

ANALYSIS OF INFLATION MANAGEMENT MODEL FACTORS AS REGARDS SUPPLY AND DEMAND

Dainius Butautas*

Vilnius Gediminas Technical University, Lithuania

Abstract. This article analyses the demand and supply aspects of the determinants of CPI inflation in Lithuania in 1998–2008. Content analysis was used to identify and group significant demand and supply inflation factors and using RGT, objectively assess and generalize the results. Pair linear correlation analysis confirmed the significance for CPI inflation of the factors identified through content analysis, and both research methods reliably and effectively helped to identify factors for regression models of inflation. Content analysis revealed that the causes of inflation most often mentioned and traditionally regarded as significant in the economic literature are factors such as money and wages, capital, competition and monopolies, and so on. Pair correlation research showed the significance for inflation of supply and demand factors such as income distribution, income levels, taxes, saving, human capital and labour productivity as well as exports and imports – things which content analysis gave only average or little mention. Regression models confirmed and helped to concretize the significance for inflation of the identified demand and supply factors. The results of the research show that inconsistent monetary and general government expenditure policies reinforce private consumption and capital shocks. Note that human capital and employment, which changed little during the analysed period, did not show the large significance for inflation that they are commonly thought to have.

Keywords: inflation, CPI, demand, supply, human capital, content analysis, Spearman ranks.

I. Introduction

Theoretical underpinnings. Inflation is one of the most complex economic processes, involving consumption, savings and investment, money, labour, and capital supply and demand, competition, monopolies, poverty, income distribution, information, projections, expectations, clear rules and so on. Economists (Marshall, Veblen and others) recognize that *via price it is possible to analyse all economic processes* (Butautas, 2011; Čiegis, 2006; Snieška et al., 2005), for which according to Wicksell, Cassel, Keynes and other authors, *stability of the purchasing power of money* is important (Čiegis, 2006; Keynes, 1978; Cassel, 1932; and others). It is important for this study that economic researchers distinguish price analysis of *static and dynamic* nature (Snieška et al., 2005; Šalčius, 1991; Cassel, 1932; and others). This study seeks to explain precisely the causes of price dynamics or inflation, *future changes of which can also impact the current economic*

* Corresponding author:

Vilnius Gediminas Technical University, Saulėtekio Ave. 11, LT-10223 Vilnius, Lithuania
E-mail: butautas.dainius@gmail.com

situation (Keynes, 1978). According to one modern definition, inflation (from the Latin *inflation* – swelling) is “*the formation of an acute surplus of money in circulation, which exceeds what is needed for transfers of goods and payments*” (Dictionary of International Words, 1985). In this paper, we define inflation as an overall growth of the price level as measured by the consumer price index (CPI), which is independent of the length of time during which such growth occurs. It is recognised that at a certain level of prices, aggregate demand and supply converge (Snieška et al., 2005; and others) to achieve economic equilibrium. When prices change, the economy goes out of sync, the economic balance degenerates, temporary rise is replaced by sudden downturn, unemployment and poverty increase and families are less often formed. Statistical data confirms this. Annual CPI inflation in 1997 was 8.4 %, while in 1998 it was 2.4 %, in 2008 it was 8.5 %, and in 2009 it was 1.3 %. Similar fluctuations during the period examined can be seen in the overall economy (GDP), the unemployment level and other important socio-economic indicators of the country’s development. It is therefore of great importance to determine the causes of inflation, especially those which man is able to control (Keynes, 1978).

The causes of inflation are universally identified as demand and supply (Snieška et al., 2005, Šalčius 1991 and others) and factors comprising *rational expectations* (Phelps, 2007; Kydland, Prescott, 2005; and others). Since inflation unbalances the economy (Keynes, 1978; Wicksell, Čiegis 2006; etc.), it is also essential to identify the economic categories and factors that characterise *economic equilibrium* and are important for inflation. Šalčius (1991) specifies the following demand causes of inflation: *a) the consumption value of goods, including a product’s usefulness to satisfy our needs; b) purchasing power, which depends on income devoted to consumption; and c) the prices of imports of goods, especially raw materials, where historical differences merely reflect transportation costs.* Things that influence supply inflation are: *a) product cost, particularly under “the most inconvenient production conditions,” which include marginal values limited by competition; b) alternative sales channels, including exports; and c) the “exchange value” of goods expressed in money terms as “the measure of tradable goods”.* Meanwhile, other authors discern the following demand causes of inflation (Snieška et al., 2005): *a) special characteristics of contemporary money supply; b) low taxes and a government budget deficit; and c) imbalance of supply and demand.* Among the supply causes of inflation they list: *a) a sudden decline in aggregate supply; b) wages; c) inflation expectations; and d) price and tax policy implemented by the government.* In summary, authors note the following essential causes of inflation: *the value of money, taxes and government expenditures, lack of supply or competition and so on.* In addition, Šalčius (1991) unlike Snieška et al. (2005) and other authors mentions wages as an indirect cause of inflation and something more related to production costs, i.e., a static price. Meanwhile, a brief Theoretical analysis of inflation (Butautas, 2011) has shown that the greatest initial impact on inflation comes from *demand factors and monopoly or lack of fair competition, taxation of primary goods, poverty, etc.* Here the

impact of poverty on inflation is understood to mean that as poverty increases, spending on everyday products increases and those products additionally become more expensive. Thus their significance (weight) in overall price growth increases. For inflation linked to poverty, the assertion is important that *the true objective of intense monetary policy is to reduce real wages* (Keynes 1978), which leads to lower purchasing power and aggregate demand. Research (Butautas, 2011) has also shown that money cannot be analysed in isolation from economic processes, which *are closely interlinked among themselves* (Cassel, 1932; and others), while according to Wicksell, *fluctuations in the value of money* (or purchasing power) *influence consumption as well as saving and investment and “destroys the economic balance”* (Čiegis 2006).

Research Methodology. For the theoretical analysis of sources in the economic literature we chose the universally recognized and widely used *Content analysis* method. According to Quest Pro Digital Dissertations, since 1861 this method has been used 5,832 times in scientific research. A particular surge can be noticed in this area in 1980, when the number of studies using *content* (including text) *analysis* increased from 55 to 202 (Kimberly A. Neuendorf, 2002). This research methodology is widely used in the fields of *communication, investigative journalism, sociology, psychology and business* (Kimberly A. Neuendorf, 2002). Perhaps the most significant problem in *content analysis* is finding the factors that best represent the object of investigation, in this case CPI inflation. The essence of the method is twofold: 1) in the selected sources, find *conceptual elements of interest for the research, fix a suitable unit of measurement* and count the frequency of their use (Tidikis, 2003), and 2) *to group the chosen elements into categories* which may *be previously known* (e.g. supply and demand) *or newly created* (Kardelis, 2007). Content analysis also enables evaluation of the *“web of concepts through which researchers view reality”* (Kardelis, 2007). Content analysis requires the development of a system for best interpreting the research results with the help of the chosen indicators. Three descriptive characteristics are generally distinguished in content analysis: *repetitiveness or frequency, average value and standard deviation* (Kardelis, 2007; D. Gall, Borg, P. Gall, 1996). In this study we mainly use the most important characteristic – *frequency* (see 7. below). Research is considered to be reliable if it *confirms the hypotheses posed or allows them to be revised* (Patrick McNeill, 1995). Other authors emphasise that research gets *its validity* from the possibility of structuring its data (*internal validity*), correspondence of the data with theoretical findings and the ability *to verify them in practice* (*external validity*), and the possibility of *predicting* possible events based on the data (*efficiency*; Франселла, Баннистер, 1987). The *content* method also helps to establish whether the selected economic literature is sufficiently *representative* and can help *answer* the research questions that have been posed.

The benefits of content analysis are multiple. First, the importance of formalisation for this method makes it possible to *“objectively examine”* the literature sources and *“get sufficient information about the solution of the problems raised”*. Second, it helps to assess

the link between the factors analysed and the research object (inflation, prices) and among themselves. Third, it makes it possible to properly systematize, compare, summarise and objectively interpret the data obtained, to deepen analysis of the problematic issue and to draw reliable conclusions (Valackienė, Mikėnė, 2008; Kardelis, 2007; Tidikis, 2003; Kimberly A. Neuendorf, 2002). Here, according to Osipov, “who said what, how, for what purpose and with what result” is not assessed (Tidikis, 2003). The dangers of such research are rather well known: *a lack of systematic, errors made at the start of research, diverse source format, imprecise interpretation of a word or term, ignorance of external conditions, translation errors, when texts often contain “not detailed characteristics of the situation but just an opinion or assessment”, and so on* (Luobikienė, 2011; Tidikis, 2003; Finnegan, Punch, 1998; Patrick McNeill, 1994). Therefore, given the benefits and dangers of this approach, *“it is best to compare data obtained by several methods”* (Luobikienė, 2003; Tidikis, 2003; Kardelis, 1997, 2007). Content analysis is selected as the primary and intermediate research method, and consistently flows from the research hypothesis (Butautas, 2011). For describing the content analysis, the convenient and easy-to-use RGT and Spearman’s rank correlation method system is used. This makes it possible, among other things, to effectively compare the theoretical and statistical data i.e., to see how theory and practice correspond. This article provides only the most essential, abbreviated from part of the content analysis research.

The preamble to the description of the Repertory Grid Technique (RGT) states that *“one of the most important traits of the modern era is the increased role of the human factor,”* because the world is becoming more complex, information flows are growing, the human psyche bears an ever heavier load and people have to make ever more complicated decisions at both personal and societal levels (Франселла, Баннистер, 1987). Thus the goal of more effective decision-making requires an *“interdisciplinary dimension”* (Benedict XVI, 2009; St. John Paul II, 1991). Those who research economic processes also acknowledge that *“for most economists the insights and experimental methods of psychology are an essential component of the modern science of economics”* including *“the link between price formation and market institutions”* and competition (Kahneman, Smith, 2002). When describing RGT two methods are used: one, an *ideographic* approach makes it possible to isolate and explain the unique characteristics of the phenomenon under investigation; and two, a *nomothetic* approach helps to generalise and systematise them (Франселла, Баннистер, 1987). Interpretation of results obtained by RGT (Kujalienė, 2004) *“do not rely on prior attitudes [and] schemes”* and therefore help *“to reveal the situation as it really is”* in order to permit a *“comprehensive, integrated, consistent and coherent”* view of the economy. Such a realistic system, according to the Kernis and Campbell, is more stable and clearer (Kujalienė, 2004). According to Kelly, one function of the RGT method is to make it possible to notice not only the invisible things (Kujalienė, 2001; Франселла, Баннистер, 1987), but also, as

the “*deep*” things in the economy, the model parameters that do not stand out, and also verify hypotheses (Sargent, 2012). It also, with rational expectations in the economy, helps to foresee future events. Only rational expectations explore external phenomena, while RGT examines internal attitudes according to the repetitiveness of certain events.

For the content analysis we have selected: 1. The section on money-wages and prices in Keynes’s *General Theory of Employment, Interest and Money* (1936); 2. R. Čiegis’s *History of Economic Theories* (2006); 3. P. Samuelson’s *Economics* (1992), both chapter 20 on demand and supply as factors influencing price and chapter 36 on price stability and growth in developed economies; 4. The chapter on prices in *Money, Banking and the Economy* by T. Mayer et al. (1995); 5. Kydland and Prescott (2005); and 6. Phelps (2007) (Items 5 and 6 are conceptual articles on rational expectations, see reference). These works are sufficiently representative of and in line with the topic of investigation (Luobikienė, 2011). In the selected sources we identify 25 authors who analyse demand and supply aspects of the causes of inflation and price formation. Their works rather effectively describe the following categories of factors: money, wages, capital, competition and monopoly, and so on. Because it combined extraction of the unit of calculation (word) and the conceptual unit (Luobikienė, 2011; Valackienė, Mikėnė, 2008; Kardelis, 2005), the study was carried out manually. The main unit of the content analysis is a factor assigned to a demand or supply factor inflation group that occurs at least once. The author calculates the frequency because this approach better suits the objectives of the research. It is considered that the authors included in the study – St. Thomas Aquinas, Smith, Ricardo, Mill, Marshall, Wickse, Chamberlain and Robinson, Keynes and Samuelson, along with the rational expectations representatives Phelps, Kydland, Prescott and others – added essentially to the formation and knowledge of the theory of inflation and prices. In conducting the research, it was determined that the sample of authors included must be increased to 29 ($n = z^2 * s^2 / \Delta^2$, where n is the sample size, z is the Student’s t reliability (90 percent), S is the standard deviation, and Δ is the margin of error (Table 2)). Meanwhile, other researchers suggest a sample of 30 authors which, according to Cohen and Manion, completely fits the examined cases (Kardelis, 2007). One of the problems in this study was the use of secondary historical sources (Čiegis, 2006). Informative content analysis permitted extending the research, which as a whole comprises of four categories or groups that are significant for inflation: *supply, demand, economic equilibrium and future-oriented rational expectations*, since it is recognised (Phelps, 2007; and others) that it is rational rather than adaptive expectations which determine actual inflation.

It is necessary to clarify the aggregate factor ‘*monopolies and competition*’ in the content analysis. These two opposite concepts mentioned as one factor in analysing the influence of competition on inflation and it is impossible to evade the effect of monopolies and vice versa. The pair correlation analysis on the supply side includes a somewhat

modified (multiplied by 100) Domestic Competitiveness Index (DCI), which the World Economic Forum (WEF) uses as a sub-index in calculating the Global Competitiveness Index (GCI). The DCI shows the ratio of the domestic market to the total domestic and foreign market $((c + g + i + ex) / (c + g + i + ex + im) * 100)$. This relationship shows in which market, domestic or foreign, there is more distortion of competition (WEF). For demand analysis, an inverse Foreign Competitiveness Index ($fci = ((im / (C + I + G + ex + IM) * 100)$) was used to calculate the competitiveness of foreign markets and how well foreign goods are able to compete with existing goods on the domestic market. Since these are objective indices, their calculation is not complicated. In addition, given the research objectives, in the content analysis the ‘*monopolies and competition*’ factor is analysed in terms of both supply and demand.

Based on the literature analysis (Butautas, 2011) and the content analysis, supply and demand inflation factors were chosen for pair linear correlation and multiple regression analysis to determine the strength of the relationship and to concretise its form (Valkauskas, 2007; Čekanavičius, Murauskas, 2000). As the correlation between the demand and supply factors for inflation in absolute terms is usually strong or very strong, a stochastic nature holds, where “*a change in the size of one influences the size distribution of the other*” (Valkauskas, 2007). This character of the nature of inflation reveals the full complexity of the process, all the more so when every fact must be regarded as strictly indeterminate and probabilistic, from which there emerges a certain order and regularity” (Valkauskas, 2007). The problem of this study is that correlation does not yet establish causality (Valkauskas, 2007; Čekanavičius, Murauskas, 2000), thus it is necessary to get better acquainted with the research object and process, and rely on scientific theory (Kėdaitis, 2009; Valkauskas, 2007). We partly resolve this problem by modelling factual CPI inflation and data for the demand and supply factors for the period $t_2 - t$, which perfectly match the 1998–2008 inflationary cycle. We assume that in the period t_2 and t_1 inflation forms as a result of ongoing processes, while in the current period t the correlation coefficient reflects mutual dependence. This type of research practice is widely used (Sims, 2012; Vetlov, 2012; Mačiulaitytė, 2007; and others).

The research objectives are:

1. With the help of content analysis and Spearman’s ranking, to single out the demand and supply factors, which are **significant** for the inflation process, to group them, and to determine their mutual relationships.
2. Using pair linear correlation analysis, to determine the statistical dependence and strength of correlation between the identified (1) demand and supply factors and inflation.
3. Using multiple regression analysis, to develop inflation management models of the selected (1 and 2) demand and supply factors, and to determine the regression coefficients and assess their reliability.
4. Present generalizations and conclusions.

II. Content analysis

By the method of Content analysis, we chose factors of supply (12), demand (8), rational expectations, (5) and economic equilibrium (3), which are important for inflation. The size of the research includes 25 authors or groups of them (Mayer et al., 1995), who single out overall 28 (12+8+5+3) economic – social factors, which are important for the inflation and prices. As much as these factors are analysed in the context of economics, we can use this research for the whole of economics in general (Čekanavičius, Murauskas, 2000). The frequency of repetitions reaches 431 times (or 61,57 %), out of the maximum possible 700 times (25*28), when one of the authors mentions some of the chosen factors important for the inflation at least once. The research is considered reliable from both, the point of the authors and frequency because it undertakes the long period of time (from XVIII till XXI c.). Also, when the process of inflation develops, more and more factors are included into the process of analysis. Therefore, starting with the XIX c., when out of 532 (19*28) possible factors the authors mention chosen factors 364 times, the intensity of mentioning the factors grows to 68.42 %. After the Great Crisis of 1930, when out of 252 (9*28) possible times the authors mention chosen factors a 180 times, the intensity grows to 72.62 %. Considering the whole scope of the research, maximal meaning reaches 92.86% (mentioned 26 factors out of 28 possible), minimal – 17.86 % (5 factors out of 28).

By the analysis of *Content* (table 4) we distinguish such factors of the inflation of supply (in brackets there is the *intensity score* IS of Spearman ranking correlation coefficients ρ , which reveals the concise analysis and is calculated in this way: $\rho * \rho * 100$): 1. Aggregate supply – 24 (IS – 26.4) times; 2. Wages and salaries – 24 (39.2); 3. Expenditure of production – 24 (39.2); 4. Factors of capital – 23 (39.2); 5. Monopolies and competition – 22 (23.4 – supply analysis and 32.8 – demand analysis); 6. Human capital – 17 (23.6); 7. Technological development – 16 (34.3); 8. Labour productivity – 15 (25.2); 9. Force majeure: war, natural disasters, draft, bad harvest etc. – 14 (36.9); 10. Export – 8 (34.9); 11. The reserve of production – 7 (12.7); 12. Marginal product of capital (MPK) – 5 (31.7). Total: 199 mentions (46.17% of the common number of mentions). We can distinguish factors of the inflation of demand analogically: 1. Money factors – 23 times (IB – 6.5); 2. Aggregate demand – 22 (34.5); 3. Saving – 18 (37.8); 4. Amount of income – 18 (49.6); 5. Tax – 15 (49.1); 6. Usefulness of a commodity – 14 (33.3); 7. Distribution – 14 (40.6); 8. Import – 7 (25.5). Total: 131 mentions (30.39%). The method of *Content* allows to research effectively and group factors of the theory of inflation of contemporary rational expectations, which are important for the process of inflation. Up until now there was no possibility to find such division: 1. Institutional factors and rules – 20 times (factors of demand IS – 5.5; supply IS – 16.8); 2. Information – 13 (correspondingly 53.4 and 64.8 points); 3. Employment – 10 (58.0 and 60.1 points);

4. Expectations – 10 (53.0 and 55.7 points); 5. Prognosis – 7 times (54.9 and 46.9 points). Total: 60 mentions (13.92%). As the inflation unbalances the economical equilibrium, by the way of *content* analysis we examine how often factors of demand and supply are mentioned together with factors, which determine the economical equilibrium. Most commonly mentioned factors are: 1. Equilibrium of economics and prices – 17 times (demand IS -19.1, supply IS – 63.1); 2. Cycles of economics and business – 14 (43.7 and 69.7); 3. Growth of economics – 10 times (39.4 and 68.1). Total: 41 mentions (9.51%). We can divide the factors examined into three groups: *the most often* (19–25 times), *average recurring* (12–18 times) and *the fewest* (5–11 times).

The research of *content* (table 1) discloses that there is not one more optimal group. According to the number of factors, the most solid is the group of factors of supply inflation, the frequency of mentions of which or intensity is the biggest and reaches 66.33 %, but its dispersion (table 2) is also the biggest because of the wider number of factors – 7.04 (table 2). Frequency of the mentions of the factors of demand (65.50 %) does not lack far behind of supply, and the frequency of distribution of factors is rather close, dispersion not big. The scale of frequency of the factors of economic equilibrium is rather small, and STDEV is the smallest – 3.51. Frequency of mentions of the factors of rational expectations is smaller (48.00 %), because this theory of describing inflation is rather young.

TABLE 1. Values of the factors of inflation

	Measure of example	Max value	Min value	Average value	Frequency of mentions, %
Factors of supply	12	24	5	16.58	66.33
Factors of demand	8	23	6	16.38	65.50
Rational expectations	5	20	7	12.00	48.00
Economic equilibrium	3	17	10	13.67	54.67

Compiled by the author.

Taking into consideration this rather close diversity, it is not easy to ascertain the most reliable group. Therefore, it is necessary to examine the sample (Valkauskas, 2007) in order to be possible to check the groups examined on the aspect of reliability. The research of the reliability of sample discloses that the *sampling error* depends on (table 2) the *sample size and standard deviation*. As we can see, the sampling error μ of all the groups examined is rather small and fluctuates from 1.8 to 2.2, and it is a little smaller in the groups of *demand and economic equilibrium* (average sampling error – 2.02). As much as *the level of reliability depends on the sample size*, the error established is *accidental* (Valkauskas, 2007; Čekanavičius, Murauskas, 2000).

TABLE 2. Research of the sampling error

	Factors of supply	Factors of demand	Rational expectations	Economic equilibrium
σ	7.04	5.10	4.95	3.51
\sqrt{n}	3.46	2.83	2.24	1.73
μ	2.03	1.80	2.21	2.03

Here: σ – Standard deviation; n – sample size; $\mu (\sigma/\sqrt{n})$ – sampling error.
Compiled by the author.

After we have fixed the 3% limit of the sampling error, we can see that under the *normal dispersion of the sample error* (Valkauskas, 2007) all the samples of the groups of inflation factors (table 2) from the aspect of reliability are suitable for further analysis. However, this reliability of the sample *includes cipher meanings, but does not say anything about the content of the sample*. Therefore, a deeper analysis of the chosen factors of inflation is necessary.

Research of the common statistics of example allows singling out the *frequency of repetitions* (ni), *relative frequency* (vi) and *mode* (Luobikienė, 2011; Valkauskas, 2007; Čekanavičius et al., 2000).

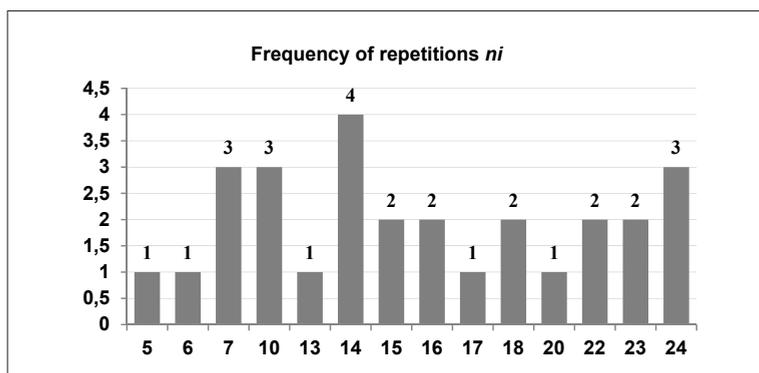


DIAGRAM 1. Distribution of frequency of variables (factors) important for inflation
Compiled by the author.

The research of the frequency of repetitions singles out that “*the value most often recurring in the data of a lot*” (Čekanavičius, Murauskas, 2000) *mode* is 14 (MO=14), which includes factors such as: *labour productivity, circumstances for major, usefulness of the commodity and economic cycles*. Modal amount includes all groups of factors except rational expectations. In addition, the connection of factors and the frequency of mentions, which is 7, 10 and 24 (all 3 times) also can be important for the research. This is *the reserve of production, import and prognosis (7); employment, expectations and*

the growth of economics (10) and exclusively factors of the group of supply: *common supply, wages and salaries, and the expenditure of production* (24). *Relative frequency of mode* (14) reaches almost half (0.143) of the accumulated relative frequency (0.32) of the other most often repeated factors (7; 10; 24) taken together. It is interesting to notice that while describing *economic cycles* in theoretical analysis out of 14 authors: *force majeure* is mentioned by 13 authors, *labour productivity* – by 9 and *usefulness of a commodity* – is mentioned as important for the inflation only by five authors. It might be important for the theory and practice of inflation that while analysing prognosis, only four authors out of seven mention the importance of the reserve of production, and only 3 authors mention *import* as important. Meanwhile, *growth of economics* in the analysed literature is too little connected with *the employment* (5 out of 10 authors), but is significantly connected with *expectations* (8 out of 10 authors).

Research of the relative frequency (table 3) discloses that in general there are no unimportant factors in the theory of inflation and prices. Therefore, the relative frequency of the group of not so often recurring factors (from 5 to 11 repetitions) coincides with the relative frequency of the group of most often recurring factors V_i (29%). Such factors are important for the analysis of inflation as *the reserve of production, export, import and MPK* are included into the group of most rarely repeated factors.

TABLE 3. Research of the relative frequency V_i of the factors important for inflation

Frequency of repetitions n_i	Number of factors	Relative frequency V_i
From 5 to 11	8	0.29
From 12 to 18	12	0.43
From 19 to 25	8	0.29
Total:	28	1

Compiled by the author.

As we can see (table 3), in the analysis of theory the second average group (from 12 to 15) has the biggest influence on inflation, which covers 12 factors, the relative frequency of which makes 43% of the common relative frequency. Therefore, while formulating the final model of inflation it is obligatory to examine the importance of the group of these factors for the CPI inflation. The third group of the most often-recurring factors (from 19 to 25) mostly consists of such factors of demand and supply as *money, wage, payment, capital, competition and monopolies etc.*

III. Analysis of the strength of relations and pair linear correlation

For the second stage of the research we choose factors created by the content analysis (tables 4, 5), except for the *force majeure*, the factors of *marginal capital of product*, the Spearman rank correlation coefficient and IS, which are high enough but their uncertainty

on the aspect of demand is one of the highest. In this stage of research we evaluate *straight and near to straight dependence* (Miškinis, 2010) between double correlation (coefficient of correlation R) of CPI inflation counted in Lithuania in 1998–2008, e. g. in the period of one cycle (1997, CPI – 8.4 percent and 2008, CPI – 8.5 percent) and factors of demand and supply of inflation chosen by using the method of content analysis. Coefficients of correlation are counted according to the widely used statistic function CORREL (Pabedinskaitė, 2005), which describes the method of smallest squares (Vetlov, 2012; Martišius, Kėdaitis, 2010; Valkauskas, 2007; Mačiulaitytė, 2007). In this research, not only *statistic but also semantic* logic relations are important (Luobikienė, 2003), e.g. at the aspect of import and export. Import is attributed to the factors of demand, because *the amount of goods brought into the country, depends on the level of demand of that country* (Čiegis, 2006; Smith, 2003). Therefore, export is attributed to the factors of supply because as it is accepted, *results of production depend not on inside, but on outside demand*, and it increases the price of demand in the exporting country, though with a later result (Mačiulaitytė, 2007; etc.). It must also be underlined that the average values of correlation coefficients (AVERAGE, \bar{x}), standard deviation (STDEV, S_x) and coefficient of variation ($V_x = S_x / \bar{x}$) are calculated regardless of the negative values of correlation coefficients (tables 4, 5). The results of the research revealed that during the analysed periods ($t-2-t$) the values of the coefficient of variation are low ($V_x < 0.10$) and the arithmetic medium reflects CPI inflation rather accurately. As the spread of the results of demand factors is lesser than of supply factors (the variation is lesser), it can be acknowledged that the demand in 1998–2008 during the analysed periods $t-2-t$ described the inflation process more accurately.

Research of the pair linear correlation discloses (table 4), that all the chosen factors of supply in period $t-2-t$ are important for CPI inflation. The results of the research showed that in period t the biggest importance for CPI inflation had *technological development* (investment), in period $t-1$ – *common supply, gross wage, expenditure of production and consumption of fixed capital (wear)* and in period $t-2$ again *aggregate supply and expenditure of production*. It is important to notice that the importance of *wage and the consumption of fixed capital and wear* to the inflation is the highest in period $t-1$. The average index of correlation of the factors mentioned in periods $t-t-2$ exceeds $R > 0.9$. This correlation dependence of the most often used factors of CPI inflation and supply reflects the theoretical conclusions and the conclusions of content analysis. In addition, it is necessary to pay attention to the higher correlation coefficients in period $t-2$ of the factor of *monopolies and competition, dci*, which reflect the common economic situation in the domestic market, *changes of the reserve of production and export*. Fluctuations of the reserves of production, which reflect the capacity of production not used (Butautas, 2011; Čiegis, 2006; Keynes, 1978), also predetermined its changeable importance for CPI inflation in period $t-1$. The research also showed that *the labour productivity* grew

TABLE 4. Research of the pair correlation of the factors of supply inflation and inflation, CPI 1998–2008

Factors of the supply inflation/ CPI inflation, 1998-2008m.		t_{-2}	t_{-1}	t
1.	Aggregate supply (income from selling+ reserve), million LTL	0.91	0.91	0.89
2.	Gross average monthly wage, LTL	0.89	0.91	0.89
3.	Production expenditure, million LTL	0.91	0.91	0.89
4.	Consumption of fixed capital, wear, million LTL	0.89	0.91	0.90
5.	Monopolies and competition, dci	-0.84	-0.73	-0.76
6.	Human capital, labour power, men and women, thousands	-0.65	-0.73	-0.79
7.	Technological advance, material investments, million LTL	0.90	0.90	0.91
8.	Labour productivity, surplus value for one employed at the current prices, thousand LTL for one employed	0.78	0.77	0.71
9.	Changes in inventories, million LTL	0.84	0.76	0.82
10.	Exports of goods and services, million LTL	0.89	0.88	0.85
	AVERAGE	0.85	0.84	0.84
	STDEV	0.08	0.08	0.07
	Coefficient of variation	0.10	0.10	0.08
	AVERAGE (positions 1-5)	0.89	0.88	0.87
	STDEV	0.03	0.08	0.06
	Coefficient of variation	0.04	0.09	0.07

Compiled by the author.

more quickly when the inflation was low in 2000–2003 (annual average 6.84 %) than when the inflation was high in 2005–2008 – 4.03 %. In addition, the *human capital* and *labour power* reacted extremely negatively to the changes of inflation in period t (table 4) and decreased consistently practically during the whole period.

Šalčius (1991) acknowledges, “*We must understand wage not only as the sum of money, paid for the work – nominal wages, but more like the real wage – what the worker can get for his monetary wage*”. This description of pay opens some contradictions between the nominal and the real sizes, between demand and supply and includes inflation and devaluation of money, so should be understood as “*the income of the worker*”, as its size. Therefore, we can admit that in supply price is formed by the nominal wage, and in the case of demand – real wage. Some of the causes of this fluctuation may be hidden in this contradiction, which we do not analyse in detail in this work. Keynes also acknowledges that *consuming depends more not on the real income (minus inflation) than on the monetary*. It means that the *value of money, nominal wage, amount of income, consumption and the level of prices* are connected. Therefore, we analyse *wage* as a factor of supply, and the *amount of income* – as a factor of demand.

The pair correlation dependence between the factors of inflation and of demand in the modelled periods $t_{-2} - t$ is shown (table 5) analogically to the correlation research of demand (table 4). In this case, in order to make the examples of the research equal (until 10 independent factors), the factor *aggregate demand* of the demand inflation is supplemented by two factors, which describe the inflation of demand: *expenditure of*

household and the expenditure of general government (positions 3–4). According to the research on income, made by the Statistical department according to quintal groups, *Distribution* as the function $S80/S20$ is calculated by the author because of the very short line (the years 2005–2009) and is only calculated in periods $t-1-t$. In addition, taking into consideration that CPI inflation is very important for the late *Distribution*, the function of distribution is analysed with the additional period $t+1$, so period $t-1$ practically is period t , and t is period $t+1$.

Results of the research proved that all the factors of demand are important for CPI inflation ($R^2 > 0.25$; Čekanavičius, 2011). The research showed (table 5) that at period t , *Distribution*, as the function $S80/S20$, *taxes (VAT)* and *the expenditure of general government* had the biggest impact on inflation. However, in periods $t-1$ and $t-2$ *the amount of income* had the biggest influence on inflation and this coefficient of correlation ($R= 0.93$, table 5) is bigger than that of *gross wages* ($R= 0.91$, table 4). Therefore, it is obligatory in the next research to include the factor of *human capital and employment*, which defines the size of income of work earned in the country. It is important that during the period $t-1$, the significance of *aggregate demand and the general government expenditure* for CPI inflation grows, which during the period t becomes smaller because of the not proportional growth of the governing expenditure and recession of the rate of the growth of inflation. The first presumption becomes proved that in spite of the growing division, *the general government* (table 5) may be interested in inflation, which considerably increases the income into the budget. In addition, it is necessary to notice the stable importance of *taxes (VAT)* for CPI inflation in period $t-t-2$. Besides, the correlation research shows the relations between the *expenditure of the governing sector and saving* ($R_{t-1} = 0.99$), which to some extent explains the rational view of people towards the persistently growing expenditure of the government

After comparing the average magnitude of correlation indicators of the factors of *demand and supply* inflation (tables 4 and 5), we can see clearly that the average correlation coefficients of the *factors of demand* ($R= 0.878$) towards inflation in the periods $t-2-t$ are bigger than of *supply* ($R= 0.845$), even if we do not pay attention to the negative meanings of the correlation coefficients. At the same time, if we compare the most often occurring factors in theory (positions 1–5), the average correlation coefficients of the factors of supply (respectively: $R= 0.870$ and $R= 0.878$) are bigger. The greater dependence between the average factors (demand positions: 6–9, table 5, and supply positions: 6–8, table 4) of demand inflation (respectively: $R= 0.884$ and $R= 0.797$) and CPI inflation was important for the bigger average correlation coefficient of the demand of common example (position 1–10, table 4 and 5), as in the content analysis (chapters 12–13). As is apparent, this study partly reflects the results of the content analysis, where the Spearman's rank on the average correlation coefficient of the average demand factors is $\rho= 0.647$ when of supply – $\rho= 0.545$.

TABLE 5. Research of the pair correlation of the factors of demand and inflation and CPI 1998-2008.

	Factors of the demand inflation/ CPI inflation, 1998–2008m.	t_{-2}	t_{-1}	t
1.	Money M3, remains at the end of the period, million LTL	0.90	0.90	0.84
2.	Aggregate demand, final consumption expenditure, million LTL	0.90	0.91	0.88
3.	Consumption, household expenditure, million LTL	0.90	0.90	0.87
4.	Consumption, expenditure of general government, million LTL	0.88	0.91	0.90
5.	Monopolies and competition, fci	0.84	0.73	0.76
6.	Saving, household deposits, million LTL	0.87	0.90	0.87
7.	Amount of income, wages and salaries, million LTL	0.93	0.93	0.89
8.	Taxes, VAT, million LTL	0.89	0.89	0.91
9.	Distribution, S80/S20	-	0.71	0.95
10.	Imports of goods and services, million LTL	0.90	0.90	0.88
	AVERAGE	0.89	0.87	0.88
	STDEV	0.03	0.08	0.05
	Coefficient of variation	0.03	0.09	0.06
	AVERAGE (positions 1-5)	0.88	0.87	0.85
	STDEV	0.03	0.07	0.06
	Coefficient of variation	0.03	0.08	0.07

Source: SD, WEF. Compiled by the author.

After comparing the factor of *monopolies and competition* from the aspect of demand and supply (tables 4, 5), we can distinguish two stages: the first 1998– 2003, when the average annual inflation reached 0.63 % and the *index of foreign competition* (fci) and analogically *domestic competition index* (dci) practically did not change (*fci* grew and *dci* became smaller 0.09 points); and the second, in 1999– 2003 under the conditions of deflation it even became smaller. At the same time in the years 2004– 2008 *fci* grew even bigger and *dci* accordingly became smaller by 2.82 points, when the annual value of inflation in that period was up to 5.40 %. In addition, the decreasing *human capital* (labour power) could have the significant negative importance for *dci* ($R\ t_{+1} - 0.932$), and correspondingly positive influence to *fci*. It means that the growth of *human capital* is an extremely important factor, which opens the hidden possibilities of competition in the domestic market. The results achieved partially explain the theoretical analysis, in which *monopolies and competitions* do not pay enough attention to human capital, mostly because of the lack of internalises of *money and income*.

IV. Analysis of the multinomial regression

According to literary review (Butautas, 2011), pair linear correlation analysis of demand and supply inflation factors, content analysis (tables 4 and 5) and the factors of inflation are being chosen for the multinomial regression analysis. The straight dependence is evaluated by the statistic function LINEST, as it describes the method of the smallest squares (Pabedinskaitė, 2005) and the equation is:

$$\pi = a_0 + a_1x_1 + a_2x_2 + \dots anxn + \varepsilon t.$$

Here: π – inflation, *CPI*; $x_1, x_2 \dots xn$ – values of factors; $a_0, a_1, a_2 \dots an$ – parameters of equation; εt – mistake of equation.

Methodical literature (Martišius, 2010; Čekanavičius, 2010 etc.) and scientific articles (Vetlov, 2012; etc.) approve such research methods. In the multinomial regression analysis all the quantities are standardised (Martišius, 2010), changing absolute quantities into the percent interchange expression ($\Delta X_t / \Delta X_{t-1}$). Taking into consideration the results of the theoretical, content and pair correlation analysis to the regression models we include *human capital, employment** (note below: * *The data of employment is presented by the Statistics Lithuania on the basis of “Statistical labour force survey: methodology” (2013) with the more precise data of the employed of 2007 and 2008*). We reject factors of labour power and the level of unemployment, because if we include them, the reliability of the model is decreasing. For the analysis three regressive models are chosen, because they describe the problems of inflation in the best way and correspond to the actualities of contemporary economic theories and practices. While making models, the attention was paid to the quantity of examples (Vetlov, 2012; Čekanavičius, 2010) and “*rather unlimited specification, when there are so many macroeconomic variables that the system would stop the main macroeconomic alterations*” (Sims, 2012). For the first multinomial regression model we choose: factors of *human capital, employment* (y_1); *gross average monthly wage* (y_2) and *expenditure of general government* (y_3):

$$\pi_1 = -0.497 - 0.634y_1 + 0.215y_2 + 0.173y_3. \quad (1)$$

In this model the most important factors for the index of inflation and CPI are *human capital, employment* (y_1), in second place is *gross wage* (y_2) and not far behind is *expenditure of general government* (y_3). It is necessary to mention that the final meanings of the model are different from the primary parameters because of their different averages (look at the specification, table 6). Also, because the average of employment is negative (-0.389), as well as the parameter of the model (-0.634), the final size of employment becomes positive (in all models under research). At the same time, the final meaning of wages is much bigger than *the expenditure of general government* because of the higher fluctuating average. The equality (1) shows how much *the meaning of the index of result changes according to the changes of the factorial meaning of the index*. According to the absolute expression, only *labour productivity* in the period under research diminished inflation rather significantly – on average the annual percent was 0.54, but this index is not included into the model because of the rather large sample. Because of this, it is necessary to evaluate the errors of the remnant with some carefulness (Vetlov, 2012; Čekanavičius, Murauskas, 2002; etc.). The reliability of the model is high enough: Fisher’s distinction reaches F-53.90 and coefficient of determination $R^2 = 0.96$, so it did

not have a great importance for the reliability of the model (correlation, F distinction, and remainder). When we include other factors into the model, we also see that such factors of supply as *expenditure and production* are important to inflation.

Into the second model of demand we include *human capital, employment*, as a stabilizing factor for the model; that's why this model consists of: *human capital, employment* (x_1), *expenditure of general government* (x_2) and *household expenditure* $t-1$ (x_3) factors:

$$\pi_2 = -1.920 - 0.618x_1 + 0.196x_2 + 0.323x_3 t-1. \quad (2)$$

As we can see in this model of demand (equation 2), comparing it with the first model, the importance of human capital and employment becomes a little smaller, though it remains the most important model describing parameter. Also, the importance of *expenditure of general government* becomes a little smaller (0.02). At the same time, *consuming and household expenditure* is extremely important for CPI inflation in the second model. Though the analysis of double linear correlation (table 5) shows that in the period t and $t-1$ the importance of *the expenditure of general government* for inflation is a little bigger. It is necessary to stress that in both cases smaller parameters of *the expenditure of general government* created immoderate policy of the governmental expenditure, which predetermined much smaller governmental expenditure during the economic crisis of 1999 (-10.8%). Both of these models show that *the expenditure of general government* is important for inflation, practically irrespective of the influence of other factors. It is interesting that when we include the meaning of taxes and VAT into the model, the importance of *the expenditure of general government* and *household* for CPI inflation proportionally becomes smaller. Therefore, when we decrease or increase the rate of VAT, it is necessary to pay attention to it. When we include the value of the expenditure of household with overdue ($t-1$) into the model, parameters of the equation practically do not change, but the reliability of the model grows rather sharp (R, F, σ). The Fisher's distinction in this model reached F – 62.43, and the determination coefficient $R^2 = 0.97$.

For the third multinomial regression model of the inflation of demand and supply (tables 4 and 5) we chose these factors of demand and supply: *human capital, employment* (z_1), *money M3* $t-1$ (z_2) and *consumption of fixed capital, wear* (z_3):

$$\pi_3 = -2.091 - 0.602z_1 + 0.094z_2 + 0.504z_3. \quad (3)$$

To compare with the models discussed above (1 and 2), *the importance of human capital and employment for CPI inflation* decreases a little, *but in this monetary model extremely great importance of consumption of fixed capital and wear to CPI inflation becomes clearer*. This importance of capital to CPI inflation, so called “*capital shock*” (Phelps, 2006; Kydland, Prescott, 2004), *is strengthened evidently by the decisions of monetary policy*. As well as in the case of *expenditure of general government*,

inconsequence of *monetary policy* only makes those shocks more clear. *Value of money* $M3_{t-1}$ (divided by GDP deflator, 2005=1) in the final counting grows because of the higher average value (16.6 % a year, table 6) in the period under research. When we include the value of *money* $M3$ in period $t-1$ into the model, money is evaluated considerably better, the importance of *human capital* goes down a little, when the reliability of this evaluation grows ($p < 0.10$), and the parameter of capital practically does not change. This analysis of *money* $M3$ in period t and $t-1$ in the model (3), also shows that while taking decisions on economic politics, it is most probably advisable not to pay attention to the monetary policy of the previous period. Fisher's distinction in this model reaches $F - 99.1$, coefficient of determination $R^2 - 0.98$. Besides, tighter connection between employment and $P3$ in Keynes way becomes a little clearer, but it did not have a big influence on the reliability of the model (F, R, σ). After evaluating the residual mistakes of equations (2.1 – 2.6) (Čekanavičius, Murauskas, 2004), we can see that their values are stationary, located in the interval from -1.5 to 1.5, scatter of mistakes (σ – standard deviation) is not bigger than 0.7 and is similar in all the models (the smallest (0.48) is in the monetary model period $t-1$). It is important that when we include *gross wage* (equation 1) into the model of the management of inflation, average size of other factors are not included into the model decrease. This model described inflation in the precise way in 2004, when inflation reached 2.9 %, the weight of other factors was 0.004 and the error of the equation was 0.5.

TABLE 6. Final specification of the value of models of demand and supply inflation

Model	R ²	F	Average standard deviation of parameters estimation, σ	Human capital, employed	Money, $M3_{t-1}$ / GDP deflator	Consumption of fixed capital, wear
1	2	3	4	5	6	7
π_3	0.980	99.101	0.073	0.234	1.555	3.141
				Human capital, employed	Expenditure of general government	Household expenditure, t-1
π_2	0.969	62.432	0.067	0.240	1.307	3.213
				Human capital, employed	Gross wage	Expenditure of general government
π_1	0.964	53.899	0.065	0.247	1.937	1.153

Compiled by the author.

In the specification of *the models of demand and supply inflation* (table 6), final average expression of value of corresponding models (equations 1–3) with respect to CPI inflation, becomes clearer. We can divide the example of CPI inflation under research into two periods. The first 1998–2003, in which annual average value of CPI

inflation reaches 0.63 %, and the second 2004–2008, in which annual average value of CPI inflation reaches 5.40 %, when 1998–2008 – 2.84 %. The influence of other factors to the inflation in the models (equations 1-3) distributed similarly, e. g. deposit of the *capital* for the inflation (equation 3) in 1999–2003 reached an average of 0.56 % a year, and in the second period – 5.72 %. At the same time, the influence of the deposit of *gross wage* (equation 1) to the inflation in the first period reached an average of 0.63 % a year, and in the second period – 3.24 %. In addition, the *gross wage* deposit in the model of inflation in 2000, when the absolute size of it decreased was even negative. Meanwhile, the average influence of *general government expenditure* to the inflation in both models (equations 1–2), in 1999 this expenditure decreased by 10.8 %, in the first period was even negative, when in the second period it reached 2.40 % (equation 1) and 2.72 % (equation 2). The tendencies of the deposits of other parameters totally differ e.g., the importance of *money M3t₋₁* (divided by GDP deflator, 2005=1) to the inflation in 1999–2003 was on the average of 1.42 %, when in 2004–2008 it reached 1.69 %. In addition, it coincided with the dynamics of absolute sizes. Accordingly, the importance of the *household expenditure* to the inflation in the annual average in the first period reached 2.05 %, and in the second period – 4.38 %. As we can see the *household expenditure* coincided more with the tendencies of *capital* and of *general government expenditure*. Meanwhile the number of employed in the period under research in Lithuania increased at annual average of 0.21 %, though theoretically (Keynes, Cassel, Phelps and others) when the inflation grows, employment is expected to increase much more. Emigration in this period could have had a great influence on the negative dynamics of employment as it reached an average of 12.83 thousand per year in 1998–2003, while under the conditions of the highest inflation in 2004–2008 it reached – 36.82 thousand, 72.5 percent of which were most employable people from 15 to 44 years old. Though the growth of economics in this research is not analysed separately, the importance of this factor to inflation is reflected in the models examined, as a deposit of factors. Similarly to these tendencies the GDP changed and reached an average of 5.67 % and 7.14 %, and during the whole analysed period – 6.34 %. It is evident that the high inflation in the period 2004–2008 did not allow reaching the planned social-economic objectives to keep the low inflation and the high level of employment (Phelps, 2006; Kydland, Prescott, 2004) and thus decrease emigration.

V. Conclusions

1. The literature review (Butautas, 2011) and content analysis made it relatively easy to effectively identify and group the most important supply and demand factors for inflation and to distinguish the *economic and price equilibrium* and the *rational expectations* factor groups. RGT and Spearman's rank correlation methods effectively helped to determine the mutual relationships between the factors (Tables 4 and 5) in

the theoretical analysis. Pair correlation confirmed the importance for inflation of the factors selected by content analysis in the period $t-2 - t$, while regression models helped flush out this link.

2. Content analysis and Spearman's rank correlation showed that in their theoretical analysis, the inflation factors that authors most frequently single out are *aggregate supply, wages and production costs, money and capital, aggregate demand, and monopolies and competition*. The research revealed that in the theory of prices and inflation, the demand factors that are most closely inter-related are: *the amount of income, taxes, saving, and income distribution*. The supply factors that are most inter-related are: *wages, production costs and capital, force majeure situations, and exports*. Meanwhile, the weakest inter-relation in the theoretical analysis of inflation was found to be *money and imports* on the demand side, *production reserves* on the supply side. The study found a weak relationship between the *institutional* factor and other rational expectations factors in terms of demand and supply, and a weak relationship between *economic and price equilibrium* factor and other equilibrium factors of demand. These analytical discrepancies, particularly in respect of *money*, may have had very large implications for the manifestation of inflation throughout history.
3. Pair correlation enabled clarification of the combined impact of demand inflation factors on *private households and general government expenditure*. Further research confirmed such necessity. The research results showed that virtually the factors selected by content analysis (p. 2) were significant for CPI inflation during the examined period of 1998–2008 ($R > 0.65$). The results showed that in the current period t the factors with the largest impact on inflation were *distribution, taxation (VAT), technological progress (investment), government expenditure, capital consumption, wear and aggregate supply*. Meanwhile, for the periods $t-2 - t$, the greatest influence on CPI inflation was displayed by demand factors such as *the amount of income, general government expenditure, aggregate demand and final consumption expenditure*, and by supply factors including *production expenditure, aggregate supply and capital consumption, wear*. It should be noted that for the period $t-2 - t$, *income and government expenditure* maintained a constant relation of CPI inflation.
4. Multi-linear regression models (Equations 1–3) confirmed that the most frequently occurring factors in the content analysis – *capital, money and wages* – combined in the linear correlation study with *households and government expenditure*, yielded a rather precise description of the inflation process. Upon inclusion in the model of wages (Equation 1), the influence on CPI inflation of other factors not included in the study decreased very significantly. The research results appear to confirm that *insufficiently coherent central bank and government expenditure policy in fact prevented achievement of the goals of this policy, namely low inflation and high employment* (Lucas, Sargent, Wallace, and others).

5. Pair correlation analysis confirmed the results obtained by the Spearman ranking method that *wages* provide a Keynesian representation of the other factors of production, *income and taxes* are the most significant demand factors of inflation and that the demand factors as a whole are more significant for inflation (average correlation coefficient of $R = 0.88$) than supply factors ($R = 0.84$). The research results suggest that the combined impact of supply factors is rather clear, while demand factors in the theoretical analysis need to be supplemented by *households and government consumption* in further studies. Moreover, in order to equalize the number of factors, wages in theoretical analysis of supply can be seen as representing the costs of production, and demand analysis can be supplemented with factors such as *poverty, delayed demand*, and so on. The modest results of this study permit the conclusion that this composite research method is simple and efficient to use, helps to distinguish important and less significant inflation factors, group them, expose their mutual inter-relations and compare the theoretical and statistical results, giving the latter the proper status, i.e., for comparing theory with practice.

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