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## **The use of complex variable functions in economic and mathematical models, using the example of the international trade model of the Visegrad four countries for 2000-2015**

### **Abstract**

Interpolation of time series by the sum of exponents of a function of a complex variable gives an approximation no worse than using regression analysis. Despite the fact that time series are interpolated by functions of a complex variable, the values of these functions under certain conditions are real numbers. The imaginary component of complex numbers that occurs during calculations is several orders of magnitude smaller than the real part. The appearance of the imaginary part is due, in the author's opinion, to the error of calculations and it can be neglected when interpreting the result of calculations. To calculate the interpolating function, the author used standard procedures used in the MATLAB software.

The absence of extremum points for exponents is the main advantage when using exponent sums for interpolation purposes compared to interpolation by polynomials.

### **Keywords**

Functions of a complex variable, series of exponents, interpolation by sums of exponents, international trade model

### **Introduction**

A significant part of modern economic and mathematical models are based on regression analysis and probability theory. The author does not question their effectiveness and practical significance. At the same time, the functions of a

complex variable, which have become widespread in the description of various physical models, starting with electrical engineering and ending with quantum mechanics, have not found their worthy application in economic and mathematical models.

Most modern economists have an extremely weak understanding of the theory of the function of a complex variable, as well as the potential capabilities of this class of functions.

Within the framework of this study, a model of international trade of the Visegrad Four countries was built (Czech Republic, Slovakia, Poland and Hungary) in 2000 -2015. When constructing the model, partial differential equations and functions of a complex variable were used.

Let there be a system of differential equations

$$F_j \left( x_1, x_2, \dots, x_n, y_1, y_2, \dots, y_m, \frac{\partial y_1}{\partial x_1}, \frac{\partial y_2}{\partial x_2} \dots \right) = 0 \quad (j=1,2,\dots,k) \quad (1)$$

At the same time , each function  $F_j$  determined on a certain number of measurements.

The Cauchy problem of the system of differential equations (1) is the following problem [ 1 ]:

Let 's say in  $n$  – dimensional space  $x_1, x_2, \dots, x_n$  there is some area  $G$ , bounded by a border  $\gamma$  , at the same time , a certain part  $\gamma$  belongs to some neighborhood  $M$  . It is necessary to define for the system (1) of some given class of functions , a solution related to  $\gamma$  in some neighborhood  $M$  . In which for  $\forall$  ( $i =1, 2, \dots, m$ ) all partial derivatives of the function  $y_i$  up to some order should have in  $\forall$  point  $M$  certain values , which are called initial data.

The question of the uniqueness of the solution of the system of differential equations (1) is to determine the conditions under which there are two solutions having the same initial data in the vicinity of the point  $M$ .

Holmgren 's Theorem [2] .

*The Cauchy problem has a unique solution for the case of a linear system of differential equations of any order, regardless of the number of independent variables and analytical coefficients for a class of functions that have continuous derivatives of higher orders that are included in the system. It is assumed that  $M$  opened in  $\gamma$  and is a doubly continuously differentiated surface , the tangent planes to which are not characteristic at the point of tangency.*

The Cauchy-Kovalevskaya theorem [ 3 ]

Let's say there is a system of partial differential equations that has unknown functions  $y_1, y_2, \dots, y_n$  kind of

$$\frac{\partial^{n_i} y_i(x, t)}{\partial t^{n_i}} = F_i \left( t, x, y_i, \dots, y_N, \dots, \frac{\partial^a y_i}{\partial t^{a_0} \partial x_1^{a_1} \dots \partial x_n^{a_n}}, \dots \right), \quad (2)$$

Where  $x = (x_1, x_2, \dots, x_N)$  ,  $a = a_0 + a_1 + \dots + a_N$  ,  $a \leq n_j$  ,  $a_0 \leq n_j$ ,

$a_0 \leq n_j, a_0 \leq n_j - 1$  ,  $a_i \geq 0$  ,  $i, j = 1, \dots, N$

If all functions  $\omega_i^k(x)$  are analytic in the neighborhood of a point

$x^0 = (x_1^0, x_2^0, \dots, x_n^0)$  , and the functions  $F_i$  are analytic and defined in the neighborhood of a point  $(t^0, x_1^0, \dots, x_n^0, \omega_i^k(x^0), \dots, \frac{\partial^a \omega_i^k(x_0)}{\partial x_1^{a_1} \dots \partial x_n^{a_n}}, \dots)$  , then the Cauchy problem has in some neighborhood a point  $(t^0, x_1^0, x_2^0, \dots, x_n^0)$  has an analytical solution, which is the only solution for a class of analytical functions.

Gravitational models are widely used in economic and mathematical modeling

A typical gravitational model of international trade is contained in the works [4,5,6,7,8,9]

$$Trade_{ij} = A(GDP_i GDP_j)^\alpha D_{ij}^\beta X_{ij}^\gamma \varepsilon_{ij} \quad (3)$$

Or

$$Ln(Trade_{ij}) = Ln(A) + \alpha Ln(GDP_i GDP_j) + \beta LnD_{ij} + \gamma LnX_{ij} + Ln\varepsilon_{ij} \quad (4)$$

## Methods

The purpose of this work is to present a new methodological approach to solving economic and mathematical problems based on the use of functions of a complex variable.

Within the framework of this study, the interpolation of numerical series by the sum of sixteen exponents of the function of a complex variable of macroeconomic parameters was applied: population, GDP, export volume.

## Results

As part of writing this paper , a somewhat simplified model of international trade is used

$$Trade_{ij} = GDP_i^{\alpha_i} GDP_j^{\alpha_j} G_i^{\beta_i} G_j^{\beta_j} \quad (5)$$

$P$  – population of the country,  $GDP$  – gross national product

Denote  $Trade_{ij} = T_{ij}$  .

$$\frac{\partial T_{ij}}{\partial (GDP_i)} = (GDP_i)^{\alpha_i-1} (GDP_j)^{\alpha_j} G_i^{\beta_i} G_j^{\beta_j} \alpha_i \quad (6)$$

$$\frac{\partial T_{ij}}{\partial (GDP_j)} = (GDP_i)^{\alpha_i} (GDP_j)^{\alpha_j-1} G_i^{\beta_i} G_j^{\beta_j} \alpha_j \quad (7)$$

$$\frac{\partial T_{ij}}{\partial (G_i)} = (GDP_i)^{\alpha_i} (GDP_j)^{\alpha_j} G_i^{\beta_i-1} G_j^{\beta_j} \beta_i \quad (8)$$

$$\frac{\partial T_{ij}}{\partial (G_j)} = (GDP_i)^{\alpha_i} (GDP_j)^{\alpha_j} G_i^{\beta_i} G_j^{\beta_j-1} \beta_j \quad (9)$$

Substituting (5) into equations (6 – 9) we get

$$\frac{\partial T_{ij}}{\partial (GDP_i)} = \alpha_i \frac{T_{ij}}{GDP_i} \quad (10)$$

$$\frac{\partial T_{ij}}{\partial (GDP_j)} = \alpha_j \frac{T_{ij}}{GDP_j} \quad (11)$$

$$\frac{\partial T_{ij}}{\partial (G_i)} = \beta_j \frac{T_{ij}}{G_j} \quad (12)$$

$$\frac{\partial T_{ij}}{\partial (G_i)} = \beta_i \frac{T_{ij}}{G_i} \quad (13)$$

Thus, the solution of the gravitational model (5) can be reduced to solving a system of linear partial differential equations (10, 11, 12, 13).

To do this, we use the formula of the derivative of a function given parametrically , in our case, the parameter is time.

$$\frac{\frac{dT_{ij}}{dt} * GDP_i}{\frac{d(GDP_i)}{dt} * T_{ij}} = \alpha_i \quad (14)$$

$$\frac{\frac{dT_{ij}}{dt} * GDP_j}{\frac{d(GDP_j)}{dt} * T_{ij}} = \alpha_j \quad (15)$$

$$\frac{\frac{dT_{ij}}{dt} * G_i}{\frac{dG_i}{dt} * T_{ij}} = \beta_i \quad (16)$$

$$\frac{\frac{dT_{ij}}{dt} * G_j}{\frac{dG_j}{dt} * T_{ij}} = \beta_j \quad (17)$$

In this paper corresponds to the Czech Republic index =1, Slovakia index =2, Poland index= 3, Hungary index= 4. To calculate the coefficients  $\alpha_j, \beta_j$ , where  $j=1,2,3,4$  data was used

Table 1. International trade data within the Visegrad Four countries for 2000-2015 [ 10]

Year	Export from the Czech Republic to Hungary, thousand US dollars	Import to the Czech Republic from Hungary, thousand US dollars	Export from the Czech Republic to Poland, thousand US dollars	Import to the Czech Republic from Poland, thousand US dollars	Export from the Czech Republic to Slovakia, thousand US dollars	Import to the Czech Republic from Slovakia, thousand US dollars	Exports from Poland to Hungary , thousand US dollars	Import to Poland from Hungary, thousand US dollars	Exports from Poland to Slovakia, thousand US dollars	Import to Poland from Slovakia, thousand US dollars	Export from Slovakia to Hungary, thousand US dollars	Import to Slovakia from Hungary, thousand US dollars
2000	544432,25	515541,59	1578192,86	1148803,78	2230168,79	1932692,24	631038	753292	416561	706313	578695,4	268374,34
2001	630815,78	632347,2	1729869,8	1368242,46	2681287,78	1961543,18	733643	778506	491745	740927	679574,49	377011,69
2002	1074292,21	857041,51	2053246,17	1880904,66	3404070,45	2988055,33	903530	909581	547724	794638	789129,54	454073,54
2003	1110620,69	1042666	2336382,59	2129850,12	3884015,21	2656816,58	1270885	1199728	846740	1028483	1067965,46	775919,34
2004	1886741,84	1397440,23	3443822,45	3218976,51	5407615,51	3573031,92	1893845,3	1663510,84	1317768,57	1453390,6	1431352,63	998002,79
2005	2085683,71	1675700,22	4266184,48	3789015,08	6733382,45	4155098,15	2538221,54	1838006,81	1709089,15	1872217,94	1891777,75	1228832,7
2006	2855510	2267417,76	5390575	5270903	8023954	5009875,11	3330689,3	2699872,51	2292906,02	2219059,06	2486490,58	1952593,35
2007	3807697,38	3358696,19	7146769,12	6684487,11	10508420,31	6220489,2	4033807,69	3449829,9	3026313,41	2986895,53	3648001,25	3040803,34
2008	4150478,26	3866684,66	9468072,68	8290826,14	13437522,1	7894163,06	4791354,2	3747065,4	4201267,41	3996143,05	4327429,78	3599398,54
2009	2886197,62	2356825,4	6577658,04	6736388,38	10185712,03	5708548,19	3698996,11	2804716,65	3131916,65	3054175,86	3828648,49	2609520,96
2010	3050705,05	2733596,47	8129414,1	8041080,16	11595995,93	6505285,71	4436609,04	3056781,91	4073253,74	3599348,32	4636805,83	2758648,79
2011	3658346,93	3341921,54	10267814,29	10001664,37	14565372,54	8648623,64	4839700,54	3693669,62	4549098,12	4314891,38	6189777,7	3164565,52
2012	3600918,59	3308285,01	9520874,06	9966392,81	14177411,26	8514252,74	4270586,78	3156863,04	4527986,69	3963624,75	6185610,61	2814832,84
2013	4216270,23	3450979,88	9667846,12	10756290,07	14304064,33	8176816,32	5191658,76	3392843,99	5306159,43	4061910,76	5832187,45	3592280,84
2014	4871279,13	3576458,42	10415027,33	11865462,9	14640788,75	8121678,79	5652912,85	3378110,33	5351192,9	3967297,56	5655846,79	3917228,77
2015	4680773,07	3334565,66	9228940,9	11159827,35	14145818,72	7227569,77	5163191,35	3120386,39	4893243,19	3389971,24	4581086,3	3623916,02

Table 2. Data on the population and GDP of the Visegrad Four countries in 2000-2015 [10]

Year	Population, total Czechia, humans	Population, total Hungary, humans	Population, total Poland, humans	Population, total Slovak Republic, humans	GDP Czechia (current US\$)	GDP Hungary (current US\$)	GDP Poland (current US\$)	GDP Slovak Republic (current US\$)
2000	10255063	10210971	38258629	5388720	61828166496	47218405892	1.7221946113e+011	29242558797
2001	10216605	10187576	38248076	5378867	67808032980	53749989092	1.9090549354e+011	30778781607
2002	10196916	10158608	38230364	5376912	82196001051	67608919144	1.9907205882e+011	35297794386
2003	10193998	10129552	38204570	5373374	1.0009046758e+011	85302003908	2.1782726081e+011	46919965224
2004	10197101	10107146	38182222	5372280	1.1981443435e+011	1.0414104263e+011	2.5511018154e+011	57437444469
2005	10211216	10087065	38165445	5372807	1.3714347133e+011	1.1323671164e+011	3.0614433627e+011	62808723477
2006	10238905	10071370	38141267	5373054	1.5626409566e+011	1.157512667e+011	3.4462200309e+011	70767338922
2007	10298828	10055780	38120560	5374622	1.9018380088e+011	1.4022756062e+011	4.2902850537e+011	86563986799
2008	10384603	10038188	38125759	5379233	2.3681648576e+011	1.5837441964e+011	5.3360908185e+011	1.0087990298e+011
2009	10443936	10022650	38151603	5386406	2.0743429681e+011	1.3111422905e+011	4.3973750841e+011	89399303222
2010	10474410	10000023	38042794	5391428	2.0906994096e+011	1.3223113416e+011	4.7983417902e+011	90801178162
2011	10496088	9971727	38063255	5398384	2.295627334e+011	1.4199996021e+011	5.2830126907e+011	99492917849
2012	10510785	9920362	38063164	5407579	2.0885771932e+011	1.2885737048e+011	4.9852356825e+011	94253181330
2013	10514272	9893082	38040196	5413393	2.1168561659e+011	1.3573259572e+011	5.2101626273e+011	98569320343
2014	10525347	9866468	38011735	5418649	2.0935883416e+011	1.4107898482e+011	5.4247709621e+011	1.0108917842e+011
2015	10546059	9843028	37986412	5423801	1.8803305046e+011	1.2521032461e+011	4.7781191139e+011	88636928905



The data in Tables 1 and 2 were interpolated by the author using the sum of sixteen exponents of the function of a complex variable

$$\begin{aligned}
 \text{Population, total CZE} = & (-92.3535895486989-1.61366174480404e- \\
 & 12i) * \exp((0.08152321349876+3.14159265358979i) * t) + (5045370.38783272+2.08144048548854e-10i) * \exp((0.00298584338518324+0i) * t) + (19653.991294099- \\
 & 17326.3767887182i) * \exp((-0.0653285319006574+0.62696985909925i) * t) + (19653.991294099+17326.3767887182i) * \exp((-0.0653285319006574- \\
 & 0.62696985909925i) * t) + (2444.63397293447-1869.77344722679i) * \exp((- \\
 & 0.150064406494982+2.04454395103633i) * t) + (2444.63397293445+1869.77344722679i) * \exp((-0.150064406494982-2.04454395103633i) * t) + (4852.04870886005- \\
 & 9733.36487667103i) * \exp((-0.186736156148224+1.42202614319956i) * t) + (4852.04870886003+9733.36487667103i) * \exp((-0.186736156148224- \\
 & 1.42202614319956i) * t) + (-92.3535895486989+1.61366174480404e-12i) * \exp((0.08152321349876-3.14159265358979i) * t) + (5045370.38783272- \\
 & 2.08144048548854e-10i) * \exp((0.00298584338518324+0i) * t) + (19653.991294099+17326.3767887182i) * \exp((-0.0653285319006574- \\
 & 0.62696985909925i) * t) + (19653.991294099-17326.3767887182i) * \exp((- \\
 & 0.0653285319006574+0.62696985909925i) * t) + (2444.63397293447+1869.77344722679i) * \exp((-0.150064406494982- \\
 & 2.04454395103633i) * t) + (2444.63397293445-1869.77344722679i) * \exp((- \\
 & 0.150064406494982+2.04454395103633i) * t) + (4852.04870886005+9733.36487667103i) * \exp((-0.186736156148224-1.42202614319956i) * t) + (4852.04870886003- \\
 & 9733.36487667103i) * \exp((-0.186736156148224+1.42202614319956i) * t)
 \end{aligned} \tag{18}$$

$$\begin{aligned}
 \text{Population, total HUN} = & (-4.56328874595069+2.64349485145883i) * \exp((0.469061032058993+1.4707099877473i) * t) + (-4.56328874595049- \\
 & 2.64349485146316i) * \exp((0.469061032058993-1.4707099877473i) * t) + (27.6634559484809+4.87661076933391e- \\
 & 11i) * \exp((0.325863843624231+3.14159265358979i) * t) + (-741.90054395611+1.02664160977954e-08i) * \exp((- \\
 & 0.124076099027199+3.14159265358979i) * t) + (459.217480962854+3367.11282659557i) * \exp((0.0665065869764588+0.463206715061013i) * t) + (459.21748095683 \\
 & 6-3367.11282658601i) * \exp((0.0665065869764588-0.463206715061013i) * t) + (5125302.71083891+7.22777503506953e-07i) * \exp((- \\
 & 0.00251800930252543+0i) * t) + (105233.872882217+4.640301769838e-07i) * \exp((-3.00804914049925+3.14159265358979i) * t) + (-4.56328874595069- \\
 & 2.64349485145883i) * \exp((0.469061032058993-1.4707099877473i) * t) + (- \\
 & 4.56328874595049+2.64349485146316i) * \exp((0.469061032058993+1.4707099877473i) * t) + (27.6634559484809-4.87661076933391e- \\
 & 11i) * \exp((0.325863843624231-3.14159265358979i) * t) + (-741.90054395611-1.02664160977954e-08i) * \exp((-0.124076099027199- \\
 & 3.14159265358979i) * t) + (459.217480962854-3367.11282659557i) * \exp((0.0665065869764588- \\
 & 0.463206715061013i) * t) + (459.217480956836+3367.11282658601i) * \exp((0.0665065869764588+0.463206715061013i) * t) + (5125302.71083891- \\
 & 7.22777503506953e-07i) * \exp((-0.00251800930252543+0i) * t) + (105233.872882217-4.640301769838e-07i) * \exp((-3.00804914049925-3.14159265358979i) * t)
 \end{aligned}$$

(19)

**Population,total POL** = (0.647380626923001-5.5699412062093e-14i)\*exp((0.832417842404027+3.14159265358979i)\*t)+(0.482158182899681+0.610052381368287i)\*exp((0.799243000547571+2.43905444815465i)\*t)+(0.482158182899548-0.610052381368325i)\*exp((0.799243000547571-2.43905444815465i)\*t)+(-149.485238394063-94.2734760650344i)\*exp((0.364356152275902+1.67167239439043i)\*t)+(-149.485238394063-94.2734760649956i)\*exp((0.364356152275902-1.67167239439043i)\*t)+(19137153.4241554-2.95646497057765e-08i)\*exp((-0.000457572041700836+0i)\*t)+(-903.920929176537-1565.87921217704i)\*exp((0.0609911927568632+0.826650787278651i)\*t)+(-903.920929177673+1565.87921217501i)\*exp((0.0609911927568632-0.826650787278651i)\*t) + (0.647380626923001+5.5699412062093e-14i)\*exp((0.832417842404027-3.14159265358979i)\*t)+(0.482158182899681-0.610052381368287i)\*exp((0.799243000547571-2.43905444815465i)\*t)+(0.482158182899548+0.610052381368325i)\*exp((0.799243000547571+2.43905444815465i)\*t)+(-149.485238394083-94.2734760650344i)\*exp((0.364356152275902-1.67167239439043i)\*t)+(-149.485238394063+94.2734760649956i)\*exp((0.364356152275902+1.67167239439043i)\*t)+(19137153.4241554+2.95646497057765e-08i)\*exp((-0.000457572041700836+0i)\*t)+(-903.920929176537+1565.87921217704i)\*exp((0.0609911927568632-0.826650787278651i)\*t)+(-903.920929177673-1565.87921217501i)\*exp((0.0609911927568632+0.826650787278651i)\*t)

(20)

**Population,total SVK** = (31.6803086607912-35.552098647253i)\*exp((0.0563236427300666+2.53606671351536i)\*t)+(31.6803086610904+35.5520986477576i)\*exp((0.0563236427300666-2.53606671351536i)\*t)+(33.7421331493507+210.250283717784i)\*exp((0.0121068106957805+1.76871681093266i)\*t)+(33.7421331500392-210.250283715277i)\*exp((0.0121068106957805-1.76871681093266i)\*t)+(2676056.0092638-7.48737495298566e-07i)\*exp((0.000768781656664689+0i)\*t)+(4131.04716189528-1951.55440584385i)\*exp((-0.0694405995158119+0.403343898039661i)\*t)+(4131.04716190039+1951.55440583659i)\*exp((-0.0694405995158119-0.403343898039661i)\*t)+(37523.4444174087-1.65062598349175e-08i)\*exp((-1.52444283645367+0i)\*t) + (31.6803086607912+35.552098647253i)\*exp((0.0563236427300666-2.53606671351536i)\*t)+(31.6803086610904-35.5520986477576i)\*exp((0.0563236427300666+2.53606671351536i)\*t)+(33.7421331493507-210.250283717784i)\*exp((0.0121068106957805-1.76871681093266i)\*t)+(33.7421331500392+210.250283715277i)\*exp((0.0121068106957805+1.76871681093266i)\*t)+(2676056.0092638+7.48737495298566e-07i)\*exp((0.000768781656664689+0i)\*t)+(4131.04716189528+1951.55440584385i)\*exp((-0.0694405995158119-0.403343898039661i)\*t)+(4131.04716190039-1951.55440583659i)\*exp((-0.0694405995158119+0.403343898039661i)\*t)+(37523.4444174087+1.65062598349175e-08i)\*exp((-1.52444283645367+0i)\*t)

(21)

$$\begin{aligned} \text{GDP CZE} = & (-75070475.7873828-5.1516976668017e-07i) \cdot \exp((0.321355800319115+3.14159265358979i) \cdot t) + (39440598.8124439- \\ & 61321175.6165081i) \cdot \exp((0.378658000153029+2.23830611136595i) \cdot t) + (39440598.8124438+61321175.6165083i) \cdot \exp((0.378658000153029- \\ & 2.23830611136595i) \cdot t) + (300937935.79452- \\ & 104051944.612416i) \cdot \exp((0.270582133503279+1.4696418306386i) \cdot t) + (300937935.79452+104051944.612417i) \cdot \exp((0.270582133503279- \\ & 1.4696418306386i) \cdot t) + (-333132630.372158-31349142.4609667i) \cdot \exp((0.365201474475659+0.462358316156179i) \cdot t) + (- \\ & 333132630.372158+31349142.4609671i) \cdot \exp((0.365201474475659-0.462358316156179i) \cdot t) + (27047966151.0115-7.28747690585278e- \\ & 06i) \cdot \exp((0.143096124979426+0i) \cdot t) + (-75070475.7873828+5.1516976668017e-07i) \cdot \exp((0.321355800319115- \\ & 3.14159265358979i) \cdot t) + (39440598.8124439+61321175.6165081i) \cdot \exp((0.378658000153029-2.23830611136595i) \cdot t) + (39440598.8124438- \\ & 61321175.6165083i) \cdot \exp((0.378658000153029+2.23830611136595i) \cdot t) + (300937935.79452+104051944.612416i) \cdot \exp((0.270582133503279- \\ & 1.4696418306386i) \cdot t) + (300937935.79452-104051944.612417i) \cdot \exp((0.270582133503279+1.4696418306386i) \cdot t) + (- \\ & 333132630.372158+31349142.4609667i) \cdot \exp((0.365201474475659-0.462358316156179i) \cdot t) + (-333132630.372158- \\ & 31349142.4609671i) \cdot \exp((0.365201474475659+0.462358316156179i) \cdot t) + (27047966151.0115+7.28747690585278e-06i) \cdot \exp((0.143096124979426+0i) \cdot t) \end{aligned}$$

(22)

$$\begin{aligned} \text{GDP HUN} = & (-5018614.31459212-5.22868102644411e- \\ & 08i) \cdot \exp((0.449605412517453+3.14159265358979i) \cdot t) + (179321593.77075+24036053.4947825i) \cdot \exp((0.254695738528276+2.1619776738455i) \cdot t) + (179321593.7 \\ & 70751-24036053.4947826i) \cdot \exp((0.254695738528276-2.1619776738455i) \cdot t) + (554704582.861207- \\ & 503190563.333326i) \cdot \exp((0.137765445552405+1.51036483788357i) \cdot t) + (554704582.861207+503190563.333326i) \cdot \exp((0.137765445552405- \\ & 1.51036483788357i) \cdot t) + (445244018.534547- \\ & 2198307403.02712i) \cdot \exp((0.210057224061636+0.316653133379989i) \cdot t) + (445244018.534549+2198307403.02712i) \cdot \exp((0.210057224061636- \\ & 0.316653133379989i) \cdot t) + (17094702624.6146-4.88798591193213e-06i) \cdot \exp((0.154349726804743+0i) \cdot t) + (-5018614.31459212+5.22868102644411e- \\ & 08i) \cdot \exp((0.449605412517453-3.14159265358979i) \cdot t) + (179321593.77075-24036053.4947825i) \cdot \exp((0.254695738528276- \\ & 2.1619776738455i) \cdot t) + (179321593.77075+24036053.4947826i) \cdot \exp((0.254695738528276+2.1619776738455i) \cdot t) + (554704582.861207+503190563.333326i) \cdot \exp((0.137765445552405- \\ & 1.51036483788357i) \cdot t) + (554704582.861207- \\ & 503190563.333326i) \cdot \exp((0.137765445552405+1.51036483788357i) \cdot t) + (445244018.534547+2198307403.02712i) \cdot \exp((0.210057224061636- \\ & 0.316653133379989i) \cdot t) + (445244018.534549- \\ & 2198307403.02712i) \cdot \exp((0.210057224061636+0.316653133379989i) \cdot t) + (17094702624.6146+4.88798591193213e-06i) \cdot \exp((0.154349726804743+0i) \cdot t) \end{aligned}$$

(23)

$$\begin{aligned} \text{GDP POL} = & (-1.16165806796962+1.16709980472563e-15i)*\exp((1.70489020898674+0i)*t)+(- \\ & 62293787.3931081+65854833.1858467i)*\exp((0.441677984649838+2.59065140734652i)*t)+(-62293787.3931083- \\ & 65854833.1858464i)*\exp((0.441677984649838-2.59065140734652i)*t)+(- \\ & 363093823.41465+137584946.91075i)*\exp((0.349366371470773+1.83117932996958i)*t)+(-363093823.41465-137584946.910749i)*\exp((0.349366371470773- \\ & 1.83117932996958i)*t)+(1471371107.99121+235526604.40754i)*\exp((0.269188856125679+0.746031692704147i)*t)+(1471371107.9912- \\ & 235526604.407541i)*\exp((0.269188856125679-0.746031692704147i)*t)+(74489024609.3572-6.74714811771176e-06i)*\exp((0.117227405861554+0i)*t) + (- \\ & 1.16165806796962-1.16709980472563e-15i)*\exp((1.70489020898674+0i)*t)+(-62293787.3931081-65854833.1858467i)*\exp((0.441677984649838- \\ & 2.59065140734652i)*t)+(-62293787.3931083+65854833.1858464i)*\exp((0.441677984649838+2.59065140734652i)*t)+(-363093823.41465- \\ & 137584946.91075i)*\exp((0.349366371470773-1.83117932996958i)*t)+(- \\ & 363093823.41465+137584946.910749i)*\exp((0.349366371470773+1.83117932996958i)*t)+(1471371107.99121-235526604.40754i)*\exp((0.269188856125679- \\ & 0.746031692704147i)*t)+(1471371107.9912+235526604.407541i)*\exp((0.269188856125679+0.746031692704147i)*t)+(74489024609.3572+6.74714811771176e \\ & -06i)*\exp((0.117227405861554+0i)*t) \end{aligned}$$

(24)

$$\begin{aligned} \text{GDP SVK} = & (-130896.234892578-6.57618631110586e-10i)*\exp((0.776135495273349+3.14159265358979i)*t)+(-5411636.14170009- \\ & 364379.269928641i)*\exp((0.505826502116734+2.44423812437637i)*t)+(-5411636.14170009+364379.269928616i)*\exp((0.505826502116734- \\ & 2.44423812437637i)*t)+(205482883.158551- \\ & 388039669.285108i)*\exp((0.151960273219643+1.56859627533171i)*t)+(205482883.158552+388039669.28511i)*\exp((0.151960273219643- \\ & 1.56859627533171i)*t)+(-479551812.517232-58902159.2043743i)*\exp((0.251222952561547+0.450631217292752i)*t)+(- \\ & 479551812.517233+58902159.2043734i)*\exp((0.251222952561547-0.450631217292752i)*t)+(12957969349.9685+7.9429792896677e- \\ & 06i)*\exp((0.129256455097872+0i)*t) + (-130896.234892578+6.57618631110586e-10i)*\exp((0.776135495273349-3.14159265358979i)*t)+(- \\ & 5411636.14170009+364379.269928641i)*\exp((0.505826502116734-2.44423812437637i)*t)+(-5411636.14170009- \\ & 364379.269928616i)*\exp((0.505826502116734+2.44423812437637i)*t)+(205482883.158551+388039669.285108i)*\exp((0.151960273219643- \\ & 1.56859627533171i)*t)+(205482883.158552-388039669.28511i)*\exp((0.151960273219643+1.56859627533171i)*t)+(- \\ & 479551812.517232+58902159.2043743i)*\exp((0.251222952561547-0.450631217292752i)*t)+(-479551812.517233- \\ & 58902159.2043734i)*\exp((0.251222952561547+0.450631217292752i)*t)+(12957969349.9685-7.9429792896677e-06i)*\exp((0.129256455097872+0i)*t) \end{aligned}$$

(25)

$$\begin{aligned}
\text{Export CZE to HUN} = & (-72438.2861385482-1.4278327559159e-09i)*\exp((-0.0608905299667871+3.14159265358979i)*t)+(- \\
& 9474.37520411455+6554.79606515747i)*\exp((0.225125273041944+1.93421427680353i)*t)+(-9474.37520411445- \\
& 6554.79606515778i)*\exp((0.225125273041944-1.93421427680353i)*t)+(-6283.47231166407- \\
& 1873.90681660707i)*\exp((0.324491166026582+1.15001002161927i)*t)+(-6283.47231166406+1873.90681660701i)*\exp((0.324491166026582- \\
& 1.15001002161927i)*t)+(16856.1903486642- \\
& 30340.2171185963i)*\exp((0.347369315291202+0.30077411154389i)*t)+(16856.1903486637+30340.2171185966i)*\exp((0.347369315291202- \\
& 0.30077411154389i)*t)+(102389.710790439+7.77224910107804e-10i)*\exp((0.329294702183838+0i)*t) + (-72438.2861385482+1.4278327559159e-09i)*\exp((- \\
& 0.0608905299667871-3.14159265358979i)*t)+(-9474.37520411455-6554.79606515747i)*\exp((0.225125273041944-1.93421427680353i)*t)+(- \\
& 9474.37520411445+6554.79606515778i)*\exp((0.225125273041944+1.93421427680353i)*t)+(- \\
& 6283.47231166407+1873.90681660707i)*\exp((0.324491166026582-1.15001002161927i)*t)+(-6283.47231166406- \\
& 1873.90681660701i)*\exp((0.324491166026582+1.15001002161927i)*t)+(16856.1903486642+30340.2171185963i)*\exp((0.347369315291202- \\
& 0.30077411154389i)*t)+(16856.1903486637-30340.2171185966i)*\exp((0.347369315291202+0.30077411154389i)*t)+(102389.710790439-7.77224910107804e- \\
& 10i)*\exp((0.329294702183838+0i)*t)
\end{aligned}$$

(26)

$$\begin{aligned}
\text{Import CZE from HUN} = & (-1730.4824828486-3.49219405625638e- \\
& 12i)*\exp((0.353705776697915+3.14159265358979i)*t)+(661.990449896344+2377.59596302426i)*\exp((0.381119354236012+2.07225053953374i)*t)+(661.99044 \\
& 9896345-2377.59596302426i)*\exp((0.381119354236012- \\
& 2.07225053953374i)*t)+(808.144250231773+4845.39620690653i)*\exp((0.365269876023779+1.35223378370392i)*t)+(808.144250231771- \\
& 4845.39620690653i)*\exp((0.365269876023779-1.35223378370392i)*t)+(- \\
& 6742.68594205485+9504.96920877265i)*\exp((0.339153689966399+0.559807521226746i)*t)+(-6742.68594205483- \\
& 9504.96920877266i)*\exp((0.339153689966399-0.559807521226746i)*t)+(252899.089190043+8.31861215383348e-11i)*\exp((0.189546401739376+0i)*t) + (- \\
& 1730.4824828486+3.49219405625638e-12i)*\exp((0.353705776697915-3.14159265358979i)*t)+(661.990449896344- \\
& 2377.59596302426i)*\exp((0.381119354236012- \\
& 2.07225053953374i)*t)+(661.990449896345+2377.59596302426i)*\exp((0.381119354236012+2.07225053953374i)*t)+(808.144250231773- \\
& 4845.39620690653i)*\exp((0.365269876023779- \\
& 1.35223378370392i)*t)+(808.144250231771+4845.39620690653i)*\exp((0.365269876023779+1.35223378370392i)*t)+(-6742.68594205485- \\
& 9504.96920877265i)*\exp((0.339153689966399-0.559807521226746i)*t)+(- \\
& 6742.68594205483+9504.96920877266i)*\exp((0.339153689966399+0.559807521226746i)*t)+(252899.089190043-8.31861215383348e- \\
& 11i)*\exp((0.189546401739376+0i)*t)
\end{aligned}$$

(27)

$$\begin{aligned}
\text{Export CZE to POL} = & (-145.471733118141-339.50607014483i) \cdot \exp((0.654205279038097+1.61390483148527i) \cdot t) + (- \\
& 145.471733118139+339.50607014483i) \cdot \exp((0.654205279038097-1.61390483148527i) \cdot t) + (- \\
& 213.010664791745+2172.77364634802i) \cdot \exp((0.518650913735057+2.0290260146977i) \cdot t) + (-213.010664791754-2172.77364634802i) \cdot \exp((0.518650913735057- \\
& 2.0290260146977i) \cdot t) + (-9201.58642372153+1.88284151626396e- \\
& 11i) \cdot \exp((0.320947947373532+3.14159265358979i) \cdot t) + (7613.72338154175+34644.748166338i) \cdot \exp((0.283804994890966+0.631207411099522i) \cdot t) + (7613.7233 \\
& 8154172-34644.7481663379i) \cdot \exp((0.283804994890966-0.631207411099522i) \cdot t) + (685351.521351328+3.8628723372054e-11i) \cdot \exp((0.178510643810008+0i) \cdot t) \\
& + (-145.471733118141+339.50607014483i) \cdot \exp((0.654205279038097-1.61390483148527i) \cdot t) + (-145.471733118139- \\
& 339.50607014483i) \cdot \exp((0.654205279038097+1.61390483148527i) \cdot t) + (-213.010664791745-2172.77364634802i) \cdot \exp((0.518650913735057- \\
& 2.0290260146977i) \cdot t) + (-213.010664791754+2172.77364634802i) \cdot \exp((0.518650913735057+2.0290260146977i) \cdot t) + (-9201.58642372153-1.88284151626396e- \\
& 11i) \cdot \exp((0.320947947373532-3.14159265358979i) \cdot t) + (7613.72338154175-34644.748166338i) \cdot \exp((0.283804994890966- \\
& 0.631207411099522i) \cdot t) + (7613.72338154172+34644.7481663379i) \cdot \exp((0.283804994890966+0.631207411099522i) \cdot t) + (685351.521351328-3.8628723372054e- \\
& 11i) \cdot \exp((0.178510643810008+0i) \cdot t)
\end{aligned}$$

(28)

$$\begin{aligned}
\text{Import CZE from POL} = & (0.00474151639557977+2.60197687026863e-18i) \cdot \exp((1.32885444817279+3.14159265358979i) \cdot t) + (- \\
& 30285.1683375273+1.66477403614018e-11i) \cdot \exp((0.173246279204926+3.14159265358979i) \cdot t) + (- \\
& 3904.88335259351+370.605254179142i) \cdot \exp((0.399130901824034+1.85695766259514i) \cdot t) + (-3904.8833525935-370.605254179126i) \cdot \exp((0.399130901824034- \\
& 1.85695766259514i) \cdot t) + (3962.97405980414- \\
& 5876.92812467451i) \cdot \exp((0.381035902832322+0.943986902796391i) \cdot t) + (3962.97405980415+5876.9281246745i) \cdot \exp((0.381035902832322- \\
& 0.943986902796391i) \cdot t) + (189396.223953894- \\
& 23846.15141822i) \cdot \exp((0.300245850385471+0.110276600887829i) \cdot t) + (189396.223953893+23846.1514182199i) \cdot \exp((0.300245850385471- \\
& 0.110276600887829i) \cdot t) + (0.00474151639557977-2.60197687026863e-18i) \cdot \exp((1.32885444817279-3.14159265358979i) \cdot t) + (-30285.1683375273- \\
& 1.66477403614018e-11i) \cdot \exp((0.173246279204926-3.14159265358979i) \cdot t) + (-3904.88335259351-370.605254179142i) \cdot \exp((0.399130901824034- \\
& 1.85695766259514i) \cdot t) + (- \\
& 3904.8833525935+370.605254179126i) \cdot \exp((0.399130901824034+1.85695766259514i) \cdot t) + (3962.97405980414+5876.9281246745i) \cdot \exp((0.381035902832322- \\
& 0.943986902796391i) \cdot t) + (3962.97405980415- \\
& 5876.9281246745i) \cdot \exp((0.381035902832322+0.943986902796391i) \cdot t) + (189396.223953894+23846.15141822i) \cdot \exp((0.300245850385471- \\
& 0.110276600887829i) \cdot t) + (189396.223953893-23846.1514182199i) \cdot \exp((0.300245850385471+0.110276600887829i) \cdot t)
\end{aligned}$$

(29)

$$\begin{aligned}
\text{Export CZE to SVK} = & (518.670943210788+394.928022215563i) \cdot \exp((0.600999239283537+1.40525203210708i) \cdot t) + (518.670943210789- \\
& 394.928022215563i) \cdot \exp((0.600999239283537-1.40525203210708i) \cdot t) + (-10655.7279571522-3.90093386231145e- \\
& 11i) \cdot \exp((0.293151686150787+3.14159265358979i) \cdot t) + (5034.71822898844+8305.19976320315i) \cdot \exp((0.374459222814771+2.06074558864743i) \cdot t) + (5034.7182 \\
& 2898845-8305.19976320315i) \cdot \exp((0.374459222814771-2.06074558864743i) \cdot t) + (- \\
& 14624.0778717981+16099.2562396482i) \cdot \exp((0.372500580643507+0.555802627100047i) \cdot t) + (-14624.0778717981- \\
& 16099.2562396482i) \cdot \exp((0.372500580643507-0.555802627100047i) \cdot t) + (988402.85473119+4.04663373947111e-11i) \cdot \exp((0.186314387351643+0i) \cdot t) + \\
& (518.670943210788-394.928022215563i) \cdot \exp((0.600999239283537- \\
& 1.40525203210708i) \cdot t) + (518.670943210789+394.928022215563i) \cdot \exp((0.600999239283537+1.40525203210708i) \cdot t) + (-10655.7279571522+3.90093386231145e- \\
& 11i) \cdot \exp((0.293151686150787-3.14159265358979i) \cdot t) + (5034.71822898844-8305.19976320315i) \cdot \exp((0.374459222814771- \\
& 2.06074558864743i) \cdot t) + (5034.71822898845+8305.19976320315i) \cdot \exp((0.374459222814771+2.06074558864743i) \cdot t) + (-14624.0778717981- \\
& 16099.2562396482i) \cdot \exp((0.372500580643507-0.555802627100047i) \cdot t) + (- \\
& 14624.0778717981+16099.2562396482i) \cdot \exp((0.372500580643507+0.555802627100047i) \cdot t) + (988402.85473119-4.04663373947111e- \\
& 11i) \cdot \exp((0.186314387351643+0i) \cdot t)
\end{aligned}$$

(30)

$$\begin{aligned}
\text{Import CZE from SVK} = & (-88706.3599637727+1.31101522627525e- \\
& 09i) \cdot \exp((0.0215300402373503+3.14159265358979i) \cdot t) + (25301.4362144452+9133.09410024525i) \cdot \exp((0.202786850789766+2.10276644958686i) \cdot t) + (25301.43 \\
& 6214445-9133.09410024522i) \cdot \exp((0.202786850789766-2.10276644958686i) \cdot t) + (- \\
& 5408.28447836883+8775.34065409795i) \cdot \exp((0.313277847981152+1.28566955761198i) \cdot t) + (-5408.28447836882- \\
& 8775.34065409793i) \cdot \exp((0.313277847981152-1.28566955761198i) \cdot t) + (- \\
& 9815.61551451437+10978.9720744645i) \cdot \exp((0.316223796641966+0.532427599273536i) \cdot t) + (-9815.61551451437- \\
& 10978.9720744645i) \cdot \exp((0.316223796641966-0.532427599273536i) \cdot t) + (862655.938487881-1.264648015749e-10i) \cdot \exp((0.139833091898633+0i) \cdot t) + (- \\
& 88706.3599637727-1.31101522627525e-09i) \cdot \exp((0.0215300402373503-3.14159265358979i) \cdot t) + (25301.4362144452- \\
& 9133.09410024525i) \cdot \exp((0.202786850789766-2.10276644958686i) \cdot t) + (25301.436214445+9133.09410024522i) \cdot \exp((0.202786850789766 \\
& +2.10276644958686i) \cdot t) + (-5408.28447836883-8775.34065409795i) \cdot \exp((0.313277847981152-1.28566955761198i) \cdot t) + (- \\
& 5408.28447836882+8775.34065409793i) \cdot \exp((0.313277847981152+1.28566955761198i) \cdot t) + (-9815.61551451437- \\
& 10978.9720744645i) \cdot \exp((0.316223796641966-0.532427599273536i) \cdot t) + (-9815.61551451437+ \\
& 10978.9720744645i) \cdot \exp((0.316223796641966+0.532427599273536i) \cdot t) + (862655.938487881+1.264648015749e-10i) \cdot \exp((0.139833091898633+0i) \cdot t)
\end{aligned}$$

(31)

$$\begin{aligned}
\text{Export POL to HUN} = & (-0.0209522219580407-1.2940224439503e-17i)*\exp((1.27306518178328+0i)*t)+(325.462211464671- \\
& 94.101960989737i)*\exp((0.558906565297033+2.80045253713109i)*t)+(325.462211464671+94.1019609897379i)*\exp((0.558906565297033- \\
& 2.80045253713109i)*t)+(-1035.54356825945-239.846625061706i)*\exp((0.462840704966323+1.82013728921948i)*t)+(- \\
& 1035.54356825945+239.846625061704i)*\exp((0.462840704966323-1.82013728921948i)*t)+(- \\
& 9617.44186211502+28903.168152554i)*\exp((0.26542019644912+0.617805848162435i)*t)+(-9617.44186211502-28903.168152554i)*\exp((0.26542019644912- \\
& 0.617805848162435i)*t)+(308831.197413421+2.44668814263613e-11i)*\exp((0.20484571827007+0i)*t) + (-0.0209522219580407+1.2940224439503e- \\
& 17i)*\exp((1.27306518178328+0i)*t)+(325.462211464671+94.101960989737i)*\exp((0.558906565297033-2.80045253713109i)*t)+(325.462211464671- \\
& 94.1019609897379i)*\exp((0.558906565297033+2.80045253713109i)*t)+(-1035.54356825945+239.846625061706i)*\exp((0.462840704966323- \\
& 1.82013728921948i)*t)+(-1035.54356825945-239.846625061704i)*\exp((0.462840704966323+1.82013728921948i)*t)+(-9617.44186211502- \\
& 28903.168152554i)*\exp((0.26542019644912-0.617805848162435i)*t)+(-9617.44186211502+28903.168152554i)*\exp((0.26542019644912+ \\
& 0.617805848162435i)*t)+(308831.197413421-2.44668814263613e-11i)*\exp((0.20484571827007+0i)*t)
\end{aligned}$$

(32)

$$\begin{aligned}
\text{Import HUN from POL} = & (-726.783025548425-2879.97509085895i)*\exp((0.301246811473+2.89828654624183i)*t)+(- \\
& 726.783025548402+2879.97509085892i)*\exp((0.301246811473-2.89828654624183i)*t)+(3304.91610520263- \\
& 11485.51201531i)*\exp((0.225676673068989+1.68146957373204i)*t)+(3304.91610520265+11485.51201531i)*\exp((0.225676673068989- \\
& 1.68146957373204i)*t)+(14776.3815685373-4395.27470164457i)*\exp((0.247422887099709+0.857507902244421i)*t)+ \\
& (14776.3815685373+4395.2747016446i)*\exp((0.247422887099709-0.857507902244421i)*t)+(117473.577720567- \\
& 43592.1510474281i)*\exp((0.245603930410049+0.124755226279164i)*t)+(117473.577720567+43592.151047428i)*\exp((0.245603930410049- \\
& 0.124755226279164i)*t) + (-726.783025548425+2879.97509085895i)*\exp((0.301246811473-2.89828654624183i)*t)+(-726.783025548402- \\
& 2879.97509085892i)*\exp((0.301246811473+2.89828654624183i)*t)+(3304.91610520263+11485.51201531i)*\exp((0.225676673068989- \\
& 1.68146957373204i)*t)+(3304.91610520265-11485.51201531i)*\exp((0.225676673068989+1.68146957373204i)*t)+ \\
& (14776.3815685373+4395.27470164457i)*\exp((0.247422887099709-0.857507902244421i)*t)+(14776.3815685373- \\
& 4395.2747016446i)*\exp((0.247422887099709+0.857507902244421i)*t)+(117473.577720567+43592.1510474281i)*\exp((0.245603930410049- \\
& 0.124755226279164i)*t)+(117473.577720567-43592.151047428i)*\exp((0.245603930410049+0.124755226279164i)*t)
\end{aligned}$$

(33)



$$\begin{aligned}
\text{Export SVK to POL} = & (-1.61415437800296e-12-5.26327995963459e- \\
& 27i) * \exp((2.7148312764801+3.14159265358979i)*t) + (624.354371072305+389.913238197523i) * \exp((0.508324439127024+2.7266135161003i)*t) + (624.35437107 \\
& 2309-389.913238197521i) * \exp((0.508324439127024-2.7266135161003i)*t) + (-2726.78206991747- \\
& 3187.74837370166i) * \exp((0.345763966805907+1.72033281941707i)*t) + (-2726.78206991749+3187.74837370167i) * \exp((0.345763966805907- \\
& 1.72033281941707i)*t) + (-7625.07272570938+18820.0472782693i) * \exp((0.275079083442411+0.568796209152067i)*t) + (-7625.07272570938- \\
& 18820.0472782694i) * \exp((0.275079083442411-0.568796209152067i)*t) + (195215.852213385+4.64444389427122e-11i) * \exp((0.224114476252042+0i)*t) + (- \\
& 1.61415437800296e-12+5.26327995963459e-27i) * \exp((2.7148312764801-3.14159265358979i)*t) + (624.354371072305- \\
& 389.913238197523i) * \exp((0.508324439127024-2.7266135161003i)*t) + (624.354371072309+389.913238197521i) * \exp((0.508324439127024+ \\
& 2.7266135161003i)*t) + (-2726.78206991747+3187.74837370166i) * \exp((0.345763966805907-1.72033281941707i)*t) + (-2726.78206991749- \\
& 3187.74837370167i) * \exp((0.345763966805907+1.72033281941707i)*t) + (-7625.07272570938-18820.0472782693i) * \exp((0.275079083442411- \\
& 0.568796209152067i)*t) + (-7625.07272570938+18820.0472782694i) * \exp((0.275079083442411+0.568796209152067i)*t) + (195215.852213385- \\
& 4.64444389427122e-11i) * \exp((0.224114476252042+0i)*t)
\end{aligned}$$

(34)

$$\begin{aligned}
\text{Import SVK from POL} = & (-36.4068135833459-7.6416681373971e-14i) * \exp((0.714120126290358+3.14159265358979i)*t) + (-116.371345598514- \\
& 208.754536236428i) * \exp((0.583033674295437+2.37631694370143i)*t) + (-116.371345598514+208.754536236427i) * \exp((0.583033674295437- \\
& 2.37631694370143i)*t) + (-2366.58207365215-2884.6990002456i) * \exp((0.35795726136926+1.68836249983428i)*t) + (- \\
& 2366.58207365215+2884.6990002456i) * \exp((0.35795726136926-1.68836249983428i)*t) + (330953.560986218+2.43884882287382e- \\
& 10i) * \exp((0.1591303449507+0i)*t) + (-484.312476470026+33285.8971582685i) * \exp((0.191719258388785+0.573906948673369i)*t) + (-484.312476469895- \\
& 33285.8971582686i) * \exp((0.191719258388785-0.573906948673369i)*t) + (-36.4068135833459+7.6416681373971e-14i) * \exp((0.714120126290358- \\
& 3.14159265358979i)*t) + (-116.371345598514+208.754536236428i) * \exp((0.583033674295437-2.37631694370143i)*t) + (-116.371345598514- \\
& 208.754536236427i) * \exp((0.583033674295437+2.37631694370143i)*t) + (-2366.58207365215+2884.6990002456i) * \exp((0.35795726136926- \\
& 1.68836249983428i)*t) + (-2366.58207365215-2884.6990002456i) * \exp((0.35795726136926+1.68836249983428i)*t) + (330953.560986218-2.43884882287382e- \\
& 10i) * \exp((0.1591303449507+0i)*t) + (-484.312476470026-33285.8971582685i) * \exp((0.191719258388785-0.573906948673369i)*t) + (- \\
& 484.312476469895+33285.8971582686i) * \exp((0.191719258388785+0.573906948673369i)*t)
\end{aligned}$$

(35)

$$\begin{aligned}
\text{Export SVK to HUN} = & (-1165.05077398612-4467.79085201982i)*\exp((0.204815710098827+2.35778070127764i)*t)+(- \\
& 1165.05077398608+4467.79085201998i)*\exp((0.204815710098827-2.35778070127764i)*t)+(-2296.75914502524- \\
& 11121.8385446978i)*\exp((0.229837769193073+1.69673481252537i)*t)+(-2296.75914502531+11121.8385446979i)*\exp((0.229837769193073- \\
& 1.69673481252537i)*t)+(975.798103272513-22988.0909797918i)*\exp((0.149207572256548+0.987692799335353i)*t)+ \\
& (975.798103272151+22988.0909797917i)*\exp((0.149207572256548-0.987692799335353i)*t)+(67294.9629197595- \\
& 92894.4614998561i)*\exp((0.245156834234631+0.148824077445825i)*t)+(67294.9629197593+92894.4614998563i)*\exp((0.245156834234631- \\
& 0.148824077445825i)*t) + (-1165.05077398612+4467.79085201982i)*\exp((0.204815710098827-2.35778070127764i)*t)+(-1165.05077398608- \\
& 4467.79085201998i)*\exp((0.204815710098827+2.35778070127764i)*t)+(-2296.75914502524+11121.8385446978i)*\exp((0.229837769193073- \\
& 1.69673481252537i)*t)+(-2296.75914502531-11121.8385446979i)*\exp((0.229837769193073+1.69673481252537i)*t)+ \\
& (975.798103272513+22988.0909797918i)*\exp((0.149207572256548-0.987692799335353i)*t)+(975.798103272151- \\
& 22988.0909797917i)*\exp((0.149207572256548+0.987692799335353i)*t)+(67294.9629197595+92894.4614998561i)*\exp((0.245156834234631- \\
& 0.148824077445825i)*t)+(67294.9629197593-92894.4614998563i)*\exp((0.245156834234631+0.148824077445825i)*t)
\end{aligned}$$

(36)

$$\begin{aligned}
\text{Import HUN from SVK} = & (-342.047429086447 +1512.46375931589i)*\exp((0.332656689559188+2.61066670454796i)*t)+(-342.047429086451- \\
& 1512.46375931589i)*\exp((0.332656689559188-2.61066670454796i)*t)+(1783.57401150215- \\
& 10477.1826677174i)*\exp((0.243013336186859+1.68415428077181i)*t)+(1783.57401150219+10477.1826677174i)*\exp((0.243013336186859- \\
& 1.68415428077181i)*t)+(686.893119629307-11602.1564500662i)*\exp((0.284798699923465+0.946862718441756i)*t)+ \\
& (686.89311962932+11602.1564500662i)*\exp((0.284798699923465-0.946862718441756i)*t)+(14605.3962400681- \\
& 98252.9616317128i)*\exp((0.226083016416692+0.193725738311885i)*t)+(14605.3962400681+98252.9616317128i)*\exp((0.226083016416692- \\
& 0.193725738311885i)*t) + (-342.047429086447-1512.46375931589i)*\exp((0.332656689559188-2.61066670454796i)*t)+(- \\
& 342.047429086451+1512.46375931589i)*\exp((0.332656689559188+2.61066670454796i)*t)+(1783.57401150215+10477.1826677174i)*\exp((0.243013336186859 \\
& -1.68415428077181i)*t)+(1783.57401150219-10477.1826677174i)*\exp((0.243013336186859+1.68415428077181i)*t)+ \\
& (686.893119629307+11602.1564500662i)*\exp((0.284798699923465-0.946862718441756i)*t)+(686.89311962932- \\
& 11602.1564500662i)*\exp((0.284798699923465+0.946862718441756i)*t)+(14605.3962400681+98252.9616317128i)*\exp((0.226083016416692- \\
& 0.193725738311885i)*t)+(14605.3962400681-98252.9616317128i)*\exp((0.226083016416692+0.193725738311885i)*t)
\end{aligned}$$

(37)

Table 3. Comparison of the values of macroeconomic parameters calculated using formulas (18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37) with their tabular values taken by them [10]

Year	Data source	Population of the Czech Republic , peoples	Population of Hungary , peoples	Population of Poland , peoples	Population of Slovakia , peoples	Czech GDP , USD	Hungary's GDP , USD	Poland's GDP , USD
2000	Calculated by the author	10255063.0000008	10210971.0000005	38258629.0000528	5388720.00000087	61828166496.0002	47218405891.9998	1,72E+11
	Данные таблиц 1,2 [10]	10255063	10210971	38258629	5388720	61828166496	47218405892	1.7221946113e+011
2001	Calculated by the author	10216605.0000008	10187576.0000007	38248076.0000529	5378867.00000086	67808032980.0002	53749989091.9997	1,91E+11
	Data from tables 1,2 [10]	10216605	10187576	38248076	5378867	67808032980	53749989092	1.9090549354e+011
2002	Calculated by the author	10196916.0000008	10158608.0000006	38230364.0000529	5376912.00000086	82196001051.0002	67608919143.9997	1,99E+11
	Data from tables 1,2 [10]	10196916	10158608	38230364	5376912	82196001051	67608919144	1.9907205882e+011
2003	Calculated by the author	10193998.0000008	10129552.0000006	38204570.0000529	5373374.00000087	1E+11	85302003907.9998	2,18E+11
	Data from tables 1,2 [10]	10193998	10129552	38204570	5373374	1.0009046758e+011	85302003908	2.1782726081e+011
2004	Calculated by the author	10197101.0000008	10107146.0000005	38182222.0000529	5372280.00000086	1,2E+11	1,04E+11	2,55E+11
	Data from tables 1,2 [10]	10197101	10107146	38182222	5372280	1.1981443435e+011	1.0414104263e+011	2.5511018154e+011
2005	Calculated by the author	10211216.0000008	10087065.0000005	38165445.000053	5372807.00000087	1,37E+11	1,13E+11	3,06E+11
	Данные таблиц 1,2[10]	10211216	10087065	38165445	5372807	1.3714347133e+011	1.1323671164e+011	3.0614433627e+011
2006	Calculated by the author	10238905.0000008	10071370.0000005	38141267.000053	5373054.00000087	1,56E+11	1,16E+11	344622003089.999
	Данные таблиц 1,2[10]	10238905	10071370	38141267	5373054	1.5626409566e+011	1.157512667e+011	3.4462200309e+011
2007	Calculated by the author	10298828.0000008	10055780.0000005	38120560.000053	5374622.00000087	1,9E+11	140227560619.999	4,29E+11
	Data from tables 1,2 [10]	10298828	10055780	38120560	5374622	1.9018380088e+011	1.4022756062e+011	4.2902850537e+011
2008	Calculated by the author	10384603.0000008	10038188.0000004	38125759.000053	5379233.00000088	236816485759.999	158374419639.999	533609081849.997
	Data from tables 1,2 [10]	10384603	10038188	38125759	5379233	2.3681648576e+011	1.5837441964e+011	5.3360908185e+011
2009	Calculated by the author	10443936.0000008	10022650.0000005	38151603.0000531	5386406.00000087	2,07E+11	1,31E+11	439737508409.998
	Data from tables 1,2 [10]	10443936	10022650	38151603	5386406	2.0743429681e+011	1.3111422905e+011	4.3973750841e+011
2010	Calculated by the author	10474410.0000008	10000023.0000004	38042794.0000531	5391428.00000088	209069940960.001	1,32E+11	479834179019.998
	Data from tables 1,2 [10]	10474410	10000023	38042794	5391428	2.0906994096e+011	1.3223113416e+011	4.7983417902e+011
2011	Calculated by the author	10496088.0000008	9971727.00000051	38063255.0000531	5398384.00000087	229562733399.999	1,42E+11	528301269070.002
	Data from tables 1,2 [10]	10496088	9971727	38063255	5398384	2.295627334e+011	1.4199996021e+011	5.2830126907e+011
2012	Calculated by the author	10510785.0000008	9920362.0000005	38063164.0000531	5407579.00000086	208857719320.001	128857370479.998	4,99E+11
	Data from tables 1,2 [10]	10510785	9920362	38063164	5407579	2.0885771932e+011	1.2885737048e+011	4.9852356825e+011
2013	Calculated by the author	10514272.0000008	9893082.00000058	38040196.0000531	5413393.00000087	211685616590.001	135732595720.001	521016262730.018
	Data from tables 1,2 [10]	10514272	9893082	38040196	5413393	2.1168561659e+011	1.3573259572e+011	5.2101626273e+011
2014	Calculated by the author	10525347.0000008	9866468.00000053	38011735.0000532	5418649.00000086	209358834160.001	1,41E+11	542477096210.005
	Data from tables 1,2 [10]	10525347	9866468	38011735	5418649	2.0935883416e+011	1.4107898482e+011	5.4247709621e+011
2015	Calculated by the author	10546059.0000008	9843028.00000059	37986412.0000531	5423801.00000085	188033050460.003	125210324609.997	477811911389.995
	Data from tables 1,2 [10]	10546059	9843028	37986412	5423801	1.8803305046e+011	1.2521032461e+011	4.7781191139e+011

Table 3 (continued). Comparison of the values of macroeconomic parameters calculated using formulas (18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37) with their tabular values taken by them [10]

Year	Data source	Slovakia's GDP , USD	Export from the Czech Republic to Hungary ,USD	Their export from Hungary to the Czech Republic , USD	Export from Czech Republic to Poland ,USD	Export from Poland to the Czech Republic , USD	Export from Czech Republic to Slovakia , USD	Export from Slovakia to the Czech Republic , USD
2000	Calculated by the author	2,92E+10	544432.249999991	515541.589999997	1578192.859999999	1148803.779999999	2230168.790000002	1932692.239999998
	Данные таблиц 1,2[10]	29242558797	544432,25	515541,59	1578192,86	1148803,78	2230168,79	1932692,24
2001	Calculated by the author	30778781607.0001	630815.779999993	632347.199999996	1729869.799999999	1368242.46	2681287.780000002	1961543.18
	Данные таблиц 1,2[10]	30778781607	630815,78	632347,2	1729869,8	1368242,46	2681287,78	1961543,18
2002	Calculated by the author	35297794386.0001	1074292.209999998	857041.509999995	2053246.169999999	1880904.659999999	3404070.450000002	2988055.329999998
	Данные таблиц 1,2[10]	35297794386	1074292,21	857041,51	2053246,17	1880904,66	3404070,45	2988055,33
2003	Calculated by the author	46919965224.0001	1110620.689999998	1042665.999999999	2336382.589999999	2129850.119999998	3884015.210000002	2656816.58
	Данные таблиц 1,2[10]	46919965224	1110620,69	1042666	2336382,59	2129850,12	3884015,21	2656816,58
2004	Calculated by the author	5,74E+10	1886741.839999997	1397440.229999999	3443822.449999999	3218976.51	5407615.510000003	3573031.919999998
	Данные таблиц 1,2[10]	57437444469	1886741,84	1397440,23	3443822,45	3218976,51	5407615,51	3573031,92
2005	Calculated by the author	6,28E+10	2085683.709999997	1675700.219999999	4266184.48	3789015.080000001	6733382.450000003	4155098.150000001
	Данные таблиц 1,2[10]	62808723477	2085683,71	1675700,22	4266184,48	3789015,08	6733382,45	4155098,15
2006	Calculated by the author	70767338922.0001	2855509.999999995	2267417.759999999	5390574.999999997	5270903.000000001	8023954.000000002	5009875.109999998
	Данные таблиц 1,2[10]	70767338922	2855510	2267417,76	5390575	5270903	8023954	5009875,11
2007	Calculated by the author	86563986799.0004	3807697.379999994	3358696.189999999	7146769.119999999	6684487.11	10508420.310000001	6220489.199999999
	Данные таблиц 1,2[10]	86563986799	3807697,38	3358696,19	7146769,12	6684487,11	10508420,31	6220489,2
2008	Calculated by the author	1,01E+11	4150478.259999993	3866684.66	9468072.679999995	8290826.139999998	13437522.100000001	7894163.059999996
	Данные таблиц 1,2[10]	1.0087990298e+011	4150478,26	3866684,66	9468072,68	8290826,14	13437522,1	7894163,06
2009	Calculated by the author	89399303222.0001	2886197.619999995	2356825.399999999	6577658.040000003	6736388.380000003	10185712.03	5708548.189999993
	Данные таблиц 1,2[10]	89399303222	2886197,62	2356825,4	6577658,04	6736388,38	10185712,03	5708548,19
2010	Calculated by the author	90801178161.9996	3050705.049999992	2733596.47	8129414.100000013	8041080.159999994	11595995.930000001	6505285.709999997
	Данные таблиц 1,2[10]	90801178162	3050705,05	2733596,47	8129414,1	8041080,16	11595995,93	6505285,71
2011	Calculated by the author	99492917848.9985	3658346.929999998	3341921.540000008	10267814.289999999	10001664.37	14565372.540000002	8648623.639999998
	Данные таблиц 1,2[10]	99492917849	3658346,93	3341921,54	10267814,29	10001664,37	14565372,54	8648623,64
2012	Calculated by the author	94253181330.0006	3600918.590000004	3308285.009999998	9520874.059999997	9966392.810000013	14177411.26	8514252.740000005
	Данные таблиц 1,2[10]	94253181330	3600918,59	3308285,01	9520874,06	9966392,81	14177411,26	8514252,74
2013	Calculated by the author	98569320342.9993	4216270.229999996	3450979.880000004	9667846.120000087	10756290.070000001	14304064.330000005	8176816.319999992
	Данные таблиц 1,2[10]	98569320343	4216270,23	3450979,88	9667846,12	10756290,07	14304064,33	8176816,32
2014	Calculated by the author	101089178419.998	4871279.130000009	3576458.420000016	10415027.330000009	11865462.899999995	14640788.750000001	8121678.790000009
	Данные таблиц 1,2[10]	1.0108917842e+011	4871279,13	3576458,42	10415027,33	11865462,9	14640788,75	8121678,79
2015	Calculated by the author	88636928904.9958	4680773.069999972	3334565.659999996	9228940.900000242	11159827.349999995	14145818.720000009	7227569.769999997
	Данные таблиц 1,2[10]	88636928905	4680773,07	3334565,66	9228940,9	11159827,35	14145818,72	7227569,77

Table 3 (continued). Comparison of the values of macroeconomic parameters calculated using formulas (18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37) with their tabular values taken by them [10]

Year	Data source	Export from Poland to Hungary , USD	Export from Hungary to Poland , USD	Export from Poland to Slovakia , USD	Export from Slovakia to Poland , USD	Export from Slovakia to Hungary , USD	Export from Hungary to Slovakia , USD
2000	Calculated by the author	631037.999999992	753292.000000006	416560.999999996	706313.000000019	578695.399999997	268374.340000004
	Данные таблиц 1,2[10]	631038	753292	416561	706313	578695,4	268374,34
2001	Calculated by the author	733642.999999992	778506.000000006	491744.999999995	740927.000000022	679574.489999999	377011.690000004
	Данные таблиц 1,2[10]	733643	778506	491745	740927	679574,49	377011,69
2002	Calculated by the author	903529.999999989	909581.000000007	547723.999999995	794638.000000026	789129.540000001	454073.540000003
	Данные таблиц 1,2[10]	903530	909581	547724	794638	789129,54	454073,54
2003	Calculated by the author	1270884.999999999	1199728.000000001	846739.999999996	1028483.000000003	1067965.46	775919.340000001
	Данные таблиц 1,2[10]	1270885	1199728	846740	1028483	1067965,46	775919,34
2004	Calculated by the author	1893845.299999998	1663510.840000001	1317768.57	1453390.600000003	1431352.629999999	998002.79
	Данные таблиц 1,2[10]	1893845,3	1663510,84	1317768,57	1453390,6	1431352,63	998002,79
2005	Calculated by the author	2538221.539999998	1838006.810000001	1709089.149999999	1872217.940000004	1891777.750000001	1228832.699999999
	Данные таблиц 1,2[10]	2538221,54	1838006,81	1709089,15	1872217,94	1891777,75	1228832,7
2006	Calculated by the author	3330689.299999997	2699872.510000001	2292906.019999999	2219059.060000004	2486490.580000001	1952593.35
	Данные таблиц 1,2[10]	3330689,3	2699872,51	2292906,02	2219059,06	2486490,58	1952593,35
2007	Calculated by the author	4033807.689999997	3449829.900000003	3026313.410000001	2986895.530000003	3648001.250000002	3040803.339999999
	Данные таблиц 1,2[10]	4033807,69	3449829,9	3026313,41	2986895,53	3648001,25	3040803,34
2008	Calculated by the author	4791354.199999998	3747065.400000002	4201267.410000002	3996143.050000003	4327429.780000002	3599398.54
	Данные таблиц 1,2[10]	4791354,2	3747065,4	4201267,41	3996143,05	4327429,78	3599398,54
2009	Calculated by the author	3698996.109999999	2804716.650000005	3131916.650000001	3054175.860000003	3828648.490000002	2609520.960000001
	Данные таблиц 1,2[10]	3698996,11	2804716,65	3131916,65	3054175,86	3828648,49	2609520,96
2010	Calculated by the author	4436609.040000001	3056781.909999997	4073253.739999998	3599348.320000005	4636805.830000001	2758648.790000001
	Данные таблиц 1,2[10]	4436609,04	3056781,91	4073253,74	3599348,32	4636805,83	2758648,79
2011	Calculated by the author	4839700.540000003	3693669.620000004	4549098.120000007	4314891.380000007	6189777.699999997	3164565.520000001
	Данные таблиц 1,2[10]	4839700,54	3693669,62	4549098,12	4314891,38	6189777,7	3164565,52
2012	Calculated by the author	4270586.779999996	3156863.039999997	4527986.690000013	3963624.75	6185610.61	2814832.839999994
	Данные таблиц 1,2[10]	4270586,78	3156863,04	4527986,69	3963624,75	6185610,61	2814832,84
2013	Calculated by the author	5191658.759999997	3392843.990000006	5306159.429999984	4061910.760000001	5832187.449999995	3592280.840000003
	Данные таблиц 1,2[10]	5191658,76	3392843,99	5306159,43	4061910,76	5832187,45	3592280,84
2014	Calculated by the author	5652912.849999966	3378110.33	5351192.900000001	3967297.56	5655846.79	3917228.769999992
	Данные таблиц 1,2[10]	5652912,85	3378110,33	5351192,9	3967297,56	5655846,79	3917228,77
2015	Calculated by the author	5163191.350000092	3120386.390000001	4893243.190000018	3389971.240000018	4581086.299999987	3623916.02
	Данные таблиц 1,2[10]	5163191,35	3120386,39	4893243,19	3389971,24	4581086,3	3623916,02

Comparison of the initial data with calculated data based on formulas (18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37) indicates that these formulas give a very good approximation

Based on the formulas ( 18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37). the author calculated their time derivatives

$$\begin{aligned}
 \text{Rate of change Population, total CZE} = & (-7.52896139815036- \\
 & 290.13735845884i) * \exp((0.08152321349876+3.14159265358979i)*t) + (15064.6857983097+6.21485530 \\
 & 524854e-13i) * \exp((0.00298584338518324+0i)*t) + (9579.14961669138+13454.3669111637i) * \exp((- \\
 & 0.0653285319006574+0.62696985909925i)*t) + (9579.14961669137-13454.3669111637i) * \exp((- \\
 & 0.0653285319006574-0.62696985909925i)*t) + (3455.98144509+5278.74804449924i) * \exp((- \\
 & 0.150064406494982+2.04454395103633i)*t) + (3455.98144509001-5278.74804449921i) * \exp((- \\
 & 0.150064406494982-2.04454395103633i)*t) + (12935.04639059+8717.31125553432i) * \exp((- \\
 & 0.186736156148224+1.42202614319956i)*t) + (12935.04639059-8717.31125553429i) * \exp((- \\
 & 0.186736156148224-1.42202614319956i)*t) + (- \\
 & 7.52896139815036+290.13735845884i) * \exp((0.08152321349876- \\
 & 3.14159265358979i)*t) + (15064.6857983097-6.21485530524854e- \\
 & 13i) * \exp((0.00298584338518324+0i)*t) + (9579.14961669137-13454.3669111637i) * \exp((- \\
 & 0.0653285319006574-0.62696985909925i)*t) + (9579.14961669136+13454.3669111637i) * \exp((- \\
 & 0.0653285319006574+0.62696985909925i)*t) + (3455.98144509-5278.74804449924i) * \exp((- \\
 & 0.150064406494982-2.04454395103633i)*t) + (3455.98144509001+5278.74804449921i) * \exp((- \\
 & 0.150064406494982+2.04454395103633i)*t) + (12935.04639059-8717.31125553432i) * \exp((- \\
 & 0.186736156148224-1.42202614319956i)*t) + (12935.04639059+8717.31125553429i) * \exp((- \\
 & 0.186736156148224+1.42202614319956i)*t)
 \end{aligned}$$

(38)

$$\begin{aligned}
 \text{Rate of change Population, total HUN} = & (-6.02827520935789- \\
 & 5.47131391237664i) * \exp((0.469061032058993+1.4707099877473i)*t) + (- \\
 & 6.02827520936417+5.47131391237432i) * \exp((0.469061032058993- \\
 & 1.4707099877473i)*t) + (9.0145200831484+86.9073099806685i) * \exp((0.325863843624231+3.14159265 \\
 & 358979i)*t) + (92.0521253279779-2330.74929858806i) * \exp((- \\
 & 0.124076099027199+3.14159265358979i)*t) + (-1529.12828430837+ \\
 & 436.647802916925i) * \exp((0.0665065869764588+0.463206715061013i)*t) + (-1529.12828430434- \\
 & 436.647802913501i) * \exp((0.0665065869764588-0.463206715061013i)*t) + (-12905.5599041512- \\
 & 1.81996047748661e-09i) * \exp((-0.00251800930252543+0i)*t) + (- \\
 & 316548.660876217+330601.961954178i) * \exp((-3.00804914049925+3.14159265358979i)*t) + (- \\
 & 6.02827520935789+5.47131391237664i) * \exp((0.469061032058993-1.4707099877473i)*t) + (- \\
 & 6.02827520936417-5.47131391237432i) * \exp((0.469061032058993+ \\
 & 1.4707099877473i)*t) + (9.0145200831484-86.9073099806685i) * \exp((0.325863843624231- \\
 & 3.14159265358979i)*t) + (92.0521253279779+2330.74929858806i) * \exp((-0.124076099027199- \\
 & 3.14159265358979i)*t) + (-1529.12828430837-436.647802916925i) * \exp((0.0665065869764588- \\
 & 0.463206715061013i)*t) + (-1529.12828430434+ \\
 & 436.647802913501i) * \exp((0.0665065869764588+0.463206715061013i)*t) + (- \\
 & 12905.5599041512+1.81996047748661e-09i) * \exp((-0.00251800930252543+0i)*t) + (- \\
 & 316548.660876217-330601.961954178i) * \exp((-3.00804914049925-3.14159265358979i)*t)
 \end{aligned}$$

(39)

**Rate of change Population,total POL =**

$$\begin{aligned} & (0.538891184677586+2.03380622161761i)*\exp((0.832417842404027+3.14159265358979i)*t)+(- \\ & 1.10258942154435+1.66359015649161i)*\exp((0.799243000547571+2.43905444815465i)*t)+(- \\ & 1.10258942154455-1.66359015649132i)*\exp((0.799243000547571-2.43905444815465i)*t)+(- \\ & 212.060233744459-215.541225391531i)*\exp((0.364356152275902+1.67167239439043i)*t)+(- \\ & 212.060233744387+215.541225391511i)*\exp((0.364356152275902-1.67167239439043i)*t)+(- \\ & 8756.62636463295+1.35279571280422e-11i)*\exp((- \\ & 0.000457572041700836+0i)*t)+(1239.30406790105- \\ & 842.731788605289i)*\exp((0.0609911927568632+0.826650787278651i)*t)+(1239.30406789931+842.73 \\ & 1788606104i)*\exp((0.0609911927568632-0.826650787278651i)*t) + (0.538891184677586- \\ & 2.03380622161761i)*\exp((0.832417842404027-3.14159265358979i)*t)+(-1.10258942154435- \\ & 1.66359015649161i)*\exp((0.799243000547571-2.43905444815465i)*t)+(- \\ & 1.10258942154455+1.66359015649132i)*\exp((0.799243000547571+2.43905444815465i)*t)+(- \\ & 212.060233744459+215.541225391531i)*\exp((0.364356152275902-1.67167239439043i)*t)+(- \\ & 212.060233744387-215.541225391511i)*\exp((0.364356152275902+1.67167239439043i)*t)+(- \\ & 8756.62636463295-1.35279571280422e-11i)*\exp((- \\ & 0.000457572041700836+0i)*t)+(1239.30406790105+842.731788605289i)*\exp((0.0609911927568632- \\ & 0.826650787278651i)*t)+(1239.30406789931- \\ & 842.731788606105i)*\exp((0.0609911927568632+0.826650787278651i)*t) \end{aligned}$$

(40)

**Rate of change Population,total SVK =**

$$\begin{aligned} & (91.9468443615014+78.3409525660128i)*\exp((0.0563236427300666+2.53606671351536i)*t)+(91.946 \\ & 8443627979-78.3409525667431i)*\exp((0.0563236427300666-2.53606671351536i)*t)+(- \\ & 371.464701696494+62.2257385216899i)*\exp((0.0121068106957805+1.76871681093266i)*t)+(- \\ & 371.464701692052-62.2257385228775i)*\exp((0.0121068106957805- \\ & 1.76871681093266i)*t)+(2057.30277212932-5.75615652042601e- \\ & 10i)*\exp((0.000768781656664689+0i)*t)+(500.285169739434+1801.74977319404i)*\exp((- \\ & 0.0694405995158119+0.403343898039661i)*t)+(500.285169736149-1801.7497731956i)*\exp((- \\ & 0.0694405995158119-0.403343898039661i)*t)+(-57202.3460411861+2.51628495619829e-08i)*\exp((- \\ & 1.52444283645367+0i)*t) + (91.9468443615014-78.3409525660128i)*\exp((0.0563236427300666- \\ & 2.53606671351536i)*t)+(91.9468443627979+78.3409525667431i)*\exp((0.0563236427300666+2.53606 \\ & 671351536i)*t)+(-371.464701696494-62.2257385216899i)*\exp((0.0121068106957805- \\ & 1.76871681093266i)*t)+(- \\ & 371.464701692052+62.2257385228775i)*\exp((0.0121068106957805+1.76871681093266i)*t)+(2057.30 \\ & 277212932+5.75615652042602e-10i)*\exp((0.000768781656664689+0i)*t)+(500.285169739434- \\ & 1801.74977319404i)*\exp((-0.0694405995158119- \\ & 0.403343898039661i)*t)+(500.285169736149+1801.7497731956i)*\exp((- \\ & 0.0694405995158119+0.403343898039661i)*t)+(-57202.3460411861-2.51628495619829e-08i)*\exp((- \\ & 1.52444283645367+0i)*t) \end{aligned}$$

(41)

$$\begin{aligned}
\text{Rate of change GDP CZE} = & (-24124332.8269895- \\
& 235840855.235132i) * \exp((0.321355800319115+3.14159265358979i) * t) + (152190060.409733+6506037 \\
& 9.6318465i) * \exp((0.378658000153029+2.23830611136595i) * t) + (152190060.409733- \\
& 65060379.6318461i) * \exp((0.378658000153029- \\
& 2.23830611136595i) * t) + (234347519.081051+414116381.701267i) * \exp((0.270582133503279+1.469641 \\
& 8306386i) * t) + (234347519.081054-414116381.701268i) * \exp((0.270582133503279- \\
& 1.4696418306386i) * t) + (-107165991.086674- \\
& 165475395.085842i) * \exp((0.365201474475659+0.462358316156179i) * t) + (- \\
& 107165991.086674+165475395.085842i) * \exp((0.365201474475659- \\
& 0.462358316156179i) * t) + (3870459144.78443-1.04280970610459e- \\
& 06i) * \exp((0.143096124979426+0i) * t) + (- \\
& 24124332.8269895+235840855.235132i) * \exp((0.321355800319115- \\
& 3.14159265358979i) * t) + (152190060.409733-65060379.6318465i) * \exp((0.378658000153029- \\
& 2.23830611136595i) * t) + (152190060.409733+65060379.631846i) * \exp((0.378658000153029+2.2383061 \\
& 1136595i) * t) + (234347519.081051-414116381.701267i) * \exp((0.270582133503279- \\
& 1.4696418306386i) * t) + (234347519.081054+414116381.701268i) * \exp((0.270582133503279+1.4696418 \\
& 306386i) * t) + (-107165991.086674+165475395.085842i) * \exp((0.365201474475659- \\
& 0.462358316156179i) * t) + (-107165991.086674- \\
& 165475395.085842i) * \exp((0.365201474475659+0.462358316156179i) * t) + (3870459144.78443+1.04280 \\
& 970610459e-06i) * \exp((0.143096124979426+0i) * t)
\end{aligned}$$

(42)

$$\begin{aligned}
\text{Rate of change GDP HUN} = & (-2256396.15917802- \\
& 15766441.8619232i) * \exp((0.449605412517453+3.14159265358979i) * t) + (- \\
& 6292965.26356721+393811162.566913i) * \exp((0.254695738528276+2.1619776738455i) * t) + (- \\
& 6292965.26356721-393811162.566915i) * \exp((0.254695738528276- \\
& 2.1619776738455i) * t) + (836420457.621313+768484025.211056i) * \exp((0.137765445552405+1.5103648 \\
& 3788357i) * t) + (836420457.621313-768484025.211057i) * \exp((0.137765445552405- \\
& 1.51036483788357i) * t) + (789627649.864378- \\
& 320782437.126358i) * \exp((0.210057224061636+0.316653133379989i) * t) + (789627649.86438+3207824 \\
& 37.126359i) * \exp((0.210057224061636-0.316653133379989i) * t) + (2638562679.91758- \\
& 7.54459290132156e-07i) * \exp((0.154349726804743+0i) * t) + (- \\
& 2256396.15917802+15766441.8619232i) * \exp((0.449605412517453-3.14159265358979i) * t) + (- \\
& 6292965.26356723-393811162.566913i) * \exp((0.254695738528276-2.1619776738455i) * t) + (- \\
& 6292965.26356724+393811162.566915i) * \exp((0.254695738528276+2.1619776738455i) * t) + (83642045 \\
& 7.621313-768484025.211056i) * \exp((0.137765445552405- \\
& 1.51036483788357i) * t) + (836420457.621314+768484025.211057i) * \exp((0.137765445552405+1.510364 \\
& 83788357i) * t) + (789627649.864378+320782437.126358i) * \exp((0.210057224061636- \\
& 0.316653133379989i) * t) + (789627649.86438- \\
& 320782437.126359i) * \exp((0.210057224061636+0.316653133379989i) * t) + (2638562679.91758+7.54459 \\
& 290132156e-07i) * \exp((0.154349726804743+0i) * t)
\end{aligned}$$

(43)



$$\begin{aligned}
\text{Rate of change GDP POL} = & (-1.98049946627186+1.98977706073546e- \\
& 15i)*\exp((1.70489020898674+0i)*t)+(-198120710.745478- \\
& 132294857.977925i)*\exp((0.441677984649838+2.59065140734652i)*t)+(- \\
& 198120710.745477+132294857.977925i)*\exp((0.441677984649838-2.59065140734652i)*t)+(- \\
& 378795482.487754-616822350.605326i)*\exp((0.349366371470773+1.83117932996958i)*t)+(- \\
& 378795482.487752+616822350.605326i)*\exp((0.349366371470773- \\
& 1.83117932996958i)*t)+(220366394.13351+1161090615.51829i)*\exp((0.269188856125679+0.7460316 \\
& 92704147i)*t)+(220366394.133508-1161090615.51829i)*\exp((0.269188856125679- \\
& 0.746031692704147i)*t)+(8732155120.11238-7.90950670803009e- \\
& 07i)*\exp((0.117227405861554+0i)*t) + (-1.98049946627186-1.98977702998705e- \\
& 15i)*\exp((1.70489020898674+0i)*t)+(- \\
& 198120710.745478+132294857.977925i)*\exp((0.441677984649838-2.59065140734652i)*t)+(- \\
& 198120710.745477-132294857.977925i)*\exp((0.441677984649838+2.59065140734652i)*t)+(- \\
& 378795482.487754+616822350.605326i)*\exp((0.349366371470773-1.83117932996958i)*t)+(- \\
& 378795482.487752- \\
& 616822350.605326i)*\exp((0.349366371470773+1.83117932996958i)*t)+(220366394.13351- \\
& 1161090615.51829i)*\exp((0.269188856125679- \\
& 0.746031692704147i)*t)+(220366394.133508+1161090615.51829i)*\exp((0.269188856125679+0.74603 \\
& 1692704147i)*t)+(8732155120.11238+7.90950670803015e-07i)*\exp((0.117227405861554+0i)*t)
\end{aligned}$$

(44)

$$\begin{aligned}
\text{Rate of change GDP SVK} = & (-101593.214097765- \\
& 411222.649921086i)*\exp((0.776135495273349+3.14159265358979i)*t)+(-1846719.27699264- \\
& 13411640.0643483i)*\exp((0.505826502116734+2.44423812437637i)*t)+(- \\
& 1846719.2769927+13411640.0643483i)*\exp((0.505826502116734- \\
& 2.44423812437637i)*t)+(639902814.988303+263353071.002299i)*\exp((0.151960273219643+1.568596 \\
& 27533171i)*t)+(639902814.988307-263353071.0023i)*\exp((0.151960273219643- \\
& 1.56859627533171i)*t)+(-93931270.5433818- \\
& 230898591.377159i)*\exp((0.251222952561547+0.450631217292752i)*t)+(- \\
& 93931270.5433825+230898591.377159i)*\exp((0.251222952561547- \\
& 0.450631217292752i)*t)+(1674901183.44381+1.02668134589826e- \\
& 06i)*\exp((0.129256455097872+0i)*t) + (- \\
& 101593.214097765+411222.649921086i)*\exp((0.776135495273349-3.14159265358979i)*t)+(- \\
& 1846719.27699264+13411640.0643483i)*\exp((0.505826502116734-2.44423812437637i)*t)+(- \\
& 1846719.2769927- \\
& 13411640.0643483i)*\exp((0.505826502116734+2.44423812437637i)*t)+(639902814.988303- \\
& 263353071.002299i)*\exp((0.151960273219643- \\
& 1.56859627533171i)*t)+(639902814.988307+263353071.0023i)*\exp((0.151960273219643+1.56859627 \\
& 533171i)*t)+(-93931270.5433818+230898591.377159i)*\exp((0.251222952561547- \\
& 0.450631217292752i)*t)+(-93931270.5433825- \\
& 230898591.377159i)*\exp((0.251222952561547+0.450631217292752i)*t)+(1674901183.44381- \\
& 1.02668134589826e-06i)*\exp((0.129256455097872+0i)*t)
\end{aligned}$$

(45)

$$\begin{aligned}
\text{Rate of change Export CZE to HUN} = & (4410.80563286646-227571.587571498i) * \exp((- \\
& 0.0608905299667871+3.14159265358979i) * t) + (-14811.3014354913- \\
& 16849.8215296889i) * \exp((0.225125273041944+1.93421427680353i) * t) + (- \\
& 14811.3014354919+16849.8215296886i) * \exp((0.225125273041944- \\
& 1.93421427680353i) * t) + (116.080361571184- \\
& 7834.1223369269i) * \exp((0.324491166026582+1.15001002161927i) * t) + (116.080361571125+7834.1223 \\
& 3692686i) * \exp((0.324491166026582-1.15001002161927i) * t) + (14980.8751477282- \\
& 5469.35477013902i) * \exp((0.347369315291202+0.30077411154389i) * t) + (14980.8751477281+5469.354 \\
& 77013928i) * \exp((0.347369315291202-0.30077411154389i) * t) + (33716.389321427+2.5593604530381e- \\
& 10i) * \exp((0.329294702183838+0i) * t) + (4410.80563286646+227571.587571498i) * \exp((- \\
& 0.0608905299667871-3.14159265358979i) * t) + (- \\
& 14811.3014354913+16849.8215296889i) * \exp((0.225125273041944-1.93421427680353i) * t) + (- \\
& 14811.3014354919-16849.8215296886i) * \exp((0.225125273041944+1.93421427680353i) * t) + \\
& (116.080361571184+7834.1223369269i) * \exp((0.324491166026582-1.15001002161927i) * t) + \\
& (116.080361571125-7834.12233692686i) * \exp((0.324491166026582+1.15001002161927i) * t) + \\
& (14980.8751477282+5469.35477013902i) * \exp((0.347369315291202- \\
& 0.30077411154389i) * t) + (14980.8751477281- \\
& 5469.35477013928i) * \exp((0.347369315291202+0.30077411154389i) * t) + (33716.389321427- \\
& 2.5593604530381e-10i) * \exp((0.329294702183838+0i) * t)
\end{aligned}$$

(46)

$$\begin{aligned}
\text{Rate of change Import CZE from HUN} = & (-612.08165065809- \\
& 5436.47105528298i) * \exp((0.353705776697915+3.14159265358979i) * t) + (- \\
& 4674.67714439536+2277.95790502584i) * \exp((0.381119354236012+2.07225053953374i) * t) + (- \\
& 4674.67714439536-2277.95790502584i) * \exp((0.381119354236012-2.07225053953374i) * t) + (- \\
& 6256.91769631836+2862.67722905232i) * \exp((0.365269876023779+1.35223378370392i) * t) + (- \\
& 6256.91769631835-2862.67722905231i) * \exp((0.365269876023779-1.35223378370392i) * t) + (- \\
& 7607.76006963203-550.960923459903i) * \exp((0.339153689966399+0.559807521226746i) * t) + (- \\
& 7607.76006963202+550.960923459891i) * \exp((0.339153689966399- \\
& 0.559807521226746i) * t) + (47936.1123591383+1.57676300122458e- \\
& 11i) * \exp((0.189546401739376+0i) * t) + (- \\
& 612.08165065809+5436.47105528298i) * \exp((0.353705776697915-3.14159265358979i) * t) + (- \\
& 4674.67714439536-2277.95790502584i) * \exp((0.381119354236012-2.07225053953374i) * t) + (- \\
& 4674.67714439536+2277.95790502584i) * \exp((0.381119354236012+2.07225053953374i) * t) + (- \\
& 6256.91769631836-2862.67722905232i) * \exp((0.365269876023779-1.35223378370392i) * t) + (- \\
& 6256.91769631835+2862.67722905231i) * \exp((0.365269876023779+1.35223378370392i) * t) + (- \\
& 7607.76006963203+550.960923459903i) * \exp((0.339153689966399-0.559807521226746i) * t) + (- \\
& 7607.76006963202- \\
& 550.960923459892i) * \exp((0.339153689966399+0.559807521226746i) * t) + (47936.1123591383- \\
& 1.57676300122458e-11i) * \exp((0.189546401739376+0i) * t)
\end{aligned}$$

(47)

$$\begin{aligned}
& \text{Rate of change Export CZE to POL} = (452.762111168611- \\
& 456.884196278131i) * \exp((0.654205279038097+1.61390483148527i) * t) + (452.762111168612+456.8841 \\
& 96278128i) * \exp((0.654205279038097-1.61390483148527i) * t) + (- \\
& 4519.09242841926+694.706856747352i) * \exp((0.518650913735057+2.0290260146977i) * t) + (- \\
& 4519.09242841926-694.706856747332i) * \exp((0.518650913735057-2.0290260146977i) * t) + (- \\
& 2953.23027527364-28907.6363101351i) * \exp((0.320947947373532+3.14159265358979i) * t) + (- \\
& 19707.2090728694+14638.1912008372i) * \exp((0.283804994890966+0.631207411099522i) * t) + (- \\
& 19707.2090728694-14638.1912008372i) * \exp((0.283804994890966- \\
& 0.631207411099522i) * t) + (122342.541312594+6.89563827870406e- \\
& 12i) * \exp((0.178510643810008+0i) * t) + \\
& (452.762111168611+456.884196278131i) * \exp((0.654205279038097- \\
& 1.61390483148527i) * t) + (452.762111168612- \\
& 456.884196278128i) * \exp((0.654205279038097+1.61390483148527i) * t) + (-4519.09242841926- \\
& 694.706856747352i) * \exp((0.518650913735057-2.0290260146977i) * t) + (- \\
& 4519.09242841926+694.706856747332i) * \exp((0.518650913735057+2.0290260146977i) * t) + (- \\
& 2953.23027527364+28907.6363101351i) * \exp((0.320947947373532-3.14159265358979i) * t) + (- \\
& 19707.2090728694-14638.1912008372i) * \exp((0.283804994890966-0.631207411099522i) * t) + (- \\
& 19707.2090728694+14638.1912008372i) * \exp((0.283804994890966+0.631207411099522i) * t) + (122342. \\
& 541312594-6.89563827870406e-12i) * \exp((0.178510643810008+0i) * t)
\end{aligned}$$

(48)

**Rate of change Import CZE from POL =**

$$\begin{aligned}
& (0.00630078515335039+0.014895913075229i) * \exp((1.32885444817279+3.14159265358979i) * t) + (- \\
& 5246.79272957149-95143.662361906i) * \exp((0.173246279204926+3.14159265358979i) * t) + (- \\
& 2246.75788058428-7103.28305381748i) * \exp((0.399130901824034+1.85695766259514i) * t) + (- \\
& 2246.75788058425+7103.28305381747i) * \exp((0.399130901824034- \\
& 1.85695766259514i) * t) + (7057.77857714703+1501.67499471093i) * \exp((0.381035902832322+0.943986 \\
& 902796391i) * t) + (7057.77857714702-1501.67499471095i) * \exp((0.381035902832322- \\
& 0.943986902796391i) * t) + (59495.1028434917+13726.2637876413i) * \exp((0.300245850385471+0.11027 \\
& 6600887829i) * t) + (59495.1028434917-13726.2637876413i) * \exp((0.300245850385471- \\
& 0.110276600887829i) * t) + (0.00630078515335039-0.014895913075229i) * \exp((1.32885444817279- \\
& 3.14159265358979i) * t) + (-5246.79272957149+95143.662361906i) * \exp((0.173246279204926- \\
& 3.14159265358979i) * t) + (-2246.75788058428+7103.28305381747i) * \exp((0.399130901824034- \\
& 1.85695766259514i) * t) + (-2246.75788058425- \\
& 7103.28305381747i) * \exp((0.399130901824034+1.85695766259514i) * t) + (7057.77857714703- \\
& 1501.67499471093i) * \exp((0.381035902832322- \\
& 0.943986902796391i) * t) + (7057.77857714702+1501.67499471095i) * \exp((0.381035902832322+0.94398 \\
& 6902796391i) * t) + (59495.1028434917-13726.2637876413i) * \exp((0.300245850385471- \\
& 0.110276600887829i) * t) + (59495.1028434917+13726.2637876413i) * \exp((0.300245850385471+0.11027 \\
& 6600887829i) * t)
\end{aligned}$$

(49)

**Rate of change Export CZE to SVK = (-**

$$\begin{aligned} & 243.252563446292+966.214837865162i) * \exp((0.600999239283537+1.40525203210708i) * t) + (- \\ & 243.252563446292-966.214837865162i) * \exp((0.600999239283537-1.40525203210708i) * t) + (- \\ & 3123.74461780314-33475.9566688409i) * \exp((0.293151686150787+3.14159265358979i) * t) + (- \\ & 15229.6070997382+13485.2320291212i) * \exp((0.374459222814771+2.06074558864743i) * t) + (- \\ & 15229.6070997382-13485.2320291213i) * \exp((0.374459222814771-2.06074558864743i) * t) + (- \\ & 14395.4864109739-2131.1186028635i) * \exp((0.372500580643507+0.555802627100047i) * t) + (- \\ & 14395.4864109739+2131.1186028635i) * \exp((0.372500580643507- \\ & 0.555802627100047i) * t) + (184153.672335857+7.53946086006049e- \\ & 12i) * \exp((0.186314387351643+0i) * t) + (-243.252563446292- \\ & 966.214837865161i) * \exp((0.600999239283537-1.40525203210708i) * t) + (- \\ & 243.252563446291+966.214837865162i) * \exp((0.600999239283537+1.40525203210708i) * t) + (- \\ & 3123.74461780314+33475.9566688409i) * \exp((0.293151686150787-3.14159265358979i) * t) + (- \\ & 15229.6070997382-13485.2320291212i) * \exp((0.374459222814771-2.06074558864743i) * t) + (- \\ & 15229.6070997382+13485.2320291213i) * \exp((0.374459222814771+2.06074558864743i) * t) + (- \\ & 14395.4864109739+2131.1186028635i) * \exp((0.372500580643507-0.555802627100047i) * t) + (- \\ & 14395.4864109739- \\ & 2131.1186028635i) * \exp((0.372500580643507+0.555802627100047i) * t) + (184153.672335857- \\ & 7.53946086006049e-12i) * \exp((0.186314387351643+0i) * t) \end{aligned}$$

(50)

**Rate of change Import CZE from SVK = (-1909.85149933303-**

$$\begin{aligned} & 278679.24878888i) * \exp((0.0215300402373503+3.14159265358979i) * t) + (- \\ & 14073.9652845299+55055.0825886525i) * \exp((0.202786850789766+2.10276644958686i) * t) + (- \\ & 14073.9652845298-55055.0825886522i) * \exp((0.202786850789766-2.10276644958686i) * t) + (- \\ & 12976.4840593018-4204.14687732685i) * \exp((0.313277847981152+1.28566955761198i) * t) + (- \\ & 12976.4840593017+4204.14687732684i) * \exp((0.313277847981152-1.28566955761198i) * t) + (- \\ & 8949.43894847585-1754.29237117167i) * \exp((0.316223796641966+0.532427599273536i) * t) + (- \\ & 8949.43894847585+1754.29237117167i) * \exp((0.316223796641966- \\ & 0.532427599273536i) * t) + (120627.847123478-1.76839642205654e- \\ & 11i) * \exp((0.139833091898633+0i) * t) + (- \\ & 1909.85149933303+278679.24878888i) * \exp((0.0215300402373503-3.14159265358979i) * t) + (- \\ & 14073.9652845299-55055.0825886525i) * \exp((0.202786850789766-2.10276644958686i) * t) + (- \\ & 14073.9652845298+55055.0825886522i) * \exp((0.202786850789766+2.10276644958686i) * t) + (- \\ & 12976.4840593018+4204.14687732685i) * \exp((0.313277847981152-1.28566955761198i) * t) + (- \\ & 12976.4840593017-4204.14687732684i) * \exp((0.313277847981152+1.28566955761198i) * t) + (- \\ & 8949.43894847585+1754.29237117167i) * \exp((0.316223796641966-0.532427599273536i) * t) + (- \\ & 8949.43894847585- \\ & 1754.29237117167i) * \exp((0.316223796641966+0.532427599273536i) * t) + (120627.847123478+1.76839 \\ & 642205654e-11i) * \exp((0.139833091898633+0i) * t) \end{aligned}$$

(51)

$$\begin{aligned}
\text{Rate of change Export POL to HUN} = & (-0.0266735442557768-1.64737491785325e- \\
& 17i) * \exp((1.27306518178328+0i) * t) + (445.431042146416+858.847272032045i) * \exp((0.5589065652970 \\
& 33+2.80045253713109i) * t) + (445.431042146419-858.847272032044i) * \exp((0.558906565297033- \\
& 2.80045253713109i) * t) + (-42.7379291882916- \\
& 1995.84224422777i) * \exp((0.462840704966323+1.82013728921948i) * t) + (- \\
& 42.737929188295+1995.84224422777i) * \exp((0.462840704966323-1.82013728921948i) * t) + (- \\
& 20409.2096234507+1729.77274227595i) * \exp((0.26542019644912+0.617805848162435i) * t) + (- \\
& 20409.2096234507-1729.77274227596i) * \exp((0.26542019644912- \\
& 0.617805848162435i) * t) + (63262.748458358+5.01193589961163e-12i) * \exp((0.20484571827007+0i) * t) \\
& + (-0.0266735442557768+1.64737491783924e- \\
& 17i) * \exp((1.27306518178328+0i) * t) + (445.431042146416- \\
& 858.847272032045i) * \exp((0.558906565297033- \\
& 2.80045253713109i) * t) + (445.431042146419+858.847272032044i) * \exp((0.558906565297033+2.800452 \\
& 53713109i) * t) + (-42.7379291882915+1995.84224422777i) * \exp((0.462840704966323- \\
& 1.82013728921948i) * t) + (-42.7379291882951- \\
& 1995.84224422777i) * \exp((0.462840704966323+1.82013728921948i) * t) + (-20409.2096234507- \\
& 1729.77274227595i) * \exp((0.26542019644912-0.617805848162435i) * t) + (- \\
& 20409.2096234507+1729.77274227596i) * \exp((0.26542019644912+0.617805848162435i) * t) + (63262.74 \\
& 8458358-5.01193589961161e-12i) * \exp((0.20484571827007+0i) * t)
\end{aligned}$$

(52)

$$\begin{aligned}
\text{Rate of change Import HUN from POL} = & (8128.05199026893- \\
& 2974.00877822686i) * \exp((0.301246811473+2.89828654624183i) * t) + (8128.05199026886+2974.008778 \\
& 22678i) * \exp((0.301246811473- \\
& 2.89828654624183i) * t) + (20058.3814638718+2965.10373452618i) * \exp((0.225676673068989+1.681469 \\
& 57373204i) * t) + (20058.3814638718-2965.10373452622i) * \exp((0.225676673068989- \\
& 1.68146957373204i) * t) + (7424.99777776963+11583.3724053223i) * \exp((0.247422887099709+0.857507 \\
& 902244421i) * t) + (7424.99777776966-11583.3724053223i) * \exp((0.247422887099709- \\
& 0.857507902244421i) * t) + (34290.321075419+3949.03913807548i) * \exp((0.245603930410049+0.124755 \\
& 226279164i) * t) + (34290.321075419-3949.03913807552i) * \exp((0.245603930410049- \\
& 0.124755226279164i) * t) + (8128.05199026893+2974.00877822686i) * \exp((0.301246811473- \\
& 2.89828654624183i) * t) + (8128.05199026886- \\
& 2974.00877822678i) * \exp((0.301246811473+2.89828654624183i) * t) + (20058.3814638718- \\
& 2965.10373452617i) * \exp((0.225676673068989- \\
& 1.68146957373204i) * t) + (20058.3814638718+2965.10373452622i) * \exp((0.225676673068989+1.681469 \\
& 57373204i) * t) + (7424.99777776963-11583.3724053223i) * \exp((0.247422887099709- \\
& 0.857507902244421i) * t) + (7424.99777776966+11583.3724053223i) * \exp((0.247422887099709+0.85750 \\
& 7902244421i) * t) + (34290.321075419-3949.03913807548i) * \exp((0.245603930410049- \\
& 0.124755226279164i) * t) + (34290.321075419+3949.03913807552i) * \exp((0.245603930410049+0.124755 \\
& 226279164i) * t)
\end{aligned}$$

(53)

$$\begin{aligned}
\text{Rate of change Export SVK to POL} = & (-4.38215679046969e-12-5.0710155356939e- \\
& 12i)*\exp((2.7148312764801+3.14159265358979i)*t)+(- \\
& 745.768119883968+1900.57549511701i)*\exp((0.508324439127024+2.7266135161003i)*t)+(- \\
& 745.768119883961-1900.57549511702i)*\exp((0.508324439127024- \\
& 2.7266135161003i)*t)+(4541.16516221247- \\
& 5793.1812091472i)*\exp((0.345763966805907+1.72033281941707i)*t)+(4541.16516221247+5793.1812 \\
& 0914724i)*\exp((0.345763966805907-1.72033281941707i)*t)+(- \\
& 12802.2695645121+839.888894756848i)*\exp((0.275079083442411+0.568796209152067i)*t)+(- \\
& 12802.2695645121-839.888894756858i)*\exp((0.275079083442411- \\
& 0.568796209152067i)*t)+(43750.6984748988+1.04088711084649e- \\
& 11i)*\exp((0.224114476252042+0i)*t) + (-4.38215679046969e-12+5.07101553569391e- \\
& 12i)*\exp((2.7148312764801-3.14159265358979i)*t)+(-745.768119883968- \\
& 1900.57549511701i)*\exp((0.508324439127024-2.7266135161003i)*t)+(- \\
& 745.768119883961+1900.57549511702i)*\exp((0.508324439127024+2.7266135161003i)*t)+(4541.1651 \\
& 6221247+5793.1812091472i)*\exp((0.345763966805907-1.72033281941707i)*t)+(4541.16516221247- \\
& 5793.18120914724i)*\exp((0.345763966805907+1.72033281941707i)*t)+(-12802.2695645121- \\
& 839.888894756848i)*\exp((0.275079083442411-0.568796209152067i)*t)+(- \\
& 12802.2695645121+839.888894756858i)*\exp((0.275079083442411+0.568796209152067i)*t)+(43750.6 \\
& 984748988-1.04088711084659e-11i)*\exp((0.224114476252042+0i)*t)
\end{aligned}$$

(54)

$$\begin{aligned}
\text{Rate of change Import SVK from POL} = & (-25.9988383139682- \\
& 114.375378094052i)*\exp((0.714120126290358+3.14159265358979i)*t)+(428.218528326151- \\
& 398.246124594848i)*\exp((0.583033674295437+2.37631694370143i)*t)+(428.21852832615+398.24612 \\
& 4594848i)*\exp((0.583033674295437-2.37631694370143i)*t)+(4023.28237743399- \\
& 5028.24737993689i)*\exp((0.35795726136926+1.68836249983428i)*t)+(4023.28237743401+5028.2473 \\
& 799369i)*\exp((0.35795726136926-1.68836249983428i)*t)+(52664.7543223993+3.88094854466518e- \\
& 11i)*\exp((0.1591303449507+0i)*t)+(- \\
& 19195.8597007747+6103.59722241324i)*\exp((0.191719258388785+0.573906948673369i)*t)+(- \\
& 19195.8597007748-6103.59722241334i)*\exp((0.191719258388785-0.573906948673369i)*t) + (- \\
& 25.9988383139682+114.375378094052i)*\exp((0.714120126290358- \\
& 3.14159265358979i)*t)+(428.218528326151+398.246124594848i)*\exp((0.583033674295437- \\
& 2.37631694370143i)*t)+(428.21852832615- \\
& 398.246124594848i)*\exp((0.583033674295437+2.37631694370143i)*t)+(4023.28237743399+5028.247 \\
& 37993689i)*\exp((0.35795726136926-1.68836249983428i)*t)+(4023.28237743401- \\
& 5028.2473799369i)*\exp((0.35795726136926+1.68836249983428i)*t)+(52664.7543223993- \\
& 3.88094854466518e-11i)*\exp((0.1591303449507+0i)*t)+(-19195.8597007747- \\
& 6103.59722241325i)*\exp((0.191719258388785-0.573906948673369i)*t)+(- \\
& 19195.8597007748+6103.59722241334i)*\exp((0.191719258388785+0.573906948673369i)*t)
\end{aligned}$$

(55)

**Rate of change Export SVK to HUN** = (10295.450346662-  
3662.00798684255i)\*exp((0.204815710098827+2.35778070127764i)\*t)+(10295.4503466624+3662.007  
98684248i)\*exp((0.204815710098827-2.35778070127764i)\*t)+(18342.9286398089-  
6453.20975778921i)\*exp((0.229837769193073+1.69673481252537i)\*t)+(18342.9286398091+6453.209  
75778938i)\*exp((0.229837769193073-1.69673481252537i)\*t)+(22850.7683972081-  
2466.20848570002i)\*exp((0.149207572256548+0.987692799335353i)\*t)+(22850.768397208+2466.208  
48570036i)\*exp((0.149207572256548-0.987692799335353i)\*t)+(30322.7526018879-  
12758.6013259513i)\*exp((0.245156834234631+0.148824077445825i)\*t)+(30322.7526018879+12758.6  
013259514i)\*exp((0.245156834234631-0.148824077445825i)\*t) +  
(10295.450346662+3662.00798684254i)\*exp((0.204815710098827-  
2.35778070127764i)\*t)+(10295.4503466624-  
3662.00798684248i)\*exp((0.204815710098827+2.35778070127764i)\*t)+(18342.9286398089+6453.209  
75778921i)\*exp((0.229837769193073-1.69673481252537i)\*t)+(18342.9286398091-  
6453.20975778938i)\*exp((0.229837769193073+1.69673481252537i)\*t)+(22850.7683972081+2466.208  
48570002i)\*exp((0.149207572256548-0.987692799335353i)\*t)+(22850.768397208-  
2466.20848570037i)\*exp((0.149207572256548+0.987692799335353i)\*t)+(30322.7526018879+12758.6  
013259513i)\*exp((0.245156834234631-0.148824077445825i)\*t)+(30322.7526018879-  
12758.6013259514i)\*exp((0.245156834234631+0.148824077445825i)\*t)

(56)

**Rate of change Import HUN from SVK** = (-4062.32314371357-  
389.840647239949i)\*exp((0.332656689559188+2.61066670454796i)\*t)+(-  
4062.32314371358+389.840647239958i)\*exp((0.332656689559188-  
2.61066670454796i)\*t)+(18078.6243111357+457.718692623548i)\*exp((0.243013336186859+1.684154  
28077181i)\*t)+(18078.6243111357-457.718692623626i)\*exp((0.243013336186859-  
1.68415428077181i)\*t)+(11181.2756635531-  
2653.88558675636i)\*exp((0.284798699923465+0.946862718441756i)\*t)+(11181.275663553+2653.885  
58675634i)\*exp((0.284798699923465-0.946862718441756i)\*t)+(22336.1595713485-  
19383.8847676263i)\*exp((0.226083016416692+0.193725738311885i)\*t)+(22336.1595713485+19383.8  
847676263i)\*exp((0.226083016416692-0.193725738311885i)\*t) + (-  
4062.32314371357+389.840647239949i)\*exp((0.332656689559188-2.61066670454796i)\*t)+(-  
4062.32314371358-389.840647239958i)\*exp((0.332656689559188+2.61066670454796i)\*t)+  
(18078.6243111357-457.718692623548i)\*exp((0.243013336186859-  
1.68415428077181i)\*t)+(18078.6243111357+457.718692623625i)\*exp((0.243013336186859+1.684154  
28077181i)\*t)+(11181.2756635531+2653.88558675636i)\*exp((0.284798699923465-  
0.946862718441756i)\*t)+(11181.275663553-  
2653.88558675634i)\*exp((0.284798699923465+0.946862718441756i)\*t)+(22336.1595713485+19383.8  
847676263i)\*exp((0.226083016416692-0.193725738311885i)\*t)+(22336.1595713485-  
19383.8847676263i)\*exp((0.226083016416692+0.193725738311885i)\*t)

(57)

Table 4. Calculated by the author, the values of the first time derivative of the macroeconomic parameters of international trade, gross national product and population of the Visegrad Four countries in 2000 – 2015

Year	The rate of change in the population of the Czech Republic , peoples	The rate of change of the Hungarian population , peoples	The rate of change in the Polish population, peoples	The rate of change in the population of Slovakia, peoples	The rate of change in Czech GDP ,US\$
2000	-14121.5908768256+0i	-1317.83539627937+0i	-9947.22818201332	-22174.7557313657+0i	5986160764.92713+0i
2001	-38470.7288184111+0i	-32767.8834160278+0i	-12764.7066526687+0i	-2650.79525825524+0i	8862414832.88036+0i
2002	-5392.47347472303	-29214.5218496365+0i	-23009.0178823762	-2860.47957194257+0i	18041630534.0288
2003	-1680.27426798225	-25546.2328315328+0i	-26140.4293896777	-3018.17271640955+0i	18260761541.7296
2004	8970.92835630088+0i	-21605.0952634437+0i	-17941.0730336319	480.905616584716+0i	19534270483.4959+0i
2005	19171.6233670299	-17069.7519407443+0i	-18877.8479543061	176.343330598549+0i	16864196565.8283
2006	39945.6148869741+0i	-15671.9508027882+0i	-27069.0692760032	701.33761254251+0i	21775982981.1257
2007	80175.3621415379+0i	-15979.5055029098+0i	-11055.4933680268	2681.85478497531+0i	51773772111.3757
2008	79396.8804269491	-17517.9917546049+0i	26778.0428208052	6660.55470613316+0i	14139900664.3926+0i
2009	40504.1834027201+0i	-16883.1247962422+0i	-17882.8081405253+0i	6416.29116973767+0i	-41661148880.3823
2010	24037.0999413285	-25166.6263810441+0i	-137362.836656245+0i	4719.76895287316+0i	36367573037.555
2011	19922.6308679244	-39806.064467047+0i	150692.380225633+0i	9321.79036365301+0i	-4899757186.08658+0i
2012	7188.10210470496	-46964.064573189+0i	-162302.243341165+0i	7630.56766375918+0i	-29421523540.6932
2013	5043.83703252146	-21016.1959186706+0i	88937.1403801495+0i	4941.47689188899+0i	51055335675.6392
2014	15570.9449661493+0i	-17634.1547361658+0i	143451.172028501+0i	5398.34556039707+0i	-124578710771.573
2015	29091.336873029	-72029.0469398374+0i	-1733221.72382917+0i	5147.64865116653+0i	355177758236.788+0i



Table 4. (continued) Calculated by the author , the values of the first time derivative of the macroeconomic parameters of international trade , gross national product and population of the Visegrad Four countries in 2000 – 2015

Year	The rate of change in Hungary's GDP, US\$	The rate of change in Poland's GDP, US\$	The rate of change in Slovakia's GDP, US\$	The rate of change of exports from the Czech Republic to Hungary, US\$	The rate of change of exports from Hungary to the Czech Republic, US\$
2000	5402153023.7105	21773052316.6943	2741574052.77872+0i	320717.78656786+0i	60605.5621755698
2001	9784877651.7745	12431506862.2186	1524831062.35216+0i	305178.648802172+0i	190370.91768461
2002	16737740837.9259	9120664111.84363	8511426868.14137+0i	136933.124450883+0i	204187.161391965+0i
2003	18689268112.0297	28986028608.8087	12934325638.9589+0i	460459.950036227+0i	246427.781610067
2004	16702152219.7373	45750122320.0332	7245413611.39468+0i	537905.90867597+0i	367890.890488549
2005	1325389244.19109	49279923175.1471	5194679635.99946+0i	337325.939687126+0i	300340.490208227
2006	10627392809.9656	38541328528.9414	11593191343.6496+0i	942298.983926453+0i	895465.060709405
2007	33299973594.281	136988555990.468	19105907891.6401+0i	997119.103075251+0i	1182911.38546032+0i
2008	-8383539084.05963	5448207076.4733	2853142578.48913+0i	-762095.193139574+0i	-703033.317485559+0i
2009	-26607400500.2123	-102745902068.146	-16549690580.3366+0i	-892421.564126416+0i	-1205040.60301578
2010	21976224748.0222	148651017888.157	18657005696.0079+0i	822775.34901365+0i	1317654.46378254
2011	-9103346145.54152	-86471409456.4806	-8430865774.12496+0i	238890.127944025+0i	-35360.1074174389+0i
2012	-8097674174.05559	102410933216.966	5430520533.88489+0i	-109602.658789557+0i	-192211.830268733+0i
2013	22872882142.1112	-176381184505.453+0i	5689504034.48186+0i	1376615.0597628+0i	1226680.49007014+0i
2014	-37360520440.145	525139583650.457+0i	-38741240049.3055+0i	-820281.786605816+0i	-3260167.69284757
2015	98027433461.2635	-2360883049575.65+0i	203685285174.239+0i	3576448.38589535+0i	12170219.5690396

Table 4. (continued) Calculated by the author , the values of the first time derivative of the macroeconomic parameters of international trade , gross national product and population of the Visegrad Four countries in 2000 – 2015

Year	The rate of change of exports from the Czech Republic to Poland, US\$	The rate of change of exports from Poland to the Czech Republic, US\$	The rate of change of exports from the Czech Republic to Slovakia, US\$	The rate of change of exports from Slovakia to the Czech Republic, US\$	The rate of change of exports from Poland to Hungary, US\$
2000	182837.363400129+0i	385215.092417617+0i	352877.291456773+0i	48562.9654215721+0i	70698.6732385551
2001	227830.166398769+0i	338098.783584592	651101.119157256+0i	722587.1525878+0i	135416.83950088
2002	269269.087666387+0i	353654.979818905+0i	555843.041136315+0i	350116.613059872+0i	225089.809955872
2003	617746.195354519+0i	637618.781980639	838931.586952219+0i	23237.8386708254+0i	536592.758905853
2004	1199042.3521729+0i	941925.210324145	1783807.68180466	1035286.05779273+0i	633922.343287489
2005	748864.809716465+0i	841385.247890131+0i	1041256.4674435+0i	624328.111952895+0i	725730.486349537
2006	1307395.31347325+0i	1535721.47807992	1589603.16776401	737296.660186169+0i	747845.989626051
2007	2741385.46700168+0i	1881943.10715064	3760869.89124953	2236675.81531358+0i	826403.940619874
2008	-156534.37687807+0i	-63576.0449466449	-155945.846902526	-476791.650636317+0i	99392.8267364713
2009	-2646129.55325539+0i	-1040155.87496019	-3130407.08244585	-1809757.92774524+0i	-1391881.5081248
2010	4061200.38947863+0i	2459762.83832399+0i	4501718.23742045	2594501.01577934+0i	2548421.87514211
2011	349680.905447379+0i	1698953.33518783	1066838.50799768	1187468.99659122+0i	-2527785.55246945+0i
2012	-2489405.86876995+0i	-2453978.59798992	-2056556.97986886	-1225075.04066846+0i	3390655.68160618
2013	6230769.88857916+0i	6277837.22118155	4864371.54665505	1151798.61188335+0i	-5128879.11662967+0i
2014	-15226894.8468499+0i	-6445017.7806117	-12047098.9369745+0i	-2826080.558914+0i	14189358.3672076
2015	56525114.8430505+0i	-18578104.0070952+0i	45854087.0445213	6682092.34081716+0i	-48470254.1047552

Table 4. (continued) Calculated by the author , the values of the first time derivative of the macroeconomic parameters of international trade , gross national product and population of the Visegrad Four countries in 2000 – 2015

Year	The rate of change of exports from Hungary to Poland, US\$	The rate of change of exports from Poland to Slovakia, US\$	The rate of change of exports from Slovakia to Poland, US\$	The rate of change of exports from Slovakia to Hungary, US\$	The rate of change of exports from Hungary to Slovakia, US\$
2000	86834.0798259734+0i	78290.7817730063	55074.1949755296	228455.543197424+0i	182715.650640583+0i
2001	52129.6288513229-1	56082.8214499629	19173.4532866045	32931.7015055175	36821.7058211149
2002	182959.912108989	114210.575266913+0i	122252.739365006	215183.895658902	194882.249985656+0i
2003	454827.586011724	478168.013213804+0i	347719.615259416	315250.647814172	357131.603070195
2004	289849.984271132	381449.566717955+0i	463694.931181526	427290.27563878	106606.756240313+0i
2005	365794.59135486	510490.388211946+0i	353230.10215351	471745.799939791	467706.049800018+0i
2006	1103904.6223392	553789.807452892+0i	429128.152636224	848158.401509223	937621.127901508+0i
2007	429897.728194254	1171294.6349717+0i	1173261.26088334+0i	1271525.7668552	1129893.80016117
2008	-108914.293778558	344163.460878969+0i	207818.226280553	-139471.827500369	-351678.975408533+0i
2009	-1213871.96389079+0i	-1368947.8194732+0i	-1212007.28592885	-255374.168032429	-939084.575187955+0i
2010	1621814.13896324	2764592.59123109+0i	1992999.71989973	1740527.38348068	998639.089556151+0i
2011	-954643.224015327	-2393654.49231389	-920830.109614093	820515.364330335	-520902.108086786+0i
2012	794548.896813964	4206847.62488807	510685.548576134+0i	-466002.082602693	497071.591778151+0i
2013	-1319634.56774507+0i	-7095301.61326348	551954.369285151+0i	-205317.68520624+0i	304832.463540444+0i
2014	2794404.55356768	20732848.6177282	-5547400.30953616+0i	-218648.828120077	1208391.5408555+0i
2015	-8159694.961821+0i	-56995576.6584027	26386955.1966192+0i	-2888251.3637545	-5483378.99015907+0i

Table 5 . Coefficient values  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \beta_1, \beta_2, \beta_3, \beta_4$  (calculated by the author) according to the formulas (14,15,16,17)

	2000	2001	2002	2003
$\alpha_1$	0,996017572316	2,263780893567	0,645711393205	0,722492711074
$\alpha_2$	1,028594978005	5,972209200528	0,587771795196	0,478160314062
$\alpha_3$	0,900107006115	1,904622698447	4,912160397382	3,015620022896
$\alpha_4$	0,994662331513	0,681298267600	0,909066905343	1,831555333934
$\beta_1$	-70,029933903248	-78,574478509720	-268,005908939348	-799,694307711133
$\beta_2$	-23,434504892292	-600,371322405371	-266,414355888595	-234,672725851855
$\beta_3$	-437,681867448418	-371,631962551343	-373,937521427151	-586,483371826222
$\beta_4$	-881,733023516184	-38,559977843848	-78,257165414400	-159,116961420659

Table 5 (Continued). Coefficient values  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \beta_1, \beta_2, \beta_3, \beta_4$  (calculated by the author) according to the formulas (14,15,16,17 )

	2004	2005	2006	2007
$\alpha_1$	2,488477947993	1,849526709469	1,089771701226	1,624334635413
$\alpha_2$	1,448015245873	1,549494182342	2,745623891934	0,525754561724
$\alpha_3$	1,619150007536	21,309710514924	3,344442570347	0,706920667648
$\alpha_4$	356,813438714012	81,473802158981	45,760426942601	46,052457369582
$\beta_1$	3506,716531782610	4660,597639469960	1367,728005668320	718,486482129663
$\beta_2$	-552,650269993030	-504,256597931577	-432,659770727730	-578,845061524565
$\beta_3$	-121,481446887272	-147,391131279225	-197,328682101045	-105,641270728933
$\beta_4$	1,925368291146	1,243967093063	1,281112000717	1,316951099619

Table 5 (Continued). Coefficient values  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \beta_1, \beta_2, \beta_3, \beta_4$  (calculated by the author) according to the formulas (14,15,16,17 )

	2008	2009	2010	2011
$\alpha_1$	-0,496779860291	1,547570553671	2,253694146618	-4,549776643238
$\alpha_2$	-1,048768387834	1,678979493550	1,907951098249	-1,145996366884
$\alpha_3$	-0,109218443167	1,714750644864	1,796410296225	2,493278396912
$\alpha_4$	0,021066094022	1,974328214128	3,348596955730	6,365738938804
$\beta_1$	-3,879581383470	-80,142974524579	170,830416664761	51,161588827038
$\beta_2$	-23,955672307644	-260,925279712881	447,817200347357	56,237718037616
$\beta_3$	-1,587691214823	854,769556740742	-154,129368084800	-103,080446197890
$\beta_4$	0,638994886293	237,849206523612	-221,135384183685	102,231044061225

Table 5 (Continued). Coefficient values  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \beta_1, \beta_2, \beta_3, \beta_4$  (calculated by the author) according to the formulas ( 14,15,16,17 )

	2012	2013	2014	2015
$\alpha_1$	1,026618082677	1,109575874367	1,098074835031	1,301288333926
$\alpha_2$	-2,510025271679	4,636327900016	1,704965631421	1,069646196568
$\alpha_3$	2,742940181809	2,218929511319	1,942690484618	1,383600520258
$\alpha_4$	-8,966561508204	-4,457668248988	-7,101439153913	-8,732140762576
$\beta_1$	-211,467899522833	557,859653882464	-441,678167812906	891,069592445757
$\beta_2$	-102,487184257164	293,170035363315	-655,865547944174	2589,881876271080
$\beta_3$	-132,147006274950	-321,295073387117	498,322565627993	149,831238421241
$\beta_4$	-119,025169595504	353,607918734023	-1052,213879510230	934,220237123137

## Discussion

Interpolation of time series by the sum of exponents of a function of a complex variable gives an approximation no worse than using regression analysis. Despite the fact that time series are interpolated by functions of a complex variable, the values of these functions can be real numbers. The imaginary component of complex numbers that occurs during calculations is several orders of magnitude smaller than the real part. The appearance of the imaginary part is due, in the author's opinion, to the error of calculations and it can be neglected when interpreting the result of calculations. To calculate the interpolating function, the author used standard procedures used in the MATLAB software.

The absence of extremum points for exponents is the main advantage when using exponent sums for interpolation purposes compared to interpolation by polynomials.

## Conclusions

The use of complex variable functions for the interpolation of numerical series makes it possible to expand the capabilities of researchers to build more accurate economic and mathematical models describing socio-economic processes.

The use of the sum of exponents of a complex variable function as an interpolation function makes it possible to achieve the accuracy required for practical application, while using standard software packages.

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