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Comparison of Different Updating Procedures and Identification of Temporal Patterns

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1 Introduction

A National Accounting Matrix (NAM) is a square matrix whose rows and columns represent the resources and uses of separate economic accounts which together summarize the basic flows within the different groups of transactors or categories of transactions in an economy. The incomings (rows) and outgoings (columns) are necessarily equilibrated following standard economic accounting standards, therefore the sum of columns and rows for each account must be the same. This matrix presents an accounting system that provides information about aspects of an economy like the structure, composition and level of production, the value added generated by the factors of production and the distribution of income among different groups of households. Normally, a NAM is constructed using an Input-Output Table as starting point and includes figures about consumption, the structure of production, and the flows related to foreign trade, savings and investment.

The updating of a NAM consists of determining the NAM corresponding to period t=T starting from a known NAM, which corresponds to moment t=0, and from certain available information about the NAM in moment t=T. It is a question of finding a NAM X^T whose structure is, in a certain sense, as close as possible to the structure of the NAM in moment t=0, X^0. Normally this structure is defined in terms of the *row (horizontal) coefficients* and the *column (vertical) coefficients*, assuming that if element x^0_{ij} of the initial matrix is null then the corresponding element x^T_{ij} of the final matrix is also null. If $X=(x_{ij})_{1 \leq i,j \leq n}$ is a NAM and $S^{\neq 0}=\{(i,j) : x_{ij} \neq 0\}$, then the matrix of row coefficients, $A = (a_{ij})_{1 \leq i,j \leq n}$, and that of column coefficients, $B = (b_{ij})_{1 \leq i,j \leq n}$, can be defined as

$$a_{ij} = \frac{x_{ij}}{\sum_j x_{ij}} \quad \text{if } (i,j) \in \boldsymbol{S}, \text{ and } a_{ij} = 0 \text{ if } (i,j) \notin \boldsymbol{S}$$

$$b_{ij} = \frac{x_{ij}}{\sum_i x_{ij}} \quad \text{if } (i,j) \in \boldsymbol{S}, \text{ and } b_{ij} = 0 \text{ if } (i,j) \notin \boldsymbol{S}$$

We consider that the adjustment objective consists of determining a NAM X^T such that the ratios $\frac{a^T_{ij}}{a^0_{ij}}$, or $\frac{b^T_{ij}}{b^0_{ij}}$, for (i,j) belonging to $S=\{(i,j) : 1 \leq i,j \leq n\}$, are as similar as possible to unity, distinguishing between two types of adjustment, the horizontal and the vertical one, depending on wether we approximate the ratios of horizontal or vertical coefficients to unity. The definition of the concept of proximity determines the updating criterium. Assuming that all elements in the matrices are non-negative, for horizontal coefficients, the criteria used in this paper are defined as follows (for the vertical updating, the horizontal coefficients are replaced by the vertical ones):

- Criterion L_1

$$F_1(A^T, A^0) = \sum_{(i,j) \in S^{\neq 0}} \left| \frac{a^T_{ij}}{a^0_{ij}} - 1 \right|$$

- Criterion L_2

$$F_2(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} \left(\frac{a_{ij}^T}{a_{ij}^0} - 1 \right)^2$$

- Criterion (L_1, L_∞) (weighted sum of L_1 and L_∞)

$$F_3(A^T, A^0) = w_1 \sum_{(i,j)\in S^{\neq 0}} \left| \frac{a_{ij}^T}{a_{ij}^0} - 1 \right| + w_2 \max_{(i,j)\, \in S^{\neq 0}} \left| \frac{a_{ij}^T}{a_{ij}^0} - 1 \right|$$

where w_1 and w_2 are positive weights.

- Criterion RAS:

$$F_4(A^T, A^0) = RAS(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} \frac{\gamma_i}{\gamma}\; a_{ij}^T \ln \frac{a_{ij}^T}{a_{ij}^0}$$

- Criterion MSCE: Minimum sum of cross entropies

$$F_5(A^T, A^0) = MSCE(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} a_{ij}^T \ln \frac{a_{ij}^T}{a_{ij}^0}$$

- Criterion Kullback:

$$F_6(A^T, A^0) = K(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} a_{ij}^T \ln \frac{a_{ij}^T}{a_{ij}^0} + \sum_{(i,j)\in S^{\neq 0}} a_{ij}^0 \ln \frac{a_{ij}^0}{a_{ij}^T}.$$

Where $\gamma_i = \sum_j x_{ij}$ and $\gamma = \sum_i \gamma_i$. Therefore γ_i is the sum of the elements of row i, which is equal to the sum of the elements of column i, and γ is the sum of all the elements of matrix X^0.

The updating problem is formulated as an optimization problem where the objective function is one of the previously mentioned and the restrictions are determined by the column and row totals, which are supposed to be known, in addition to other given values.

The vertical criterium F_1 has been used by Matuszewski, Pitts and Sawyer (1964). Criterium F_4 corresponds to the well known RAS algorithm and F_5 is based on an entropy measure which has been used by Golan, Judge and Robinson (1994), and Robinson, Cattaneo and El-Said(2000), among others. Criteria F_4 and F_5 are particular cases of the updating criterion of the minimization of the sum of weighted crossed entropies (McDougall, 1999). In contrast to Criterion F_4 and F_5, F_6 is a distance in the mathematical sense. Measures F_1 to F_5 have been used by Manrique de Lara and Santos-Peñate (2004).

The basic updating problem is formulated as follows:

$$\min F(A)$$

subject to:

$$\sum_j x_{ij} = \gamma_i,\ i = 1,...,n \qquad (1)$$

$$\sum_i x_{ij} = \gamma_j,\ j = 1,...,n \qquad (2)$$

$$x_{ij} = 0,\ \forall(\text{i,j}) \notin S^{\neq 0}$$

$$x_{ij} \geq 0,\ \forall(\text{i,j})$$

where γ_i are given, F is one of the criterion defined previously and $a_{ij} = \dfrac{x_{ij}}{\gamma_i},\ \forall(i, j) \in S.$

More general formulations include other constraints in addition to the balance restrictions. On the other hand, certain situations require some particular treatment; for example, if the structure of the accounting matrices varies in time, which means that the index set with positive values is not constant.

In this paper, we apply the previous criteria to update a series of NAM for the Spanish Economy. In order to evaluate the results of the updating procedure and compare the criteria used, we calculated the dissimilarities between the initial and final matrices using the measures defined in the appendix 1. The results provided by the updating procedure can be used to classify the results obtained using the different NAMs available for different periods. The rest of the paper is organized as follows. In Section 2, we present some computational experience and Section 3 includes some concluding remarks. The appendix1 contains the measures used to calculate the dissimilarity between the initial matrix and the final matrix.

2. Computational experience

In this research we have prepared the National Accounting Matrices (NAM) of the Spanish Economy for the years 1995 to 2003 using the data published by the National Statistics Office (INE). This experiment consisted in updating the Spanish NAMs of each year using the previously existing matrices as benchmark reference.

We use the criteria described in Section 1 to update a NAM for each of the mentioned years except for the first year of the series (1995). Obviously the more recent the NAM the more initial matrices could be used to estimate the NAM. In total we had to generate 36 updated matrices. In order to maintain a coherent and simple updating structure, we introduced in the optimization program only those values that where positive in both versions simultaneously. The rest of the values where fixed to the observed values beforehand. We implemented the different updating approaches in GAMS and use Matlab to calculate the dissimilarity measures between pairs of matrices. For the updating process of each year t, being t greater than 1, we have (t-1) initial NAMs which we used to generate (t-1) new matrices for year t for each of the six updating procedures corresponding to the six different updating criterion.

Appendix2 contains the different results obtained by year. For each of the 36 estimated matrices, we show 23 distance measures for each of the 6 adjustment methods considered.

3. Concluding remarks

In this paper, we have applied six updating criteria to analyze 36 pairs of initial and final matrices for the Spanish economy. We have modified the basic updating problem formulation in order to obtain solutions in cases where the structure of the NAM changes in time. Once we have obtained the estimated final matrices for any year, a comparison between any pair of matrices, initial, final and final estimated, is possible. We can compare the updating criteria and the importance of the number of years elapsed between the estimated matrix and the one used as initial reference of the updating procedure.

The first step in the future research will be focused to a deeper analysis of the data, the updating criteria and results. Other subjects are the definition of macroeconomic behaviours by means of cluster analysis, the treatment of different scenarios defined by the set of data we know, and the structural analysis.

5. References

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Appendix1

The following measures are defined for horizontal coefficients. The definitions for vertical coefficients are similar. Additionally, we calculated the correlation coefficient. As in the previous sections, the notation $S^{\neq 0}$ represents the set of indices (i, j) such that $a_{ij} \neq 0$.

- Metrics L₁, absolute and relative:

$$L_1(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} \left| a_{ij}^T - a_{ij}^0 \right|$$

$$L_{1R}(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} \left| \frac{a_{ij}^T}{a_{ij}^0} - 1 \right|$$

- Metrics L_2, absolute and relative:

$$L_2(A^T, A^0) = \sum_{(i,j)\in S} \left(a_{ij}^T - a_{ij}^0\right)^2$$

$$L_{2R}(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} \left(\frac{a_{ij}^T}{a_{ij}^0} - 1\right)^2$$

- Metrics L_∞, absolute and relative:

$$L_\infty(A^T, A^0) = \max_{(i,j)\in S} \left|a_{ij}^T - a_{ij}^0\right|$$

$$L_{\infty R}(A^T, A^0) = \max_{(i,j)\in S^{\neq 0}} \left|\frac{a_{ij}^T}{a_{ij}^0} - 1\right|$$

- Theils measure:

$$T(A^T, A^0) = \sqrt{\frac{\sum_{(i,j)\in S} \left(a_{ij}^T - a_{ij}^0\right)^2}{\sum_{(i,j)\in S} \left(a_{ij}^0\right)^2}}$$

- Weighted absolute difference (WAD), absolute and relative:

$$WAD(A^T, A^0) = \frac{\sum_{(i,j)\in S} \left|a_{ij}^T + a_{ij}^0\right| \left|a_{ij}^T - a_{ij}^0\right|}{\sum_{(i,j)\in S} \left|a_{ij}^T + a_{ij}^0\right|}$$

$$WAD_R(A^T, A^0) = \frac{\sum_{(i,j)\in S^{\neq 0}} \left|\frac{a_{ij}^T}{a_{ij}^0} + 1\right| \left|\frac{a_{ij}^T}{a_{ij}^0} - 1\right|}{\sum_{(i,j)\in S^{\neq 0}} \left|\frac{a_{ij}^T}{a_{ij}^0} + 1\right|}$$

For the following definitions, we will assume that all matrix elements are equal or greater than cero.

- RAS:

$$RAS(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} \frac{\gamma_i}{\gamma}\, a_{ij}^T \ln \frac{a_{ij}^T}{a_{ij}^0}$$

- Sum of cross entropies (SCE):

$$SCE(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} a_{ij}^T \ln \frac{a_{ij}^T}{a_{ij}^0}$$

- Kullback measure:

$$K(A^T, A^0) = \sum_{(i,j)\in S^{\neq 0}} a_{ij}^T \ln \frac{a_{ij}^T}{a_{ij}^0} + \sum_{(i,j)\in S^{\neq 0}} a_{ij}^0 \ln \frac{a_{ij}^0}{a_{ij}^T}$$

Where $\gamma_i = \sum_j x_{ij}$ and $\gamma = \sum_i \gamma_i$. Therefore γ_i is the sum of the elements of row i, which is equal to the sum of the elements of column i, and γ is the sum of all the elements of matrix X^0.

Appendix 2

Results obtained for the updating of the Spanish NAM for 2003

2003	1995 m1	1.48620	0.16348	0.04835	0.02692	0.01730	0.00421	0.01538	0.00175	0.00301	0.03227	0.09091	0.09091	2.60979	2.61313	0.99983	3.81906	1.31123	0.64793	0.03065	0.00135	0.03156	0.04601	1.26443
	1995 m2	3.50384	0.38542	0.15721	0.10614	0.05625	0.01520	0.03867	0.00290	0.00335	0.07926	0.09091	0.09091	2.60979	2.61056	0.99819	4.49567	1.56161	1.12678	0.03861	0.00319	0.03715	0.15325	1.50718
	1995 m3	3.47345	0.38208	0.15727	0.10609	0.05627	0.01516	0.03699	0.00262	0.00347	0.07547	0.09091	0.09091	2.60979	2.60999	0.99818	4.35968	1.44106	0.94612	0.03592	0.00316	0.03603	0.15339	1.38548
	1995 m4	2.25353	0.24789	0.08292	0.05230	0.02967	0.00828	0.01986	0.00226	0.00189	0.04203	0.09091	0.09091	2.60979	2.61162	0.99950	3.90263	1.25386	0.63036	0.02975	0.00205	0.03225	0.07980	1.20262
	1995 m5	2.25353	0.24789	0.08292	0.05230	0.02967	0.00828	0.01986	0.00226	0.00189	0.04203	0.09091	0.09091	2.60979	2.61162	0.99950	3.90263	1.25386	0.63036	0.02975	0.00205	0.03225	0.07980	1.20262
	1995 m6	2.68669	0.29554	0.11068	0.07454	0.03960	0.01088	0.02400	0.00220	0.00198	0.04979	0.09091	0.09091	2.60979	2.61087	0.99910	3.89913	1.23061	0.61376	0.02984	0.00244	0.03222	0.10737	1.17845
2003	1996 m1	1.93293	0.21262	0.06957	0.04309	0.02489	0.00736	0.01564	0.00177	0.00224	0.03300	0.09091	0.09091	2.60979	2.61596	0.99965	3.91185	1.45291	1.00340	0.03262	0.00176	0.03233	0.06684	1.40871
	1996 m2	3.30248	0.36327	0.14553	0.09972	0.05207	0.01422	0.03340	0.00234	0.00270	0.06765	0.09091	0.09091	2.60979	2.61091	0.99845	4.62968	1.67664	1.32703	0.04210	0.00300	0.03826	0.14173	1.62295
	1996 m3	3.17021	0.34872	0.14023	0.09598	0.05017	0.01367	0.03105	0.00223	0.00249	0.06301	0.09091	0.09091	2.60979	2.61070	0.99856	4.35986	1.55038	1.18738	0.03859	0.00288	0.03603	0.13660	1.49886
	1996 m4	1.70564	0.18762	0.05986	0.03748	0.02142	0.00598	0.01348	0.00155	0.00073	0.02837	0.09091	0.09091	2.60979	2.61266	0.99974	3.54483	1.20068	0.69542	0.02771	0.00155	0.02930	0.05738	1.15663
	1996 m5	1.70564	0.18762	0.05986	0.03748	0.02142	0.00598	0.01348	0.00155	0.00073	0.02837	0.09091	0.09091	2.60979	2.61266	0.99974	3.54483	1.20068	0.69542	0.02771	0.00155	0.02930	0.05738	1.15663
	1996 m6	2.35849	0.25943	0.09834	0.06826	0.03518	0.00966	0.01898	0.00155	0.00107	0.03900	0.09091	0.09091	2.60979	2.61137	0.99929	3.64942	1.19102	0.68537	0.02874	0.00214	0.03016	0.09547	1.14387
2003	1997 m1	1.72700	0.18997	0.06835	0.04482	0.02446	0.00711	0.00965	0.00080	0.00119	0.01948	0.09091	0.09091	2.60979	2.61523	0.99966	2.77976	1.16690	1.02908	0.02637	0.00157	0.02297	0.06614	1.13921
	1997 m2	1.73965	0.19136	0.06284	0.03952	0.02248	0.00644	0.01160	0.00125	0.00121	0.02372	0.09091	0.09091	2.60979	2.61129	0.99971	3.29890	1.30144	1.07251	0.03005	0.00158	0.02726	0.06038	1.26641
	1997 m3	1.72839	0.19012	0.06328	0.04073	0.02264	0.00650	0.01094	0.00111	0.00112	0.02225	0.09091	0.09091	2.60979	2.61117	0.99971	3.29557	1.28233	1.05369	0.02989	0.00157	0.02724	0.06087	1.24684
	1997 m4	1.56369	0.17201	0.05708	0.03853	0.02042	0.00604	0.00935	0.00089	−0.00045	0.01940	0.09091	0.09091	2.60979	2.61681	0.99977	2.77167	0.92230	0.54715	0.02213	0.00142	0.02291	0.05489	0.88721
	1997 m5	1.56369	0.17201	0.05708	0.03853	0.02042	0.00604	0.00935	0.00089	−0.00045	0.01940	0.09091	0.09091	2.60979	2.61681	0.99977	2.77167	0.92230	0.54715	0.02213	0.00142	0.02291	0.05489	0.88721
	1997 m6	0.87994	0.09679	0.02882	0.01614	0.01031	0.00228	0.00639	0.00074	−0.00014	0.01337	0.09091	0.09091	2.60979	2.61315	0.99994	2.49424	0.89400	0.54138	0.01991	0.00080	0.02061	0.02744	0.86477
2003	1998 m1	1.89132	0.20805	0.08513	0.05730	0.03046	0.00830	0.01212	0.00092	−0.00022	0.02462	0.09091	0.09091	2.60979	2.61694	0.99947	3.11335	1.35592	1.19398	0.03077	0.00172	0.02573	0.08300	1.32605
	1998 m2	0.86997	0.09570	0.02821	0.01481	0.01010	0.00277	0.00388	0.00045	0.00193	0.00782	0.09091	0.09091	2.60979	2.60908	0.99994	1.92292	0.76412	0.60936	0.01698	0.00079	0.01589	0.02684	0.74386
	1998 m3	0.83684	0.09205	0.02635	0.01455	0.00943	0.00254	0.00432	0.00054	0.00186	0.00871	0.09091	0.09091	2.60979	2.60977	0.99995	2.15365	0.92405	0.77779	0.01962	0.00076	0.01780	0.02499	0.90307
	1998 m4	1.24392	0.13683	0.05017	0.03226	0.01795	0.00511	0.00490	0.00048	0.00035	0.00998	0.09091	0.09091	2.60979	2.61358	0.99982	1.58045	0.55157	0.35733	0.01264	0.00113	0.01306	0.04861	0.53252
	1998 m5	1.24392	0.13683	0.05017	0.03226	0.01795	0.00511	0.00490	0.00048	0.00035	0.00998	0.09091	0.09091	2.60979	2.61358	0.99982	1.58045	0.55157	0.35733	0.01264	0.00113	0.01306	0.04861	0.53252
	1998 m6	0.84829	0.09331	0.02924	0.01608	0.01046	0.00311	0.00285	0.00039	0.00049	0.00584	0.09091	0.09091	2.60979	2.61189	0.99994	1.43192	0.52964	0.35244	0.01149	0.00077	0.01183	0.02798	0.51340
2003	1999 m1	1.84797	0.20328	0.08418	0.05615	0.03012	0.00809	0.01129	0.00085	0.00020	0.02309	0.09091	0.09091	2.60979	2.61726	0.99949	2.12136	0.69366	0.33816	0.01675	0.00168	0.01753	0.08213	0.66631
	1999 m2	1.04159	0.11458	0.03318	0.01913	0.01187	0.00366	0.00494	0.00040	0.00206	0.00968	0.09091	0.09091	2.60979	2.61100	0.99992	2.40524	1.15289	1.06860	0.02446	0.00095	0.01988	0.03151	1.13196
	1999 m3	1.06085	0.11669	0.03426	0.02034	0.01226	0.00378	0.00494	0.00039	0.00205	0.00970	0.09091	0.09091	2.60979	2.61115	0.99991	2.42317	1.15063	1.06752	0.02459	0.00096	0.02003	0.03258	1.12935
	1999 m4	1.45646	0.16021	0.05507	0.03635	0.01970	0.00585	0.00661	0.00050	0.00137	0.01324	0.09091	0.09091	2.60979	2.61315	0.99978	2.28005	0.96545	0.84866	0.02135	0.00132	0.01884	0.05311	0.94294
	1999 m5	1.45646	0.16021	0.05507	0.03635	0.01970	0.00585	0.00661	0.00050	0.00137	0.01324	0.09091	0.09091	2.60979	2.61315	0.99978	2.28005	0.96545	0.84866	0.02135	0.00132	0.01884	0.05311	0.94294
	1999 m6	1.35591	0.14915	0.05094	0.03373	0.01823	0.00546	0.00577	0.00042	0.00132	0.01150	0.09091	0.09091	2.60979	2.61272	0.99981	2.19298	0.95249	0.84798	0.02071	0.00123	0.01812	0.04910	0.93140
2003	2000 m1	1.84797	0.20328	0.08418	0.05615	0.03012	0.00809	0.01129	0.00085	0.00020	0.02309	0.09091	0.09091	2.60979	2.61726	0.99949	2.12136	0.69366	0.33816	0.01675	0.00168	0.01753	0.08213	0.66631
	2000 m2	0.41954	0.04615	0.01361	0.00807	0.00487	0.00119	0.00139	0.00020	−0.00007	0.00280	0.09091	0.09091	2.60979	2.61097	0.99999	1.46972	0.57684	0.39232	0.01271	0.00038	0.01215	0.01295	0.56116
	2000 m3	0.32902	0.03619	0.00991	0.00549	0.00355	0.00103	0.00090	0.00012	−0.00023	0.00179	0.09091	0.09091	2.60979	2.61064	0.99999	1.38600	0.60307	0.42021	0.01232	0.00030	0.01145	0.00935	0.58976
	2000 m4	0.27673	0.03044	0.00875	0.00438	0.00313	0.00065	0.00081	0.00011	−0.00038	0.00165	0.09091	0.09091	2.60979	2.61048	0.99999	1.09685	0.46945	0.35501	0.00930	0.00025	0.00906	0.00830	0.45873
	2000 m5	0.27673	0.03044	0.00875	0.00438	0.00313	0.00065	0.00081	0.00011	−0.00038	0.00165	0.09091	0.09091	2.60979	2.61048	0.99999	1.09685	0.46945	0.35501	0.00930	0.00025	0.00906	0.00830	0.45873
	2000 m6	0.37993	0.04179	0.01171	0.00619	0.00419	0.00126	0.00085	0.00011	−0.00042	0.00172	0.09091	0.09091	2.60979	2.61099	0.99999	1.12464	0.47006	0.35491	0.00953	0.00035	0.00929	0.01108	0.45880
2003	2001 m1	1.84797	0.20328	0.08418	0.05615	0.03012	0.00809	0.01129	0.00085	0.00020	0.02309	0.09091	0.09091	2.60979	2.61726	0.99949	2.12136	0.69366	0.33816	0.01675	0.00168	0.01753	0.08213	0.66631
	2001 m2	0.42586	0.04685	0.01395	0.00759	0.00499	0.00113	0.00192	0.00020	−0.00073	0.00393	0.09091	0.09091	2.60979	2.61205	0.99999	1.44198	0.55158	0.29999	0.01205	0.00039	0.01192	0.01329	0.53577
	2001 m3	0.60896	0.06699	0.02076	0.01447	0.00743	0.00237	0.00203	0.00017	−0.00100	0.00415	0.09091	0.09091	2.60979	2.61275	0.99997	1.56553	0.62620	0.43423	0.01326	0.00055	0.01294	0.01985	0.60982
	2001 m4	0.41276	0.04540	0.01522	0.01122	0.00545	0.00170	0.00148	0.00009	−0.00113	0.00301	0.09091	0.09091	2.60979	2.61172	0.99998	1.41549	0.62384	0.45141	0.01252	0.00038	0.01170	0.01465	0.61042
	2001 m5	0.41276	0.04540	0.01522	0.01122	0.00545	0.00170	0.00148	0.00009	−0.00113	0.00301	0.09091	0.09091	2.60979	2.61172	0.99998	1.41549	0.62384	0.45141	0.01252	0.00038	0.01170	0.01465	0.61042
	2001 m6	0.57823	0.06361	0.02386	0.01803	0.00854	0.00255	0.00182	0.00009	−0.00116	0.00368	0.09091	0.09091	2.60979	2.61260	0.99996	1.45144	0.61997	0.44084	0.01272	0.00053	0.01200	0.02315	0.60576
2003	2002 m1	1.73689	0.19106	0.07794	0.05274	0.02789	0.00742	0.01022	0.00073	−0.00047	0.02090	0.09091	0.09091	2.60979	2.61551	0.99956	2.97175	1.09894	0.75626	0.02522	0.00158	0.02456	0.07598	1.06521
	2002 m2	0.42910	0.04720	0.01369	0.00636	0.00490	0.00109	0.00200	0.00021	−0.00066	0.00421	0.09091	0.09091	2.60979	2.61108	0.99999	1.50251	0.65330	0.52856	0.01095	0.00039	0.01242	0.01300	0.63887
	2002 m3	0.37026	0.04073	0.01124	0.00448	0.00402	0.00116	0.00167	0.00018	−0.00076	0.00360	0.09091	0.09091	2.60979	2.61095	0.99999	1.50279	0.70212	0.58919	0.01065	0.00034	0.01242	0.01061	0.68870
	2002 m4	0.25937	0.02853	0.00833	0.00531	0.00298	0.00090	0.00125	0.00008	−0.00086	0.00266	0.09091	0.09091	2.60979	2.61053	0.99999	1.21585	0.59920	0.50241	0.00883	0.00024	0.01005	0.00791	0.58892
	2002 m5	0.25937	0.02853	0.00833	0.00531	0.00298	0.00090	0.00125	0.00008	−0.00086	0.00266	0.09091	0.09091	2.60979	2.61053	0.99999	1.21585	0.59920	0.50241	0.00883	0.00024	0.01005	0.00791	0.58892
	2002 m6	0.32920	0.03621	0.01192	0.00862	0.00427	0.00127	0.00131	0.00008	−0.00092	0.00278	0.09091	0.09091	2.60979	2.61109	0.99999	1.22917	0.60023	0.50274	0.00893	0.00030	0.01016	0.01146	0.58974