"The modeling of equilibrium of the reinsurance markets in Germany, France and Ukraine: comparative characteristics"

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The modeling of equilibrium of the reinsurance markets in Germany, France and Ukraine: comparative characteristics

Abstract

The article studies the modeling of equilibrium of the reinsurance markets in Germany, France and Ukraine, identifies their positions on the basis of deviations from the equilibrium point and optimization of the basic parameters of reinsurance companies' functioning. It is suggested to consider the utility theory as the basis of mathematical formalization of demand and supply functions.

Keywords: reinsurance market, demand market, supply market, equilibrium point, utility theory.

Introduction

In conditions of functioning of the contemporary insurance market the determination of its inadequate position is accompanied by the formation of tactical and strategic goals, which do not correspond to the needs of its major subjects. The consequence of these tendencies is the inconsistency between the main trends of the country's internal insurance market and the global development trends. In its turn, the deepening of the imbalance between the demand and supply is also observed on the reinsurance market, which is a derivative of the insurance market and reflects a considerable part of big risks, which are reinsured. At the same time, it should be noted that the distortion of the trends of the insurance market development makes it impossible to use the economic indicators of its functioning as the indicators of crisis phenomena. As distinct from the insurance market, an adequate identifier of the insurance market deviation from its equilibrium point is the market of reinsurance, which makes it possible to use the economic indicators of its functioning as the criteria of crisis phenomena.

The research of the general tendencies of the reinsurance market's functioning and development is carried out in the works of such authors as V.D. Basylevych, K.S. Basylevych, O.O. Vlasenko, L.O. Pozdnyakova, V.M. Furman, V.V. Shahova and others.

Earlier unsolved parts of the general problem. In most of the contemporary scientific works dedicated to the research of the reinsurance market no proper attention is paid to the issue of this market's equilibrium position, the formation of the necessary conditions for its achievement as well as the practical aspects of the modeling of reinsurance markets equilibrium and the forecasting of the further development trends. Moreover, no adequate attention was given to the determination of peculiarities of reinsurance markets functioning in different countries with the goal of their further comparison and the formation of specific characteristics and stability intervals of the achieved equilibrium points.

The goal of the paper is the formalization of demand and supply of the reinsurance market as the basis for the modeling of the market's equilibrium, definition of the specific features and general patterns for the achievement of equilibrium of the reinsurance market in Germany, France and Ukraine.

1. The main results of the research

At the present phase of the life cycle the reinsurance market is defined as a totality of relationships between the insurance and reinsurance companies, in which the subject of agreements is the insurance protection of companies, the formation of its demand and supply according to the conditions of its functioning in relation to the optimal equilibrium point. The increase in the re-insurers' quality, the provision of the guaranteed and timely insurance payments as well as the aspiration of insurance and reinsurance companies to maintain an adequate level of efficiency in the competitive environment is possible only if the real economic situation of the insurance market's current state is adequately defined. Therefore, it is necessary not only to find an equilibrium point of the reinsurance market, but to determine the optimal range for the changes of its parameters relating to this equilibrium position with the purpose of the further planning of the activities of the market's principal participants.

The main characteristics of the reinsurance market are the supply and demand, which can be defined as the expected utility for the insurance company from reinsuring significant risks ($U(x)$) and the expected utility of the reinsurance company's profit ($V(y)$). The formalization of the supply and demand on the market is conducted on the basis of the following ratio:

$$U(x): = \left[p \cdot u \left[q \cdot \left[\alpha \cdot (1+\theta)\right]x\right] + (1-p) \cdot u \left[A - r \cdot \left[\alpha \cdot (1+\theta)\right] \cdot x\right]\right] -$$
$$- \left[p \cdot u \left[q \cdot \left[(1-\alpha) \cdot (1+\phi)\right] \cdot x\right] + (1-p) \cdot u \left[A - r \cdot \left[(1-\alpha)\right] \cdot (1+\phi)\right] \cdot x\right]] \tag{1}$$

where x is the value of the insurance asset; p is the probability of insured accidents; $u(\cdot)$ is the function of utility of the insurance company, defined by the size of the remaining asset after the insurance accident (as the value of the minimal guaranteed remaining asset depending on the size of the insured asset is presented in the form of the second degree polynomial, this function would be $u(v) := a \cdot v^2 + + b \cdot v + c$); q is a part of insurance payments of the reinsurer in the structure of the insured asset; α is a part that the

ceding insurance company retains; θ is a risk premium of the ceding insurance company; A is a pecuniary valuation of the object of insuring; r is a part of insurance deposits of the ceding insurance company in the structure of the insured assets; ϕ is a risk premium of the reinsurance company.

The optimization of the ceding insurance company's activity on the reinsurance market is connected with the definition of such parameters as the value of the insured asset

$$x := -\frac{b \cdot p \cdot q - 2 \cdot A \cdot a \cdot r \cdot b \cdot r + b \cdot p \cdot r + 2 \cdot A \cdot a \cdot p \cdot r}{2 \cdot a \cdot r^2 + 2 \cdot a \cdot \phi \cdot r^2 + 2 \cdot a \cdot p \cdot q^2 - 2 \cdot a \cdot p \cdot r^2 + 2 \cdot a \cdot \phi \cdot p \cdot q^2 - 2 \cdot a \cdot \phi \cdot p \cdot r^2 + 2 \cdot a \cdot \alpha \cdot \theta \cdot r^2 - 2 \cdot a \cdot \alpha \cdot \phi \cdot r^2 + 2 \cdot a \cdot \alpha \cdot \theta \cdot p \cdot q^2 - 2 \cdot a \cdot \alpha \cdot \phi \cdot p \cdot q^2 - 2 \cdot a \cdot \alpha \cdot \theta \cdot p \cdot r^2 + 2 \cdot a \cdot \alpha \cdot \phi \cdot p \cdot r^2} \tag{2}$$

and the part retained by the ceding insurance company

$$\alpha := \left[\frac{(1+\phi)}{(\theta+2+\phi)} \cdot \frac{1}{2} \cdot \frac{\left(-2 \cdot p \cdot a \cdot q^2 \cdot x \cdot \phi - 2 \cdot a \cdot r^2 \cdot x \cdot \phi + 2 \cdot p \cdot a \cdot r^2 \cdot x \cdot \phi + b \cdot r - 2 \cdot a \cdot r^2 \cdot x - p \cdot b \cdot q - 2 \cdot p \cdot a \cdot A \cdot r - p \cdot b \cdot r + 2 \cdot p \cdot a \cdot r^2 \cdot x - 2 \cdot p \cdot a \cdot q^2 \cdot x + 2 \cdot a \cdot A \cdot r\right)}{a \cdot x \cdot \left(-p \cdot q^2 \cdot \phi - r^2 \cdot \phi + r^2 \cdot p \cdot \phi + p \cdot q^2 \cdot \theta - p \cdot r^2 \cdot \theta + r^2 \cdot \theta\right)}\right], \tag{3}$$

where a, b, c are the constant values, the parameters of the function of utility of the ceding insurance company.

These are the determining values for management decisions as they are the basis for reinsurance operations and influence the profitability of companies.

Thus, the reinsurance company tries to satisfy the demand on the market by carrying out reinsurance operations, the analytical expression of which characterizes the expected utility of the reinsurance company's profit:

$$V(y): = 1 - u(P),$$
$$P := \left[r \cdot \left[(1-\alpha) \cdot (1+\phi)\right] \cdot (1-Is) - (q-r) \cdot \left[(1-\alpha) \cdot (1+\phi)\right] \cdot Is\right] \cdot y, \tag{4}$$

where P is a profit of the ceding insurance company (the increase of this value is accompanied by the worsening of the reinsurance company's profitability indicators); Is is an indicator of the insured accident (receives the value "1" with the occurrence

of the insured accident and value "0" in other cases); y is the value of the insured asset (chosen by the ceding insurance company).

The analytical expression of parameters for the optimization of the reinsurance company:

$$y := -\frac{b}{2 \cdot \left[Is \cdot (q-r) \cdot (\varepsilon-1) \cdot (\phi+1) + r \cdot (Is-1) \cdot (\alpha-1) \cdot (\phi+1)\right]},$$

$$\alpha := \left[1 \frac{1}{2} \cdot \frac{\left(2 \cdot r \cdot a \cdot y \cdot \phi + 2 \cdot r \cdot a \cdot y - 2 \cdot a \cdot y \cdot Is \cdot q \cdot \phi + b - 2 \cdot a \cdot y \cdot Is \cdot q\right)^{-}}{a \cdot y \cdot (r \cdot \phi + r - Is \cdot q \cdot \phi - Is \cdot q)}\right]_{-}. \tag{5}$$

The establishment of balance on the reinsurance market requires the estimation of such level of the insured asset of the ceding insurance company, which optimizes the

activity indicators of all market participants, that is $x = y$. So, we can obtain the dependence between the main parameters of the supply and demand functions:

$$p := \frac{b \cdot r + 2 \cdot A \cdot a \cdot r + \dfrac{b \cdot \left(2 \cdot a \cdot r^2 + 2 \cdot a \cdot \phi \cdot r^2 + 2 \cdot a \cdot \alpha \cdot \theta \cdot r^2 - 2 \cdot a \cdot \alpha \cdot \phi \cdot r^2\right)}{2 \cdot a \cdot \left[Is \cdot (q-r) \cdot (\alpha-1) \cdot (\phi+1) + r \cdot (Is-1) \cdot (\alpha-1) \cdot (\phi+1)\right]}}{b \cdot q + b \cdot r + 2 \cdot A \cdot a \cdot r - \dfrac{b \cdot \left(2 \cdot a \cdot q^2 - 2 \cdot a \cdot r^2 + 2 \cdot a \cdot \phi \cdot q^2 - 2 \cdot a \cdot \phi \cdot r^2 + 2 \cdot a \cdot \alpha \cdot \theta \cdot q^2 - 2 \cdot a \cdot \alpha \cdot \phi \cdot q^2 - 2 \cdot a \cdot \alpha \cdot \theta \cdot r^2 + 2 \cdot a \cdot \alpha \cdot \phi \cdot r^2\right)}{2 \cdot a \cdot \left[Is \cdot (q-r) \cdot (\alpha-1) \cdot (\phi+1) + r \cdot (Is-1) \cdot (\alpha-1) \cdot (\phi+1)\right]}}. \tag{6}$$

In the equilibrium point (the equality of the retained part of the ceding insurance company on the one hand, and the activity of the reinsurance company

during the optimization of the insurance company's activity, on the other hand) the value of the insurance asset is as follows:

$$-\frac{1}{2} \cdot b \cdot \frac{(\theta + 2 + \phi)}{a \cdot (r \cdot \phi + r - Is \cdot q \cdot \phi - Is \cdot q + r \cdot \phi \cdot \theta + r \cdot \theta - Is \cdot q \cdot \phi \cdot \theta - Is \cdot q \cdot \theta)},$$

(7)

$$\frac{1}{2} \cdot \frac{(-b \cdot r + p \cdot b \cdot q + 2 \cdot p \cdot a \cdot r \cdot A + p \cdot b \cdot r - 2 \cdot a \cdot r \cdot A)}{a \cdot (-r^2 + r^2 \cdot p - p \cdot q^2 - p \cdot q^2 \cdot \theta + r^2 \cdot p \cdot \theta - r^2 \cdot \theta)}.$$

Therefore, the modeling of equilibrium of the reinsurance market makes it possible to assess the values of the insured asset and the part retained by the ceding insurance company itself. The deviation from the equilibrium values becomes the characteristic of the current state of the reinsurance market at the present stage of its life cycle in general and the strategies of the market participants (insurance and reinsurance companies).

We will analyze some practical aspects of establishing equilibrium on the reinsurance market in the following three countries: Germany, France and Ukraine. We will study the peculiarities of achieving the equilibrium, the peculiar features and differences in establishing the equilibrium on the reinsurance market of each country. It is necessary to emphasize that the incoming data for the reinsurance market modeling are the quantitative characteristics and such indicators as premiums for reinsurance and payments compensated to reinsurance companies (Table 1).

Table 1. Incoming data for the modeling of equilibrium on the reinsurance market in Germany, France and Ukraine (mln. euros/year)

	Germany		France		Ukraine	
	Paid for reinsurance (mln. euros)	Payments reimbursed to reinsurance companies, (mln. euros)	Paid for reinsurance, (mln. euros)	Payments reimbursed to reinsurance companies, (mln. euros)	Paid for reinsurance, (mln. euros)	Payments reimbursed to reinsurance companies (mln. euros)
2001	24484,60	12131,86	12,00	11,90	1294,02	91,22
2002	25984,40	12494,01	14,00	12,20	2105,56	148,43
2003	22910,30	9103,52	17,30	14,60	5416,90	381,86
2004	22157,60	7862,64	18,10	13,70	11674,07	822,96
2005	22964,80	7680,51	21,50	17,90	6046,97	426,28
2006	19307,40	4945,16	20,20	16,60	5621,70	396,30
2007	17925,20	3850,32	22,80	19,80	6423,90	654,70
2008	17536,60*	2386,60*	21,60	19,80	9064,60	926,50
2009	16358,80*	909,30*	-	-	8888,40	967,90

Note: * – according to the linear trend.

We will conduct the research of regularities in the development of reinsurance market in Germany.

Based on the data in Table 1 and analytical correlations (equations (1) and (4)), which characterize the function of demand and supply of the reinsurance market as a function of expected utility, we present the results of the conducted calculations in Tables 2 and 3.

Table 2. Calculation of quantitative characteristics for the formalization of demand and supply of the reinsurance market in Germany

	r	q	v	$u(v)$	$U(x)$	t	$u(t)$
2001	24484,60	12131,86	50587,57	-23031671060,37	23049895328,69	-84017,53	-63530931542,34
2002	25984,40	12494,01	52097,71	-24427282324,93	27097480469,01	-90271,42	-73340812237,66
2003	22910,30	9103,52	37959,99	-12968460686,80	19853427350,24	-77452,99	-53991084982,37
2004	22157,60	7862,64	32785,76	-9673990740,40	18325421405,54	-74314,38	-49704010249,87
2005	22964,80	7680,51	32026,28	-9230985142,38	20294061274,83	-77680,25	-54308379136,16
2006	19307,40	4945,16	20620,38	-3826695700,88	12727334627,58	-62429,57	-35077377451,90
2007	17925,20	3850,32	16055,10	-2319816780,68	10320753205,27	-56666,06	-28899662240,83
2008	17536,60	2386,60	9951,68	-891273084,01	9775865084,32	-55045,67	-27270505555,49
2009	16358,80	909,30	3791,61	-129367892,97	7962715945,77	-50134,46	-22621429137,45

Table 3. Calculation of quantitative characteristics for the formalization of demand and supply
of the reinsurance market in Germany

	v^*	$u(v^*)$	t^*	$u(t^*)$	P	V(x)
2001	37892,63	-12922474521,33	-58396,51	-30691659366,90	41130,20	15225032660,58
2002	39023,80	-13705517342,12	-63080,98	-35813206666,74	44918,13	18158522997,57
2003	28433,94	-7276258732,86	-53479,34	-25740623963,45	45971,60	19020263464,80
2004	24558,18	-5427814976,17	-51128,36	-23527234169,66	47597,06	20389084910,45
2005	23989,29	-5179255800,36	-53649,56	-25904749236,16	50891,20	23308972254,82
2006	15445,70	-2147048433,26	-42226,04	-16047558723,40	47821,11	20581488383,49
2007	12026,08	-1301578852,49	-37908,88	-12933937587,40	46864,30	19766128904,68
2008	7454,31	-500062745,52	-36695,13	-12118973957,79	50444,05	22901169489,91
2009	2840,11	-72581679,42	-33016,39	-9810900814,17	51441,28	23815590017,87

By presenting the graphic interpretation of the modeling results of the current state of the reinsurance market in Germany as a deviation from equilibrium points, it is necessary to indicate that for the reinsurance market of this country the equilibrium state was observed only in 2003. Moreover, it should be noted that from the beginning of that period a fundamental change in the demand and supply ratio has taken place. Thus, the value of supply function has always exceeded the value of the function of demand for reinsurance operations. Within the period of 2004-2007 and the predicted 2008-2009 there was a constant growth of gap between demand and supply. Within these periods one should emphasize two points: 2005 – the convergence of extreme points of the two functions; 2007 – the points of the crossing of the two functional dependencies. Based on the predicted values of demand and supply on the market of reinsurance in Germany in the period of 2008-2009, one can make a conclusion about the growing gap between the analyzed functional dependencies.
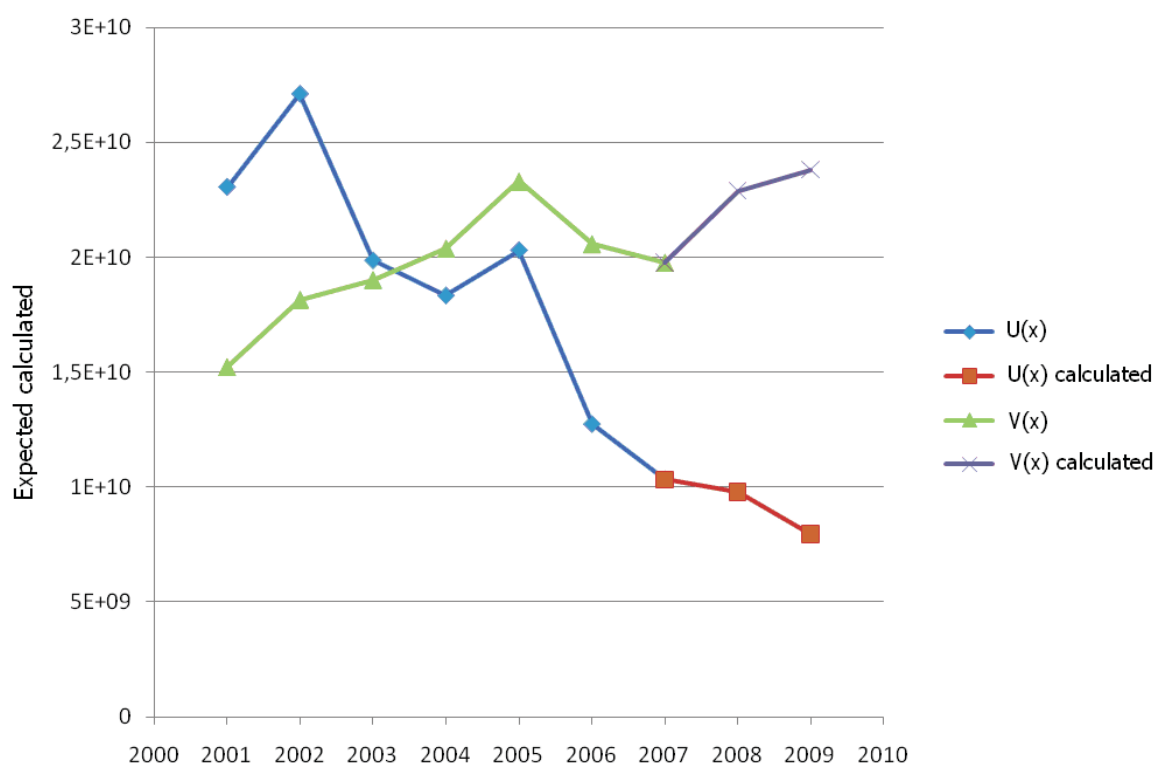

Fig. 1. The dynamics of demand and supply on the reinsurance market of Germany within the period of 2001-2009

During the modeling of equilibrium of reinsurance markets there is a growing importance in the assessment of the mathematical model's management – the value of the insured asset, which value of the demand function corresponds to the value of the supply function. For the reinsurance market in Germany the achievement of the equilibrium point is possible only with the value of the insured asset at about 18500 mln. euros (see Figure 2).
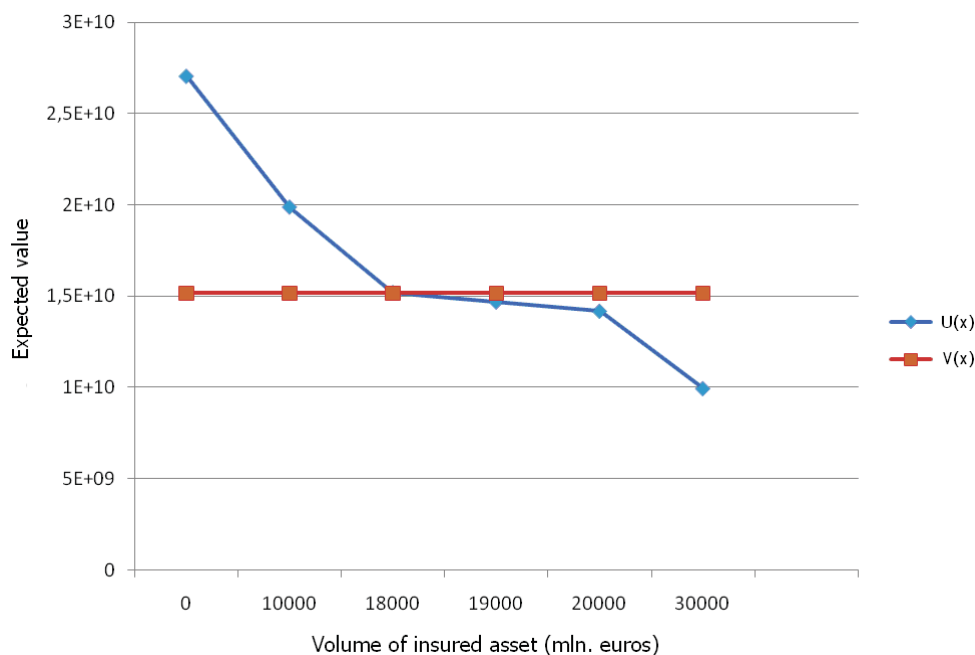
Fig. 2. The assessment of the expected value of the insured asset, which makes possible the convergence of the demand and supply functions on the reinsurance market in Germany

Now we will study the peculiarities of establishing equilibrium on the reinsurance market in France. The data about the dynamic changes in the formation of demand and supply function is in Tables 4 and 5.

Table 4. Calculation of quantitative characteristics for the formalization of demand and supply of the reinsurance market in France

	r	q	v	$u(v)$	$U(x)$	t	$u(t)$
2001	12,00	11,90	214,25	-412042,40	65451,77	99783,95	-89611036495,22
2002	14,00	12,20	219,65	-433107,26	66124,84	99747,95	-89546374261,49
2003	17,30	14,60	262,86	-620530,03	72387,07	99688,53	-89439732598,89
2004	18,10	13,70	246,65	-546308,18	69867,41	99674,13	-89413889643,27
2005	21,50	17,90	322,27	-933110,19	82854,70	99612,92	-89304098740,50
2006	20,20	16,60	298,87	-802387,65	78468,58	99636,32	-89346069650,94
2007	22,80	19,80	356,48	-1141903,22	89874,71	99589,51	-89262137690,44
2008	21,60	19,80	356,48	-1141903,22	89897,35	99611,12	-89300870617,35

Table 5. Calculation of quantitative characteristics for the formalization of demand and supply of the reinsurance market in France

	v^*	$u(v^*)$	t^*	$u(t^*)$	P	$V(x)$
2001	217,83	-425956,96	99780,34	-89604547405,44	2,93	62,56
2002	223,32	-447732,69	99743,73	-89538806411,55	52,72	24749,47
2003	267,25	-641480,05	99683,32	-89430386515,48	79,08	55884,00
2004	250,78	-564753,66	99668,68	-89404112795,67	128,87	148816,42
2005	327,66	-964607,17	99606,44	-89292492550,02	105,44	99525,06
2006	303,86	-829473,96	99630,24	-89335162646,49	105,44	99525,06
2007	362,44	-1180444,74	99582,65	-89249832646,46	87,86	69041,40
2008	362,44	-1180444,74	99604,61	-89289210657,10	52,72	24749,47

Based on the results of the calculations presented in Tables 4 and 5 we will graphically show the relationship between the demand and supply functions of the reinsurance market in France (Figure 3). We can make a conclusion that during the period of 2001-2008 the peculiar feature of the reinsurance market in France is the presence of three

equilibria: in 2003, 2005 and in the end of 2006. It should also be mentioned that within 2001-2008 the reinsurance market in France experienced three different ranges of correlation between the functional dependencies of demand and supply:

1. 2001-2003. During this period one observed bigger demand than supply. While the two

functions were growing the gap was reduced and, as a result, we had the equilibrium point in 2003.

2. 2003-the end of 2006. This period is characterized by the supply function exceeding the demand function and the constant fluctuation of these two functions. In 2004 the biggest gap between the values of the functional dependencies of demand and supply was observed. In 2005 the values of these functions returned to equilibrium state.

3. 2007-2008. The peculiarity of this stage is the return to the tendency when demand exceeded supply on the reinsurance market in France. It should be noted that the supply function has a tendency towards reduction during this period while the demand function becomes constant. As a result, the gap between the values of the functional dependencies of demand and supply grows.

Fig. 3. The dynamics of demand and supply on the reinsurance market in France in 2001-2008

Having studied the functions of demand and supply on the reinsurance market in France, we can determine when the equality of values of the functional depen-dencies of the market is possible. Figure 4 shows the dynamic changes not only of demand and supply functions, but also the absolute value of differences between these values. It is offered to identify an equilibrium value of the insured asset on the basis of the change in the sign of the function, which reflects the difference between demand and supply. Therefore, the insured asset of 29,3 mln. euros corresponds to establishing equilib-rium on the reinsurance market in France in the studied period of 2001-2009.
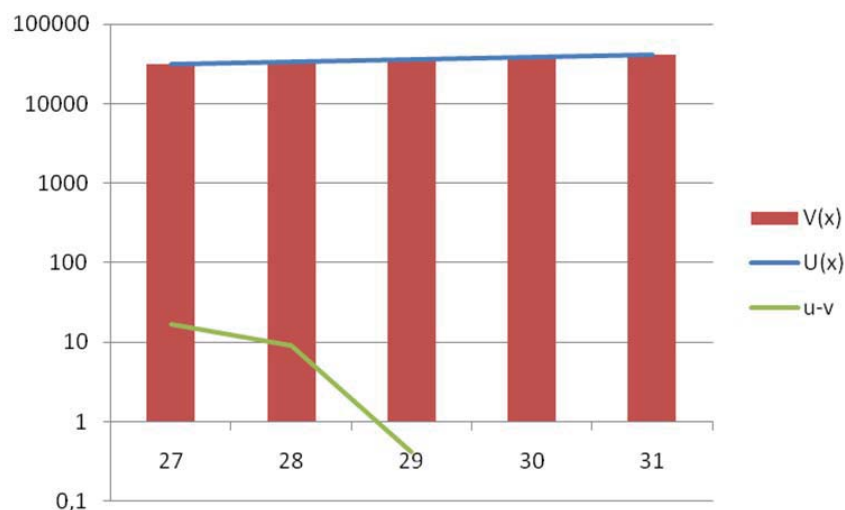

Fig. 4. The determination of the expected value of the insured asset, which leads to the convergence of demand and supply functions of the reinsurance market in France

Along with the peculiar features of equilibrium points on the reinsurance markets in Germany and France we will study the achievement of equilibrium state on the reinsurance market in Ukraine. In comparison with Germany and France the modeling of this market's equilibrium (Tables 6 and 7) reveals both common trends and specific Ukrainian features on the reinsurance market.

Table 6. Calculation of quantitative characteristics for the formalization of demand and supply of the reinsurance market in Ukraine

	r	q	v	$u(v)$	$U(x)$	t	$u(t)$
2001	1294,02	91,22	1436,74	-18570892,57	37474362222,84	79619,13	-57052454481,82
2002	2105,56	148,43	2337,78	-49175247,70	33097475001,94	66837,50	-40204931415,27
2003	5416,90	381,86	6014,34	-325520208,68	17975504290,37	14683,83	-1940459029,55
2004	11674,07	822,96	12961,62	-1511967337,91	1405252851,36	-83866,60	-63302882466,05
2005	6046,97	426,28	6713,90	-405654340,57	15596075510,81	4760,22	-203913662,13
2006	5621,70	396,30	6241,73	-350600969,16	17184624178,70	11458,23	-1181560989,23
2007	6423,90	654,70	10311,53	-956896371,81	14045009329,24	-1176,42	-12461663,15
2008	9064,60	926,50	14592,38	-1916363710,39	5997035592,55	-42767,45	-16461706851,77
2009	8888,40	967,90	15244,43	-2091456219,10	6347403110,74	-39992,30	-14394656494,11

Table 7. Calculation of quantitative characteristics for the formalization of demand and supply of the reinsurance market in Ukraine

	v^*	$u(v^*)$	t^*	$u(t^*)$	P	$V(x)$
2001	615,75	-3409220,17	91265,34	-74963806498,95	8118,91	593209931,33
2002	1001,91	-9029324,95	85787,50	-66235029089,13	13210,59	1570611910,64
2003	2577,57	-59782060,77	63435,93	-36216732044,83	33986,50	10395570845,46
2004	5554,98	-277692414,37	21200,03	-4044864492,87	73244,99	48283094572,62
2005	2877,39	-74499718,19	59182,95	-31523300883,79	37939,66	12954572135,85
2006	2675,03	-64388452,63	62053,53	-34655449415,71	35271,45	11196500308,67
2007	4419,23	-175743849,28	56638,68	-28871172357,43	38942,10	13648189661,19
2008	6253,88	-351967302,27	38813,95	-13558510360,67	54932,18	27157619991,20
2009	6533,33	-384126352,38	40003,30	-14402176080,51	53463,38	25724724880,64

The analysis of the data in Tables 6 and 7 makes it possible to determine the existing ratios between the quantitative indicators of demand and supply on the reinsurance market of Ukraine and to identify the dynamics of establishing equilibrium points on this market. As seen from Figure 5, in most cases Ukraine has the same tendency as observed on the reinsurance market in France. First of all, this concerns the equilibrium points, which occurred in 2003, 2005 and 2007, although Ukrainian market has 4 interval changes in the correlation between demand and supply, which kept changing during the whole trend. Within the period of 2001-2003 the reinsurance market of Ukraine was characterized by significant prevalence of the demand function over supply, which during this period has declined and reached the equilibrium point in 2003. At the present stage we witness an opposite tendency – the supply is bigger than the demand. In 2004 there is the biggest gap between the functional dependencies, which corresponds to the maximum point of the function of supply and the minimum point of the function of demand. Con-

tinuing the research of the equilibrium state of the reinsurance market in Ukraine we should emphasize that the equilibrium point in 2005 changes the existing ratio in 2005-2007 towards insignificant prevalence of the demand function over the corresponding value of the supply function. During this period (2006) one observes the points of local extremes of the two functions, although the gap between them is characterized by the lowest value for the whole studied period of the Ukrainian reinsurance market. The final stage is the period from 2007 till 2009, which is characterized by the trends similar to the German reinsurance market, when the function of supply of reinsurance operations receives the values, which are bigger than corresponding values of the demand function. However, as distinct from Germany, where the gap between the functional dependencies is deepening, the market of reinsurance of Ukraine is characterized by the gradual convergence of these functions since 2008. The consequence of this convergence in the future is the tendency towards the next equilibrium point on the insurance market.
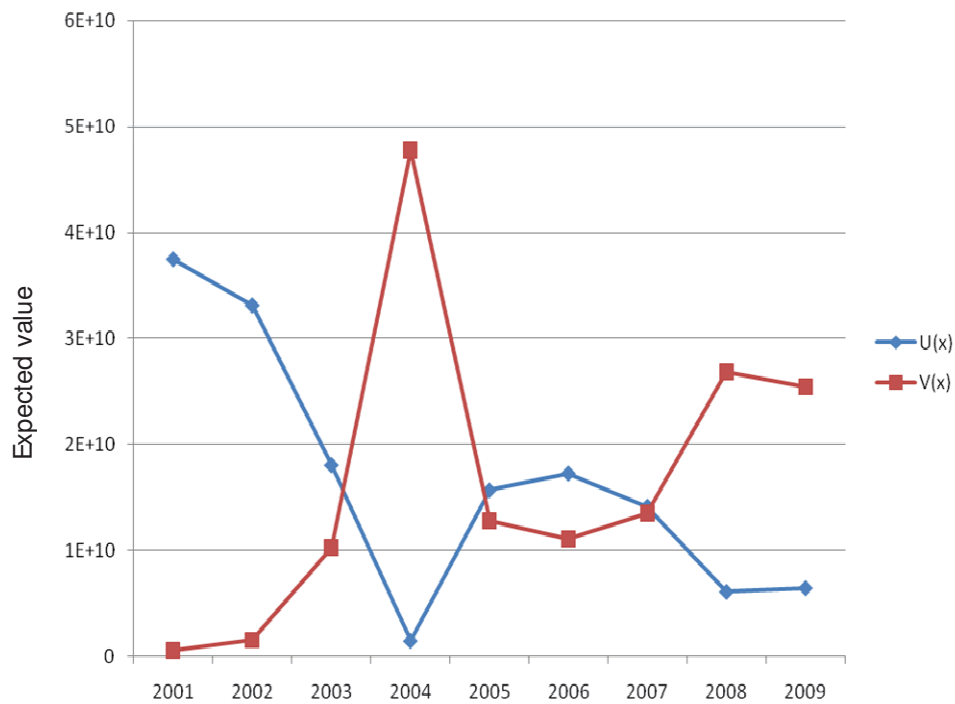
Fig. 5. The dynamics of demand and supply on the reinsurance market in Ukraine in 2001-2009

The detection of the three equilibrium points on the reinsurance market in Ukraine requires the identification of the determining parameter for the management of economic and mathematical model for the equilibrium state of this market. Its value would enable the demand and supply functions to reach an equal level. On Figure 6 we see the graphic interpretation of the equivalence between the demand and supply functions on the Ukrainian reinsurance market if the size of the insured asset reaches the level of 15 mln. hryvnas.
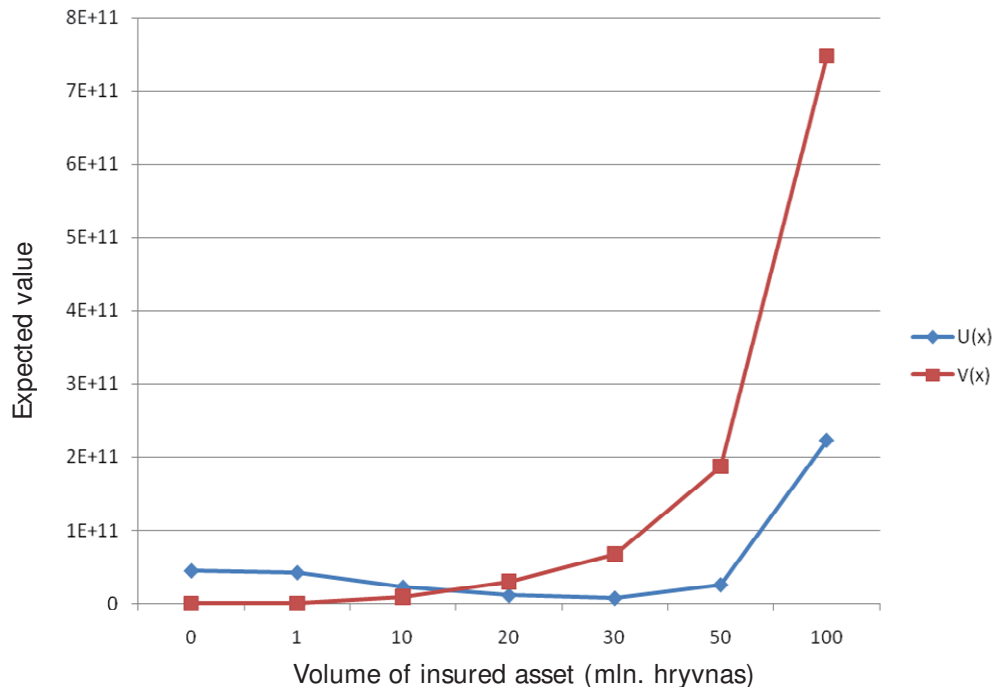

Fig. 6. The determination of the expected value of the insured asset, which leads to the convergence of demand and supply functions of the reinsurance market in Ukraine

The research of the equilibrium states on the insurance markets in Germany, France and Ukraine serves as an informational base for furter comparison of special points for these markets, especially equilibrium points. The obtained results for every year within the period of 2001-2009 are presented in Table 8.

Table 8. The comparative characteristic of the special points of demand and supply functions on the reinsurance markets in Germany, France and Ukraine

Country\special points of the function points	Germany	France	Ukraine
2001	-	-	-
2002	Point of global maximum of demand function	-	-
Beginning of 2003	Point of intersection of demand and supply	-	-
2003	-	Point of intersection off demand and supply	Point of intersection off demand and supply
2004	Point of local minimum of demand function	Point of global maximum of supply function, point of local minimum of supply function	Point of global maximum of supply function, point of global minimum of demand function
2005	Point of local maximum of demand function, point of global maximum of supply function	Point of intersection of demand and supply	Point of intersection of demand and supply
2006	-	Point of local maximum of supply function, point of local minimum of supply function	Point of local maximum of supply function, point of local minimum of supply function
End of 2006	-	Point of intersection of demand and supply	-
2007	-	-	Point of intersection of demand and supply
2008	X	-	Point of local maximum of supply function, point of local minimum of supply function
2009	X	x	-
Trend	Growth of gap between demand and supply functions, different rates of reduction of demand and supply functions	Growth of gap between demand and supply functions, leveling off of demand function, reduction of supply function	Convergence of demand and supply functions, tendency towards the next equilibrium point of the reinsurance market

We will conduct the analysis and comparison of equilibrium points on the reinsurance markets of Germany, France and Ukraine using the discovered peculiarities in the formation of these markets. The first equilibrium point on the reinsurance markets (common point for all three countries) takes place in 2003. Further equilibrium points (in 2005 and 2007) coincide only for France and Ukraine. For the reinsurance market in Germany this is the period for special points only. These facts testify to the presence of common trends and mutual conditionality of reinsurance markets in different countries and can be used as a basis for the making of managerial decisions for both ceding insurance companies and reinsurance companies.

Conclusions of the paper and the prospects of further research in this field

Within this research we have carried out the formalization of demand and supply functions of the reinsurance market; constructed the economic and mathematical model, which makes it possible to determine the equilibrium points for the markets of Germany, France and Ukraine; defined both common equilibrium points in the studied countries and their specific peculiarities in achieving the equilibrium state; given a comparative characteristic of equilibrium positions of Germany, France and Ukraine and determined the trends for further development.

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