Are blue chip stock market indices good proxies for all-shares market indices? The case of the Brussels Stock Exchange 1833–2005¹

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In this article, we calculate a market-weighted return index for the 20 largest stocks listed on the Brussels Stock Exchange over the period 1833–2005, based on a new, unique and high-quality database. We find that this index captures the most important stylised facts of the value-weighted return of all shares listed on the Brussels Stock Exchange in this period. Our results support the empirical practice of concentrating on just the largest stocks. The indices we construct are based on one of the longest Belgian time series available. The indices take into account the exact dividends, the timing of the dividend cash flows and all capital operations. We are therefore able to decompose total returns into capital gain returns and dividend returns, which is not possible with most historical return series. We show that, to construct a credible return index, it is crucial to fully take into account dividends.

Keywords: stock return indices, Brussels stock exchange, capital gain, dividends

JEL classification: G100, G110, G120

I

When Charles Dow computed the first Dow-Jones Industrial Average Index in 1896, his goal was to construct an index that could measure changes in market sentiment. His approach was crude by modern standards since he simply took the average of the prices of a select number of securities and neglected dividend payments. Nevertheless, this rough measure is still reported in the news headlines on a daily basis. In a similar vein, nineteenth- and early twentieth-century historians have

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measured stock market trends with a limited number of securities, sometimes without even taking the relative importance of companies into account. The concept of a market portfolio, consisting of a weighted sum of every asset in the market, with weights proportional to their market capitalisation, only gained importance when equilibrium models such as the Capital Asset Pricing Model were published. Hence, when calculating an index in pre-computer days, no particular attention was devoted to weighting schemes (with some notable exceptions, such as in Cowles 1938), nor to the inclusion of dividends. The selected stocks were assumed to represent the economy. One can argue that Dow's approach merely represents an application of the Pareto principle (also known as the 80–20 rule or the law of the vital few), which states that, for many events, roughly 80 per cent of the effects stem from 20 per cent of the causes. The remarkably high correlations often reported between the Dow-Jones Industrial Average Index and broader-based indices such as the S&P500 seem to confirm the Pareto principle.

In this article, we calculate a market-weighted return index for the 20 largest stocks listed on the Brussels Stock Exchange (BSE) over the period 1833–2005, based on a new, unique and high-quality database. While the importance of the BSE on a world scale is nowadays negligible, in the past it was among the top ten stock markets of the world (Neymarck 1911, p. 442). The BSE was the most important Belgian stock exchange in the nineteenth and twentieth centuries. It was a very international and open market, with listed companies from all over the world. This is not surprising, as Belgium was the first country to take part in the Industrial Revolution on the European continent (Bairoch 1982, pp. 269–312). Much foreign capital (largely French and German) flowed to the BSE and was subsequently reinvested abroad (Chlepner 1930; Maddison 1995). Before World War I, Belgium was, per capita, among the top foreign direct investors. In the period between the two World Wars, there were more than 1000 companies and more than 1500 stocks quoted on the BSE (see Figure 1). Contrary to some other countries where only a few sectors developed, the Belgian economy was widely diversified with important activities ranging from railways, tramways, coal mining, steel and glass to banking, telecommunications and electricity.

We find that a market-weighted return index for the 20 largest stocks, which we call the SCOB20 index, captures relatively well the most important stylised facts of the value-weighted return of all shares listed on the BSE in this period. Our results support the empirical practice of limiting return indices to just the largest stocks of an economy. The indices take into account the exact dividends, the timing of the dividend cash flows and all capital operations. We are therefore able to decompose total returns into capital gain returns and dividend returns, which is not possible with most historical return series. We show that, to construct a credible return index, it is crucial to fully take into account dividends. Unfortunately, most countries' historical records do not include precise dividend data for the nineteenth century.

The remainder of the article is structured as follows. In Section II we describe our dataset. In Section III we discuss the methodology used to construct our indices.

Figure 1. *Evolution of the (end of the year) number of stocks at the BSE (1832–2005)*

Source: SCOB database. Version 2008.05.

In Section IV we discuss the historical context of the evolution of the SCOB20 index and the Belgian all-shares index. In Section V we investigate whether the SCOB20 index is a good proxy for overall market returns. In Section VI we discuss the delisting bias. Finally, we conclude in Section VII.

II

The data used in this article were taken from the database of the SCOB (Studiecentrum voor Onderneming en Beurs) Research Centre of the University of Antwerp. This database includes end-of-the-month stock prices, dividends, interests, ex-dividend day and the number of stocks for all stocks ever quoted on the BSE. The SCOB database is unique for several reasons. First, the data go back to 1832, making Belgium one of the very few countries for which such a long time series is available. Second, the data have been well conserved in the official quotation lists available from 1832 onwards. There was hardly any need to rely on newspaper information. We only lack the official lists of 1833, 1835–8, 1840–5 and 1848–52. To fill these gaps, we use the IPO information lists of the Belgian Ministry of Foreign Affairs (Belgium, *Relevé des côtes* 1867) as well as the price lists printed in the official gazette *Le Moniteur Belge* (Belgium, *Moniteur Belge*). A publication of the official stock brokers (Commission des Agents de Change 1855) filled the remaining gaps. Third, complete information on dividends, capital operations, sector affiliation and number of quoted stocks is available. A lack of information on dividends, in particular, is one of the biggest difficulties when constructing historical time series for other markets. Last but not least, many high-quality secondary sources allowed us to double check the data. In Belgium, the secondary literature on company, stock and dividends

information is rather abundant and early, occurring in several important publications (Trioën 1839; Demeur 1857–4, 1876–84; Courtois 1855–1883; Van Damme 1859; Vitu 1864) in addition to financial newspapers such as *Moniteur des Intérêts Matériels* (various issues) and *Het Handelsblad*. The official price lists contain information on dividends from 1873 onwards. From 1893, the annual *Recueil Financier* (1893–1975), as well as the monographs by Coppin, provide a wealth of information (Coppin 1893–1901; *Recueil Financier*, 1893–1975). Company information is extracted from Frère and Laureyssens (Frère 1938, 1951; Laureyssens 1975). For recent decades, information is found in the *Memento der Effecten*, (internal) Euronext company files (with detailed information on capital operations) and the newspaper *Financieel-Economische Tijd* (subsequently *De Tijd*), which has published a detailed survey of all corporate operations on a monthly basis from 1992 until now (*Financieel-Economische Tijd*; *De TIJD*; *Het Handelsblad*; *Journal du Commerce d'Anvers*; *L'Avenir*; *Memento der Effecten*).

III

In this section we outline our methodology to construct the SCOB all-shares index and a narrower (blue chip) SCOB20 index. After discussing the computational issues, we address some stock selection issues.

First, in order to measure the investment performance on the Belgian stock market, we calculate a Laspeyres market capitalisation-weighted nominal price (capital gain without dividends) and a total nominal return (with dividends) index by linking monthly returns by the chain method. The index reflects the evolution of the value of 100 Belgian Francs (BEF) invested in Belgian-based stocks from the end of 1832 on. The indices are constructed as follows:

$$I_t = I_{t-1} \cdot \left(1 + \sum_{i=1}^{L_{t-1}} w_{i,t-1} r_{i,t} \right),$$

where I_t is the value of the index at the end of period t , $w_{i,t-1}$ is the weight attached to stock i at time $t-1$, L_{t-1} is the number of stocks at the end of month $t-1$ and $r_{i,t}$ is the ordinary return of stock i , including (excluding) dividends for the total return (price) indices. Dividends are included at the end of the ex-dividend month. We set I equal to 100 at the end of 1832. The weights used are the relative market capitalisations:

$$w_{i,t-1} = \frac{P_{i,t-1} N_{i,t-1}}{\sum_{j=1}^{L_{t-1}} P_{j,t-1} N_{j,t-1}},$$

where $N_{i,t-1}$ is the number of outstanding shares for stock i at the end of period $t-1$. Of course, adjustments for stock splits and reverse splits, bonus stocks, inscription rights and attribution rights are made. We take the geometric average (time-weighted rate of return) as an indicator of the return on investment.

Volatility typically is measured by the standard deviation of returns, which is calculated based on monthly returns in order to capture intra-year volatility. However, when annualising the variance, we adjust for potential autocorrelation (11 lags), as the hypothesis that there is no autocorrelation in the monthly return data is rejected by the data. The annualised variance is:

$$\sigma_{\text{yearly}}^2 = \left\{ 12 + 2 \times \sum_{j=1}^{11} (12 - j)\rho_j \right\} \sigma_{\text{monthly}}^2,$$

where ρ_j is the return autocorrelation at lag j .

Besides nominal returns, we also compute real returns. The consumer price index (CPI) is used to deflate the nominal series. For the period before World War I, we use data from Michotte and Van de Velde (Michotte 1937, pp. 346–57; Van de Velde 1943, pp. 21–5). For the period after World War I, we use data from the Ministry of Economics (Belgium, *CPI-index 1920–2008*). The biggest problem with respect to estimating inflation is the highly murky price evolution during the two World War periods. We follow the methodology proposed by Van de Velde (1943) for World War I by taking the official price index, as this index approximately followed the real price evolution. For World War II we compute inflation as a weighted average of inflation based on the official price index and the index on the black market (National Bank of Belgium 1951, p. 224, table 22.2). More specifically, we take 75 per cent of the official market rate and 25 per cent of the black market rate. Although somewhat arbitrary, these proportions approximately correspond to what people spent on both markets.

Second, we consider stock selection issues. The SCOB database contains various kinds of stocks (common stock, preferred stock, etc.). We only select common stocks, and ignore bonds and other instruments with mixed characteristics (Fisher and Lorie 1964, pp. 1–21; 1968, pp. 291–316; 1977). We also restrict the sample to stocks traded on the spot market. There are several reasons for this. First, stocks that were listed on the forward market had to be listed on the spot market, but not vice versa, implying that the spot market had wider coverage. Second, there are no continuous data on the forward market, as it was closed from 1940 until 1950 due to World War II and its aftermath, while spot market data are available for this period. Third, before 1871 there was no forward market. Indeed, forward contracts were not officially allowed and were considered a form of gambling (known as *exception de jeu*). Fourth, between 1871 and 1914 the forward market was comprised nearly exclusively of foreign stocks.

We only take into account Belgian-based companies, even when they invested mainly abroad, such as steel producer Société Métallurgique Dniéprovienne du Midi de la Russie (founded in 1886 and mainly producing in Russia) and Belgian Congo companies such as Union Minière du Haut Katanga (founded in 1906). However, no foreign-based companies ('cross-listings') are in our sample.

All data are taken from the SCOB database, which offers end-of-the-month prices, dividends, interests, ex-dividend day and number of stocks from the BSE. Whenever a given stock does not trade on the last day of a month, the previous price is used. In general, whenever the default opening price is missing we take either one of the following (in order of preference): previous price, bid and ask prices or external prices (as available in the *Prix Courant* published in the *Le Moniteur Belge*). All stocks ever quoted are available, so selection bias is avoided. We always consider the number of stocks admitted on the official quotation list. This number can be smaller than the total number of stocks issued.

We define the SCOB20 as an index comprising the common stock of the 20 companies that had the largest market capitalisation on the last day of the previous year. The SCOB20 therefore does not suffer from survivorship bias, as we select stocks without any look-ahead knowledge (the same applies to the all-shares index). As for the all-shares index, the SCOB20 index uses market capitalisation weights. We keep the composition of the SCOB20 constant during the year and rebalance at the end of the year. In the exceptional case that a SCOB20 company delists, it is only replaced at the end of December. There was one year in which the twentieth and twenty-first companies had identical market capitalisations; in that case we included both of them in the index.

IV

In order to put the realised stock market performance into perspective, in this section we discuss the historical context of the evolution of the SCOB20 index and the all-shares index (Chlepner 1930; Van der Wee 1997; Van de Velde 1943; Mommen 1994). Yearly nominal and real capital gain and total returns for the SCOB20 and the all-shares index are tabulated in Table 1, while Table 2 reports, for different sub-periods, the geometric average return and volatility for the all-shares return index and the SCOB20 index, as well as the CPI. Furthermore, Figures 2, 3 and 4 show yearly total returns and the total real return all-shares index for the periods 1832–1914, 1914–50 and 1950–2005, respectively. At the end of this section, we also discuss the market constituents of our stock exchange indices. As the performance of the BSE was, to a large extent, driven by some dominant sectors, a breakdown of the market constituents into sectors can help one to understand the evolution of the indices considered in this study.

First, we discuss the period 1833–1914, which was characterised by moderate inflation and sometimes even deflation; and a rather stable currency: compared to the period after World War I, the BEF had the same purchasing power in 1913 as in 1832. Furthermore, in this period there were no dividend taxes and almost no company taxes. It was also a period of ‘capitalism for the few’, with huge disparities in income and wealth, extremely low wages, hardly any social protection for the working class and, on the political side, restricted voting rights for the vast majority of the population (although more so in the early years). This had consequences for

Table 1. *Annual indices SCOB20 and all shares (capital gain, total return, both nominal and real)*

	SCOB 20				All shares			
	Nominal		Real		Nominal		Real	
	CG	TR	CG	TR	CG	TR	CG	TR
1833	100	106	100	106	100	106	100	106
1834	116	130	116	130	116	130	116	130
1835	123	144	123	144	119	138	119	138
1836	124	151	123	149	128	153	126	151
1837	128	161	126	159	131	161	130	160
1838	117	151	109	141	122	153	113	142
1839	105	138	98	130	109	139	102	131
1840	96	130	88	119	99	130	91	119
1841	89	124	82	113	92	124	84	113
1842	85	121	76	108	88	121	78	108
1843	86	126	90	132	88	125	92	130
1844	85	128	89	134	86	126	90	132
1845	102	160	98	153	106	159	101	152
1846	115	185	108	174	120	186	113	174
1847	105	176	95	158	109	174	98	157
1848	58	100	56	97	60	99	58	96
1849	66	118	65	116	68	117	67	114
1850	79	145	79	145	83	146	83	146
1851	79	151	81	155	83	152	85	156
1852	109	215	110	218	113	213	115	215
1853	108	221	106	217	113	220	111	215
1854	104	222	85	183	108	221	89	182
1855	113	255	88	199	117	251	91	196
1856	120	284	94	223	125	283	99	223
1857	115	293	94	238	120	289	97	236
1858	121	326	106	286	125	319	109	280
1859	114	325	105	299	118	318	108	292
1860	107	322	94	285	110	314	97	278
1861	108	346	90	287	110	333	91	276
1862	115	389	93	314	115	367	93	297
1863	110	392	96	340	111	371	96	322
1864	108	400	98	364	107	374	97	341
1865	110	430	96	377	109	404	95	354
1866	106	437	88	365	105	412	88	344
1867	102	448	83	365	102	420	83	342
1868	108	498	91	421	104	448	88	378
1869	98	472	84	402	98	437	83	372
1870	99	502	87	440	99	461	86	404

Continued

Table 1. *Continued*

	SCOB 20				All shares			
	Nominal		Real		Nominal		Real	
	CG	TR	CG	TR	CG	TR	CG	TR
1871	109	567	94	488	106	514	91	442
1872	128	693	106	574	127	638	105	529
1873	139	782	107	600	145	762	111	584
1874	135	825	109	666	135	769	109	621
1875	116	741	97	620	119	710	100	594
1876	98	661	78	524	102	636	81	505
1877	96	670	76	531	98	635	78	504
1878	93	674	77	559	94	630	78	522
1879	112	842	96	717	120	833	102	710
1880	105	816	94	730	122	879	109	786
1881	105	837	93	748	119	883	106	789
1882	94	781	85	705	107	826	96	745
1883	90	781	80	698	99	795	88	711
1884	87	786	83	753	90	761	87	729
1885	83	783	82	775	84	735	83	728
1886	81	794	88	860	81	735	88	797
1887	82	837	84	856	83	783	85	801
1888	89	936	93	979	92	905	96	947
1889	98	1078	100	1103	115	1183	118	1211
1890	99	1140	97	1115	111	1198	109	1173
1891	97	1166	95	1141	103	1173	101	1148
1892	96	1214	98	1242	101	1207	103	1235
1893	92	1208	97	1278	97	1220	103	1290
1894	99	1360	107	1473	106	1374	114	1489
1895	101	1444	112	1601	105	1414	116	1568
1896	109	1615	125	1858	112	1564	129	1800
1897	119	1840	135	2090	121	1757	137	1996
1898	118	2121	134	2410	128	2021	146	2297
1899	124	2323	139	2607	127	2093	142	2349
1900	107	2125	106	2102	109	1899	108	1879
1901	96	2002	93	1939	93	1698	90	1644
1902	98	2114	97	2091	90	1730	89	1711
1903	106	2383	104	2357	96	1937	95	1916
1904	117	2741	133	3115	105	2197	120	2497
1905	123	2994	136	3319	119	2559	131	2837
1906	127	3218	128	3255	128	2856	129	2889
1907	117	3094	114	3028	113	2652	111	2595
1908	118	3246	114	3146	111	2709	107	2625

Continued

Table 1. *Continued*

	SCOB 20				All shares			
	Nominal		Real		Nominal		Real	
	CG	TR	CG	TR	CG	TR	CG	TR
1909	128	3693	126	3614	125	3183	122	3115
1910	136	4074	130	3905	131	3464	126	3320
1911	131	4069	118	3673	126	3469	114	3131
1912	138	4469	116	3773	130	3727	110	3146
1913	131	4575	116	4048	120	3617	106	3201
1914	124	4480	101	3675	114	3552	94	2914
1915	124	4543	76	2781	114	3587	70	2196
1916	126	4676	48	1784	113	3592	43	1370
1917	130	4829	25	939	122	3875	24	753
1918	154	5765	22	818	142	4577	20	650
1919	163	6326	37	1446	177	5831	40	1333
1920	138	5496	26	1053	154	5311	29	1018
1921	129	5359	29	1212	147	5354	33	1211
1922	153	6583	37	1592	180	6831	43	1652
1923	223	9900	47	2092	263	10343	56	2186
1924	245	11203	44	2022	245	10043	44	1813
1925	299	14162	52	2473	251	10723	44	1872
1926	486	23646	71	3461	400	17703	59	2591
1927	872	43324	100	4984	656	29850	76	3434
1928	1024	51740	113	5705	809	37598	89	4146
1929	651	33479	67	3460	549	26148	57	2703
1930	419	22150	43	2291	380	18693	39	1934
1931	265	14492	30	1643	252	12869	29	1459
1932	270	15294	34	1922	249	13179	31	1656
1933	242	14082	31	1807	217	11795	28	1514
1934	180	10815	24	1469	170	9572	23	1300
1935	234	14489	32	2004	254	14719	35	2036
1936	261	16759	34	2213	306	18395	40	2429
1937	235	15569	29	1916	277	17219	34	2120
1938	205	14248	24	1693	240	15730	29	1869
1939	163	11942	19	1407	181	12518	21	1474
1940	358	26959	28	2082	397	28510	31	2201
1941	631	48175	26	1969	694	50531	28	2066
1942	663	50822	18	1391	748	54819	20	1500
1943	581	44695	14	1073	677	49913	16	1198
1944	647	49800	16	1251	772	57022	19	1433
1945	618	48359	20	1570	746	55726	24	1809
1946	542	43244	20	1583	660	50286	24	1840

Continued

Table 1. *Continued*

	SCOB 20				All shares			
	Nominal		Real		Nominal		Real	
	CG	TR	CG	TR	CG	TR	CG	TR
1947	384	31536	13	1053	438	34383	15	1148
1948	381	32400	12	998	422	34566	13	1064
1949	436	38556	14	1250	490	41808	16	1355
1950	514	47117	16	1494	542	48110	17	1525
1951	722	68733	21	1980	728	67481	21	1944
1952	676	68003	20	1987	690	67568	20	1974
1953	725	76942	21	2238	722	74432	21	2165
1954	1080	119011	31	3424	988	105762	28	3043
1955	1429	168832	41	4842	1223	138166	35	3963
1956	1306	160761	36	4469	1149	135078	32	3755
1957	983	125567	27	3391	908	111211	25	3003
1958	1104	147264	30	3969	1011	129622	27	3494
1959	953	131864	25	3497	957	127478	25	3381
1960	776	112761	21	2996	788	110003	21	2922
1961	856	129845	23	3415	883	128826	23	3388
1962	781	122776	20	3192	822	124757	21	3244
1963	860	139581	21	3482	921	144741	23	3611
1964	913	153152	22	3675	931	151553	22	3637
1965	847	147849	20	3408	857	145192	20	3346
1966	648	117836	14	2633	665	117264	15	2620
1967	792	150287	17	3255	792	145802	17	3158
1968	870	172300	18	3631	879	168832	19	3558
1969	855	176700	17	3568	876	175741	18	3548
1970	902	196320	18	3844	874	184651	17	3615
1971	945	215903	18	4004	910	201975	17	3746
1972	1167	277659	20	4840	1138	263780	20	4598
1973	1220	301573	20	4899	1170	282628	19	4592
1974	839	217982	12	3061	831	211227	12	2966
1975	1009	276393	13	3496	967	259539	12	3283
1976	928	267934	11	3151	863	243585	10	2864
1977	911	280687	10	3104	829	248732	9	2751
1978	962	315921	10	3364	890	283897	9	3023
1979	1020	355274	10	3598	919	310242	9	3142
1980	828	310135	8	2921	756	273767	7	2578
1981	833	341538	7	2974	775	304849	7	2655
1982	943	420674	8	3389	906	386215	7	3111
1983	1246	605149	9	4549	1197	553304	9	4160
1984	1475	758942	11	5416	1410	688755	10	4915

Continued

Table 1. *Continued*

	SCOB 20				All shares			
	Nominal		Real		Nominal		Real	
	CG	TR	CG	TR	CG	TR	CG	TR
1985	1968	1071639	14	7352	1839	947884	13	6503
1986	2746	1555505	19	10609	2545	1362197	17	9290
1987	2341	1376790	16	9256	2183	1209221	15	8129
1988	3447	2095618	23	13823	3203	1832808	21	12089
1989	3598	2257357	23	14371	3578	2114396	23	13461
1990	2812	1824933	17	11226	2770	1688152	17	10385
1991	3145	2115351	19	12660	3044	1918142	18	11480
1992	2984	2089468	17	12212	2899	1894853	17	11074
1993	3938	2853375	22	16238	3808	2570311	22	14627
1994	3616	2701997	20	15096	3572	2481608	20	13865
1995	4018	3099807	22	17069	3939	2820916	22	15534
1996	4798	3805051	26	20437	4855	3560638	26	19124
1997	6208	5113418	33	27152	6349	4810681	34	25545
1998	8986	7519326	47	39694	8812	6782959	47	35807
1999	8006	6821431	41	35325	7970	6244498	41	32338
2000	8228	7136975	42	36060	7998	6380676	40	32238
2001	7944	7049754	39	34858	7688	6266151	38	30984
2002	5537	5028726	27	24529	5468	4561210	27	22249
2003	6258	5876255	30	28174	6285	5422011	30	25996
2004	8596	8289902	40	38862	8554	7589425	40	35578
2005	10594	10523885	48	47949	10640	9722753	48	44299

Notes: CG stands for capital gain; TR for total return, 1832 = 100.

Source: SCOB database. Version 2008.05.

the stock exchange. Stocks had an extremely high nominal value (on average, 1000 BEF a share, approximately the same as one year's labour wage), limiting participation in the stock market and causing liquidity problems, reinforced by the very strict government regulation of the stock market until 1867. Before 1873 it was extremely difficult to set up a limited liability company, as a Royal Decree was needed. A listing on the stock exchange also required government intervention. Interest rates were capped at 6 per cent for commercial loans. From 1865 until 1873 a set of fundamental institutional reforms transformed the legal system completely by removing almost all impediments to founding companies and stock exchange listings.

The period 1833–1914 starts with the *Gründerjahre* of Belgian capitalism (1833–48). The mixed banks Société Générale (established 1822) and Banque de Belgique (established 1835), the first universal banks in the world, financed the rapid upswing of an impressive number of new companies in a wide range of industries. The Belgian

Figure 2. *Total returns and the total return SCOB all shares index (1832–1914)*

Note: The total return index (left scale) represents the accumulated value of an investment of 100 BEF (starting at the end of 1832) in the stock market over time. The returns (right scale) are annual total real returns at the end of December for each year.

Source: SCOB database. Version 2008.05.

government financed a basic national railway system, which came into existence within a few years (1835–43). Economic life was regulated and the basic structures of a modern market economy were laid down. They were, however, not well established. In the absence of a lender of last resort, private banks could issue their own money. This had terrible consequences for the economy. Belgium went through two economic and financial crises in 1837–8 and 1847–8. The negative real return of –39.06 per cent in 1848 was the largest negative return recorded in Belgium over the period 1833–2005.

The crisis of 1848 resulted in the founding of the National Bank of Belgium in 1850, with the intention to bring stability to financial markets. In 1851 an interest guarantee system for constructing railways by private companies was established, which gave a boost to the construction of new railways and to railway-related industries such as coal mining and steel. As a result, the real capital gain index (starting in 1833 at an index value of 100) climbed from 55.94 in 1848 to 110.49 in 1852. During 1865–73 the Belgian economy liberalised, participating in a Europe-wide economic liberalisation movement. From 1865 on, interest rates could be freely determined in Belgium. In 1867 the liberalisation of the stock exchanges was initiated. This liberalisation was completed with the law of 1873 freeing-up the founding of limited liability companies. Belgium would not be involved in the first French–German War (1870–1), and it actually profited from an inflow of French and German capital after the war.

The period 1871–1914 represents the high days of European economic power and the first period of economic globalisation. Belgian firms invested heavily in countries as far flung as Argentina, Russia, Egypt and China (Peeters 1998, pp. 101–25; Cuyvers

Table 2. *Summary data on total return for the all shares and SCOB20 (real) data (all numbers are in percentage points)*

Period	All shares (real)		SCOB20 (real)		CPI ^c
	GM ^a	SD ^b	GM ^a	SD ^b	GM ^a
1833–2005	3.59	19.01	3.63	19.24	3.87
1833–1914	4.20	11.58	4.49	10.98	0.23
1921–2005	4.54	20.38	4.59	21.15	5.19
1900–2000	2.63	22.48	2.64	22.94	6.67
1833–1840	2.24	11.36	2.23	11.48	−0.37
1841–1850	2.00	18.40	1.98	18.40	−0.63
1851–1860	6.69	10.87	6.98	11.30	1.46
1861–1870	3.80	3.93	4.44	4.79	0.20
1871–1880	6.88	12.97	5.20	11.30	−0.10
1881–1890	4.09	7.58	4.34	4.85	−0.81
1891–1900	4.82	10.13	6.54	9.65	0.00
1901–1910	5.86	12.03	6.39	10.11	0.47
1911–1920	−11.15	35.64	−12.28	34.67	22.54
1921–1930	6.63	25.76	8.08	27.81	7.06
1931–1940	1.30	25.70	−0.96	25.29	4.11
1941–1950	−3.60	20.32	−3.26	19.12	12.92
1951–1960	6.72	15.61	7.21	19.94	1.83
1961–1970	2.15	10.02	2.53	10.21	3.10
1971–1980	−3.32	15.63	−2.71	16.33	7.64
1981–1990	14.95	19.77	14.41	20.66	4.38
1991–2000	11.99	13.87	12.38	14.13	1.99
2001–2005	6.56	23.21	5.86	23.48	2.09

^aGeometric mean. ^bAnnualised standard deviation. ^cCPI (average inflation by period).

Source: SCOB database. Version 2008.05.

and Van Bets 2009, pp. 189–210). Belgium also colonised the Congo. From the crisis of 1848 until the outbreak of World War I, Belgian shareholders were spared from large negative returns. Total real returns climbed as high as 6.54 per cent for the decade 1891–1900 and 6.39 per cent for the decade 1901–10.

World War I would put an end to economic globalisation, to monetary stability and to relatively peaceful European relations. At the same time it would bring democratisation of the Belgian political system and improve the miserable conditions of the working class. During World War I, Germany occupied Belgium and exploited the Belgian economy on a tremendous scale. Many firms were completely destroyed, machinery was deported and a lot of money was issued to finance the German war efforts (de Kerckhove de Denterghem 1927). Moreover, the Russian Revolution of 1917 made Foreign Direct investments in that country worthless, which hit

Figure 3. *Total returns and the total return SCOB all shares index (1914–1950)*

Note: The total return index (left scale) represents the accumulated value of an investment of 100 BEF (starting at the end of 1832) in the stock market over time. The returns (right scale) are annual total real returns at the end of December for each year.

Source: SCOB database. Version 2008.05.

Belgium especially hard, being one the main investors in Russia. The overall economic consequences were disastrous: World War I left Belgium with one-third of its fixed capital destroyed, a substantial part of its Foreign Direct investments permanently lost, monetary instability, a tremendous loss of purchasing power for its currency and a high government debt.

The interwar years were characterised by a highly unstable monetary situation, two devaluations of the BEF (in 1926 and 1935), a large banking crisis and a deep economic depression. Surprisingly, all this turmoil did not result in large negative average returns. However, this average hides very diverse evolutions. In the first decade after the war, total real returns average around 8.08 per cent for the decade 1921–30. However, after the ‘monster’ returns of 67 per cent and 83 per cent in 1926–7, the stock market in 1929–31 recorded three consecutive large negative returns of, respectively, –35 per cent, –34 per cent and –35 per cent. Overall, the decade 1930–40 was a disastrous one at the BSE. World War II brought an end to this. Within a few months, stock prices had nearly doubled in nominal terms. In real terms this resulted in a 44.32 per cent return in 1940.

During World War II, Belgian industry worked for occupying Germany. Therefore, in contrast to World War I, the industrial, transport and mining infrastructure was not destroyed, and firms continued to make profits and dividends continued to be distributed. Nevertheless, due to high inflationary pressure, the overall total real returns were –3.26 for the 1941–50 decade.

Figure 4. Total returns and the total return SCOB all shares index (1950–2005)

Note: The total return index (left scale) represents the accumulated value of an investment of 100 BEF (starting at the end of 1832) in the stock market over time. The returns (right scale) are annual total real returns at the end of December for each year.

Source: SCOB database. Version 2008.05.

The period 1946–60 was characterised by post-war reconstruction; the beginning of the European integration process and the decolonisation process of the Belgian Congo (1960) and Ruanda-Urundi (1962). Returns on colonial stocks were among the highest in the world in the 1950s, strongly contributing to the soaring total real return of 7.21 per cent for the decade 1951–60 (Buelens and Marysse 2009, pp. 135–66).

The next decade, although generally characterised as the ‘golden sixties’, brought poor performance for investors, with an average total real return of only 2.53 per cent. The effects of decolonisation were felt (the companies involved are in our sample) and could not be sufficiently compensated by the European integration process. Moreover, a structural crisis in some major sectors of the Belgian economy, especially coal mining, was felt at the time.

During 1973–80 Belgium went through one of the most severe economic crises of the post-World War II period, culminating in a combination of towering inflation and high unemployment (‘stagflation’). Inflation, already a permanent phenomenon in Belgium after World War II, reached 15 per cent in 1974, driving the short rate on T-bills up to 17 per cent around 1980–1. As a result, total (geometric) returns were negative in the period 1971–80 in real terms (–2.71 per cent).

From the 1980s onwards, the importance of the BSE greatly diminished. The Cooreman–De Clercq Law of 1982 (inspired by the Monory Law in France) tried to give a boost to the stock market by providing important fiscal incentives to buy

stocks. Similar to other countries, the next decades lead to impressive equity returns: 14.41 per cent (1981–90) and 12.38 per cent (1991–2000). But this bull market could not hide that the composition of the BSE was rapidly changing: fewer stocks were listed; fewer Belgian companies survived; and a few sectors, such as financials, came to dominate the listings. During the 1990s, far-reaching technological and institutional changes took place at the BSE.

Various sectors have dominated the BSE throughout its history. We select the most important ones: the financial sector (banks and holding companies); transport (railways and tramways); steel and non-ferrous metal; coal mining; and the sector chemicals, oil and electricity. The ‘other’ category is rather diversified, including companies from the following industries: glass, food, breweries, land companies, water, as well as many others. Table 3 reports the relative importance of these sectors in each year of the period 1833–2005.

The financial sector clearly dominated the BSE in the beginning, as the two universal banks, Société Générale and Banque de Belgique, were of paramount importance to the Belgian economy. Their market share diminished gradually as the transport sector grew in importance. In 1862 transport accounted for 32.33 per cent of total market cap, compared to 31.36 per cent for banks. As in many other countries, private railway was the most important non-financial industry on the BSE during the nineteenth century. Coal mining companies were also very important. In the nineteenth century, Belgium was one of Europe’s biggest coal producers. And coal mining became the most important non-financial industry after World War I, with 25.32 per cent of market cap in 1918. However, it was to soon decline to only 4.43 per cent by 1927. In the meantime, chemicals, oil and electricity had taken over the leading position of the non-financial sector, with 21.01 per cent of market cap in 1928. It would come to dominate the BSE after World War II, with 54.57 per cent of market cap in 1981. From then on, the financial sector made a fast climb, primarily due to the transformation of many companies into holding companies, but also due to the increasing importance of several giant banks (e.g. Fortis and Dexia). Their share of market cap was 62.06 per cent in 2000, while chemicals, oil and electricity was second with 26.67 per cent.

V

The number of data inputs needed to compute our SCOB20 is only a fraction of the full SCOB database. The question remains, however, whether researchers would infer economically and statistically different conclusions when taking a SCOB20-like index to proxy for market performance (Le Bris and Hautcoeur 2010, pp. 1–43). Evidently, as the SCOB20 dataset is composed of a fixed number of companies, it represents a time varying percentage of total market cap (see Figure 5).²

² The composition of the SCOB20, company by company, can be consulted at the SCOB website (www.scob.be).

Table 3. *Breakdown of the sectors contained in the (all shares) stock market indices (percentage of market cap)*

	Banks and holdings	Transport	Metals and non-ferrous	Coal	Chemicals, electricity and oil	Others
1833	100.00	0.00	0.00	0.00	0.00	0.00
1834	100.00	0.00	0.00	0.00	0.00	0.00
1835	100.00	0.00	0.00	0.00	0.00	0.00
1836	55.22	2.11	13.64	0.00	0.00	29.03
1837	66.69	1.14	13.66	6.25	0.00	12.27
1838	59.01	4.34	12.18	8.58	0.00	15.89
1839	63.21	0.98	11.87	7.25	0.00	16.69
1840	66.31	1.09	10.77	7.36	0.00	14.47
1841	68.14	1.33	10.04	7.08	0.00	13.41
1842	65.90	1.36	9.74	6.94	0.00	16.06
1843	64.73	1.23	7.90	6.37	0.00	19.76
1844	65.24	1.51	7.08	6.53	0.00	19.63
1845	57.76	1.26	8.18	5.56	0.00	27.24
1846	56.28	1.22	12.02	5.52	0.00	24.96
1847	54.44	7.59	9.67	5.35	0.00	22.95
1848	52.05	7.56	10.93	6.83	0.00	22.63
1849	54.70	5.84	9.05	6.64	0.00	23.78
1850	52.60	9.03	8.84	6.72	0.00	22.81
1851	54.75	10.32	7.21	6.45	0.00	21.26
1852	52.18	14.56	5.89	6.47	0.00	20.90
1853	42.41	15.74	16.41	7.02	0.00	18.42
1854	38.53	16.62	14.49	9.37	0.00	20.99
1855	38.51	19.39	14.28	11.24	0.00	16.59
1856	37.69	19.45	13.69	15.03	0.00	14.15
1857	36.78	17.96	11.96	15.17	0.00	18.12
1858	31.67	25.75	11.58	16.33	0.00	14.67
1859	30.57	27.22	12.20	15.65	0.00	14.36
1860	31.28	28.54	11.87	15.26	0.00	13.06
1861	31.69	30.96	10.80	15.09	0.00	11.46
1862	31.36	32.33	11.26	13.29	0.00	11.76
1863	26.80	29.32	8.68	10.62	3.01	21.58
1864	27.24	29.53	9.84	9.51	2.79	21.09
1865	26.24	32.45	8.92	9.71	2.87	19.80
1866	26.93	30.49	8.85	11.67	2.92	19.15
1867	26.12	32.70	8.12	11.39	4.00	17.66
1868	51.25	24.07	4.93	6.83	2.12	10.80
1869	46.66	26.65	5.39	7.78	1.51	12.02
1870	39.57	30.65	6.18	8.77	1.55	13.28
1871	41.87	30.03	5.87	8.19	1.47	12.57

Continued

Table 3. *Continued*

	Banks and holdings	Transport	Metals and non-ferrous	Coal	Chemicals, electricity and oil	Others
1872	37.45	28.67	8.75	11.69	1.37	12.07
1873	36.88	20.86	8.94	21.10	1.14	11.09
1874	37.36	21.72	8.09	18.28	1.10	13.45
1875	37.07	24.66	6.35	17.82	0.89	13.21
1876	31.20	29.26	6.13	18.46	1.04	13.92
1877	33.99	26.11	6.90	17.25	1.04	14.71
1878	36.17	28.45	6.56	15.50	0.84	12.48
1879	33.66	25.78	8.54	18.72	1.00	12.29
1880	31.10	33.24	7.13	15.21	0.95	12.38
1881	31.74	31.86	7.91	12.50	1.82	14.16
1882	32.34	29.73	8.69	13.27	1.60	14.38
1883	32.33	30.48	7.22	13.81	1.24	14.91
1884	31.15	33.66	6.43	12.23	1.44	15.08
1885	31.04	35.45	5.87	11.81	1.50	14.32
1886	32.22	36.87	5.88	10.43	1.57	13.03
1887	31.34	36.78	6.49	11.00	1.41	12.98
1888	30.01	35.06	7.08	13.94	1.45	12.46
1889	28.08	24.74	9.57	22.58	1.52	13.51
1890	27.09	24.63	9.33	22.35	1.80	14.81
1891	28.47	25.88	8.34	19.24	2.25	15.82
1892	27.83	27.18	9.09	17.82	2.36	15.71
1893	26.91	28.74	8.98	17.81	2.56	15.01
1894	25.30	28.91	9.93	18.64	2.91	14.31
1895	25.24	28.08	12.89	15.65	4.87	13.27
1896	24.48	27.33	14.34	15.93	4.66	13.26
1897	25.50	26.44	12.63	16.57	4.57	14.30
1898	27.95	20.87	12.85	17.09	4.32	16.92
1899	29.07	17.31	13.63	18.64	4.95	16.40
1900	28.86	17.18	14.47	21.05	4.32	14.11
1901	28.95	18.45	12.31	22.82	4.18	13.29
1902	30.01	17.82	11.06	23.82	3.75	13.54
1903	28.89	18.10	11.01	23.13	3.86	15.02
1904	29.07	18.83	11.70	20.35	4.17	15.88
1905	26.95	17.80	13.02	21.92	4.44	15.87
1906	24.65	16.78	13.18	25.28	3.96	16.14
1907	26.36	15.63	12.05	25.18	4.44	16.34
1908	27.04	15.61	12.11	23.56	5.34	16.33
1909	26.26	13.52	14.12	24.65	5.35	16.11
1910	26.88	13.23	13.88	21.70	5.97	18.33
1911	26.37	13.04	14.10	20.58	7.19	18.71

Continued

Table 3. *Continued*

	Banks and holdings	Transport	Metals and non-ferrous	Coal	Chemicals, electricity and oil	Others
1912	24.50	12.92	15.16	20.39	8.02	19.00
1913	26.57	13.49	14.26	18.67	8.62	18.40
1914	26.17	13.59	15.00	17.79	9.19	18.27
1915	26.17	13.59	15.00	17.79	9.19	18.27
1916	25.77	12.41	13.51	20.55	9.12	18.65
1917	26.32	12.15	11.82	23.69	8.43	17.59
1918	27.36	10.83	12.68	25.32	7.23	16.58
1919	19.09	7.45	20.46	23.39	5.90	23.72
1920	19.39	6.64	18.96	23.33	6.94	24.73
1921	22.41	5.73	21.92	18.83	8.83	22.27
1922	19.66	5.75	17.71	19.05	12.21	25.63
1923	18.36	6.30	14.08	18.80	15.64	26.82
1924	20.72	7.71	12.26	14.63	17.50	27.17
1925	20.34	6.70	10.31	10.41	18.75	33.49
1926	21.56	8.73	11.64	9.16	18.88	30.03
1927	31.94	15.53	8.97	4.43	19.57	19.56
1928	32.26	12.48	11.09	5.32	21.01	17.84
1929	27.76	14.45	11.49	6.35	17.31	22.64
1930	37.05	15.66	9.68	5.54	14.25	17.81
1931	36.59	16.69	9.90	4.73	14.64	17.46
1932	36.37	17.07	9.67	4.59	15.82	16.48
1933	36.97	17.47	8.01	4.54	17.11	15.91
1934	34.70	22.50	7.92	4.32	16.09	14.47
1935	31.53	18.13	10.25	6.91	15.74	17.43
1936	27.90	15.95	14.00	9.11	14.07	18.96
1937	28.05	17.01	13.26	8.87	14.98	17.83
1938	25.68	16.74	14.85	9.30	17.06	16.37
1939	22.07	19.13	14.32	11.37	16.71	16.41
1940	23.33	13.33	14.63	16.71	14.83	17.17
1941	27.24	10.03	14.63	15.82	14.27	18.02
1942	26.62	9.87	13.59	15.86	14.82	19.25
1943	25.49	10.77	13.95	14.38	14.93	20.47
1944	25.08	10.22	14.21	13.80	14.71	21.97
1945	23.31	9.81	15.77	9.91	14.83	26.36
1946	19.96	10.39	15.11	9.04	17.35	28.15
1947	21.07	12.81	18.21	8.09	16.88	22.94
1948	20.72	12.24	22.55	7.59	16.40	20.49
1949	20.84	10.77	17.53	9.69	19.77	21.40
1950	22.95	9.89	17.75	9.17	20.21	20.03
1951	23.78	7.72	17.73	10.58	21.77	18.42

Continued

Table 3. *Continued*

	Banks and holdings	Transport	Metals and non-ferrous	Coal	Chemicals, electricity and oil	Others
1952	26.50	8.57	16.57	9.96	23.08	15.32
1953	29.61	8.47	12.67	8.87	24.45	15.93
1954	30.69	7.07	14.58	7.29	23.49	16.88
1955	29.61	6.09	15.94	7.68	23.62	17.05
1956	30.16	6.06	16.50	7.70	22.80	16.79
1957	31.47	5.83	15.40	8.00	24.32	14.99
1958	34.24	5.45	14.64	5.90	24.81	14.97
1959	32.75	4.61	16.80	3.65	23.96	18.23
1960	31.26	4.81	17.66	2.50	24.13	19.65
1961	29.17	4.01	16.93	2.22	25.74	21.93
1962	31.53	4.37	14.80	2.15	25.52	21.63
1963	32.56	3.90	12.71	2.96	25.83	22.05
1964	34.43	3.47	11.16	1.81	29.38	19.75
1965	37.89	3.67	9.68	0.98	28.79	19.00
1966	36.96	3.97	7.50	0.73	30.13	20.71
1967	33.72	3.28	7.71	0.89	32.47	21.93
1968	31.98	2.93	6.26	1.00	35.23	22.60
1969	32.07	2.52	8.11	0.90	33.79	22.61
1970	32.44	2.44	7.18	0.66	36.92	20.36
1971	33.28	2.56	5.53	0.70	40.22	17.71
1972	32.13	2.11	5.34	0.91	42.39	17.11
1973	32.64	1.94	4.80	0.69	44.27	15.66
1974	35.18	2.37	5.74	0.80	40.27	15.64
1975	33.25	2.31	5.33	0.77	43.91	14.43
1976	33.08	2.09	4.15	0.72	47.03	12.92
1977	33.59	2.54	3.12	0.85	47.54	12.36
1978	35.85	2.54	2.96	0.92	45.98	11.74
1979	31.90	1.96	2.50	0.94	52.03	10.68
1980	29.67	1.99	2.13	0.78	54.14	11.28
1981	29.13	1.43	2.22	0.65	54.57	11.99
1982	30.46	1.63	3.08	0.73	49.87	14.23
1983	32.24	0.61	3.55	0.71	49.65	13.23
1984	33.49	1.14	3.55	0.61	49.81	11.39
1985	37.32	0.94	3.86	0.52	46.48	10.88
1986	37.22	0.76	3.38	0.40	46.15	12.09
1987	39.18	0.75	2.49	0.30	42.97	14.32
1988	43.51	0.67	3.05	0.29	37.54	14.94
1989	41.14	1.05	4.20	0.14	36.29	17.18
1990	38.11	0.90	2.84	0.09	40.20	17.85
1991	37.46	0.88	2.69	0.07	41.79	17.11

Continued

Table 3. *Continued*

	Banks and holdings	Transport	Metals and non-ferrous	Coal	Chemicals, electricity and oil	Others
1992	42.62	0.62	3.23	0.06	36.16	17.30
1993	44.56	0.54	3.91	0.07	35.84	15.08
1994	44.47	0.72	4.91	0.06	33.29	16.55
1995	44.92	0.59	4.72	0.03	34.39	15.35
1996	45.46	0.48	3.95	0.01	34.31	15.78
1997	51.63	0.46	3.69	0.00	29.96	14.26
1998	55.07	0.18	2.64	0.00	29.56	12.55
1999	52.79	0.34	2.31	0.00	29.48	15.08
2000	62.06	0.43	1.60	0.00	26.67	9.24
2001	60.78	0.31	1.21	0.00	18.01	19.69
2002	61.31	0.36	1.89	0.00	19.61	16.83
2003	57.08	0.61	2.51	0.00	18.37	21.43
2004	54.74	0.24	1.78	0.00	18.45	24.79
2005	53.27	1.25	1.70	0.00	17.84	25.94

Source: SCOB database. Version 2008.05.

Quite naturally, when only a small number of stocks were listed, the results of the SCOB20 index and the all-shares index are nearly identical, but this is only the case for the first few years.

Figure 5. Market capitalisation SCOB20 as a percentage of total market capitalisation (Belgian-based companies only)

Source: SCOB database. Version 2008.05.

As can be seen in Figure 5, the evolution of market capitalisation of the SCOB20 is in line with the number of stocks quoted. In the early days the SCOB20 included the entire market, but very soon more stocks appeared, resulting in an ever-decreasing share of the SCOB20 in total market capitalisation, reaching its lowest level in the early 1920s. During the 1920s the number of stocks increased even further, but important merger and acquisition activity took place, resulting in an increasing share of the SCOB20 (Kurgan-Van Hentenryk 1997, pp. 65–286). After World War II the decreasing number of Belgian-based firms on the BSE brought an ever-increasing market share of the SCOB20 in the total market capitalisation.

Of course, by selecting only 20 stocks out of the investment universe, we are likely to poorly mimic the industrial composition of the total market with only 3403 company-years (which is the number of selection years times the number of companies included in the SCOB20 in every year). The SCOB20 has been heavily dominated by the following industries: steel and metals (493 company-year observations), holding companies (489), bank and insurance (469), railways and tramways (447), non-ferrous metals (302), coal mining (271) and electricity and gas (208). The differences in industrial composition between the SCOB20 and the all-shares index are illustrated in Table 4. The most important sector in both the SCOB20 and the all-shares index was ‘banks, holdings and mixed banks’ (42.88 per cent of SCOB20 and 36.24 per cent of all-shares), whereas the smallest sector in SCOB20 (coal mining) had only 1.5 per cent of SCOB20, while it made up 9.5 per cent of the all-shares composition. Clearly, there are differences, and formally testing demonstrates that the following industries are significantly differently represented (at the 1 per cent level) in both indices: banks, holdings and mixed banks ($t = 4.93$), steel and non-ferrous metals ($t = 5.45$), coal mining ($t = -7.25$), and transport ($t = -2.72$). Only the chemicals, electricity and oil industry ($t = -0.70$) is not different between the indices.

Table 4. *Differences in sector composition between SCOB20 and all shares (percentage of market cap)*

	Chemicals, electricity and oil	Banks, holdings and mixed banks	Transport	Metals and non-ferrous	Coal	Others
SCOB20						
Average	14.15	42.88	10.47	21.54	1.52	9.44
Stdv	19.48	12.64	10.90	17.11	1.30	9.06
All shares						
Average	14.86	36.24	12.60	9.74	9.54	17.03
Stdv	15.32	14.26	10.78	4.84	7.64	4.84
Average difference between the two indices						
Average	-0.71	6.65	-2.13	11.80	-8.01	-7.59
t values	-0.70	4.93	-2.72	5.45	-7.25	-4.84

Source: SCOB database. Version 2008.05.

However, since asset pricing does not recognise industries as significant priced factors, we still might be able to ignore these differences and compute risk and return measures on the limited index to proxy for the market.

Since we cover a period of over a century, with numerous upswings and downswings of the business cycle, we focus on real returns in the discussion. Figure 6 displays the logarithmic capital gain and total return indices both in real and nominal terms. From the nineteenth century up to World War I, the nominal and real return indices virtually coincide. Inflation years and deflation years balanced each other out and kept the general price level stable. After World War I inflation became a prominent factor, as Figure 7 shows. It can also be noted that the difference between the real capital gain index and the total real return index grows continuously in the nineteenth century, indicating the importance of dividends (see Figure 8).

Over the whole period (1833–2005), the Belgian market realised a real total (geometric) return of 3.59 per cent per annum (see Table 2 above). For the SCOB20 data the total (geometric) return was 3.63 per cent. A t-test corrected for heteroskedasticity and autocorrelation does not allow rejecting the null hypothesis that the average return on the SCOB20 index equals the all-shares return over the period 1833–2005 at conventional levels of significance.

Focusing on various decades, large variability is clearly present. Real returns for the all-shares index vary between -11.15 per cent and 14.95 per cent. Three decades record a negative return: 1910–20, 1941–50 and 1971–80. Especially during the 1980s and 1990s, equity investors realised extremely positive returns. Based on the

Figure 6. *Logarithmic capital gain and total return indices (nominal and real terms)*

Source: SCOB database. Version 2008.05.

Figure 7. Belgian CPI index (left scale) and inflation rates (right scale)

Note: The bars (right scale) indicate annual inflation rates; the continuous line (left scale) represents the CPI-index value, starting from index level 1 in 1832.

Sources: Michotte 1937; Van de Velde 1943; Belgium, Ministry of Economics (2007), *CPI-index*; National Bank of Belgium, *Belgische Economische Statistieken 1940–1950*, table 22.2.

SCOB20, the quoted numbers change only marginally and the same bull and bear segments are identified. Moreover, the correlation between the 10-year geometric means of the all-shares index and the SCOB20 is 98 per cent.

The annualised volatility for the overall period was 19.01 per cent for the all-shares index and 19.24 per cent for the SCOB20 index, and although it changed considerably over shorter time periods, the differences between standard deviations for the two indices are rather small. To evaluate their equality we used the Levene test. It is based on the analysis of variance of the absolute difference from the mean, as we know that returns are not normally distributed (making the traditional F-test less reliable). The resulting statistic for the Levene test has a p-value of 0.12, which does not allow us to reject the null hypothesis that the variances are equal at conventional significance levels. This is in line with our result on the total returns data and is further confirmed by the correlation between the two time series, which is extremely high (0.97). The two time series of 10-year volatilities (see Table 2) have a 98 per cent correlation. Even when we take smaller windows of economic volatility, the similarity is remarkable (see Figure 9).

The equity premium measures the extra return above the (risk-free) short rate, and is one of the most widely used (and important) numbers in finance, with several

Figure 8. *Nominal and real dividends*

Note: Annual nominal and real dividend yields are reported (left scale) as well as the difference between them (right scale).

Source: SCOB database. Version 2008.05.

Figure 9. *Volatility (10-year (monthly) moving average) (1833–2005)*

Source: SCOB database. Version 2008.05.

applications (Salomons 2008, pp. 299–329; DeLong and Magin 2009, pp. 193–208). In the long run, the equity premium was nearly identical for both indices (Table 5) and the t-statistic (−0.69) on the (monthly) difference of −0.016 between both equity premia indicates that we cannot reject the null that they are equal. (The compilation of the Belgian short rate series is explained in Appendix 1.)

A (geometric) excess return of about 2.8 per cent (4 per cent arithmetic mean) may appear low compared to American data, e.g. in Ibbotson, reporting an equity premium of 8.5 per cent (arithmetic) or 6.7 (geometric) (Ibbotson Associates 2006). Several other studies also report evidence of a substantial equity premium, although there is a wide difference even when reporting data on the same country (Fernandez 2007). Interestingly, employing their new NYSE database for 1815–1925, Goetzmann, Ibbotson and Peng find an equity premium for 1815–1925 of only 3.76 per cent (arithmetic, compared to bonds) (Goetzmann *et al.* 2001, pp. 1–32). Le Bris and Hautcoeur calculate returns and equity premia for the Paris Stock Exchange (1854–2007) (indices constructed in a way comparable to the present-day CAC40) (Le Bris and Hautcoeur 2010). The arithmetic (geometric) equity premium they find is 3.45 per cent (1.98 per cent) for the period 1854–2006. The corresponding 1951–2000 values are 4.72 and 2.09 per cent. Dimson, Marsh and Staunton (2002) calculate equity premia for 17 countries for the twentieth century. They report arithmetic equity premia of 6.14, 9.07 and 9.84 per cent for the UK, Germany and Japan, respectively, with corresponding geometrical values of 4.43, 3.83 and 6.67 per cent. Undoubtedly, the higher equity premium found in post-1926 US data is due to the exceptional situation the US was in. After World War I, and even more after World War II, it became increasingly obvious that the US would develop into the dominant economic power. To the extent that this was unanticipated, the ex post equity premium overestimates the expected risk premium. Corroborating evidence for this interpretation

Table 5. *The equity premium for SCOB20 and all shares real data (1833–2005)*

	Arithmetic mean	Geometric mean	Standard deviation	Excess returns ^a	Excess returns ^b
All shares return	5.47	3.59	19.01	4.07	2.79
SCOB20 return	5.51	3.63	19.24	4.11	2.83
Short rate	1.40	0.76	10.76		

^aExcess return (stocks compared to short rate) based on arithmetic mean, $R_{\text{equity}} - R_{\text{risk free rate}}$.

^bExcess return (stocks compared to short rate) based on geometric mean. Excess returns are calculated as $(1 + R_{\text{equity}})/(1 + R_{\text{risk free rate}}) - 1$.

Source: SCOB database. Version 2008.05.

is found using UK data. For the period 1825–70, Turner finds extremely high returns (and correspondingly high equity premia) for the UK. In contrast, by linking the Grossman (2002, pp. 121–46) and Acheson *et al.* (2009, pp. 1106–36) data, Ye and Turner (2010) find a premium of 3.24 per cent for the period 1825–1913 for the UK, which is clearly much lower and more comparable to our estimates for Belgium.

Finally, we compare the Sharpe ratios (Sharpe 1994, pp. 49–58). The Sharpe ratio or reward-to-variability ratio is a widely used portfolio performance measure. We estimate it by dividing the sample arithmetic average excess return by the standard deviation of excess returns. The Sharpe ratio also varies considerably over time, but produces nearly identical results for the all-shares and the SCOB20 data in all subperiods (Table 6). Summarised over large periods Sharpe ratios (on an annual basis) vary between 0.14 and 0.42 for the all-shares data and between 0.18 and 0.40 for the SCOB20 data (see Table 6).

To test for differences between these Sharpe ratios of the series, we use the corrected Jobson–Korkie pair-wise test of the equality of Sharpe ratios (Mommel 2003, pp. 21–3). Under the null hypothesis that the Sharpe ratios of two portfolios are equal, the test statistic asymptotically follows a standard normal distribution (with zero mean and a unit standard deviation for large samples). The test statistic for our series is very low (see Table 6) and the null hypothesis cannot be rejected.

These results show that both series approximate each other, notwithstanding the significantly different sector composition (see above). One can argue, however, that these results could be expected, as the market capitalisation of SCOB20 companies makes up a large part of all-shares companies. To investigate this issue, we performed a second series of tests on the period 1872–1967, when the SCOB20 index made up a relatively small part of the all-shares index. In Figure 5 it can be

Table 6. *Sharpe ratios and corresponding Jobson–Korkie (and p values) (annual data) for SCOB20 data and all shares data*

Period	Sharpe ratio (SCOB20)	Sharpe ratio (all shares)	Jobson–Korkie	p-value (two-sided)
1833–1914	0.181	0.149	0.983	0.326
1833–2005	0.225	0.223	0.125	0.901
1900–2000	0.249	0.249	0.005	0.996
1921–2005	0.279	0.277	0.080	0.936
1951–2005	0.305	0.306	–0.040	0.968
1980–2005	0.406	0.426	–0.850	0.396

Note: A negative value of the Jobson–Korkie statistic indicates all shares outperform SCOB20, a positive value indicates SCOB20 is outperforming all shares. The Jobson–Korkie z statistic is asymptotically standard normally distributed.

Source: SCOB database. Version 2008.05.

seen that during this period the SCOB20 companies accounted for less than 60 per cent of total market capitalisation. Repeating our analysis on this period results in similar conclusions: neither from an economic nor from a statistical perspective can we reject the equality of the SCOB20 average return, volatility, dividend yield and Sharpe ratio from their all-shares counterparts. Likewise, the correlation coefficient between the two time series is high (0.905), although somewhat lower than for the 1833–2005 time series.

VI

A final (and conceptually important) problem is delisting bias (CRSP 2001; CRSP 2008; Shumway 1997, pp. 327–40; Shumway and Warther 1999, pp. 2361–79). Whenever stocks delist, the last stock price on the stock exchange is used to calculate returns. However, if delisting results from bankruptcy, returns will be too high (as the latest stock price will never be zero). This calls for an adjustment of the final returns in cases of bankruptcy. Such adjustment will not be the same for the all-shares index and SCOB20 index. As SCOB20 data reflect the largest firms, they have arguably a lower propensity to fail, whereas small companies (that are, by definition, comprised in the all-shares index) have a higher default probability, so the delisting bias will not affect both samples similarly.

For the full period 1832–2005 the total number of stock delistings is 1790. We exclude delistings for which the final liquidation procedure is ongoing, and exclude stocks that are relisted in later years. As in CRSP, delisting returns are defined as the returns on securities after their removal from the stock exchange. Delisting returns are identified by comparing the value of a stock after its delisting with its price on the last day of trading. The value of a stock after the delisting is either an off-exchange price (or even off-exchange bid-ask prices) or the sum of a series of distribution payments.

We deal with delistings in three different ways. In strategy one, we consider the last stock exchange price as the end value of a stock, regardless of the delisting reason. This is the usual way in which most indices are calculated and it will introduce a delisting bias if the delisting value is different from the last trading price. In strategy two, we take the last stock exchange price as the end value of a stock in all cases *except* those where the delisting value is known to be zero (345 delistings, 19.21 per cent of all delistings). For these cases, we assume a delisting return of –100 per cent. In strategy three, we also assume a delisting return of –100 per cent (instead of the –30 per cent single replacement value of Shumway 1997) for stocks that delist for unknown reasons (139 delistings, 7.77 per cent of all delistings). Most of these stocks are likely to have a delisting value of zero. If they have a non-zero value, our procedure will introduce a negative bias.

The effects of the three ways of dealing with delistings on the overall results are minor, even in the case of strategy three. As this strategy implies a correction that is overall too strong (as not every delisting for which there is no information has zero

value), it provides an upper limit to the correction for the delisting bias. In period 1872–2005, e.g. strategies one and two give a difference in return of only 0.02 per cent; if we compare strategies one and three the difference is only 0.05 per cent. This is in line with the results of CRSP. There is no change in the return for the SCOB20. The reason is obvious, as the constituent firms were large companies that very rarely went bankrupt because they were excluded from the SCOB20 before the final delisting.

The small effect of delistings on overall returns is probably due to two elements: (a) the rather limited number of delistings; (b) the observation that, if a stock is delisted, almost always a sharp drop in prices could be observed in the months before delisting.

VII

In this article we have introduced new return indices for the BSE over the years 1832–2005. We constructed these indices using monthly returns for all Belgian-based companies that at any point in time were listed on the BSE. The individual returns were averaged using market-capitalisation weights, thus obtaining a market value-weighted all-shares return index and a return index for the 20 largest stocks. We documented their risk and return characteristics over the entire period, as well as over several subperiods. We confirm that the dividend component in stock returns is of utmost importance to obtain accurate estimates for the total realised return on equity investments. Particularly during the period before World War I, this return component captures the bulk of total equity return, leaving hardly anything for the capital appreciation component.

By comparing the SCOB20 index returns to the all-shares return index, we showed that accurate performance estimates can be made based on limited data. Both returns are highly correlated. Moreover, both indices produce similar average return and risk estimates and their dividend yields are almost identical. For 1833–2005, a real total (geometric) return of 3.59 per cent per annum was realised by the all-shares index, whereas for the SCOB20 the total (geometric) return was 3.63 per cent; standard deviations were, respectively, 19.01 and 19.24 per cent. Our finding that it is possible to mimic the return on the overall stock market with a limited number of stocks provides evidence that only a small number of (the largest) stocks is needed to get a diversified (market cap-weighted) portfolio.

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Appendix 1: The Belgian short-term interest rate

The short-term interest rate (Figure A1) was calculated based on the commercial paper (1833–1940) and T-bill rates (1940–2005). The commercial paper rates for 1832–1918 comes from the official quotation lists of the Antwerp Stock Exchange (where it was published on a daily basis until 1883) and from the newspapers *Journal du Commerce d'Anvers*, *L'Avenir*, *Moniteur des Intérêts Matériels* and *Het Handelsblad*. For the period 1919–40, we took data on the commercial paper rate from the National Bank of Belgium (1929, pp. 1–85; 1919–90). From 1940 onwards we used T-bill rates, compiled from Vanheurck (1954, pp. 401–39) spanning 1940–5, and Baudhuin (1958, p. 127) and Homer and Sylla (Homer and Sylla 1991, pp. 498–501) for the period 1945–57. For the period 1957–2005, the data come from the National Bank of Belgium (1929–90) and the financial newspaper *Financieel-Economische Tijd* and *De Tijd* (1991–2005). Publications on the short rate for Belgium are sparse; until now there has never been published one long-term series for Belgium on the short rate. A publication by a Belgian bank (Generale Bank 1992, pp. 1–8, 11–16) includes some graphs using the official discount rate as well as T-bills (from 1957 on).

Although T-bills were issued from 1833 (Nicolai 1921) and their data are available until 1926 (Gérard 1928, pp. 215–48), the rate did not move very much, indicating it probably did not reflect the evolution of the money market very well. No T-bills were issued between 1926 and 1937. The rate on commercial paper (*taux hors banque*) was recognised by experts at the time, such as Léon Dupriez, a leading Belgian scholar (Dupriez 1930, p. 124; Vanes 1967, pp. 342–79; IRES 1957, pp. 75–122), as being the best rate for the money market in the absence of T-bills.

Figure A1. *The Belgian short-term interest rate (1830–2005)*

Source: SCOB database. Version 2008.05.