CORRECTION OF CHAIN-LINKING METHOD BY MEANS OF LLOYD-MOULTON-FISHER-TÖRNQVIST INDEX ON CROATIAN GDP DATA

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Abstract

National statistical agencies of European Union use chain-linking method to achieve the best possible decomposition of GDP. The main advantage of this method is its simplicity, thus it can be applied in practice, which makes it particularly attractive in the situation when GDP has to be compiled on due time. By this method transformation-substitution effect – inherent to rational producers and consumers, has been implicitly built into GDP compilation, which is prior assumption of normative economic theory. On empirical (ex-post) ground it gives more precise volume-price decomposition. In this paper, by means of constructing LMTF index and Fisher index derived from the previous one, it is suggested how to improve chain linking method, due to following reasons: a) it is theoretically restrictive), b) it gives only rough GDP decomposition into volume and price and, what seems to be its main disadvantage, c) it gives additively inconsistent GDP.

Key words: *Transformation-substitution effect, Elasticity of substitution, Lloyd-Moulton index, LMTF index, Fisher index supported by LMTF, Additive GDP consistency*

1. INTRODUCTION

In this paper authors offer new, more refined approach to GDP compilation; especially calculation of real GDP growth rates (on annual and quarterly basis). Croatian Central Bureau of Statistics as well as other national statistical agencies throughout European Union use chain linking as fundamental approach to avoid index number drift (i.e. phenomenon where Laspeyres index deviate from its Paasche counterpart index, whenever weighting base is kept fixed into one period). Index number drift is getting even more and more profound as weighting structure has been put more backward in the past. In order to avoid this bias in GDP measurement at least temporary change of weighting scheme is necessary each five or (rare) ten years at least. Eurostat imposed on EU member state an obligation to chain link GDP data, i.e. this institution obliged member states national statistical offices to change weighting scheme each year.

Chain linking is sufficiently good approach (the second best solution), particularly under the pressure when quarterly GDP has to be produced on due time (timeliness requirement), but this approach splits GDP on real growth and inflationary component only roughly. Therefore authors in this paper suggest LMTF index, as combination of Llloyd-Moulton (LM), Fisher (F) and Törnqvist-Theil (TT). As LM index require econometrics, it is recommended to be used during ex-post methodological revisions when national accountants can work more relaxed due to absence of time pressure. If LMTF index is used for constructing so called LMTF supported Fisher index with additive weights in relative (Diewert-Eheman) and absolute (Van-Ijzeren) sense, where these weights are anchored onto fixed (reference) year then problem of non- additivity of QGDP chain-linked data could also be resolved.

2. CONSTRUCTION OF TARGETED INDICES: FISHER, TöRNQVIST AND LLOYD-MOULTON - ON CROATIAN GDP DATA – FOR THE PERIOD 2000-2007

Referring to the previous papers of the authors (Šutalo I., heading 2, pp. 17-77), where it was clearly exposed (on theoretical ground) why they prefer LM, F and T indices, in this paragraph they will construct LMTF index, using LM, F and T as its constituents for the period q1.2000 till q4.2007[1], for which (LMTF) authors ascertain to improve GDP decomposition performed by means of chain-linking technique, which CBS[2] has been applied so far. Also, the same data set will be used for construction of Fisher LMTF supported index which possesses properties of absolute (in the sense of Van-Ijzeren formulae, (see Šutalo, equations (58) and (59), pp. 45) and relative (in the sense of Diwert-Eheman

[1] q1.2000 do q4.2007 –first quarter 2000. up to fourth quarter 2007
[2] CBS – Central Bureau of Statistics

formulae, see (Šutalo I., equations (69) and (71), pp. 48-49.) additivity. If CBS adopted this technique it would improve compilation of quarterly GDP which is non-additive so far.

CBS QGDP time series, QGDP[3] q1.2000 up to QGDP q4.2007, which CBS disposed of officially to the authors, consists of annual and quarterly data in current prices and volume terms (in average prices of the previous years).[4]).

When constructing Lloyd-Moulton index, the first LMTF component starts up from econometric estimate of parameter **σ** (elasticity of substitution), (see: Šutalo I., subheading 2.2., equations (79) and (80), pp**.** 55**)**. Coefficient **σ** is obtained by econometric estimation of the following - double logarithm - equation[**5**]:

$$\ln\left[\frac{\left(\frac{s_i^{qt}}{s_j^{qt}}\right)}{\left(\frac{s_i^{qt-1}}{s_j^{qt-1}}\right)}\right] = \sigma * \ln(P_j^{pt} / P_i^{pt}) + u_i,\ za\ \forall\ (i, j)\ \ i, j = 1 \ldots 1540 \qquad (1)$$

Where $\boldsymbol{s_i}$ are GDP shares by 56 NKD divisions, expressed in previous year prices, and P_i and P_j are "GDP prices" (expressed as GDP deflators current period, quarter or year relative to average prices of the previous year).

Estimated coefficient $\hat{\sigma}$ from equation (170) is classical coefficient of elasticity, defined in the following way:

$$\sigma = \eta_{s,P} = \frac{\partial \ln\left[\frac{s_i^{qt}}{s_j^{qt}} / \frac{s_i^{qt-1}}{s_j^{qt-1}}\right]}{\partial \ln(\frac{P_j^P}{P_i^P})}\ \ z\ \forall\ (i, j) = i, j = 1 \ldots 1540 \qquad (2)$$

After first estimation of equation (1) was carried out high positive autocorrelation was detected. After that AR (1) transformation was applied. The new regression throughput gave the following results:

[3] QGDP - Quarterly Gross domestic product
[4] Quarterly and annual GDPs in this series are chain-linked data derived applying annual overlap technique.
[5] 1540 industries pairs, among 56 NKD divisions, are defined after, from total set of 60 NKD divisions, four of them were eliminated, due to nonexistent production: 10 – Coal and lignite mining, 12 - Mining of uranium and thorium, 13 – Metal ore mining and 99 – Extraterritorial organisations and bodies.

Table 1: Elasticity of substitution, after AR (1) correction

Years	Quarters			
	q1	q2	q3	q4
2001.	0,0100	0,2539	0,2271	0,1672
2002.	0,6926	0,7026	0,6775	0,5165
2003.	0,8069	0,9085	1,0955	0,4506
2004.	0,0266	0,5100	0,5717	0,5384
2005.	0,0370	0,0956	0,2595	-0,2718
2006.	0,2618	0,1507	0,2553	0,0377
2007.	0,1794	0,0958	0,0316	-0,0586

Summary of statistical diagnostics is shown in table 2:

Table 2. Estimates of elasticises of substitution coefficients among 1539 pairs of NKD divisions, after AR(1) transformation was applied

Quarter (1)	Elasticity coefficient (2)	t – statistic (3)	*p* - value. T-stat. (4)	F – stat. (5)	*p* - value F stat. (6).	DW (7)
q1 -2001.	0,0100	0,4247	0,6711 × 10^{0}	0,1804	0,6711 × 10^{0}	2,2679
q2 -2001.	0,2539	11,3435	1,0645 × 10^{-28}	131,4093	1,0645 × 10^{-28}	2,4105
q3 -2001.	0,2271	11,7450	1,4000 × 10^{-30}	137,9443	1,4000 × 10^{-30}	2,4354
q4 -2001.	0,1672	9,8756	2,4146 × 10^{-22}	117,9162	2,4146 × 10-22	2,2693
q1 -2002.	0,6926	25,1191	5,8000 × 10^{-117}	630,9682	5,8000 × 10^{-117}	2,0321
q2 -2002.	0,7026	38,9803	9,7000 × 10^{-232}	1519,4632	9,7000 × 10^{-232}	2,2398
q3 -2002.	0,6775	38,6095	1,4013 × 10^{-228}	1490,6898	1,4013 × 10^{-228}	2,5561
q4 -2002.	0,5165	26,0736	2,0657 × 10^{-124}	679,8304	2,0657 × 10^{-124}	2,4679
q1 -2003.	0,8069	18,2341	2,0857 × 10^{-67}	332,4825	2,0857 × 10^{-67}	1,9642
q2 -2003.	0,9085	27,3031	3,600 × 10^{-134}	745,4601	3,600 × 10^{-134}	1,9660
q3 -2003.	1,0955	44,1131	2,2357× 10^{-235}	1945,9640	2,2357× 10^{-235}	2,1551
q4 -2003.	0,4506	6,6662	3,6470 × 10^{-11}	44,4387	3,6470 × 10^{-11}	1,0799
q1 -2004.	-0,0266	-0,7740	0,4390 × 10^{0}	0,5991	0,4390 × 10^{0}	2,12025
q2 -2004.	0,5100	17,1599	1,5832 × 10^{-60}	294,4616	1,5832 × 10^{-60}	2,1185
q3 -2004.	0,5717	23,3486	1,8647 × 10^{-103}	545,1588	1,8647 × 10^{-103}	2,1544
q4 -2004.	0,5384	26,5078	7,7496 × 10^{-128}	702,6641	7,7496 × 10^{-128}	2,2991
q1 -2005.	0,0370	1,5858	0,1130 × 10^{0}	2,5146	0,1130 × 10^{0}	2,29333
q2 -2005.	0,0956	10,7141	6,9736 × 10^{-26}	114,7921	6,9736 × 10^{-26}	0,6148
q3 -2005.	-0,2595	-11,1775	6,0709 × 10^{-28}	124,9358	6,0709 × 10^{-28}	2,3925
q4 -2005.	-0,2718	-13,7523	1,1321 × 10^{-40}	189,1249	1,1321 × 10^{-40}	2,5001
q1 -2006.	0,2618	14,2912	1,3477 × 10^{-43}	204,2378	1,3477 × 10^{-43}	2,4414
q2 -2006.	-0,1507	-5,5595	3,1844 × 10^{-8}	30,9082	3,1844 × 10^{-8}	2,4864
q3 -2006.	-0,2553	-8,3247	1,8435 × 10^{-16}	69,3012	1,8435 × 10^{-16}	2,5127
q4 -2006.	0,0377	2,4136	0,0493× 10^{0}	204,2378	0,0493× 10^{0}	2,4136
q1 -2007.	0,1794	14,9943	1,5405 × 10^{-47}	224,8279	1,5405 × 10^{-47}	2,4752
q2 -2007.	-0,0958	-3,5603	0,0004 × 10^{0}	12,6758	0,0004 × 10^{0}	2,6488
q3 -2007.	0,0316	1,5769	0,1150 × 10^{0}	2,4865	0,1150 × 100	2,2983
q4 -2007.	-0,0586	-3,7962	0,0002 × 10^{0}	14,4113	0,0002 × 10^{0}	2,2954

As simple regression is in question, empirical **F statistic** (**$F_{1,1537}$**) calculated on the sample (subscripts are degrees of freedom) is equal to Student t statistic **t_{1537}**. ***p*-values** for both empirical statistics are the same.

Values of DW statistic which are moving around 2 indicate acceptable autocorrelation level for 26 quarters; while autocorrelation (despite AR(1) transformation) remains on high positive levels in two quarters: fourth quarter of 2003 and second quarter of 2005. If one looks at rigorous formal check of DW validity by means of DW table {look at: [134], pp. 629 and 630} it is noticed that DW statistics (at 5% i 1% significance levels) for all quarters, except for the two already mentioned, exceed upper critical bound d_U for 100 observations, indicating the absence of autocorrelation.

Diminishing of autocorrelation by means of AR(1) transformation caused, first of all, big changes in significance of elasticity of substitution parameters, what is well known feature of autocorrelation. Parameter estimates underwent significantly lower changes, where the two quarters (q1 2003 and q4 2003) stand out - in the sense of bigger oscillations (situation before autocorrelation correction compared to the situation after correction).

Regarding significance of parameters after AR(1) transformation, situation is like this: in the four quarters (yellow highlighted cells) coefficients are not significant at 5% level (in q1-2001 and q1 2004 they are no significant absolutely, while in the two – of these four quarters – coefficients are significant at 11% level, q1-2005 and q3-2007 are in question). In eighteen quarters (white rows) parameters are highly significant – with expected positive values, while in six quarters (gray rows) parameters are highly significant – but with negative values.

Nevertheless, it is important to note that positive, a priory expected substitution prevails in all twenty eight quarters. Average of all 28 parameters, keeping their signs intact, amounts to 0,2734; if one calculates average of absolute values of all 28 sigmas (σ), a little bigger number 0,3532 is achieved because, as it has been pointed out, the six already mentioned sigmas which indicate complementary, instead of substitutable relationships among 1540 commodity groups – sigmas with negative signs – have no big absolute values. Formula (3) is used for calculation of LM empirical index:

$$P_{LM}(p^0, p^1, q^0, q^1) \equiv \left\{ \sum_{i=1}^{n} s_i^0 \left(\frac{p_i^1}{p_i^0} \right)^{1-\sigma} \right\}^{(1/1-\sigma)} \quad (3)$$

Calculation of this index was carried out in two stages in linked Excel sheets. In the first stage LM base were calculated, expression in curly brackets under exponent 1 – σ in equation (3), and yet in the second stage these bases were raised to the exponent 1/(1 – σ).

Base in curly brackets is „modified L index“, where relative prices (implicit deflators of quarterly GDP, current quarter in current prices through average prices of the previous year) are modified raising them to the exponent (1 – σ).

Table 3. Lloyd-Moulton indices - quarters q_1 2001. till q_4 2007.

Year	Lloyd-Molutonov price indices (through quarters)			
	q_1	q_2	q_3	q_4
2001.	102,136	104,590	104,028	103,487
2002.	102,556	102,987	104,480	104,408
2003.	102,503	103,223	104,913	103,722
2004.	102,911	104,703	106,376	105,773
2005.	101,983	103,687	104,293	105,208
2006.	102,042	104,383	104,795	104,599
2007.	101,247	104,285	105,095	106,267

Table 4. Calculation of Fisher price index – quarters q1 2001. till q4 2007.

Ordinal number of the quarter (1)	**Quarter** (2)	**Laspeyres index** (3)	**Paasche index** (4)	**Fisher index** $[(3)*(4)]^{1/2}$	**Relationship between L i P** (5)
1	q1 -2001.	102,1455	102,0942	102,1198	OK!
2	q2 -2001.	104,8237	104,2541	104,5385	OK!
3	q3 -2001.	104,1971	104,2289	104,2130	No correct!
4	q4 -2001.	103,6675	103,2159	103,4415	OK!
5	q1 -2002.	103,1266	103,1831	103,1549	No correct!
6	q2 -2002.	103,6363	103,3409	103,4885	OK!
7	q3 -2002.	105,0436	104,6583	104,8508	OK!
8	q4 -2002.	104,9147	104,3131	104,6134	OK!
9	q1 -2003.	102,9253	103,3952	103,1600	No correct!
10	q2 -2003.	103,8517	103,7141	103,7829	OK!
11	q3 -2003.	105,3612	105,4402	105,4007	No correct!
12	q4 -2003.	104,0354	103,8295	103,9324	OK!
13	q1 -2004.	102,8971	103,1544	103,0256	No correct!
14	q2 -2004.	105,2181	104,9412	105,0795	OK!
15	q3 -2004.	106,9996	106,5667	106,7829	OK!
16	q4 -2004.	106,3984	105,2355	105,8153	OK!
17	q1 -2005.	102,0101	102,2822	102,1461	No correct!
18	q2 -2005.	103,7731	103,5154	103,6442	OK!
19	q3 -2005.	104,3044	104,2503	104,2773	OK!
20	q4 -2005.	105,0405	104,7333	104,8868	OK!
21	q1 -2006.	102,1786	102,2974	102,2380	No correct!
22	q2 -2006.	104,2951	104,0966	104,1958	OK!
23	q3 -2006.	104,6917	104,6305	104,6611	OK!
24	q4 -2006.	104,6149	104,6081	104,6115	OK!
25	q1 -2007.	101,3640	101,2695	101,3167	OK!
26	q2 -2007.	104,2404	104,2172	104,2288	OK!
27	q3 -2007.	105,1051	105,0495	105,0773	OK!
28	q4 -2007.	106,2392	106,2725	106,2558	No correct!

Weights in the equation (3) are GDP shares at current prices in total GDP for each of 56 NKD divisions in total GDPs for years 2000 till 2006. Weights are always from the year which precedes quarterly implicit deflators (which are from the period 2001 - 2007).

Raising Lloyd-Moulton index bases to the exponent 1/(1 - σj), according to formula (3), and after multiplication by 100, Lloyd-Moulton indices are obtained for all 28 quarters: q1 2005 till q4 2007. These indices are shown in table 3.After LM index has been calculated using econometrics, which measures substitution in the best possible way, which admittedly is not „superlative" in theoretical sense like Fisher or Törnqvist indices, but like it also demonstrates exact decomposition like Fisher or Törnqvist do (see [149], pp. 53, equation (87)); now F i T indices, together with corresponding elasticity of substitution, are going to be calculated.

Detailed display of Fisher index calculation is shown in table 4.

Likewise Törnqvist index was calculated according to formula (4):

$$TT = \prod_{i=1}^{56} I_i^{\left(\frac{S_{i0}+S_{i1}}{2}\right)}, \ \Sigma_i s_{i\,0} = 1,\ \Sigma_i s_{i\,1} = 1 \tag{4}$$

Törnqvist-Theil indices, for the whole analysed period, are shown in table 5.

Table 5: Calculation of Törnqvist-Theil price index – quarters q1 2001. till q4 2007.

Ordinal number of the quarter (1)	Quarter (2)	Törnqvist-Theil indices (3)	Ordinal number of the quarter (1)	Quarter (2)	Törnqvist-Theil indices (3)
1	q1 -2001.	101,6303	15	q3 -2004.	106,3253
2	q2 -2001.	104,3046	16	q4 -2004.	105,4671
3	q3 -2001.	103,8538	17	q1 -2005.	101,3937
4	q4 -2001.	103,0724	18	q2 -2005.	103,1681
5	q1 -2002.	102,6754	19	q3 -2005.	103,9224
6	q2 -2002.	103,1146	20	q4 -2005.	104,6051
7	q3 -2002.	104,5504	21	q1 -2006.	101,6176
8	q4 -2002.	104,3614	22	q2 -2006.	103,7732
9	q1 -2003.	102,6488	23	q3 -2006.	104,2505
10	q2 -2003.	103,3814	24	q4 -2006.	104,2308
11	q3 -2003.	105,1233	25	q1 -2007.	100,6857
12	q4 -2003.	103,5965	26	q2 -2007.	103,8430
13	q1 -2004.	102,4162	27	q3 -2007.	104,7393
14	q2 -2004.	104,5628	28	q4 -2007.	105,8104

The three above mentioned indices: LM, F and TT were used for calculation of LMTF index. LMTF index has been derived as mean of the above three indices and is shown in table 6:

Table 6. Calculation of Lloyd-Moulton price index (LMTF I) -quarters q1 2001. till q4 2007., as an average of LM, T i F indices (the first mode of calculation)

Ordinal number of the quarter (1)	Quarter (2)	LM index (3)	Fisher index (4)	Törnqvist-Theil index (5)	LMTF – index (6) = [(3)+(4)+(5)] / 3
1	q1 -2001.	102,1362	102,1198	101,6303	**101,9621**
2	q2 -2001.	104,5899	104,5385	104,3046	**104,4777**
3	q3 -2001.	104,0277	104,2130	103,8538	**104,0315**
4	q4 -2001.	103,4872	103,4415	103,0724	**103,3337**
5	q1 -2002.	102,5562	103,1549	102,6754	**102,7955**
6	q2 -2002.	102,9867	103,4885	103,1146	**103,1966**
7	q3 -2002.	104,4795	104,8508	104,5504	**104,6269**
8	q4 -2002.	104,4076	104,6134	104,3614	**104,4608**
9	q1 -2003.	102,5026	103,1600	102,6488	**102,7705**
10	q2 -2003.	103,2229	103,7829	103,3814	**103,4624**
11	q3 -2003.	104,9126	105,4007	105,1233	**105,1455**
12	q4 -2003.	103,7220	103,9324	103,5965	**103,7503**
13	q1 -2004.	102,9111	103,0256	102,4162	**102,7843**
14	q2 -2004.	104,7029	105,0795	104,5628	**104,7817**
15	q3 -2004.	106,3762	106,7829	106,3253	**106,4948**
16	q4 -2004.	105,7728	105,8153	105,4671	**105,6851**
17	q1 -2005.	101,9826	102,1461	101,3937	**101,8408**
18	q2 -2005.	103,6867	103,6442	103,1681	**103,4997**
19	q3 -2005.	104,2934	104,2773	103,9224	**104,1644**
20	q4 -2005.	105,2080	104,8868	104,6051	**104,9000**
21	q1 -2006.	102,0422	102,2380	101,6176	**101,9659**
22	q2 -2006.	104,3830	104,1958	103,7732	**104,1173**
23	q3 -2006.	104,7952	104,6611	104,2505	**104,5689**
24	q4 -2006.	104,5988	104,6115	104,2308	**104,4804**
25	q1 -2007.	101,2474	101,3167	100,6857	**101,0833**
26	q2 -2007.	104,2848	104,2288	103,8430	**104,1189**
27	q3 -2007.	105,0947	105,0773	104,7393	**104,9704**
28	q4 -2007.	106,2672	106,2558	105,8104	**106,1112**

The second mode of calculating LMTF index is by means of equation (3), after average σ was inserted into this equation. Average σ is obtained as mean of the LM, F and TT corresponding σ-s. LM corresponding elasticity coefficients are derived by econometrics in the way already described above. F and TT corresponding σ-s were derived numerically, i.e. using iterative procedure, where coefficients of substitution which give predetermined F and TT indices (from tables 4 and 5) were looking for. Values of this type of LMTF index (LMTF II) are shown in table 7.

Table 7. Calculation of Lloyd-Moulton price index -quarters q1 2001 till q4 2007, via common (averaged) elasticity of substitution (the second mode of calculation)

Ordinal number of the quarter (1)	Quarter (2)	LMTF index– calculated from common substitution (3)	LMTF - index-average (4)	Differences (5) = (4) – (3)
1	q1 -2001.	101,9613	101,9621	0,0009
2	q2 -2001.	104,4778	104,4777	-0,0002
3	q3 -2001.	104,0304	104,0315	0,0011
4	q4 -2001.	103,3333	103,3337	0,0004
5	q1 -2002.	102,7993	102,7955	-0,0038
6	q2 -2002.	103,1938	103,1966	0,0028
7	q3 -2002.	104,9196	104,6269	-0,2927
8	q4 -2002.	104,4602	104,4608	0,0006
9	q1 -2003.	102,7649	102,7705	0,0056
10	q2 -2003.	103,4613	103,4624	0,0011
11	q3 -2003.	105,1491	105,1455	-0,0035
12	q4 -2003.	103,7516	103,7503	-0,0013
13	q1 -2004.	102,7755	102,7843	0,0088
14	q2 -2004.	104,7787	104,7817	0,0030
15	q3 -2004.	106,4903	106,4948	0,0044
16	q4 -2004.	105,6838	105,6851	0,0013
17	q1 -2005.	101,8441	101,8408	-0,0033
18	q2 -2005.	103,4971	103,4997	0,0025
19	q3 -2005.	104,1633	104,1644	0,0011
20	q4 -2005.	104,9029	104,9000	-0,0029
21	q1 -2006.	101,9676	101,9659	-0,0016
22	q2 -2006.	104,1160	104,1173	0,0013

Ordinal number of the quarter (1)	Quarter (2)	LMTF index– calculated from common substitution (3)	LMTF - index-average (4)	Differences (5) = (4) – (3)
23	q3 -2006.	104,5635	104,5689	0,0054
24	q4 -2006.	104,4821	104,4804	-0,0018
25	q1 -2007.	101,0866	101,0833	-0,0034
26	q2 -2007.	104,1176	104,1189	0,0013
27	q3 -2007.	104,9704	104,9704	0,0001
28	q4 -2007.	106,1147	106,1112	-0,0035

Column six from table 8 shows the two types of LMTF indices approximate to each other up to the second decimal place. Using LMTF index (of both variants) will alter official CBS QGDP growth rates. Differences are shown in the tables 8 and 9.

It could be noted that there are substantial differences in annual GDP growth rates between official CBS data and hypothetical data if LMTH index would have been used for deflating nominal GDPs. These differences are the most pronounced in the yellow highlighted cells. Since authors in their previous works see (Šutalo, pp. 17-113) exposed biggish numbers of arguments why LMTF index is superior to the classic CBS approach (chained linked Laspeyres and Paasche) its application in national accounts practice would improve GDP compilation.

Table 8: Differences among growth rates between LMTF (I) and classical CBS calculation – referent 2000 year

Years	Quarters			
	q1	q2	q3	q4
2001/2000	0,1347	**-0,2240**	0,1980	-0,1184
2002/2001	0,2568	0,3685	-0,1723	-0,0307
2003/2002	0,3432	0,2112	0,3643	0,3256
2004/2003	0,0525	0,2148	0,0877	-0,2135
2005/2004	0,1118	-0,1058	0,0533	0,3169
2006/2005	-0,0221	0,0539	0,0665	**0,3857**
2007/2006	-0,0251	0,2455	0,1402	0,1527

Table 9: Differences among growth rates between LMTF (II) and classical CBS calculation – referent 2000 year

Years	Quarters			
	q1	q2	q3	q4
2001/2000	0,1356	-0,2242	0,1991	-0,1180
2002/2001	0,2526	0,3721	**-0,4711**	-0,0299
2003/2002	0,2738	0,1299	**0,5773**	0,2459
2004/2003	0,0562	0,2171	0,0959	-0,2106
2005/2004	0,1039	-0,1019	0,0544	0,3172
2006/2005	-0,0209	0,0521	0,0702	0,3172
2007/2006	-0,0260	0,2464	0,1359	0,1519

3. CONCLUSION

In this paper authors highly argumented why LMTF index and Fisher index supported by LMTF better measure substitution effect and why these two indices improve quality of GDP in the following sense:

- more precise volume price decomposition
- additive (relative and absolute) consistency
- multiplicative consistency (volume times price = value).

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