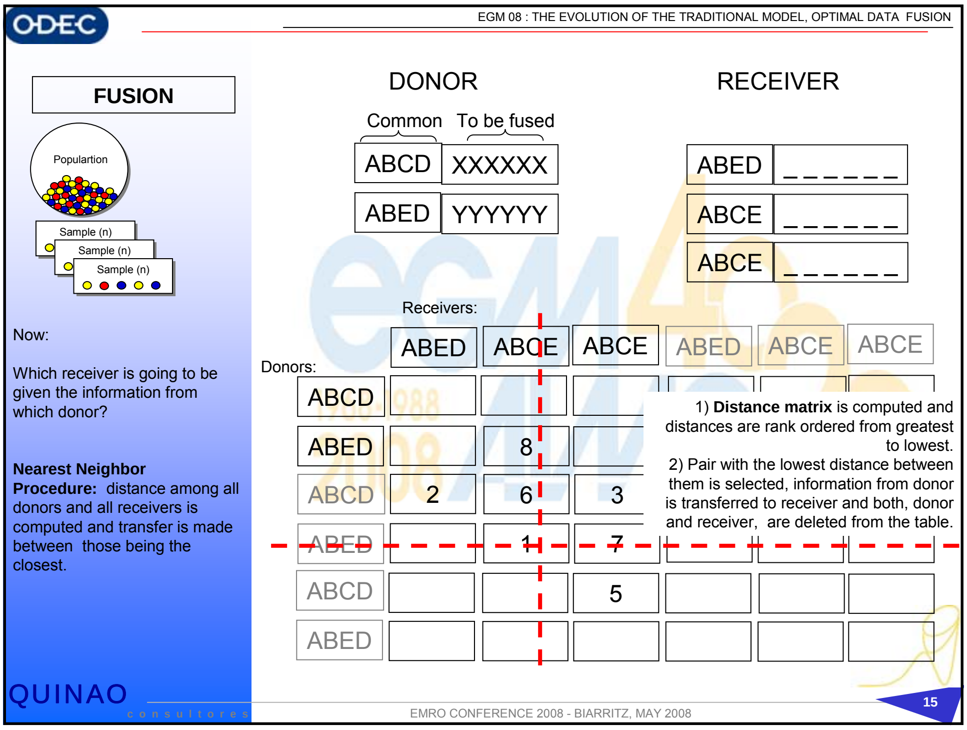

FUSION

Popularion

Sample (n)

Sample (n)

Sample (n)

Now:

Which receiver is going to be given the information from which donor?

Nearest Neighbor Procedure: distance among all donors and all receivers is computed and transfer is made between those being the closest.

DONOR	
Common	To be fused
ABCD	XXXXXX
ABED	YYYYYY

RECEIVER	
ABED	_ _ _ _ _ _
ABCE	_ _ _ _ _ _
ABCE	_ _ _ _ _ _

Receivers:

Donors:	ABED	ABCE	ABCE	ABED	ABCE	ABCE
ABCD						
ABED		8				
ABCD	2	6	3			
ABED		1	7			
ABCD			5			
ABED						

1) **Distance matrix** is computed and distances are rank ordered from greatest to lowest.

2) Pair with the lowest distance between them is selected, information from donor is transferred to receiver and both, donor and receiver, are deleted from the table.

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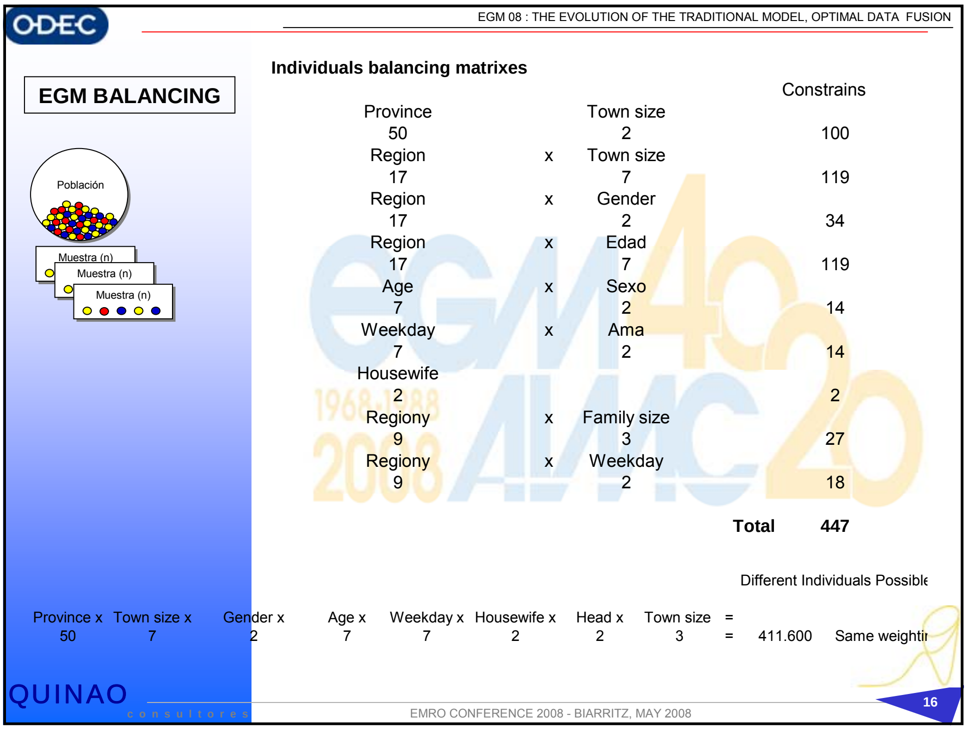

EGM BALANCING

Población

Muestra (n)

Muestra (n)

Muestra (n)

Individuals balancing matrixes

			Constrains
Province 50		Town size 2	100
Region 17	x	Town size 7	119
Region 17	x	Gender 2	34
Region 17	x	Edad 7	119
Age 7	x	Sexo 2	14
Weekday 7	x	Ama 2	14
Housewife 2			2
Regiony 9	x	Family size 3	27
Regiony 9	x	Weekday 2	18
		Total	**447**

Different Individuals Possible

Province x	Town size x	Gender x	Age x	Weekday x	Housewife x	Head x	Town size	=		
50	7	2	7	7	2	2	3	=	411.600	Same weightir

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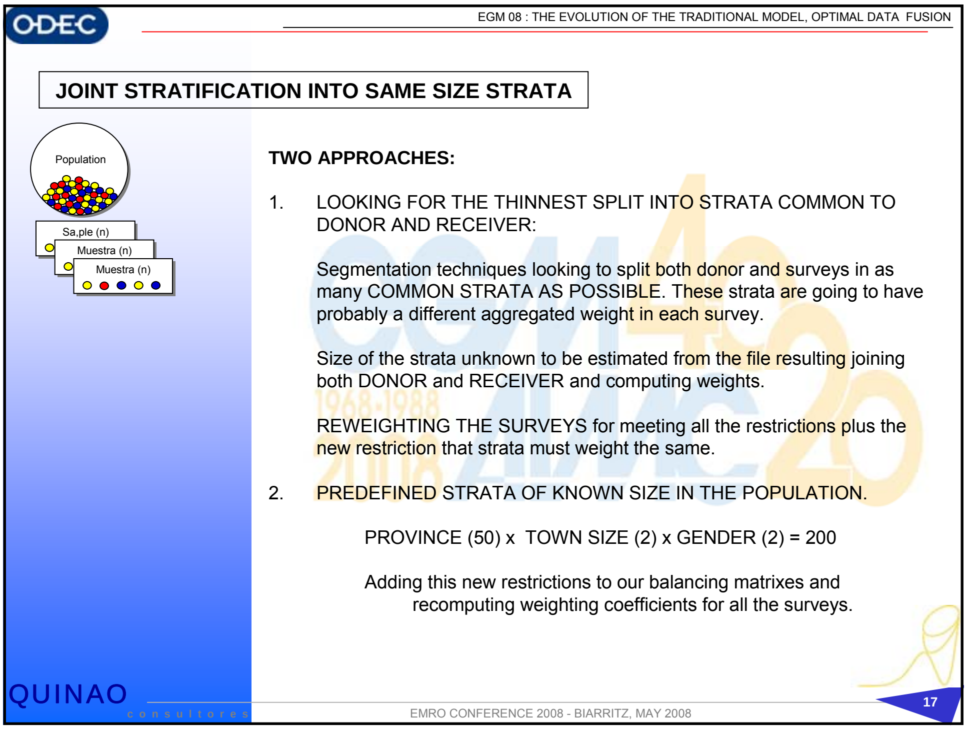

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JOINT STRATIFICATION INTO SAME SIZE STRATA

Population
Sa,ple (n)
Muestra (n)
Muestra (n)

TWO APPROACHES:

1. LOOKING FOR THE THINNEST SPLIT INTO STRATA COMMON TO DONOR AND RECEIVER:

   Segmentation techniques looking to split both donor and surveys in as many COMMON STRATA AS POSSIBLE. These strata are going to have probably a different aggregated weight in each survey.

   Size of the strata unknown to be estimated from the file resulting joining both DONOR and RECEIVER and computing weights.

   REWEIGHTING THE SURVEYS for meeting all the restrictions plus the new restriction that strata must weight the same.

2. PREDEFINED STRATA OF KNOWN SIZE IN THE POPULATION.

   PROVINCE (50) x TOWN SIZE (2) x GENDER (2) = 200

   Adding this new restrictions to our balancing matrixes and recomputing weighting coefficients for all the surveys.

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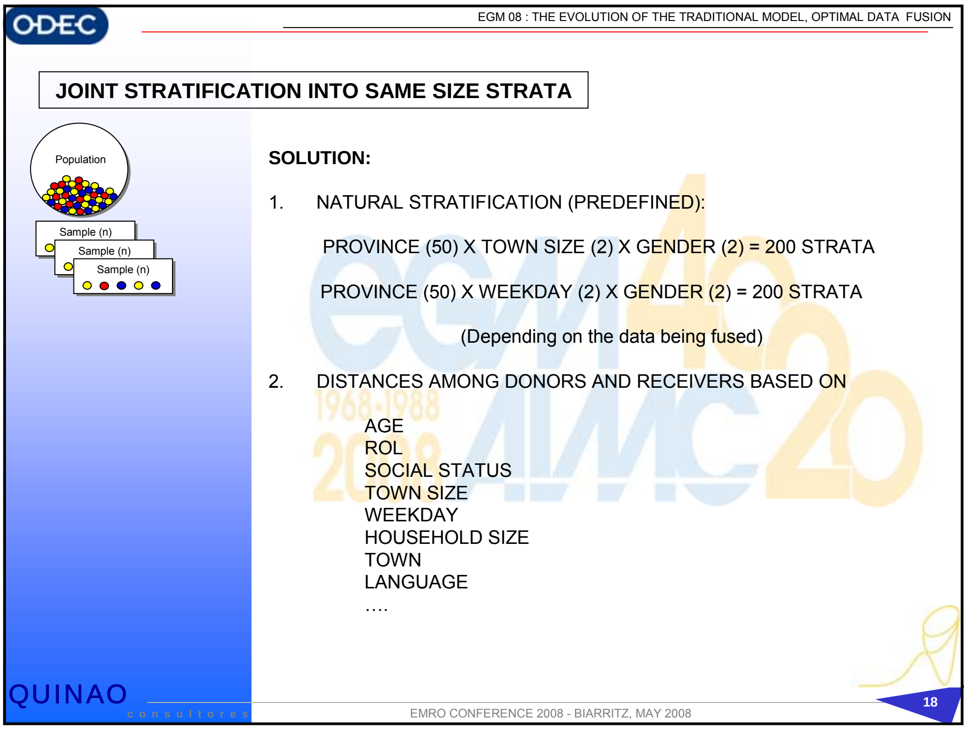

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JOINT STRATIFICATION INTO SAME SIZE STRATA

Population
Sample (n)
Sample (n)
Sample (n)

SOLUTION:

1. NATURAL STRATIFICATION (PREDEFINED):

   PROVINCE (50) X TOWN SIZE (2) X GENDER (2) = 200 STRATA

   PROVINCE (50) X WEEKDAY (2) X GENDER (2) = 200 STRATA

   (Depending on the data being fused)

2. DISTANCES AMONG DONORS AND RECEIVERS BASED ON

   AGE
   ROL
   SOCIAL STATUS
   TOWN SIZE
   WEEKDAY
   HOUSEHOLD SIZE
   TOWN
   LANGUAGE
   ….

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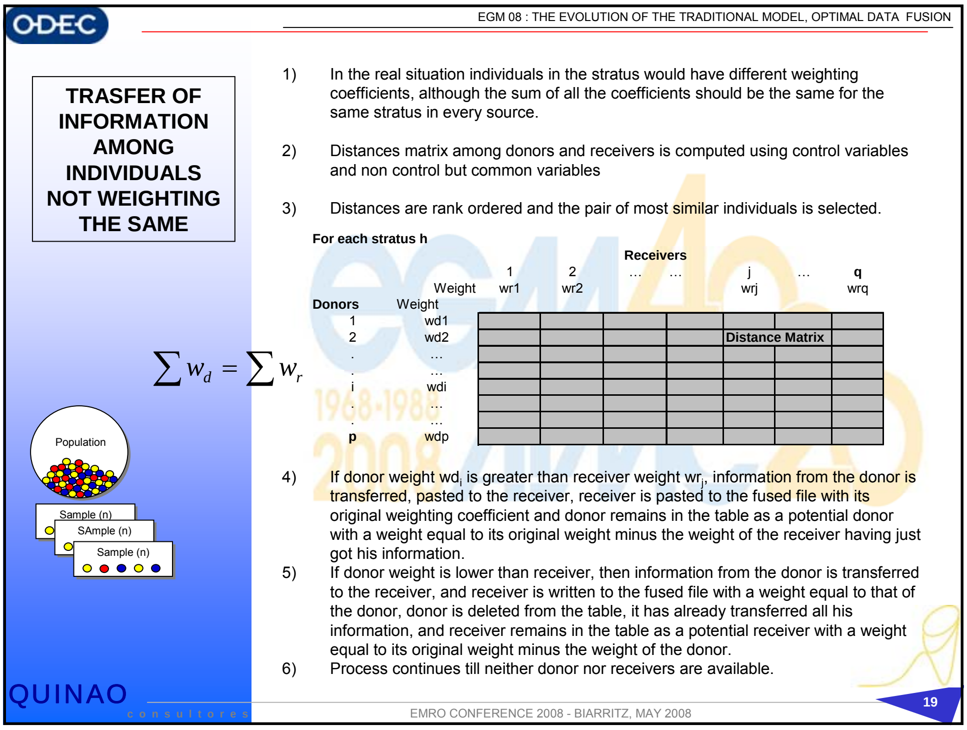


TRASFER OF INFORMATION AMONG INDIVIDUALS NOT WEIGHTING THE SAME

$$\sum w_d = \sum w_r$$

Population
Sample (n)
SAmple (n)
Sample (n)

1) In the real situation individuals in the stratus would have different weighting coefficients, although the sum of all the coefficients should be the same for the same stratus in every source.

2) Distances matrix among donors and receivers is computed using control variables and non control but common variables

3) Distances are rank ordered and the pair of most similar individuals is selected.

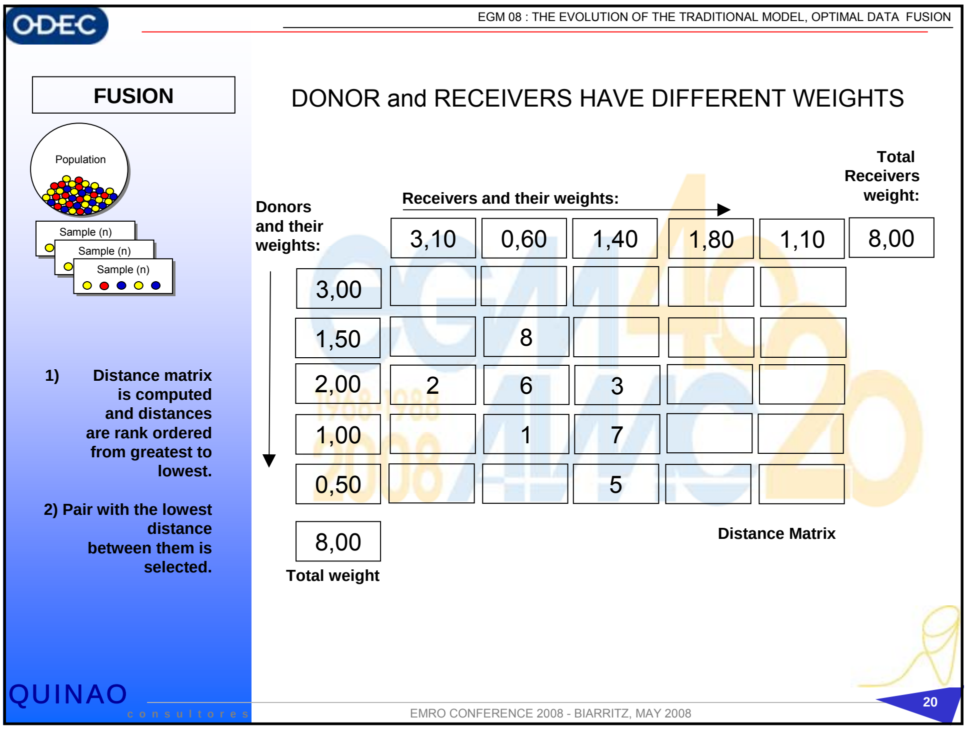
For each stratus h

		Receivers						
		1	2	…	…	j	…	q
	Weight	wr1	wr2			wrj		wrq
Donors	Weight							
1	wd1							
2	wd2					**Distance Matrix**		
.	…							
.	…							
i	wdi							
.	…							
.	…							
p	wdp							

4) If donor weight wd_i is greater than receiver weight wr_j, information from the donor is transferred, pasted to the receiver, receiver is pasted to the fused file with its original weighting coefficient and donor remains in the table as a potential donor with a weight equal to its original weight minus the weight of the receiver having just got his information.

5) If donor weight is lower than receiver, then information from the donor is transferred to the receiver, and receiver is written to the fused file with a weight equal to that of the donor, donor is deleted from the table, it has already transferred all his information, and receiver remains in the table as a potential receiver with a weight equal to its original weight minus the weight of the donor.

6) Process continues till neither donor nor receivers are available.



FUSION

Population
Sample (n)
Sample (n)
Sample (n)

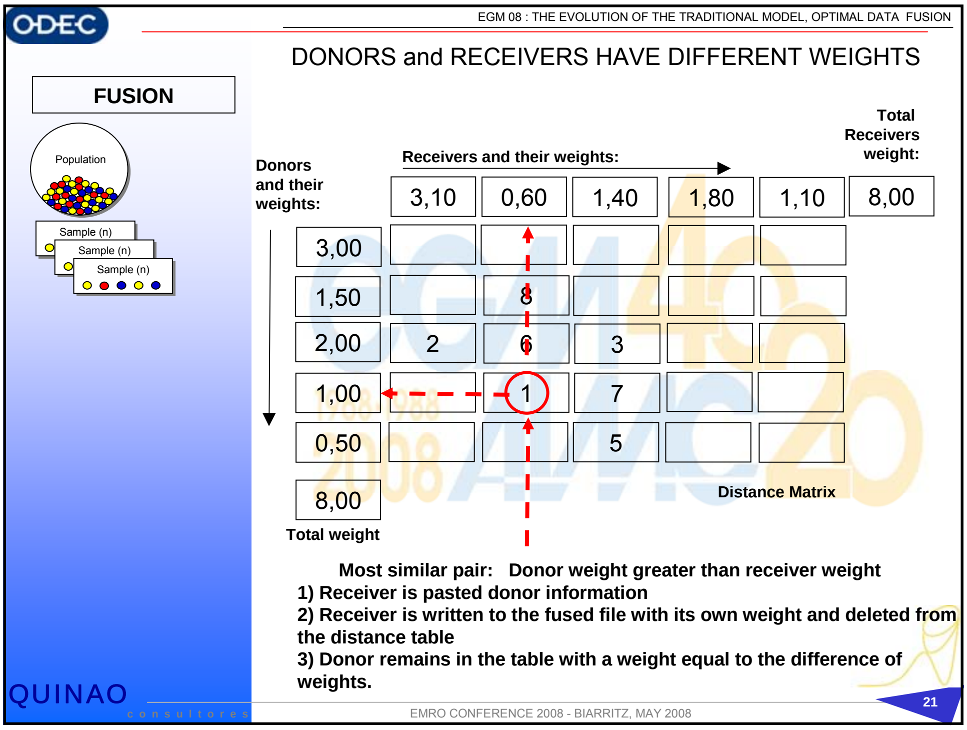
1) Distance matrix is computed and distances are rank ordered from greatest to lowest.

2) Pair with the lowest distance between them is selected.

DONOR and RECEIVERS HAVE DIFFERENT WEIGHTS

Donors and their weights:	Receivers and their weights: 3,10	0,60	1,40	1,80	1,10	Total Receivers weight: 8,00
3,00						
1,50		8				
2,00	2	6	3			
1,00		1	7			
0,50			5			
8,00 Total weight						

Distance Matrix



FUSION

Population
Sample (n)
Sample (n)
Sample (n)

DONORS and RECEIVERS HAVE DIFFERENT WEIGHTS

Receivers and their weights:

Donors and their weights:

Donors and their weights:	3,10	0,60	1,40	1,80	1,10	Total Receivers weight: 8,00
3,00						
1,50		8				
2,00	2	6	3			
1,00		1	7			
0,50			5			
Total weight 8,00						

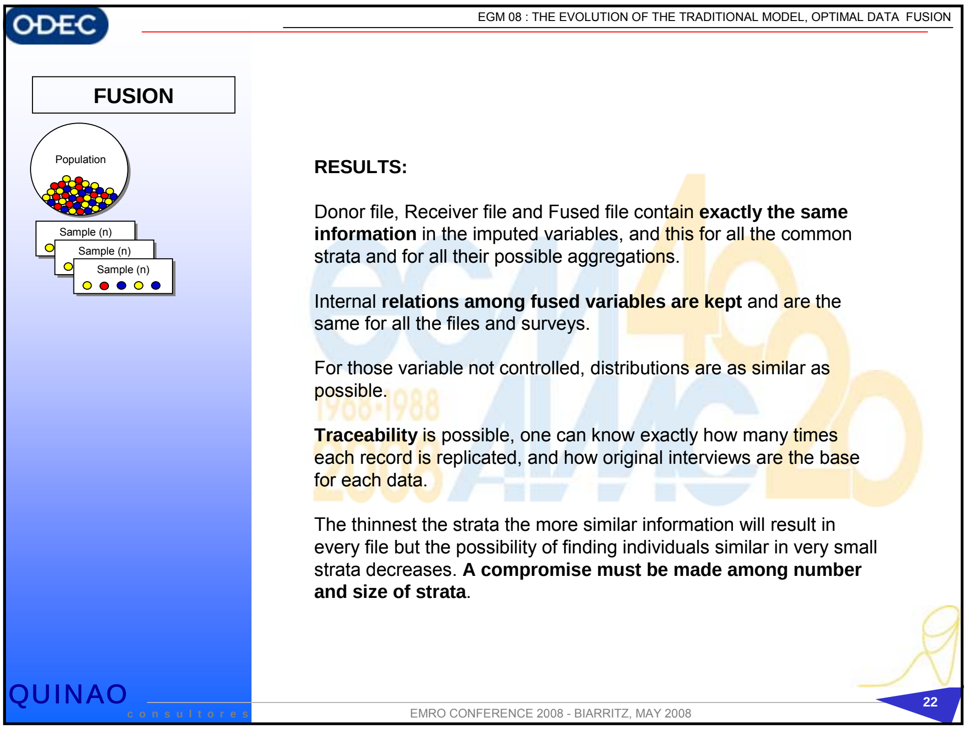
Distance Matrix

Most similar pair: Donor weight greater than receiver weight

1) Receiver is pasted donor information

2) Receiver is written to the fused file with its own weight and deleted from the distance table

3) Donor remains in the table with a weight equal to the difference of weights.



FUSION

Population
Sample (n)
Sample (n)
Sample (n)

RESULTS:

Donor file, Receiver file and Fused file contain **exactly the same information** in the imputed variables, and this for all the common strata and for all their possible aggregations.

Internal **relations among fused variables are kept** and are the same for all the files and surveys.

For those variable not controlled, distributions are as similar as possible.

Traceability is possible, one can know exactly how many times each record is replicated, and how original interviews are the base for each data.

The thinnest the strata the more similar information will result in every file but the possibility of finding individuals similar in very small strata decreases. **A compromise must be made among number and size of strata**.

SINCRONIZING

	Interviews							
MULTIMEDIA	10.000	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
	+	+	+	+	+	+	+	+
MONOMEDIA PRESS	15.000	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
	+	+	+	+	+	+	+	+
MONOMEDIA RADIO	12.333	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
	+	+	+	+	+	+	+	+
MONOMEDIA MAGAZINES	6.666	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor
	=	=	=	=	=	=	=	=
TOTAL	120.000	DEMO GRAPHICS	LIFE STILES EQUIPMENT GOODS CONSUMPTION	PRESS	RADIO	MAGAZINES	TV	OTHERS Internet Cine Outdoor

STEP 1:

- **Information from Multimedia, TO Multimedia + Press + Radio + magazines**

STEP 1(A):

- **Information for HOUSEWIFE from Multimedia, TO Multimedia + Press + Radio + magazines**

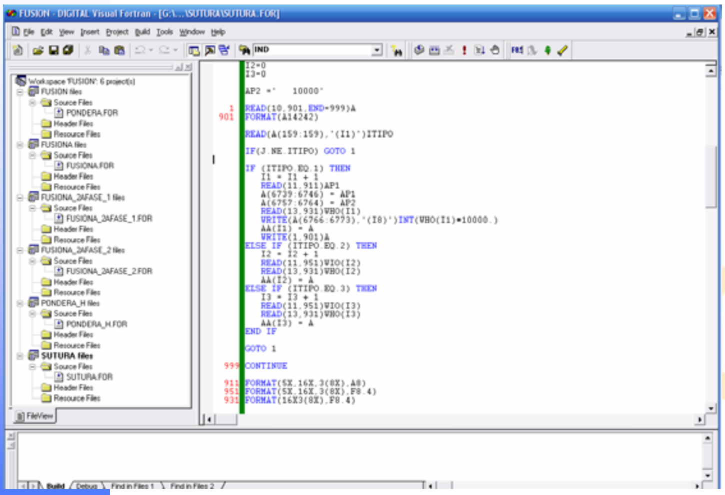
STEP 2:

- **Information from Multimedia + RADIO TO Multimedia + Press + Radio + magazines**

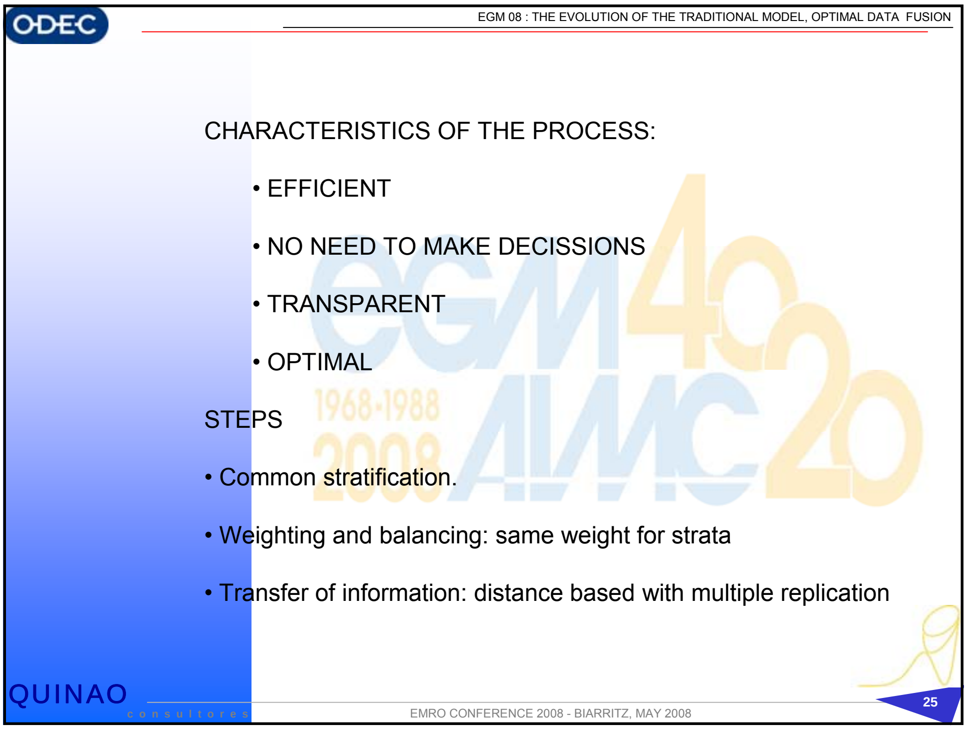
. . . . . .

Size of the final file is roughly three times the size resulting from simply joining the surveys

AUTOMATIZATION



```
      I2=0
      I3=0

      AP2 ='   10000'

    1 READ(10,901,END=999)A
  901 FORMAT(A14242)

      READ(A(159:159),'(I1)')ITIPO

      IF(J.NE.ITIPO) GOTO 1

      IF (ITIPO.EQ.1) THEN
         I1 = I1 + 1
         READ(11,911)AP1
         A(6739:6746) = AP1
         A(6757:6764) = AP2
         READ(13,931)WHO(I1)
         WRITE(A(6766:6773),'(I8)')INT(WHO(I1)*10000.)
         AA(I1) = A
         WRITE(1,901)A
      ELSE IF (ITIPO.EQ.2) THEN
         I2 = I2 + 1
         READ(11,951)WIO(I2)
         READ(13,931)WHO(I2)
         AA(I2) = A
      ELSE IF (ITIPO.EQ.3) THEN
         I3 = I3 + 1
         READ(11,951)WIO(I3)
         READ(13,931)WHO(I3)
         AA(I3) = A
      END IF

      GOTO 1

  999 CONTINUE

  911 FORMAT(5X,16X,3(8X),A8)
  951 FORMAT(5X,16X,3(8X),F8.4)
  931 FORMAT(16X3(8X),F8.4)
```



ODEC

EGM 08 : THE EVOLUTION OF THE TRADITIONAL MODEL, OPTIMAL DATA FUSION

CHARACTERISTICS OF THE PROCESS:

- EFFICIENT
- NO NEED TO MAKE DECISSIONS
- TRANSPARENT
- OPTIMAL

STEPS

- Common stratification.
- Weighting and balancing: same weight for strata
- Transfer of information: distance based with multiple replication

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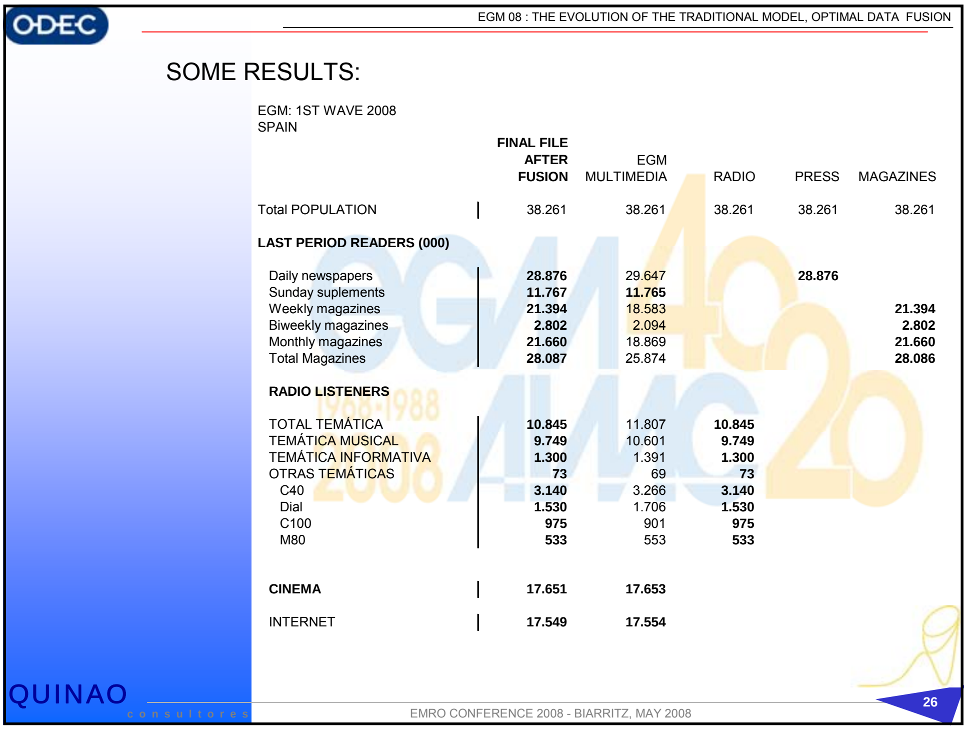

ODEC

EGM 08 : THE EVOLUTION OF THE TRADITIONAL MODEL, OPTIMAL DATA FUSION

SOME RESULTS:

EGM: 1ST WAVE 2008
SPAIN

	FINAL FILE AFTER FUSION	EGM MULTIMEDIA	RADIO	PRESS	MAGAZINES
Total POPULATION	38.261	38.261	38.261	38.261	38.261
LAST PERIOD READERS (000)					
Daily newspapers	**28.876**	29.647		**28.876**	
Sunday suplements	**11.767**	**11.765**			
Weekly magazines	**21.394**	18.583			**21.394**
Biweekly magazines	**2.802**	2.094			**2.802**
Monthly magazines	**21.660**	18.869			**21.660**
Total Magazines	**28.087**	25.874			**28.086**
RADIO LISTENERS					
TOTAL TEMÁTICA	**10.845**	11.807	**10.845**		
TEMÁTICA MUSICAL	**9.749**	10.601	**9.749**		
TEMÁTICA INFORMATIVA	**1.300**	1.391	**1.300**		
OTRAS TEMÁTICAS	**73**	69	**73**		
C40	**3.140**	3.266	**3.140**		
Dial	**1.530**	1.706	**1.530**		
C100	**975**	901	**975**		
M80	**533**	553	**533**		
CINEMA	**17.651**	**17.653**			
INTERNET	**17.549**	**17.554**			

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