

Munich Re

# Market Consistent Embedded Value Report 2011

A large, stylized number '2011' rendered in a light blue color with a dense orange diagonal hatching pattern. The background of the entire page is a light blue with a fine, white diagonal line pattern.

# Contents



<b>1</b>	<b>Introduction</b>	<b>03</b>
1.1	Scope of disclosure	03
1.2	Business covered	03
1.3	Definition of Market Consistent Embedded Value	04
<b>2</b>	<b>Overview of embedded value results 2011</b>	<b>05</b>
<b>3</b>	<b>Reinsurance</b>	<b>06</b>
<b>4</b>	<b>Primary insurance</b>	<b>11</b>
<b>5</b>	<b>Embedded value methodology</b>	<b>19</b>
5.1	Look-through principle	19
5.2	Adjusted net worth (ANW)	19
5.3	Value of in-force covered business (VIF)	20
5.4	Change in embedded value	23
5.5	Embedded value earnings	23
5.6	Value of new business (VNB)	24
5.7	Operating assumptions	25
5.8	Tax assumptions	25
5.9	Economic assumptions	25
5.10	Business covered	26

<b>6</b>	<b>Assumptions</b>	<b>27</b>
6.1	Tax rates	27
6.2	Currency exchange rates	27
6.3	Economic assumptions	27
<b>7</b>	<b>Independent assurance report</b>	<b>31</b>
<b>8</b>	<b>Statement by directors</b>	<b>33</b>
<b>9</b>	<b>Disclaimer</b>	<b>34</b>
<b>10</b>	<b>Glossary and abbreviations</b>	<b>35</b>

# 1 Introduction

## 1.1 Scope of disclosure

In June 2008, the European Insurance CFO Forum (CFO Forum) published the Market Consistent Embedded Value Principles<sup>1</sup> (MCEV Principles) in order to bring greater consistency and improved disclosure to the European insurance industry's embedded value. Throughout this document, MCEV as well as embedded value refer to the above MCEV Principles.

In October 2009, the CFO Forum published an amendment to the MCEV Principles to allow for the inclusion of an illiquidity premium. Furthermore, in December 2011 a press release was issued by the CFO Forum to take account of the current sovereign debt market conditions in embedded value reporting as an initial step towards the expected convergence of MCEV with the developing European regulatory regime (Solvency II). However, the discussions on how and to which products to apply such illiquidity premiums, as well as on how to take sovereign debt market conditions into account under Solvency II is still ongoing. Therefore, Munich Re adopts a prudent approach: it does not apply any illiquidity premiums or make allowance for the current sovereign debt market conditions in its valuation. To illustrate the impact of an illiquidity premium on our business, we state the respective sensitivities.

Munich Re does not report its Group MCEV. In all other respects, we fully comply with the MCEV Principles.

In this supplement, the following topics are reported for the reinsurance and primary insurance business we cover:

- // The Market Consistent Embedded Value as at 31 December 2011
- // An analysis of embedded value earnings for 2011
- // A reconciliation of embedded value with IFRS equity
- // An analysis of the sensitivities of the embedded value and value of new business as at 31 December 2011
- // A detailed description of the embedded value methodology applied

## 1.2 Business covered

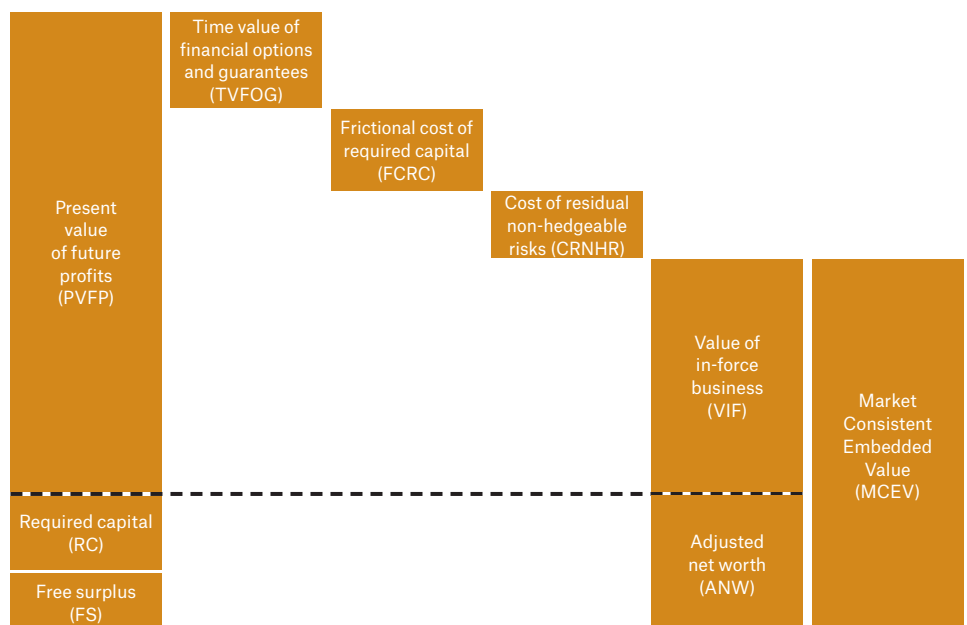
This embedded value report covers 100% of the life reinsurance business written by Munich Re and more than 94% of business written in the life and German health primary insurance entities of Munich Re. German health primary business is long-term business and is therefore included, whereas health reinsurance business is short-term in nature and therefore excluded. For a detailed list of Munich Re segments and entities covered in this report, refer to Section 5.10.

<sup>1</sup> Copyright Stichting CFO Forum Foundation 2008, available online at <http://www.cfoforum.nl>

### 1.3 Definition of Market Consistent Embedded Value

Embedded value is the present value of shareholders' interests in the earnings distributable from assets allocated to the covered business after making sufficient allowance for the aggregate risks involved. The MCEV Principles distinguish between the following components of embedded value:

- // Adjusted net worth (ANW) broken down into the components
  - Free surplus (FS) and
  - Required capital (RC)
- // Value of in-force covered business (VIF), subdivided into
  - Present value of future profits (PVFP)
  - Time value of financial options and guarantees (TVFOG)
  - Frictional cost of required capital (FCRC)
  - Cost of residual non-hedgeable risks (CRNHR).



All components are net of taxes, minority interests and policyholder participations (where applicable). The present value of future profits (PVFP) already includes the intrinsic value of all financial options and guarantees; their time value (TVFOG) is separately disclosed. Any non-hedgeable risks that are not already reflected in the PVFP or TVFOG are covered by the cost of residual non-hedgeable risks (CRNHR). The CRNHR is calculated using a cost-of-capital approach, i.e. the product of projected risk capital for non-hedgeable risks and the respective cost rate. The frictional cost of required capital (FCRC) consists of the projected tax to be paid as well as fees for the management of these assets and, only for our German health primary business, the policyholder participation on the earnings from assets backing required capital. A detailed description of the MCEV methodology used for preparing this supplement is given in Section 5.

## 2 Overview of embedded value results 2011

Since 2005, Munich Re has adhered to a strict market consistent framework. Our prudent approach is proven by a good track record in respect of experience variances and assumption changes in recent years. As last year, we refrain from applying any illiquidity premium in our valuation. Furthermore, we do not make allowance for the current sovereign debt market conditions.

The change from the Market Consistent Embedded Value as at 31 December 2010 to the Market Consistent Embedded Value as at 31 December 2011 is driven by overall strong operating MCEV earnings as well as negative economic variances in our primary insurance business.

### Highlights

€m	Reinsurance	Primary insurance	Total
<b>Market Consistent Embedded Value 31.12.2010</b>	<b>8,284</b>	<b>4,108</b>	<b>12,393</b>
Opening adjustments	-258	-3	-261
<b>Adjusted MCEV 31.12.2010</b>	<b>8,026</b>	<b>4,106</b>	<b>12,132</b>
Value of new business	643	37	680
Expected return at reference rate	233	95	329
Expected return in excess of reference rate	37	187	224
Experience variances	22	357	378
Assumption changes	61	335	396
Other operating variance	113	306	419
<b>Operating MCEV earnings 2011</b>	<b>1,109</b>	<b>1,317</b>	<b>2,426</b>
Economic variances	355	-4,259	-3,904
Other non-operating variance	50	-36	13
<b>Total MCEV earnings 2011</b>	<b>1,513</b>	<b>-2,977</b>	<b>-1,465</b>
Closing adjustments	453	-253	200
<b>Market Consistent Embedded Value 31.12.2011</b>	<b>9,992</b>	<b>875</b>	<b>10,867</b>
IFRS equity excluding goodwill	6,224	3,554	9,777
<b>Value not recognised in IFRS equity</b>	<b>3,769</b>	<b>-2,679</b>	<b>1,090</b>

Besides the excellent value of new business in our reinsurance entities, positive experience variances as well as positive effects due to updates of assumptions and model refinements in our primary insurance segment contributed to strong operating earnings of €2,426m.

The deterioration of financial markets in combination with our prudent valuation approach caused economic variances of -€3,904m, where a strong decrease in our primary business was only partly compensated by a moderate increase in our reinsurance business.

Total embedded value earnings in respect of business covered by Munich Re amounted to -€1,465m. Our MCEV decreased by 12.3% to €10,867m, and the value not recognised in IFRS equity fell by 71.7% to €1,090m.

### 3 Reinsurance

In 2011, the embedded value of our life reinsurance business amounted to €9,992m, which is again a significant increase as against the value published in 2010 (€8,284m). This development was mainly driven by strong MCEV earnings of €1,513m. Besides an overall positive impact from decreasing interest rates, strong operating MCEV earnings of €1,109m contributed to this success. The operating MCEV earnings were supported by a very satisfying value of new business of €643m (€475m in 2010). The new business values of recent years, including 2011, have been supported in particular by large solvency relief business opportunities that came about as a result of Munich Re's financial strength. In addition to realising those special business opportunities, we continued to acquire substantial recurring new business volumes across several geographical areas, even though in certain markets pressure on available traditional reinsurance volumes and margins has been increasing.

The embedded value components of our life reinsurance business are presented in the following table. The table displays the MCEV as at 31 December 2011 as well as at 31 December 2010.

#### MCEV components

	31.12.2011	31.12.2010	Change
	€m	€m	%
Present value of future profits (PVFP)	7,980	6,897	15.7
Time value of financial options and guarantees (TVFOG)	-125	-84	48.9
Frictional costs of required capital (FCRC)	-450	-446	1.0
Cost of residual non-hedgeable risks (CRNHR)	-2,125	-1,482	43.4
<b>Value of in-force covered business (VIF)</b>	<b>5,279</b>	<b>4,884</b>	<b>8.1</b>
Free surplus (FS)	862	526	63.8
Required capital (RC)	3,852	2,874	34.0
<b>Adjusted net worth (ANW)</b>	<b>4,714</b>	<b>3,400</b>	<b>38.6</b>
<b>Market Consistent Embedded Value (MCEV)</b>	<b>9,992</b>	<b>8,284</b>	<b>20.6</b>

At €9,992m, the embedded value for Munich Re's life reinsurance business as at 31 December 2011 was 20.6% higher than last year's MCEV (€8,284m). A detailed explanation of the drivers of this increase in embedded value follows later in this section.

The time value of financial options and guarantees as at 31 December 2011 increased to –€125m (–€84m in 2010). This still moderate value results from the fact that within life reinsurance we concentrate on assuming biometric risks so that the business only has minor exposure to capital market risks.

The increase in the cost of residual non-hedgeable risks was characterised by two effects: the rise in the economic risk capital, mainly due to the growth of the book of business, and the lower discounting of the annual costs as a consequence of the decreased interest rates.

The change in required capital from €2,874m as at 31 December 2010 to €3,852m as at 31 December 2011 was driven by three factors: the increase in required capital for new business by €768m, reflecting the strong new business production in life reinsurance over the year 2011. Secondly, the release of required capital by running off existing business was more than compensated for by additional required capital for reinsurances entities where the local regulatory capital requirements are determined through risk-based approaches. There, the impact of decreased interest rates led to an increase in required capital. In total, the required capital for existing business went up by €134m. Additionally, changes in foreign-exchange rates increased the required capital in the reporting currency by €75m.

The total required capital of €3,852m for business covered as at 31 December 2011 exceeds by €592m the capital required at a life reinsurance level to cover all minimum solvency requirements.

The change in embedded value in 2011 is shown in the following table:

#### Analysis of MCEV earnings

€m	Free surplus	Required capital	VIF	MCEV
<b>Opening MCEV</b>	<b>526</b>	<b>2,874</b>	<b>4,884</b>	<b>8,284</b>
Opening adjustments	-7	-96	-155	-258
<b>Adjusted opening MCEV</b>	<b>519</b>	<b>2,778</b>	<b>4,729</b>	<b>8,026</b>
Value of new business	-821	768	696	643
Expected return at reference rate	5	27	201	233
Expected return in excess of reference rate	36	-	-	37
Transfers from VIF and required capital to free surplus	851	-177	-674	-
Experience variances	45	-72	48	22
Assumption changes	-52	92	21	61
Other operating variance	-31	49	96	113
<b>Operating MCEV earnings</b>	<b>33</b>	<b>687</b>	<b>388</b>	<b>1,109</b>
Economic variances	253	216	-114	355
Other non-operating variance	5	-1	45	50
<b>Total MCEV earnings</b>	<b>291</b>	<b>903</b>	<b>319</b>	<b>1,513</b>
Closing adjustments	51	171	231	453
<b>Closing MCEV</b>	<b>862</b>	<b>3,852</b>	<b>5,279</b>	<b>9,992</b>



The **opening adjustments** of –€258m represent foreign-exchange adjustments from beginning-of-year exchange rates to average-of-year exchange rates used in the MCEV earnings analysis. The negative value reflects the strength of the euro over large parts of the year 2011 when comparing average-of-year (2011) exchange rates to the exchange rates at the beginning of the year for the major currencies.

As in 2010, the very favourable **value of new business (VNB)** of €643m contributed to strong operating MCEV earnings (€1,109m). Compared with 2010 (€475m), this is an impressive increase of more than 35%, marking a new record level. The new business was driven by an increase in sustainable new business volumes, mainly in North America, Europe and Asia. In addition, the realisation of special business opportunities, aiming to provide capital relief for customers by exploiting Munich Re's financial strength and expertise, supported the strong VNB.

#### VNB split by region



The **expected return** at reference rate (using assumptions at the start of the year) increased to €233m (€189m in 2010) due to a higher opening MCEV and the development of one-year interest rates for the major currencies. Because of our prudent asset allocation, the **expected return in excess of reference rate**, amounting to €37m, is rather low.

Experience on mortality and disability business varied slightly against expected values across different markets. The revision of assumptions for our Australian disability income business led to a strengthening of reserves. In the MCEV framework, the effect from the revaluation of Australian disability income business is reflected in negative operating **assumption changes**, straining the ANW component of Munich Re's embedded value. In total, the negative assumption change for Australian disability income business was more than offset by improved mortality assumptions in North America as well as by value-optimising business strategies in several markets, resulting in €61m of positive assumption changes at a life reinsurance level.

**Other operating variance** shows model changes resulting from the continuous refinement of embedded value calculation models across several markets.

Overall, we observed very strong operating embedded value earnings measuring 13.8% of the adjusted opening MCEV.

A fall in interest rates and widely stable credit spreads for main parts of our reinsurance business (especially North America) led to overall positive **economic variances** of €355m. As our reinsurance business is dominated by insurance risks such as mortality risk, the impact of changes in the interest rate-environment has an opposite, albeit lower, effect on the embedded value than for our primary business.

The total embedded earnings account for 18.9% of the opening MCEV after opening adjustments.

The **closing adjustments** of €453m were dominated by foreign-exchange adjustments from the average-of-year exchange rates used in the MCEV earnings analysis to the end-of-year exchange rates (€411m). The positive value reflects the depreciation of the euro relative to almost all major currencies at the end of 2011. Additionally, the capital repatriations from our reinsurance companies and branches to the Group were offset by a capital injection at our Australian subsidiary as a consequence of the revaluation of Australian disability income business.

#### New business

	2011	2010	Change
	€m	€m	%
Value of new business (VNB)	643	475	35.4
Present value of new business premiums (PVNBP)	10,175	12,196	-16.6
Annual premium equivalent (APE)	1,133	2,126	-46.7
%			
New business margin (VNB/PVNBP)	6.3	3.9	62.4
VNB/APE	56.8	22.3	154.2

The present value of new business premiums as well as the annual premium equivalent are down on last year. In connection with the strong VNB, the new business margin and the VNB/APE ratio increased for 2011. Especially the profitability of financially motivated transactions, measured in relation to the premiums, increased in 2011 as against 2010. For this kind of business, reinsurance solutions are specially tailored to meet our clients' specific requirements. For new business in 2011, this resulted in a significant reduction of premium volumes and, at the same time, an increased VNB.

#### IFRS reconciliation

	31.12.2011	31.12.2010	Change
	€m	€m	%
IFRS equity excluding goodwill	6,224	4,772	30.4
Market Consistent Embedded Value	9,992	8,284	20.6
<b>Value not recognised in IFRS equity</b>	<b>3,769</b>	<b>3,512</b>	<b>7.3</b>

The embedded value of business covered as at 31 December 2011 exceeds the corresponding IFRS equity (excluding goodwill) by €3,769m, as against €3,512 in the previous year.

## Sensitivities for embedded value as at 31 December 2011:

**MCEV and VNB sensitivities**

	<b>MCEV</b>		<b>Change</b>	<b>VNB</b>		<b>Change</b>
	€m	€m	%	€m	€m	%
Base case	9,992			643		
<b>Interest rates and assets</b>						
Interest rates -100 BP	10,223	230	2.3	713	70	10.9
Interest rates +100 BP	9,655	-337	-3.4	584	-60	-9.3
Equity/property values -10%	9,975	-17	-0.2	643	-	-
Equity/property-implied volatilities +25%	9,983	-10	-0.1	643	-	-
Swaption-implied volatilities +25%	9,969	-23	-0.2	643	-	-
Illiquidity premium 10 BP	10,032	39	0.4	638	-5	-0.8
<b>Expenses and persistency</b>						
Maintenance expenses -10%	10,096	103	1.0	653	10	1.5
Lapse rates -10%	10,724	732	7.3	733	90	14.0
Lapse rates +10%	9,422	-570	-5.7	575	-68	-10.6
<b>Insurance risk</b>						
Mortality/morbidity (life business) -5%	11,892	1,899	19.0	769	126	19.6
Mortality (life business) +5%	8,345	-1,647	-16.5	543	-100	-15.6
Mortality (annuity business) -5%	9,939	-53	-0.5	628	-16	-2.4
No mortality improvements (life business)	5,182	-4,810	-48.1	314	-329	-51.2
Morbidity (life business) +5%	9,721	-272	-2.7	618	-25	-3.8
<b>Required capital</b>						
Minimum solvency capital	10,062	70	0.7	647	4	0.6
<b>Other</b>						
Value of original currencies -10%	9,127	-865	-8.7	586	-57	-8.9

Our life reinsurance business is dominated by insurance risks, most notably mortality risk, i.e. changes in mortality or morbidity assumptions strongly impact the embedded value and the value of new business. In contrast to our primary insurance business, changes of economic assumptions in total only have a minor effect on the overall MCEV of our life reinsurance business.

The sensitivity of exchange rates relative to the reporting currency reflects the high proportion of business written in non-euro currencies. More than 80% of this business is denominated in foreign currencies, especially in Canadian and the US dollars.

Since Munich Re's embedded value is calculated without taking an illiquidity premium into consideration, we show the impact of an illiquidity premium of 10 BP as a sensitivity.

Except for the stressed assumptions, the sensitivity calculations are performed analogous to the base case.

## 4 Primary insurance

The embedded value components of our primary business are presented in the following table. Displayed are the embedded value as at 31 December 2011 as well as at 31 December 2010.

### MCEV components

	Primary insurance (Total)		
	31.12.2011	31.12.2010	Change
	€m	€m	%
Present value of future profits (PVFP)	1,447	4,151	-65.1
Time value of financial options and guarantees (TVFOG)	-1,817	-1,052	72.7
Frictional costs of required capital (FCRC)	-419	-703	-40.5
Cost of residual non-hedgeable risks (CRNHR)	-571	-549	4.0
<b>Value of in-force covered business (VIF)</b>	<b>-1,360</b>	<b>1,847</b>	<b>-173.6</b>
Free surplus (FS)	137	266	-48.5
Required capital (RC)	2,098	1,996	5.1
<b>Adjusted net worth (ANW)</b>	<b>2,235</b>	<b>2,262</b>	<b>-1.2</b>
<b>Market Consistent Embedded Value (MCEV)</b>	<b>875</b>	<b>4,108</b>	<b>-78.7</b>

Our primary insurance shows positive operating MCEV earnings of €1,317m (or 32.1% relative to the adjusted opening MCEV in 2011). But unfavourable financial markets (a combination of low interest rates, a rise in interest-rate volatility, and the sovereign debt market crisis) continued to have a negative effect on the embedded value of our primary insurance business, in particular German life primary business. These and other details of the change from MCEV 2010 to MCEV 2011 are given on page 13 onward.

In contrast to 2010, the PVFP decreased by 65.1% mainly as a result of the extraordinary widening of government spreads in many European countries (e.g. Greece, Ireland, Italy, Spain, Portugal) and the fall in interest rates. The TVFOG shows an increase of 72.7%, mainly on account of falling interest rates, rise in interest-rate volatility, and the European sovereign debt crisis. After the allowance for FCRC and CRNHR, the MCEV decreased by 78.7% to €875m.

The development of the economic environment affected in particular the value of Munich Re's German life primary business as this segment is characterised by substantial financial options and guarantees. The MCEV decreased from €1,010m to -€1,633m. Most of this effect is reflected in the PVFP, but the TVFOG also increased considerably.

Compared with German life primary business, our international life primary business is less affected by the interest-rate development. However, the European sovereign debt market crisis had a particular negative impact. The VIF decreased by 65.2%, from €769m to €268m. In total, the MCEV decreased to €761m.

	German life primary			International life primary			German health primary		
	31.12.2011	31.12.2010	Change	31.12.2011	31.12.2010	Change	31.12.2011	31.12.2010	Change
	€m	€m	%	€m	€m	%	€m	€m	%
	-717	1,383	-151.9	509	959	-46.9	1,655	1,809	-8.5
	-1,682	-973	72.8	-135	-79	71.2	-	-	-
	-153	-294	-47.9	-50	-62	-19.7	-216	-348	-37.9
	-331	-279	18.8	-57	-49	15.3	-182	-221	-17.3
	<b>-2,884</b>	<b>-163</b>	<b>1,664.4</b>	<b>268</b>	<b>769</b>	<b>-65.2</b>	<b>1,256</b>	<b>1,241</b>	<b>1.2</b>
	32	32	-	105	234	-55.1	-	-	-
	1,219	1,141	6.8	388	362	7.2	491	492	-0.3
	<b>1,251</b>	<b>1,173</b>	<b>6.6</b>	<b>493</b>	<b>596</b>	<b>-17.3</b>	<b>491</b>	<b>492</b>	<b>-0.3</b>
	<b>-1,633</b>	<b>1,010</b>	<b>-261.7</b>	<b>761</b>	<b>1,365</b>	<b>-44.3</b>	<b>1,747</b>	<b>1,733</b>	<b>0.8</b>

Our German health primary business is less exposed to capital market fluctuations as technical interest rates are not guaranteed for the whole contract term, and policyholder options are more restricted. Since 2009, changed policyholder options caused by the German Health Reform Act (WSG) increased the influence of policyholder behaviour on shareholder cash flows, especially for comprehensive health insurance. These policyholder options are covered by the MCEV model in accordance with current experience, but changed policyholder behaviour is still difficult to estimate in the long run. A change of assumptions according to future experience may lead to substantial future changes in our MCEV figures. Examples of policyholder options are:

- // Lapses with transfer values
- // Obligatory benefit for non-payers without possibility to cancel contracts
- // Change of tariffs

There are ongoing discussions concerning the German healthcare system. If these lead to material changes in legislation, our future MCEV figures are expected to change substantially.

Due to adverse financial market developments, the PVFP of our German health primary business decreased by 8.5%. The FCRC and CRNHR went down by 37.9% and 17.3% respectively. The positive development of FCRC and CRNHR compensated for the decrease in PVFP. All in all, the VIF and the MCEV slightly increased by 1.2% and 0.8% respectively.

Details of the change from MCEV 2010 to MCEV 2011 are explained in the following analysis of MCEV earnings.

#### Analysis of MCEV earnings

€m	Primary insurance (Total)			
	Free surplus	Required capital	VIF	MCEV
<b>Opening MCEV</b>	<b>266</b>	<b>1,996</b>	<b>1,847</b>	<b>4,108</b>
Opening adjustments	-1	-1	-1	-3
<b>Adjusted opening MCEV</b>	<b>265</b>	<b>1,995</b>	<b>1,846</b>	<b>4,106</b>
Value of new business	-101	19	120	37
Expected return at reference rate	26	2	67	95
Expected return in excess of reference rate	9	-	179	187
Transfers from VIF and required capital to free surplus	342	8	-350	-
Experience variances	-65	21	400	357
Assumption changes	-70	70	335	335
Other operating variance	9	1	295	306
<b>Operating MCEV earnings</b>	<b>150</b>	<b>121</b>	<b>1,047</b>	<b>1,317</b>
Economic variances	-55	-	-4,203	-4,259
Other non-operating variance	-	-	-36	-36
<b>Total MCEV earnings</b>	<b>94</b>	<b>121</b>	<b>-3,192</b>	<b>-2,977</b>
Closing adjustments	-223	-18	-13	-253
<b>Closing MCEV</b>	<b>137</b>	<b>2,098</b>	<b>-1,360</b>	<b>875</b>

Large parts of our primary business are denominated in euro; therefore foreign-exchange adjustments shown as **opening adjustments** do not have a material impact.

**New business** increased the embedded value by €37m. More details are given below.

The **expected return at reference rate** contributed €95m. The **expected return in excess of reference rate** shows favourable additional earnings (€187m), as credit risk exposure is higher for our primary business than for our reinsurance business. The assumed risk premiums are shown in Section 6.3.

In total, **experience variances** had a positive impact of €357m. For our German life primary business, various positive effects (e.g. expenses, lapses, taxation) set off negative effects (e.g. profit-sharing) resulting in a considerable positive total effect (€327m). The positive impact also stems partly from asset-liability management (ALM) actions in 2011, e.g. enhanced duration management and swaption programmes. For our German health primary business, the technical result in 2011 was better than expected (e.g. due to low expenses and claims as well as favourable developments of lapses and mortality), which were the main driver for positive experience variances (€75m). The total effect of -€46m for international life primary business mainly derives from deviations of contract persistency in Belgium and a strengthening of claims reserves in Austria. Fluctuations in actual expense altogether led to a negative effect.

German life primary				International life primary				German health primary			
Free surplus	Required capital	VIF	MCEV	Free surplus	Required capital	VIF	MCEV	Free surplus	Required capital	VIF	MCEV
<b>32</b>	<b>1,141</b>	<b>-163</b>	<b>1,010</b>	<b>234</b>	<b>362</b>	<b>769</b>	<b>1,365</b>	-	<b>492</b>	<b>1,241</b>	<b>1,733</b>
-	4	-	-	-1	-1	-1	-3	-	-	-	-
<b>32</b>	<b>1,141</b>	<b>-163</b>	<b>1,010</b>	<b>233</b>	<b>361</b>	<b>768</b>	<b>1,363</b>	-	<b>492</b>	<b>1,241</b>	<b>1,733</b>
-48	-	-28	-76	-60	19	104	63	6	-	44	50
16	-	36	53	3	2	11	16	7	-	19	26
4	-	128	132	4	-	11	15	1	-	40	40
188	7	-196	-	70	-	-70	-	84	-	-84	-
-69	1	395	327	-32	20	-34	-46	36	-	39	75
-70	70	26	26	-	-	-1	-1	-	-	310	310
-	-1	184	183	9	2	66	77	-	-	45	45
<b>22</b>	<b>78</b>	<b>546</b>	<b>646</b>	<b>-5</b>	<b>43</b>	<b>87</b>	<b>125</b>	<b>133</b>	-	<b>414</b>	<b>547</b>
1	-	-3,266	-3,266	-45	-	-538	-583	-11	-	-399	-410
-	-	-	-	-	-	-36	-36	-	-	-	-
<b>23</b>	<b>78</b>	<b>-2,720</b>	<b>-2,620</b>	<b>-51</b>	<b>43</b>	<b>-487</b>	<b>-495</b>	<b>122</b>	-	<b>15</b>	<b>137</b>
-23	-	-	-23	-78	-16	-13	-107	-122	-1	-	-123
<b>32</b>	<b>1,219</b>	<b>-2,884</b>	<b>-1,633</b>	<b>105</b>	<b>388</b>	<b>268</b>	<b>761</b>	-	<b>491</b>	<b>1,256</b>	<b>1,747</b>

Positive effects from our German life primary business (€26m) and from our German health primary business (€310m) led to an overall positive impact of **assumption changes** (€335m). For German health primary business, the review and the adaption of best estimate assumptions, such as mortality, lapses, expenses and claims had a positive impact. Also the evaluation of best estimate assumptions of our German life business resulted in favourable effects. The main drivers were profit-sharing levels together with and lump-sum assumptions. An update of our international life primary business assumptions on future profit-sharing and management rules as well as morbidity had a positive impact. On the other hand, changes in assumptions on future expense and tax loss carry-forward effects had negative impacts. In total, assumption changes for our international life primary business were negligible.

Positive **other operating variance** (€306m) comes from positive effects in all three segments. Enhancements of actuarial projection models to better capture peculiarities of the business led to a positive impact. In particular, a refined modelling of insurance riders in Belgium now better reflects the value of the business. For our German life primary business, other operating variance amounted to €183m. Our international life primary business contributed €77m. Finally, for our German health primary business, other operating variance was at €45m.

In total, strong operating MCEV earnings were at €1,317m. This corresponds to 32.1% relative to the adjusted opening MCEV.

The poor **economic variances** refer almost entirely to the VIF, and are mainly due to the extraordinary widening of spreads between government bonds and swap rates in many European countries, coupled with lower interest rates, higher interest-rate volatilities and higher corporate bond spreads. In particular, the disruptions on government bond spreads have a significant impact on the valuation of the VIF which, according to our current methodology based on swap rates, does not benefit on the liability side from higher returns offered by government bonds, but on the contrary is depressed on the asset side by lower market values of government bonds in our investment portfolio. By means of a conservative approach, we have chosen to represent the expected default of non-AAA-rated bonds to fully correspond to their prices observed on the capital markets as at the valuation date.

Altogether, unfavourable financial market developments led to a decrease of €4,259m for Munich Re's primary insurance business. Most of the decrease stems from our German life primary business (–€3,266m), which is characterised by substantial financial options and guarantees. Adverse developments of interest rates and credit spreads affected the PVFP, whereas the TVFOG additionally suffered from rising volatilities. Due to fewer earning restrictions and different legal frameworks, international life primary business is less exposed to changes in economic assumptions; the main driver for the negative impact (–€583m) was the widening of credit spreads and, in second place, by the drop in interest rates. The economic variances for German health primary business were moderate (–€410m) as technical interest rates are not guaranteed for the whole contract term, but can be changed through a premium adjustment process.

The effect of a newly introduced reserve tax in Belgium is shown as **other non-operating variance** (–€36m) for international life primary business.

Altogether, total MCEV earnings of Munich Re's primary insurance business amounted to –€2,977m or –72.5% relative to the adjusted opening MCEV.

**Closing adjustments** were predominated by dividends. In particular, high dividends stem from our international life and German health primary business. Furthermore, the sale of our Portuguese subsidiary VICTORIA-Seguros de Vida S.A. has been included.

In the light of our conservative valuation approach and the very unfavourable financial environment, the MCEV of Munich Re's primary insurance business decreased by 78.7% to €875m as at the end of 2011.

#### New business

	Primary insurance (total)		
	2011	2010	Change
	€m	€m	%
Value of new business (VNB)	37	141	–73.7
Present value of new business premiums (PVNBP)	8,189	7,798	5.0
Annual premium equivalent (APE)	783	722	8.5
%			
New business margin (VNB/PVNBP)	0.5	1.8	–74.9
VNB/APE	4.7	19.6	–75.7



The **value of new business** for our primary insurance decreased from €141m to €37m. The loss of profitability in our new business – measured in relation to premiums – mainly derives from the already mentioned impact of the low interest rates and high implied volatilities. The present value of new business premiums as well as the annual premium equivalent increased. In total, the new business margin of our primary insurance business decreased from 1.8% to 0.5%.

For our German life primary business, the value of new business decreased to –€76m, mainly due to interest-rate guarantees of the products sold. The new business margin decreased from 1.3% to –1.8%.

The value of new business of our international life primary business increased from €58m to €63m. In Belgium, a high volume of very profitable Universal Life policies was sold, while in Poland bancassurance business continued to be the main driver. The overall new business margin slightly dropped from 4.2% to 4.1%.

For our German health primary business, the value of new business increased from €28m to €50m. The new business margin increased from 1.2% to 2.1%. Responsible for this is a modelling refinement for health business without ageing reserves, but also the actual business mix, further refinements of the actuarial projection model and low expenses.

	German life primary			International life primary			German health primary		
	2011	2010	Change	2011	2010	Change	2011	2010	Change
	€m	€m	%	€m	€m	%	€m	€m	%
	-76	56	-236.2	63	58	7.8	50	28	81.8
	4,207	4,176	0.7	1,544	1,374	12.4	2,439	2,247	8.5
	463	462	0.3	170	150	13.2	150	109	37.2
	-1.8	1.3	-235.2	4.1	4.2	-4.0	2.1	1.2	67.5
	-16.3	12.0	-235.8	36.8	38.6	-4.7	33.4	25.2	32.5

**IFRS reconciliation**

	<b>31.12.2011</b>	<b>31.12.2010</b>	<b>Change</b>
	€m	€m	%
IFRS equity excluding goodwill	3,554	3,773	-5.8
Market Consistent Embedded Value	875	4,108	-78.7
<b>Value not recognised in IFRS equity</b>	<b>-2,679</b>	<b>336</b>	<b>-897.5</b>

The embedded value of the covered primary insurance business as at 31 December 2011 is €2,679m below the corresponding IFRS equity (excluding goodwill). The value not recognised in IFRS equity decreased by €3,015m as at the end of 2011.

## MCEV and VNB sensitivities

	MCEV		Change	VNB		Change
	€m	€m	%	€m	€m	%
Base case	875			37		
<b>Interest rates and assets</b>						
Interest rates -100 BP	-3,134	-4,009	-458.2	-194	-231	-620.8
Interest rates +100 BP	3,244	2,369	270.8	156	119	319.9
Equity/property values -10%	665	-210	-24.0	33	-4	-11.1
Equity/property-implied volatilities +25%	730	-145	-16.6	25	-13	-33.9
Swaption-implied volatilities +25%	404	-470	-53.8	5	-32	-86.9
Illiquidity premium 10 BP	1,549	674	77.1	45	8	22.1
<b>Expenses and persistency</b>						
Maintenance expenses -10%	981	106	12.1	41	4	10.0
Lapse rates -10%	760	-115	-13.1	35	-2	-5.9
Lapse rates +10%	986	112	12.7	39	1	3.7
<b>Insurance risk</b>						
Mortality/morbidity (life business) -5%	1,010	135	15.4	46	9	23.3
Mortality (life business) +5%	827	-48	-5.5	31	-6	-15.3
Mortality (annuity business) -5%	689	-186	-21.3	30	-7	-18.8
No mortality improvements (life business)	875	-	-	37	-	-
Morbidity (life business) +5%	790	-85	-9.7	32	-5	-13.5
<b>Required capital</b>						
Minimum solvency capital	991	116	13.2	37	-	-
<b>Other</b>						
Value of original currencies -10%	868	-7	-0.8	36	-1	-2.3

Compared with our reinsurance business, most of our primary business is characterised by substantial financial options and guarantees. Therefore, the main drivers are economic assumptions; non-economic assumptions are of far less significance.

As in previous years, we do not apply an illiquidity premium in our calculation. To show the impact of including an illiquidity premium, we calculate a sensitivity of 10 BP for the whole portfolio. In general, the sensitivity of an illiquidity premium shows a stronger effect on the MCEV than an interest-rate sensitivity of the same amount.

In particular, for our German life primary business, embedded financial options and guarantees have a strong asymmetrical and non-linear impact on cash flows to shareholders. Thus, falling interest rates have a higher impact on embedded value than rising interest rates. The effect increases for each further step down. For large parts of our German life insurance portfolio, current interest rates are already below guaranteed interest rates. All in all, the effects of all economic and non-economic sensitivities are higher than in 2010. In particular, the sensitivity to interest rates and illiquidity premium is relatively high.

As an increase in volatilities leads to a higher TVFOG for traditional participating business, embedded value decreases for an increase in swaption-implied volatility as well as for an increase in equity and property-implied volatility. But, because of low exposure to equity and property, the corresponding sensitivities are moderate.

The substantial effects of cross-subsidisation between new and in-force participating business (especially in German life and health primary insurance) are reflected in the approach we used to calculate the VNB sensitivities.

Except for the stressed assumptions, the sensitivity calculations are performed analogous to the base case.

## 5 Embedded value methodology



The embedded value methodology adopted by Munich Re is in accordance with the Market Consistent Embedded Value Principles® (MCEV Principles) published by the European Insurance CFO Forum (CFO Forum) in June 2008. We neither apply any illiquidity premiums as permitted by an amendment to the MCEV Principles, published by the CFO Forum in October 2009, nor do we make allowance for the sovereign debt market conditions in our current valuation. In this section, we specify the methodology used in preparing this supplementary report.

The embedded value results and IFRS equities are presented at a consolidated Group level. Results are presented net of minority interests and policyholders' interests. Intra-Group reinsurance ceded from primary insurers to reinsurers is shown in the reinsurance segment.

The embedded value reporting currency is the euro. Calculations are undertaken in the original currency of the business covered and converted to euros for consolidation purposes. In converting original currency embedded values and their components into euros, the exchange rates as at the relevant valuation dates are used. Changes in the embedded value due to changes in foreign-exchange rates are part of opening and closing adjustments. For converting embedded value earnings based on the original currency into euros, average-of-year exchange rates are used.

### 5.1 Look-through principle

The assets related to the business covered are mainly managed by the Group's asset management units. The costs and profits from managing these assets are included in the embedded value on a look-through basis.

Where material, costs of other service companies, such as administration and IT, are also included in the embedded value on a look-through basis. Costs of holding companies related to the business covered have been allowed for in the embedded value calculations as well.

### 5.2 Adjusted net worth (ANW)

The adjusted net worth (ANW) of our business covered is defined as follows:

- // For pure life reinsurance entities, the ANW equals the local regulatory net worth adjusted to reflect the market value of assets.
- // For composite reinsurance entities, the allocated required capital is used.
- // For primary insurance entities, the ANW is based on the local regulatory net worth.

Differences between IFRS and statutory pension liabilities are included in the MCEV as an adjustment to net assets.

The required capital (RC) is defined as follows:

- // For reinsurance entities, the RC is derived from a combination of regulatory requirements and internal objectives (e.g. rating requirements, internal economic capital model).
- // For German primary insurers, the RC is set to statutory net worth adjusted for differences between IFRS and statutory pension liabilities. With their statutory net worth, all German primary insurers covered in this report have statutory solvency ratios well above 150%.
- // For international primary insurers, the RC is equal to 100% of the EU minimum solvency requirements. This simplified assumption has little impact on the MCEV.

The free surplus (FS) is defined as the adjusted net worth less the required capital.

### 5.3 Value of in-force covered business (VIF)

A bottom-up approach to allow for risk is adopted for the calculation of the present value of in-force covered business. The economic assumptions and discount rates used are calibrated applying a market-consistent methodology to allow for financial risk. In principle, each cash flow is valued according to its inherent financial risk.

For business without significant financial options and guarantees, the certainty-equivalent technique is used. Under this valuation approach, the individual cash flows are adjusted to remove the effects of financial risks. The resulting stream of risk-adjusted profits is then discounted at the reference rate.

For business with significant financial options and guarantees, a stochastic model using market-consistent scenarios is applied to determine the VIF. The stochastic models take interactions of assets and liabilities into account and include expected management behaviour; e.g. regarding the investment strategy, the management of unrealised capital gains, and the determination of bonus rates for participating business. In addition, dynamic policyholder behaviour with respect to lapses and surrenders has been allowed for.

In some territories where life reinsurance business is written, only limited policy data is available. In such cases, projections are made on a portfolio basis to reflect expected profitability ratios and all other relevant information.

For our German life primary business, it is assumed that in the case of severe financial distress approval from the regulator is granted to restrict policyholder participation and to cover policyholder guarantees by the free RfB and the Terminal Bonus Fund. Besides this, we do not model any limited liability put options and assume that guarantees are not changed, even in Japanese-like scenarios.

For our German health primary business, the development of healthcare costs is based on general inflation assumptions adjusted for higher health inflation in some parts of the business. Premium rates are assumed to increase in line with these developments.

The VIF is broken down into the following items that are exemplified in the sections below:

- // Present value of future profits (PVFP)
- // Time value of financial options and guarantees (TVFOG)
- // Cost of residual non-hedgeable risks (CRNHR)
- // Frictional cost of required capital (FCRC)

#### 5.3.1 Present value of future profits (PVFP)

The PVFP is the present value of future local statutory shareholder after-tax profits emerging from the business covered on the condition that all economic and non-economic assumptions are met.

In this respect, the PVFP already includes the intrinsic value of financial options and guarantees of the business covered. The time value of financial options and guarantees arising from the uncertainty of economic assumptions is disclosed separately.

### 5.3.2 Time value of financial options and guarantees (TVFOG)

Participating life business is generally characterised by the following key features:

- // A minimum interest rate or a minimum level of bonus is guaranteed to the policyholder. Hence, whenever the investment return on the allocated assets does not exceed the necessary minimum and other means of funding the guarantees are depleted, the shareholder will bear the cost of maintaining the guarantees.
- // Generally, bonuses and crediting rates exceed minimum guaranteed levels. In this case, the amount credited will be based on profit-sharing rules which involve a degree of management discretion.

The participating features are usually a combination of contractual or legal constraints, and management discretion that has to take competitive pressure or market practice into account. The participating business has been modelled to reflect both contractual and regulatory constraints as well as management discretion. Projected surrender rates depend dynamically on the difference between the reference rate and the credited rate.

In our market-consistent calculation, we allow for the potential impact on future shareholder cash flows of all financial options and guarantees within the in-force covered business. This allowance is based on stochastic techniques using methods and assumptions consistent with the underlying embedded value. All projected cash flows are valued using economic assumptions in line with the price of similar cash flows that are traded in the capital markets.

Stochastic models are used for all significant life primary and health primary insurance business. The time value of financial options and guarantees is determined as the difference between the average present value over all stochastic scenarios and the present value for the certainty equivalent scenario. The stochastic model is run using 1,000 scenarios based on an econometric model and takes the following explicitly into account:

- // Management discretion concerning bonus policy and profit-sharing rules
- // Timing of realisation of unrealised capital gains
- // Dynamic asset allocation, in particular management of the equity-backing ratio
- // Dynamic adjustment of technical interest rates for German health primary business
- // Surrender rates dependent on the capital markets

It is predominantly life primary business that is exposed to financial options and guarantees. The following aspects of financial options and guarantees are of particular relevance:

- // All policyholder options (such as full or partial surrender, premium discontinuance and annuitisation) combined with policyholder guarantees (like interest-rate guarantees, guaranteed surrender values or guaranteed annuity rates) have a large influence on the VIF.
- // On the other hand, companies are able to substantially influence the value of financial options and guarantees, for example by changing their bonus policy for participating life business or by adjusting the long-term asset allocation. Such management discretion is subject to any contractual guarantees and regulatory or legal constraints.

The TVFOG published in this and other documents of Munich Re reports the net effect.

Our life reinsurance portfolio has only a very limited exposure to financial options and guarantees.

#### 5.3.2.1 TVFOG in German life primary business

In German life primary business, by far the biggest share of the time value of financial options and guarantees results from the guaranteed interest rate together with legal restrictions for the minimum policyholder participation.

The maximum actuarial interest rate in life insurance (commonly referred to as the “guaranteed interest rate”) is laid down in the German federal ordinance concerning actuarial assumptions for future policy benefits (“Deckungsrückstellungsverordnung”).

The German federal ordinance relating to minimum policyholder participation in life insurance (“Mindestzuführungsverordnung”) applies rules concerning customers’ minimum participation in statutory profits that strongly restrict loss offset from the different profit sources (investment result, mortality result, remaining result).

#### 5.3.2.2 TVFOG in German health primary business

For participating German health primary business, minimum profit-sharing rules are set according to current legal requirements. Management discretion is relevant for the use of free policyholder funds in order to reduce future premium increases necessary to cover the assumed development of healthcare costs. Furthermore, management decisions on how to proceed with changes in technical interest rates are taken into account, subject to legal restrictions.

As detailed analyses show, German health primary business is not exposed to financial options and guarantees since policyholder options are counterbalanced by options of the company. The main reasons are:

- // Technical interest rates are not guaranteed for the whole contract term, but can be changed through a premium adjustment process. In the event of an interest-rate reduction, this leads to higher premium rates for the policyholder.
- // If future investment returns are expected to be below the guaranteed interest rate, the German Federal Financial Supervisory Authority (BaFin) demands in accordance with the “Aktuarielle Unternehmenszins-Verfahren (AUZ-Verfahren)” a reduction in the interest-rate guarantee which corresponds to premium rate increases.

#### 5.3.3 Cost of residual non-hedgeable risks (CRNHR)

The cost of residual non-hedgeable risks reflects the impact of risks not already allowed for in the TVFOG or the PVFP. For determining the CRNHR, we use a cost of capital approach.

For all businesses, the amount of economic risk capital for non-hedgeable risks (ERCNHR) is determined by our internal economic capital model and projected over the run-off of the business. In anticipation of future amendments to the MCEV Principles, we already include the diversification between our covered and non-covered business to reflect our integrated risk management process. Diversification between hedgeable and non-hedgeable risk is disregarded. The economic risk capital corresponds to the value at risk over one-year time horizon with a confidence level of 99.5%. CRNHR is the present value of future ERCNHR of the covered business times the cost rate of 7%.

#### 5.3.4 Frictional cost of required capital (FCRC)

The cost of holding capital is caused by taxes on profits of assets backing required capital as well as by the cost of their management. For our German health primary business, investment income on shareholder funds is subject to policyholder participation and thus also included in the FCRC.

### 5.4 Change in embedded value

The change in embedded value from one valuation date to the next comprises the following elements:

- // Opening adjustments
- // Embedded value earnings
- // Closing adjustments

The value of acquired or divested business, including the change in stakes of Munich Re in companies covered in this report are shown – in a manner designed to best reflect the economic return Munich Re has achieved in the period – either as **opening adjustment** or **closing adjustment**. Also the change in scope as well as the impact of changes in currency exchange rates from the end of last year to the average of the reporting year is included in the opening adjustments. Furthermore, closing adjustments contain changes in currency exchange rates from the average of year to the end of the reporting year and any capital movements, especially dividends.

**Embedded value earnings** are stated at average-of-year currency exchange rates and at average share of Munich Re in the respective companies. They are explained in more detail in the following section.

### 5.5 Embedded value earnings

The embedded value earnings can be split into the following components:

- // Value of new business
- // Expected return at reference rate
- // Expected return in excess of reference rate
- // Transfer from VIF and required capital to free surplus
- // Experience variances
- // Assumption changes
- // Other operating variance
- // Economic variances
- // Other non-operating variance

The sum of the first seven components of embedded value earnings is referred to as operating embedded value earnings.

The **value of new business** is explained in the following section.

The **expected return at reference rate** ("Expected existing business contribution (reference rate)" according to the MCEV Principles) is calculated assuming a risk-free roll-forward of the embedded value at the beginning of the year.



The **expected return above reference rate** ("Expected existing business contribution (in excess of reference rate)" according to the MCEV Principles) reflects management's expectation for one year with regard to asset returns above the reference rate. The parameters used for 2010 and 2011 are shown in Section 6.3.

The **experience variances** summarise the prospective and retrospective outcome of differences between the actual operating experience in the reporting year and the operating result assumed in the previous embedded value calculation.

**Assumption changes** represent the aggregate impact on the embedded value of changes in the operating assumptions within the reporting year. All operating assumptions are subject to an active review at each valuation date.

**Other operating variances** comprise model changes or model refinements as well as the effect of tax planning action.

The **economic variances** describe the aggregate impact on the embedded value of changes in economic assumptions (including reference rate and implied volatilities) during the reporting year and in the projections years. They are the net effect of a change of economic parameters on the assets and the liabilities.

**Other non-operating variances** summarise the impact of changes in the regulatory framework such as taxation or legislation concerning policyholder participation.

## 5.6 Value of new business (VNB)

The VNB is the present value as at the end of the reporting year of the future local statutory after-tax profits in respect of new business written in the reporting year; reduced by the time value of financial options and guarantees, cost of residual non-hedgeable risks and frictional costs associated with the new business. Additionally, after-tax regulatory profits in respect of this business during the reporting year are included in the reported VNB. The calculation is consistent with the methodology outlined for the value of in-force business.

For reinsurance business, the value of new business can be calculated on a stand-alone basis, as there are no material interactions between in-force and new business. New business is defined as that arising from new reinsurance contracts as well as that from the sale of new contracts on existing reinsurance treaties by our customers during the reporting period. Due to the nature of life reinsurance, the value of new business includes the value of expected renewals on those new contracts and expected future contractual alterations to those new contracts. New life reinsurance business comprises:

- // For individual business, new cessions in the year on either new or existing treaties
- // For group business, new group schemes on either new or existing treaties, and also new members to existing group schemes
- // For annually renewable reinsurance contracts (e.g. stop-loss and other non-proportional reinsurance business), new treaties and renewals of existing treaties

For primary insurance business, because of material interactions between existing and new business, a marginal approach is used, i.e. the difference between the embedded value with and without new business. The marginal approach helps to capture the effect of interactions between in-force and new business. New business is defined as business arising from the sale of new contracts during the reporting period. The value of new business includes the value of expected renewals on those new contracts and expected future contractual alterations to those new contracts. For German life primary business, new business includes the current year's increments on existing policies.

## 5.7 Operating assumptions

Operating assumptions describe expected future operating experience. They refer mainly to mortality, morbidity, persistency, expenses and – in primary insurance business – to policyholder participation. The operating assumptions are based on best estimate assumptions derived from company experience and/or market experience. They are in line with management expectations and reflect recent operating experience of the entities concerned.

All costs related to the covered business are split into acquisition, maintenance and investment-related expenses and are fully allowed for in the embedded value. We use a going-concern approach in line with the MCEV Principles. Future productivity gains are not anticipated in the embedded value calculations beyond what has been achieved.

## 5.8 Tax assumptions

Taxation assumptions included in the embedded value models reflect local taxation rates and bases, including future changes that are at an advanced stage of legislative implementation. Tax modelling also includes the valuation of existing tax losses carried forward. No withholding taxes on dividends from subsidiaries have been allowed for.

Within the business covered of ERGO, tax grouping effects are taken into account.

## 5.9 Economic assumptions

The economic assumptions are derived following a market-consistent valuation approach. Many asset classes and economic assumptions are modelled stochastically. These include equity and property returns, bond yields, interest rates and inflation.

The construction of risk-neutral economic scenarios requires careful calibration to the underlying market parameters to ensure that the valuation replicates the market prices of assets. The key areas for calibration are initial yield curves, implied market-consistent volatilities of all relevant asset classes and correlations between asset classes. The interest-rate model used considers both parallel shifts and twists to the yield curve.

The economic scenarios have been calibrated to the market conditions at the valuation dates, i.e. reference rates, swaption prices and equity option prices. Generally, swap rates have been used as an approximation of the risk-free yield curves. In countries without deep and liquid swap markets, government bonds were used instead.

The calculations of the time value of financial options and guarantees are based on stochastic simulations. The calibration has been provided by Barrie & Hibbert, a UK-based financial consulting company. An Economic Scenario Generator (ESG), also provided by Barrie & Hibbert, has been used to centrally generate the stochastic scenarios. Risk-free nominal interest rates are modelled using a LIBOR market model.

The parameters used for year-end 2010 and 2011 are shown in Section 6.3.

## 5.10 Business covered

The MCEV reported for 2011 covers 100% of the life reinsurance business written by Munich Re. With regard to our primary insurance business, the MCEV 2011 covers 94% of our business written in the life and the German health primary insurance entities of Munich Re.

Reinsurance companies, major branches writing covered life reinsurance business as well as primary insurance companies writing covered primary insurance business are listed in the following table:

### Business covered

<b>Life reinsurance business</b>
Munich Reinsurance Company of Australasia Ltd, Sydney
Münchener Rück do Brasil Resseguradora S.A., São Paulo
Münchener Rückversicherungs-Gesellschaft AG, Munich
Munich Reinsurance Company Life Reinsurance Eastern Europe/Central Asia, Moscow
Munich Reinsurance Company of Africa Ltd, Johannesburg
Neue Rückversicherungs-Gesellschaft, Zurich
Munich Re of Malta p.l.c., Floriana
Munich American Reassurance Company, Atlanta, Georgia
Major branch offices writing life reinsurance business
Munich Reinsurance Company Canada Branch (Life), Toronto
Munich Reinsurance Company United Kingdom Life Branch, London
<b>German life primary business</b>
ERGO Lebensversicherung Aktiengesellschaft, Hamburg
VICTORIA Lebensversicherung Aktiengesellschaft, Düsseldorf
ERGO Direkt Lebensversicherung AG, Fürth
Vorsorge Lebensversicherung Aktiengesellschaft, Düsseldorf
Vorsorge Luxemburg Lebensversicherung S.A., Munsbach
<b>German health primary business</b>
DKV Deutsche Krankenversicherung Aktiengesellschaft, Cologne
<b>International life primary business</b>
ERGO Previdenza S.p.A., Milan
Sopockie Towarzystwo Ubezpieczeń na Życie Ergo Hestia Spółka Akcyjna, Sopot
ERGO Life Insurance SE, Vilnius
ERGO Insurance N.V., Brussels
VICTORIA-VOLKSBANKEN Versicherungsaktiengesellschaft, Vienna
Bank Austria Creditanstalt Versicherung AG, Vienna

In 2011, ERGO has sold its Portuguese subsidiary VICTORIA-Seguros de Vida S.A.. The transaction became effective as of 31 December 2011.

Furthermore; ERGO's life insurance companies in the Baltic States became one European company called ERGO Life Insurance SE as of 3 January 2011. The head office of the company is located in Lithuania (Vilnius), with branches in Estonia and Latvia.

## 6 Assumptions



### 6.1 Tax rates

#### Long-term tax rates

%	Reinsurance		Primary insurance	
	31.12.2011	31.12.2010	31.12.2011	31.12.2010
Germany	33	33	32	32
Italy	34	32	35	33
US	35	35		
UK	25	27		
Canada	26	26		

Within the business covered, tax grouping effects at ERGO are taken into account. The above tax rates show the company tax rates.

### 6.2 Currency exchange rates

#### Currency exchange rates

€1 = ... foreign currency	31.12.2011	2011	31.12.2010
		average year	
US\$	1.296	1.393	1.338
£	0.833	0.868	0.857
Can\$	1.324	1.377	1.336

Munich Re's reporting currency is the euro. Embedded value earnings based on the original currency are converted using average-of-year currency exchange rates. In the table above, the average-of-year exchange rates and the period-end exchange rates for the valuation year 2011 as well as the exchange rates from the end of last year are shown for the major currencies.

### 6.3 Economic assumptions

The embedded value results for 2011 are based on economic market conditions as of 31 December 2011.

In the following sections, the key economic assumptions, i.e. the reference yield curve, implied volatilities for each asset class as well as correlations between different asset classes, are described for the major currencies.

#### 6.3.1 Reference rates

Generally, swap rates have been used as an approximation of the risk-free yield curves. In countries without deep and liquid swap markets, government bonds were used instead.

For interpolation, a regression spline technique is used and extrapolation is done using the Nelson-Siegel form.

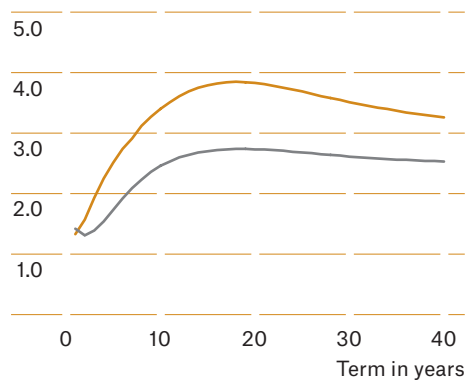
The table below shows the zero spot rates at the relevant valuation date for the major currencies.

#### Zero spot rate

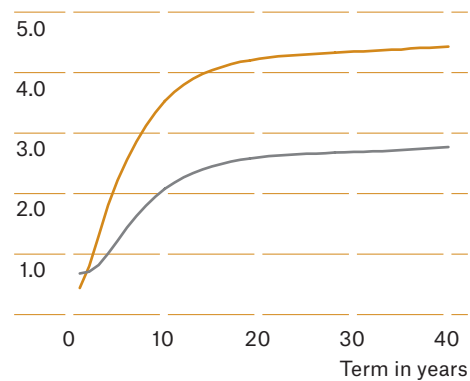
Term %	31.12.2011				31.12.2010			
	€	US\$	£	Can\$	€	US\$	£	Can\$
1 year	1.42	0.68	1.09	1.02	1.33	0.44	0.88	1.25
2 years	1.31	0.71	1.30	1.10	1.57	0.80	1.51	1.80
3 years	1.39	0.82	1.37	1.21	1.93	1.30	1.99	2.12
4 years	1.54	1.01	1.47	1.33	2.25	1.81	2.37	2.38
5 years	1.73	1.22	1.61	1.48	2.51	2.22	2.69	2.60
6 years	1.92	1.44	1.75	1.63	2.74	2.56	2.96	2.81
7 years	2.09	1.63	1.91	1.80	2.94	2.86	3.19	3.01
8 years	2.23	1.80	2.06	1.97	3.12	3.12	3.39	3.20
9 years	2.36	1.95	2.20	2.14	3.27	3.34	3.56	3.37
10 years	2.46	2.08	2.32	2.29	3.40	3.53	3.70	3.53
15 years	2.70	2.45	2.79	2.76	3.79	4.04	4.08	4.04
20 years	2.73	2.60	3.02	2.86	3.83	4.23	4.17	4.18
25 years	2.68	2.66	3.12	2.76	3.69	4.30	4.12	4.11
30 years	2.61	2.69	3.17	2.62	3.51	4.35	4.03	3.96

The following graphs illustrate the zero spot rate curves.

#### Zero spot rate (%)

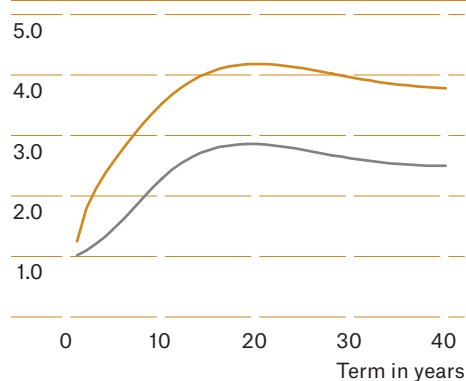


● € (year-end 2010) ● € (year-end 2011)

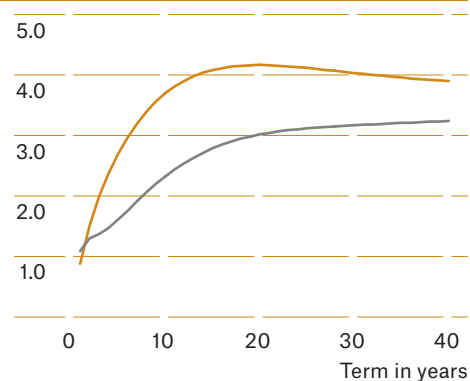


● US\$ (year-end 2010) ● US\$ (year-end 2011)

#### Zero spot rate (%)



● Can\$ (year-end 2010) ● Can\$ (year-end 2011)



● £ (year-end 2010) ● £ (year-end 2011)

### 6.3.2 Volatilities

The interest-rate scenarios have been generated to replicate at-the-money swaption prices. The implied volatilities for these swaptions are outlined in the following table:

**Target swaption implied volatilities (tenor of 20 years)**

Term	31.12.2011		31.12.2010	
	€	US\$	€	US\$
1 year	38.50	40.20	24.10	25.10
2 years	35.30	36.90	22.00	23.40
3 years	32.90	34.50	20.70	22.10
4 years	31.20	33.20	19.40	21.20
5 years	30.30	32.20	18.70	20.20
10 years	28.70	28.40	18.20	16.30
15 years	29.30	27.40	20.50	15.20
20 years	29.20	26.90	22.70	13.80
30 years	23.30	32.80	20.50	14.40

The equity models have been calibrated to implied volatilities of at-the-money equity index options observed in the OTC market. The ten-year implied volatility (the longest maturity option available) is shown in the table below.

**Target equity implied volatilities**

Equity index	31.12.2011		31.12.2010	
	EURO STOXX	S&P 500	EURO STOXX	S&P 500
%	27.90	31.00	27.30	27.40

### 6.3.3 Correlation coefficients

Our models have been calibrated to the coefficients shown in the table below, reflecting global long-term assumptions concerning the correlations between equities and interest rates. The coefficients have been estimated from historic market data.

**Target correlation coefficients**

Correlation pair	31.12.2011	31.12.2010
Equity and ten-year government bond	0.130	0.160
Equity and nominal short rates	-0.090	-0.150
Equity and real short rates	-0.070	0.000
Equity and ten-year inflation-linked government bond	0.100	0.100

### 6.3.4 Expected return in excess of reference rate

For the expected return in excess of reference rate 2011 Munich Re refined its approach to support management's expectation. The revised approach is more granular, assigning excess return expectations to all fixed income securities differentiated by their rating. In contrast, in 2010 an expected return in excess of reference rate was only applied to corporate bonds, having amounted to 80 BP for all corporate bonds. The following table shows management's expectations for 2011 based on the refined methodology and for 2010 based on the former approach.

#### Expected return in excess of reference rate

BP	2011	2010
Equities	440	520
Real estate	300	200
Corporate bonds	-	80
Fixed income		
AAA	0	-
AA/A	110	-
BBB and worse	170	-
All other assets	0	0

## 7 Independent assurance report



### Introduction

Based on the engagement letter dated 13 December 2011, KPMG has been engaged to audit the Market Consistent Embedded Value (MCEV) of Münchener Rückversicherungs-Gesellschaft Aktiengesellschaft, München, (Munich Re) as at 31 December 2011 as stipulated in the accompanying MCEV Report of Munich Re. Munich Re is responsible for the preparation of the MCEV Report including the calculation of the MCEV. This includes particularly setting the operative and economic assumptions, the explanation concerning the determination of the MCEV and its roll forward, the implementation and the operativeness of the system which ensures the completeness and correctness of the data which are necessary for the calculation of the MCEV. Our responsibility is to express an opinion on the calculation of the MCEV as to whether the methodology and the assumptions used comply with the Market Consistent Embedded Value Principles® as published by the CFO Forum on 4 June 2008 and amended in October 2009 (Market Consistent Embedded Value Principles) except principles 17.3.37 to 17.3.45 (Group MCEV). Munich Re does not apply an illiquidity premium in the calculation of the MCEV but discloses an additional sensitivity which allows to understand and to assess the impact of an illiquidity premium on the MCEV of Munich Re.

### Subject matter and criteria

For the calculation of the MCEV, Munich Re applies criteria as set out in the Market Consistent Embedded Value Principles except principles 17.3.37 to 17.3.45. The calculation of Market Consistent Embedded Values is necessarily based on numerous assumptions with respect to economic conditions, operating conditions, taxes, and other matters. Many of these are beyond the Company's control. Actual cash flows in the future are likely to be different from those assumed in the calculation and such variation may be material.

### Work performed

We conducted our audit of the MCEV in accordance with the International Standard on Assurance Engagements (3000): "Assurance engagements other than audits or reviews of historical financial information", issued by the International Auditing and Assurance Standards Board. The effectiveness of the accounting-related internal control system in the MCEV calculation is examined primarily on a test basis within the framework of the audit. The audit includes assessing the MCEV principles used and significant estimates and assumptions made by management. As a result of determining our audit strategy and audit objectives we have established Market Consistent Embedded Value Principles 3, 6, 7, 9, 11, 12, 13, 14, 15 and 16 as the special focus of our audit.

We believe that our audit provides a reasonable basis for our opinion.

Regarding our independence, we comply with the requirements of the IFAC Code of Ethics for Professional Accountants.



## Conclusion

In our opinion, the methodology and the assumptions used comply with the Market Consistent Embedded Value Principles except principles 17.3.37 to 17.3.45. Munich Re does not apply an illiquidity premium in the calculation of the MCEV but discloses an additional sensitivity which allows to understand and to assess the impact of an illiquidity premium on the MCEV of Munich Re. In particular:

- // The calculated MCEV is the present value of shareholders' interests in the earnings distributable from assets allocated to the covered business after sufficient allowance for the aggregate risks in the covered business. Section 5 sets out the methodology of making allowance for the aggregate risks. In particular by the use of
  - a level of required capital derived from internal risk models and additional regulatory restrictions,
  - a market-consistent assessment of the time value of financial options and guarantees, and
  - a deduction for frictional cost of required capital based on the cost of double taxation, investment expenses and, where applicable, policyholder participation on the required capital,
  - a deduction for the cost of residual non-hedgeable risks.
- // The operating assumptions have been set with appropriate regard to past, current and expected future experience.
- // The economic assumptions used are internally consistent and consistent with observable market data.
- // For the primary participating business, the assumed bonus distribution, asset allocation, allocation of profit between policyholders and shareholders, and other management actions are consistent with other assumptions used in the projections, and with local market practice.
- // We have also performed limited high-level checks on the results of the calculations. We have not, however, performed detailed checks on all the models and processes involved.

We have provided the services described above on behalf of Münchener Rückversicherungs-Gesellschaft Aktiengesellschaft, München. We have carried out our engagement on the basis of the General Engagement Terms included in our engagement agreement dated as of January 1, 2002. By taking note of and using the information as contained in our Assurance Report each recipient confirms to have taken note of the terms and conditions stipulated in the aforementioned General Engagement Terms (including the liability limitations to €4m for negligence specified in item No. 9 included therein) and acknowledges their validity in relation to us.

Cologne, 12 March 2012

KPMG Bayerische Treuhandgesellschaft Aktiengesellschaft  
Wirtschaftsprüfungsgesellschaft  
Steuerberatungsgesellschaft

**Hanno Reich**  
Partner

**Stefan Hensen**  
Manager

## 8 Statement by directors



I confirm that the MCEV of Munich Re as at 31 December 2011 has been prepared in accordance with the Market Consistent Embedded Value Principles® (MCEV principles) issued by the CFO Forum on 4 June 2008 and amended in October 2009. In particular, I confirm that

- Non-economic assumptions for future experience have been set with regard to past, current and expected future experience and to any other relevant data.
- The economic assumptions used are internally consistent and consistent with observable market data.
- Management actions are consistent with other assumptions used in the projections and assumptions used for other purposes, e.g. projections required in the annual planning of profits and losses. The investment strategy and the realisation of unrealised capital gains are in line with management's expectations. For participating business, assumptions on future bonus rates and profit allocation between policyholders and shareholders are made on a basis consistent with the projection assumptions, established company practice and local market practice.
- Dynamic policyholder behaviour is, where material, taken into consideration in the time value of financial options and guarantees.

However, the following Group-wide items of non-compliance exist:

- Munich Re does not publish a Group MCEV in line with MCEV principles 17.3.37 to 17.3.45

Munich, 12 March 2012

**Dr. Jörg Schneider**  
CFO

## 9 Disclaimer



This report contains forward-looking statements that are based on current assumptions and forecasts of the management of the Munich Re. Known and unknown risks, uncertainties and other factors could lead to material differences between the forward-looking statements given here and the actual development; in particular the results, financial situation and performance of our company. Munich Re assumes no liability to update these forward-looking statements or to conform them to future events or developments.

## 10 Glossary and abbreviations



Aa

### **Acquired (divested) business //**

Business acquired (divested) through acquisition (sale) of stakes in insurance or reinsurance companies

### **Adjusted net worth (ANW) //**

Also known as shareholders' net worth or adjusted net asset value. MCEV Principles distinguish between free surplus and required capital.

### **Assumption changes //**

Aggregate impact of changes in the operating assumptions on the embedded value

Bb

### **Best estimate assumption //**

An assumption that represents the expected outcome from the range of possible outcomes of future experience

Cc

### **Capital movements //**

Dividends and capital contributions

### **Costs of residual non-hedgeable risks (CRNHR) //**

Allowance for risks not already included in the PVFP or TVFOG. Munich Re uses a cost-of-capital approach with a unique cost rate applied to the projected risk capital for non-hedgeable risks.

### **Covered business //**

The business for which the embedded value is reported

### **Currency movements //**

Aggregate impact of currency movements on the embedded value

Ee

### **Economic assumptions //**

These include reference rates, discount rates, inflation rates and assumptions on the volatility of economic parameters

### **Economic variances //**

Sum of the difference between projected and actual investment return in the reporting year and effects on the embedded value from changes in capital market parameters

### **Embedded value //**

Present value of shareholders' interests in the earnings distributable from assets allocated to the business covered after sufficient allowance for the aggregate risks in business covered

### **European Embedded Value (EEV) //**

Embedded value according to the European Insurance CFO Forum European Embedded Value Principles ('EEV Principles'). Published in May 2004, available online at <http://www.cfoforum.nl>

### **Expected return at reference rate //**

Return for the reporting year if all assumptions of the previous year would remain constant. Besides the risk-free roll-forward of the embedded value at the beginning of the year, it also reflects the unwind of frictional costs, costs for non-hedgeable risks and the decay of the time value of financial options and guarantees.

**Expected return in excess of reference rate //**

Additional return for one year expected by the management due to assumed risk premiums for certain asset classes

**Experience variances //**

The impact on the embedded value of differences between the actual operating experience in the reporting year and the operating result assumed in the previous embedded value calculation

Ff

**Free surplus (FS) //**

Amount of capital allocated to the business in excess of the required capital

**Frictional costs of required capital (FCRC) //**

Allowance for taxation and investment costs on the assets backing required capital. Additionally, for German health primary business FCRC includes the cost of profit sharing of investment income on assets backing required capital.

Ii

**IFRS //**

International Financial Reporting Standard

Li

**Look-through basis //**

A basis via which the impact of an item on the whole Group is measured, rather than on a particular part

Mm

**Market Consistent Embedded Value (MCEV) //**

Embedded value according to the European Insurance CFO Forum Market Consistent Embedded Value Principles ('MCEV Principles'), Copyright Stichting CFO Forum Foundation 2008. Published in June 2008, available online at <http://www.cfoforum.nl>. Currently we do not make use of any illiquidity premiums in line with to the amendment to the MCEV Principles, published by the CFO Forum in October 2009.

Oo

**Opening/closing adjustments //**

Change in embedded value due to capital movements, foreign exchange variance or acquired/divested business

**Operating assumptions //**

All assumptions relating to demographic assumptions (e.g. mortality, morbidity), expenses, policyholder participation and policyholder behaviour

**Operating MCEV earnings //**

The sum of expected return, value of new business, experience variances, assumption changes and other operating variance

**Other operating variance //**

Effects from a change or improvement in models and tax planning action

**Other non-operating variance //**

Impacts of legal or regulatory changes including taxation

Pp

**Participating business //**

Primary insurance business in which policyholders have the right to participate in the performance of a specified pool of assets or contracts

**Present value of future profits (PVFP) //**

The value of future profits from the in-force covered business and the assets backing the associated liabilities; net of tax, policyholder participation and minorities

**Present value of new business premiums (PVNBP) //**

Present value of future premiums from new business

Rr  
Rr

**Reference rate //**

Proxy for a risk-free rate

**Required capital (RC) //**

The amount of surplus assets whose distribution to shareholders is restricted

**RfB //**

The "Rückstellung für Beitragsrückerstattung (RfB)" is the provision for premium refunds in German primary insurance

**Risk-free (interest) rates //**

Prospective yields on securities considered to be free of default and credit risk

Ss

**Statutory basis //**

Valuation basis used for reporting financial statements to local regulators

Tt

**Time value of financial options and guarantees (TVFOG) //**

The time value of financial options and guarantees is part of the VIF; the VIF before deduction of the allowance for the time value of financial options and guarantees reflects their intrinsic value

Vv

**Value of in-force business (VIF) //**

The value of in-force covered business is the present value of future shareholder cash flows (PVFP) reduced by costs of residual non-hedgeable risks (CRNHR), the frictional costs of required capital (FCRC) and the time value of financial options and guarantees (TVFOG)

**Value of new business (VNB) //**

The value added through the activity of writing new business

© 2012  
Münchener Rückversicherungs-Gesellschaft  
Königinstrasse 107  
80802 München  
Germany  
[www.munichre.com](http://www.munichre.com)

**Responsible for content**

Group Controlling  
Group Communications

Editorial deadline: 12 March 2011  
Online publication date: 13 March 2011

**Service for investors and analysts**

If you have general questions on Munich Re shares, please use our shareholder hotline:  
Tel.: +49 89 38 91-22 55  
[shareholder@munichre.com](mailto:shareholder@munichre.com)

If you are an institutional investor or analyst, please contact our investor relations team:  
Christian Becker-Hussong  
Tel.: +49 89 38 91-39 10  
Fax: +49 89 38 91-98 88  
[ir@munichre.com](mailto:ir@munichre.com)

**Service for media**

Journalists may address their queries to our Media Relations Department:  
Johanna Weber  
Tel.: +49 89 38 91-26 95  
Fax: +49 89 38 91-35 99  
[presse@munichre.com](mailto:presse@munichre.com)

