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The exposure of Polish pension funds and banks to the carbon bubble

A research paper prepared for The Greens in the European Parliament



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Summary

The carbon bubble and its risks

The carbon bubble refers to the overvaluation of oil, gas and coal mining companies because of the need to shift from fossil fuels to renewable ones. To avoid harmful climate change, the rise of average global surface temperature since the industrial age should be limited to, at most, 2°C by 2050. Meeting this target puts a limit on future carbon dioxide (CO₂) emissions and hence on the amount of fossil fuels that can be burnt. The current global reserves of oil, gas and coal are several times larger than this limit. This means that the majority of fossil fuel reserves cannot be used if harmful climate change is to be avoided. Private companies own about a quarter of fossil fuel reserves. If a large part of these reserves cannot be extracted, that reduces the valuation of these companies and their ability to repay their debt. This is a risk for the financial sector because financial institutions like pension funds and banks have large exposures to oil, gas and coal mining companies through equity, bond, and loan portfolios.

Research objective

The Greens in the European Parliament commissioned this study to assess the carbon bubble risks faced by the five largest Polish private pension funds, the five largest Polish banks and seven selected large Polish coal and energy companies. The specific objectives of this research project were to:

- Assess the exposure of the top-5 Polish private pension funds and top-5 Polish banks to high carbon investments; and
- Analyze the financial situation of the seven selected Polish coal and energy companies and the potential impact on the Polish government finances.

The following Polish private pension funds were selected for this research project:

- ING
- Aviva
- PZU Żłota Jesie
- Amplico
- AXA

The following Polish banks were selected for this research project:

- PKO Bank Polski
- Bank Pekao
- Bank Zachodni WBK (BZ WBK)
- mBank
- ING Bank I ski

The following Polish coal and energy companies were selected for this research project:

- Jastrz bska Spółka W glowa (JSW)
- Katowicki Holding W glowy (KHW)
- Kompania W glowa (KW)
- Lubelski W giel Bogdanka (LWB)
- Polska Grupa Energetyczna (PGE)
- Tauron Polska Energy (Tauron)
- Zespół Elektrowni P tnów Adamów Konin (ZE PAK)

Exposure of selected Polish pension funds to high-carbon assets

The selected Polish pension funds are exposed to high-carbon companies through their equity and bond portfolios. For equities, we found that the value of the total shareholdings in high-carbon companies of the five selected pension funds adds up to €3.6 billion. The share of holdings in high-carbon companies doesn't differ much across the pension funds, ranging from 14.3% (Amplico) to 18.1% (AXA) of the total equity investments, with a weighted average of 16.1%. The high-carbon part of the corporate bond holdings for the combined selected Polish pension funds amounts to €354.3 million. As a weighted average, high carbon corporate bonds account for an estimated 19.2% of the total corporate bond holdings and 0.7% of the total assets of the analysed pension funds.

As for the combined total exposure of the selected pension funds, we found that AXA and PZU are most exposed to the carbon bubble, with a combined share of high-carbon equities and corporate bonds in the total assets of 8.9% and 8.5% respectively. These pension funds are followed by Amplico (7.3%), Aviva (7.1%) and ING (6.5%). PZU has the highest percentage of high-carbon equities (7.3%) in its total assets, while AXA holds the highest percentage of high-carbon bonds (1.8%). The weighted average of the contribution of high-carbon assets to total assets is 7.3%. The EU weighted average is, with 5%, considerably lower than the 7.3%. The estimated value of all high-carbon investments of the combined analysed Polish pension funds is €3.9 billion.

Exposure of selected Polish banks to high-carbon related assets

The selected Polish banks are exposed to high-carbon companies through their equity, bond and loan portfolios. The total estimated combined value of the outstanding loans to high-carbon companies for the five Polish banks is €1.4 billion. PKO Bank Polski has the highest share of outstanding loans to carbon-intensive industries with a 1.3% share of its total assets, followed by BZ WBK at 1.2% and Bank Pekao at 0.8%. The exposure of the lowest-scoring banks mBank and ING Bank Polski stands at 0.5% of total assets. The weighted average among the selected banks is 0.9% of total assets. When calculating the share of high-carbon loans in the estimated value of overall outstanding corporate loans, this share varies between 1.8% (mBank) and 4.6% (PKO Bank Polski), with a weighted average of 3.2%.

Next, we analyzed the high-carbon shares of the selected banks' equity and bond portfolios. The calculations show that high-carbon equity holdings have an estimated value of €32.8 million for the five combined selected Polish banks. On average, they account for 0.02% of total assets. The value of corporate bond holdings has a value of €173.6 million. On average, holdings of corporate bonds account for 0.11% of total assets. Adding up the two asset classes, this leads to shares ranging from 0.03% (Bank Pekao) to 0.25% (BZ WBK) of total assets, with a weighted average across the five Polish banks of 0.13%.

With this information, we estimated the combined exposure of the selected Polish banks to high-carbon companies. BZ WBK stands out with the highest share of high-carbon exposure, standing at an estimated 1.44% of its total assets. This is followed by PKO Bank Polski with 1.41% of total assets, Bank Pekao with 0.79%, ING Bank Polski with 0.68% and mBank with 0.59% of its total assets. The weighted average exposure to high-carbon assets for the five Polish banks is 1.04%. The EU weighted average is, with 1.4%, somewhat higher than the 1.04%. The total value of the high-carbon assets of the selected Polish banks adds up to €1.6 billion.

Feedback loop from Polish banks to the selected Polish pension funds

If substantial shocks occur to various financial institutions at the same time or to a whole sector, which would happen in case of a carbon bubble shock, harmful feedback loops may occur. One of the potential feedback loops is the way in which the high-carbon risks faced by Polish banks could affect the Polish pension funds - because of their exposure to the Polish banking sector. In order to assess the importance of this feedback loop, we calculated the holdings of the five selected Polish pension funds in Polish bank equities and bonds.

The results from our calculations show that PZU stands out with the highest share of exposure to the Polish banking sector, with an estimated 29.7% of its total assets. This is followed by Aviva with 23.6% of its total assets, AXA with 19.1%, Amplico with 15.7% and ING with 14.6% of its total assets. The weighted average exposure of the five Polish pension funds to the Polish banking sector is 20.6% and the total value of these assets adds up to € 11.0 billion.

Impact of the carbon bubble for pension funds and banks

This report also analyzed the potential impact of a carbon bubble shock for the selected Polish pension funds and banks. It discussed different shock scenarios. The main shock scenario, called “Low-carbon Breakthrough”, consists of a quick and definite transition to a low-carbon economy. It assumes losses on exposures to fossil fuel firms ranging from 60% on equity investments to 20% on credit facilities. This scenario causes average losses in the order of 4.2% for the selected Polish pension funds. This implies a loss of € 2.3 billion on € 53.7 billion of the five pension funds’ total assets. The estimated loss is considerably larger than the estimated weighted average loss of 2.5% for the entire EU pension funds. AXA has the highest estimated loss with 4.8% of its total assets, followed by PZU with 4.7%, Aviva with 4.2%, Amplico with 4.0% and ING with 3.9%.

For the selected Polish banks, the “Low-carbon Breakthrough” scenario causes average losses in the order of 0.3% (€ 434 million of losses on € 158 billion of total assets). This is slightly lower than the 0.4% estimated loss for the entire EU banking sector. The impact differs considerably between the selected Polish banks. The most vulnerable banks (BZ WBK and PKO Bank Polski) could face losses of 0.4% of total assets, whereas the less vulnerable banks (mBank, ING Bank i ski and Bank Pekao) could face losses of 0.2% of total assets.

Besides this main scenario, two other scenarios were analyzed. One discussed a slower and uncertain transition, and one discussed no transition to a low-carbon economy, but instead a roll back of climate measures. Both of these scenarios turn out to be even more costly and to cause larger risks than the main “Low-carbon Breakthrough” scenario. This is all in line with the famous Stern Review on the economics of climate change, an extensive report which states that the benefits of strong, early action on climate change outweigh the costs.

Financial situation of the selected Polish coal and energy companies

The analyses of the selected Polish coal and energy companies show that when looking at the net profit margin, it can be concluded that the coal mining companies (JSW, KHW and KW) are doing worse than the energy companies (PGE, Tauron and ZE PAK). The exception is LWB, which has the highest net profit margin of all the selected companies. The negative net profits for KW and KHW indicate that these two coal companies reported a net loss for the FY 2013. The profitability ratios (ROA and ROE) confirm that except for LWB, the coal energies are doing worse than the energy companies. Finally, when looking at the leverage ratios, the analysis shows that KW and KHW are heavily leveraged, with a debt level that is higher than the value of its equity. In combination with their net loss, this makes that these two companies are encountering severe problems.

Risks for Polish government finances

The Polish government is highly dependent on its domestic coal and energy companies. Over 80% of Poland's economy is based on its electricity being produced by domestic coal-fired power stations. However, Poland's coal-mining sector has growing, unsolved problems. There is about seven million tons of unsold coal in Poland, and since 2008 Poland has imported more coal than it has exported. The Russian coal price is lower than the Polish price, and in the first half of 2014, Polish coal companies lost over €250 million. In response to these problems, the Polish government provides state aid to collapsing coal mines.

The total number of employees of the selected coal and energy companies adds up to 188,290. This shows the huge amount of people working in the high-carbon sector, and the incentive for the Polish government to continue the coal-dependency. When looking at the ownership structure of the selected companies, it can be noted that five of the seven companies are (partially) state-owned, and that all of the troubled companies (KW, JSW, KHW) fall into this category. This puts pressure on the Polish government to provide state aid. When the 2 degrees goal causes the selected Polish coal and energy companies to write off part of their high-carbon assets, this will likely force the Polish government to provide even more state aid or bail-out the troubled companies because of the size of the industry and its ownership in most of the companies. Therefore, the carbon bubble poses a very severe risk for the Polish government. In order to lower this risk, the Polish economy should become less coal-dependent and diversify into other energy sources.

In order to reduce the impact of the carbon bubble and to be more prepared for a sudden drop in the value of carbon-related assets, several steps could be taken. One of them could be stress-testing by the Polish government of the Polish financial institutions, to see how their policies would cope with a sudden drop in the value of carbon-related assets. In relation to this the Polish government could create, in collaboration with coal and energy companies, "transition strategies" or "exit strategies" so as to ensure the move towards a more low-carbon economy. The Polish government could also put into place rules that would require financial institutions to publish their exposure to the climate risk in a more transparent way. This could create the public awareness necessary to realize a break away from the Polish carbon-dependency. Another step could be to advance in a public debate on divestment. Finally, the Polish government could promote the diversification of its economy by providing support to the high-tech/low-carbon industry and focus more on investing in research and development.

Introduction

The Greens in the European Parliament commissioned this study to assess the carbon bubble risks faced by the five largest Polish private pension funds, the five largest Polish banks and seven selected large Polish coal and energy companies. The carbon bubble refers to the overvaluation of oil, gas and coal mining companies because of the need to shift from fossil fuels to renewable ones. The specific objectives of this research project are to:

- Assess the exposure of the top-5 Polish private pension funds and top-5 Polish banks to high carbon investments; and
- Analyze the financial situation of the seven selected Polish coal and energy companies and the potential impact on the Polish government finances.

This report is organized as follows: First, Chapter 1 provides a brief background on the carbon bubble and an overview of the methodology of the research. After that, Chapter 2 discusses the exposure of the five selected Polish private pension funds to carbon bubble risks; Chapter 3 discusses the exposure of the five selected Polish banks to carbon bubble risks; Chapter 4 discusses the potential feedback loop from Polish banks to the selected Polish pension funds; Chapter 5 discusses the impact of the carbon bubble on Polish pension funds and banks using different scenario analyses; Chapter 6 discusses the financial situation of the selected Polish coal and energy companies and the consequences for the Polish government finances. It also provides some recommendations. Finally, Chapter 7 discusses the methodological limitations of this research.

A summary of the findings of this report can be found on the first pages of this report.

Chapter 1 Background and methodology

1.1 The carbon bubble and its risks

The carbon bubble refers to the overvaluation of oil, gas and coal mining companies because of the need to shift from fossil fuels to renewable ones. The logic behind this is simple. First, to avoid harmful climate change, the rise of average global surface temperature since the industrial age should be limited to, at most, 2°C by 2050, as agreed at the climate summit in Cancun in 2010. Second, meeting this target puts a limit on future carbon dioxide (CO₂) emissions and hence on the amount of fossil fuels that can be burnt. The current global reserves of oil, gas and coal are several times larger than this limit. This means that the majority of fossil fuel reserves are stranded assets: they cannot be used if harmful climate change is to be avoided. Third, private companies own about a quarter of fossil fuel reserves. If a large part of these reserves cannot be extracted, that reduces the valuation of these companies and their ability to repay their debt.

Expanding this reasoning, it can be concluded that the carbon bubble poses risks to the financial sector because financial institutions like pension funds and banks have large exposures to oil, gas and coal mining companies through equity, bond, and loan portfolios.

1.2 Objective

The Greens in the European Parliament commissioned this study to assess the carbon bubble risks faced by the five largest Polish private pension funds, the five largest Polish banks and seven selected large Polish coal and energy companies. The specific objectives of this research project are to:

- Assess the exposure of the top-5 Polish private pension funds and top-5 Polish banks to high carbon investments; and
- Analyze the financial situation of the seven selected Polish coal and energy companies and the potential impact on the Polish government finances.

1.3 Selected financial institutions and companies

The following Polish private pension funds are selected for this research project:

- ING
- Aviva
- PZU Złota Jesie
- Amplico
- AXA

The following Polish banks are selected for this research project:

- PKO Bank Polski
- Bank Pekao
- Bank Zachodni WBK (BZ WBK)
- mBank
- ING Bank I ski

The following Polish coal and energy companies are selected for this research project:

- Jastrzębska Spółka Węglowa
- Katowicki Holding Węglowy
- Kompania Węglowa
- Lubelski Węgiel Bogdanka
- Polska Grupa Energetyczna
- Tauron Polska Energy
- Zespół Elektrowni Pignów Adamów Konin

1.4 Research steps

This report includes the following analyses related to the objective of the report:

- An analysis of the investment portfolios of the top-5 Polish pension funds at the end of December 2013 in relation to Polish and foreign oil, gas and coal producers (equity and debt investments). This leads to an overview of the share of high-carbon investments in total investment portfolios of the pension funds at 31 December 2013;
- An analysis of outstanding loans as at 31 December 2013 provided by the top-5 Polish banks to Polish and foreign producers of oil, gas and coal. This analysis is mainly based on financial database Thomson ONE. A distinction is made between term loans and revolving credits. The analysis leads to an overview of the value of outstanding loans to high-carbon companies in relation to overall outstanding loans of the banks at 31 December 2013 and the share in the overall assets of the banks;
- An analysis of the investment portfolios of the top-5 Polish pension funds at the end of December 2013 to assess how the high-carbon risks faced by Polish banks could affect the selected Polish pension funds - because of their exposure to the Polish banking sector;
- An assessment of the risk which the selected Polish pension funds and banks face in case of stricter regulations getting implemented in order to achieve the 2 degrees goal. Different scenarios reflecting different levels of strictness of regulations and resulting changes in the relative values between high-carbon and low-carbon investments and the effect on the balance sheets for pension funds and banks are briefly discussed;
- An analysis of the financial situation of the selected Polish coal and energy companies and the potential risk for the Polish government finances.

Chapter 2 Exposure of Polish pension funds to carbon bubble risks

2.1 Selection of pension funds

For the analysis of Polish pension funds' exposure to high-carbon assets, the five largest Polish private pension funds (Polish: Otwartego Funduszu Emerytalnego (OFE)) were selected for an in-depth investment analysis. The top-5 Polish pension funds were selected based on their total assets in 2013.¹ The analysis uses total assets because unit-linked policies and fixed non-financial assets do not play a sizeable role for the pension funds. Information on their equity holdings can either be accessed through the funds' own publications or through financial databases.

Table 1 shows the five largest Polish pension funds listed by their total assets at the end of December 2013. The combined total assets of the five largest Polish pension funds have a value of €53.7 billion.

Table 1 Analysis of top-5 Polish pension funds by total assets

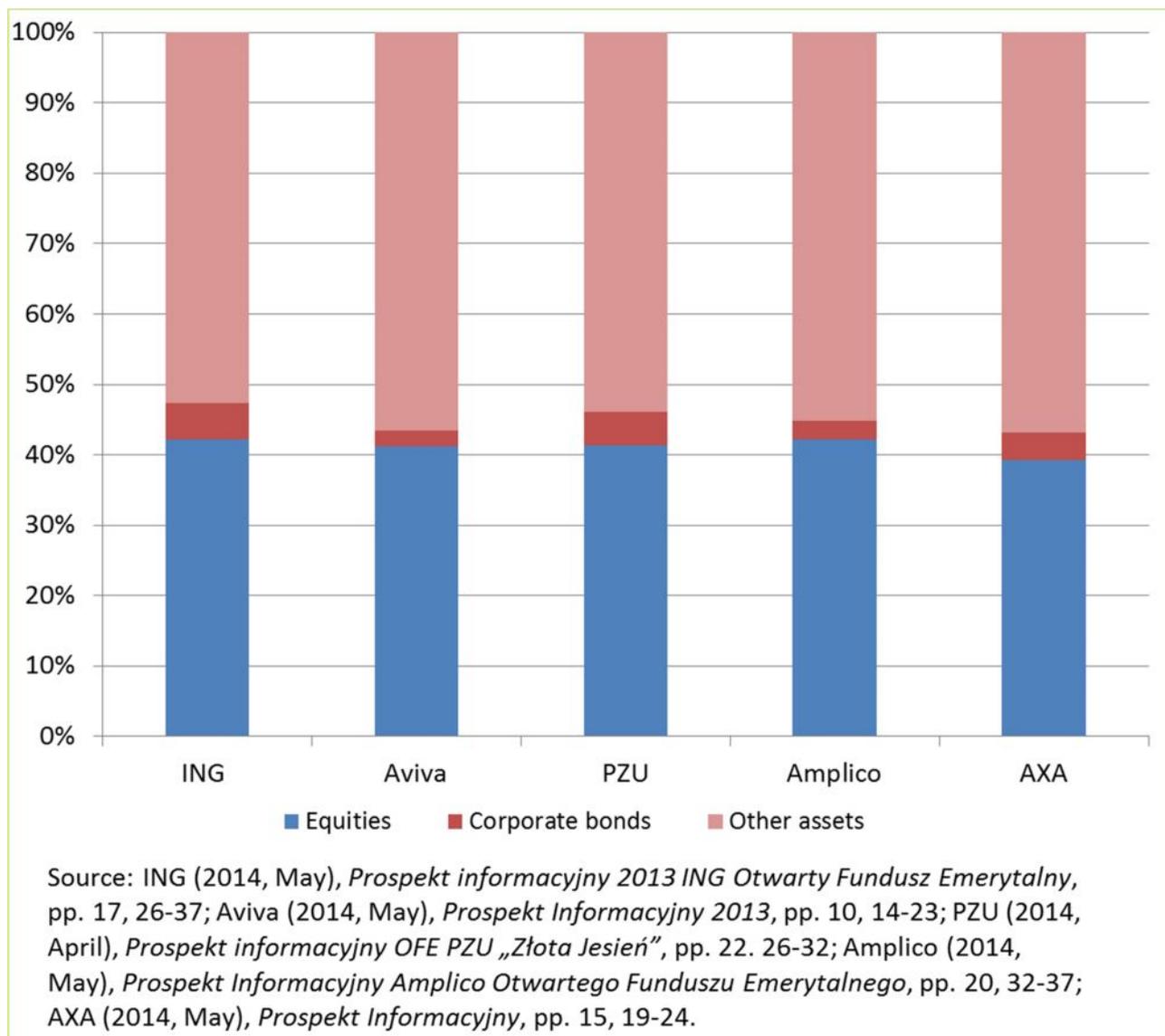
Pension fund	Total assets as of 31 Dec 2013 (€billion)	Source
ING	17.43	2
Aviva	16.22	3
PZU Złota Jesie	9.68	4
Amplico	5.89	5
Axa	4.50	6
Total	53.72	

2.2 General asset distribution

Typical instruments used by pension funds to invest their assets include listed equities, bonds (government, mortgage and corporate bonds), real estate and infrastructure, as well as alternative investments, such as derivatives or private equity. Figure 1 depicts the share of listed and unlisted equity and corporate bonds in the overall investment portfolios of the analysed Polish pension funds as at 31 December 2013. The pension funds are ordered by total asset size.

The distribution of investments over the different asset classes is almost the same for the five Polish pension funds. The share of investments in equities ranges between 39.2% (AXA) and 42.2% (ING and Amplico), while the share of corporate bond holdings varies between 2.3% (Aviva) and 5.1% (ING). The five selected Polish pension funds do not hold commodities. Across the five pension funds, the weighted average asset proportions are 41.5% for equities, and 3.8% for corporate bonds. Other assets include government bonds, real estate and private equity.

Figure 1 Distribution of investments in shares and corporate bonds



2.3 Investments in high-carbon equities and bonds

The investments of the five selected Polish pensions funds in listed shares of oil, gas and coal related companies were analysed on the basis of the reported shareholdings of the pension funds as at 31 December 2013. These reported holdings were retrieved from the Thomson ONE Database. The high-carbon companies were identified through screening all of the holdings of the pension funds and examining each company separately.

The value of the high-carbon shareholdings was calculated and multiplied by a correction factor to account for other business activities besides involvement in fossil fuels. The correction factor is based on the segment assets, revenue from different business segments or similar information. Such a correction applies in particular to mining companies, as these have more often a diversified range of mining activities besides coal mining. So while a coal mining company like Netherlands-based New World Resources was assigned a 100% share of high-carbon activities, this share stands at 41% for diversified U.S.-based mining company Freeport-McMoRan. For oil and gas companies in most cases the full amount can be applied as the majority of these companies focus exclusively on these high-carbon business activities.

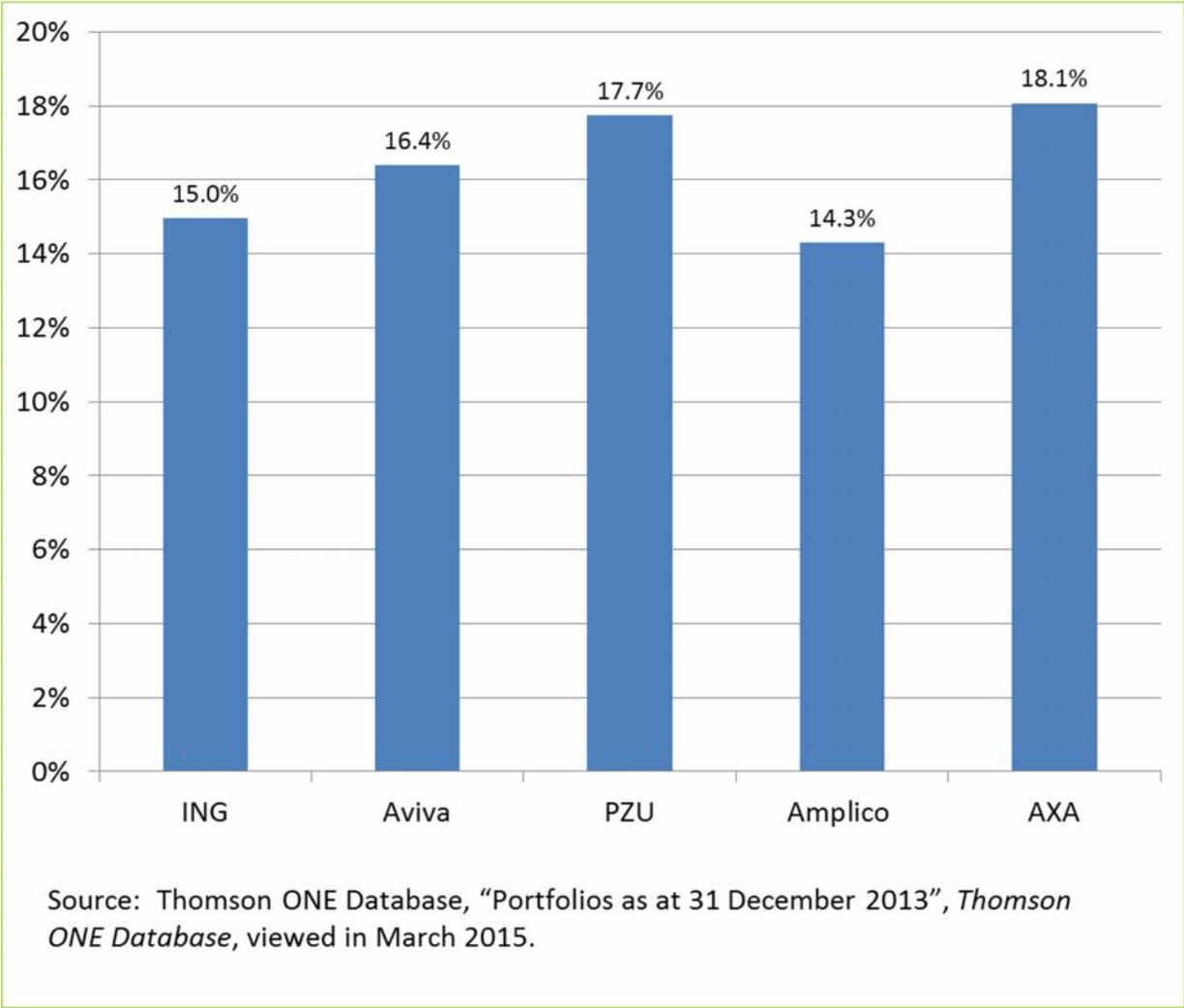
It must be taken into account that coverage of equity holdings derived from the Thomson ONE Database is often not complete. For the five Polish pension funds, the following percentages of equity holdings were covered:⁷

- ING 58.7%
- Aviva 99.9%
- PZU 100.0%
- Amplico 90.5%
- AXA 100.0%

Where the covered holdings are not 100%, for the purpose of this analysis it is assumed that the covered holdings are representative for the overall portfolios of the pension funds.

Figure 2 illustrates the share of high-carbon equities in the total holdings of the pension funds in listed equities.

Figure 2 Share of high-carbon equities in total equity holdings



As can be seen in Table 2, the actual value of the total shareholdings adds up to €22.3 billion for the five selected Polish pension funds. The share of holdings in high-carbon companies doesn't differ much, ranging from 14.3% (Amplico) to 18.1% (AXA) of the total equity investments across the pension funds. The total estimated value of the combined high-carbon shareholdings amounts to €3.6 billion. On (weighted) average, high-carbon equities account for an estimated 16.1% of their shareholdings and for an estimated 6.7% of their total assets. The high-carbon share of equities in the MSCI World Index is, at 9.4%, considerably lower than the 16.1%. Also, the EU average of high-carbon equities accounts for an estimated 7% of total shareholdings and for an estimated 2.3% of total assets, which are both considerably lower than the 16.1% and 6.7% for the selected Polish pension funds.⁸

Apart from equities, the five Polish pension funds are also exposed to corporate bonds issued by fossil fuel producers. The pension funds provide detailed break downs of their bond holdings in their annual reports, so the high-carbon share of bond holdings can be derived from this information. For each identified high-carbon company, the same correction factor method for other business activities besides involvement in fossil fuels is used as was also used with shareholdings.

Table 2 shows that the five selected Polish pension funds hold corporate bonds with a total value of €2.1 billion. The high-carbon part of these corporate bond holdings for the combined pension funds amounts to €354.3 million. As a weighted average, high carbon corporate bonds account for an estimated 19.2% of the total corporate bond holdings and 0.7% of the total assets of the analysed pension funds.

Table 2 Total share- and bondholdings as at 31 December 2013

Pension funds	Total shareholdings (€billion)	Total corporate bond holdings (€billion)
ING	7.36	0.89
Aviva	6.68	0.37
PZU	4.00	0.46
Amplico	2.48	0.15
AXA	1.76	0.18
Total	22.29	2.06

Source: ING (2014, May), Prospekt informacyjny 2013 ING Otwarty Fundusz Emerytalny, pp. 17, 26-37; Aviva (2014, May), Prospekt Informacyjny 2013, pp. 10, 14-23; PZU (2014, April), Prospekt informacyjny OFE PZU „Złota Jesie ”, pp. 22, 26-32; Amplico (2014, May), Prospekt Informacyjny Amplico Otwartego Funduszu Emerytalnego, pp. 20, 32-37; AXA (2014, May), Prospekt Informacyjny, pp. 15, 19-24.

2.4 Combined exposure to high-carbon assets

Figure 3 shows the combined distribution of the share of high-carbon equities and corporate bonds in the total assets of the five Polish pension funds. AXA (8.9%) and PZU (8.5%) seem most exposed to the carbon bubble, followed by Amplico (7.3%), Aviva (7.1%) and ING (6.5%). PZU has the highest percentage of high-carbon equities (7.3%) in its total assets, while AXA holds the highest percentage of high-carbon bonds (1.8%).

Figure 3 Share of high-carbon investments in total assets

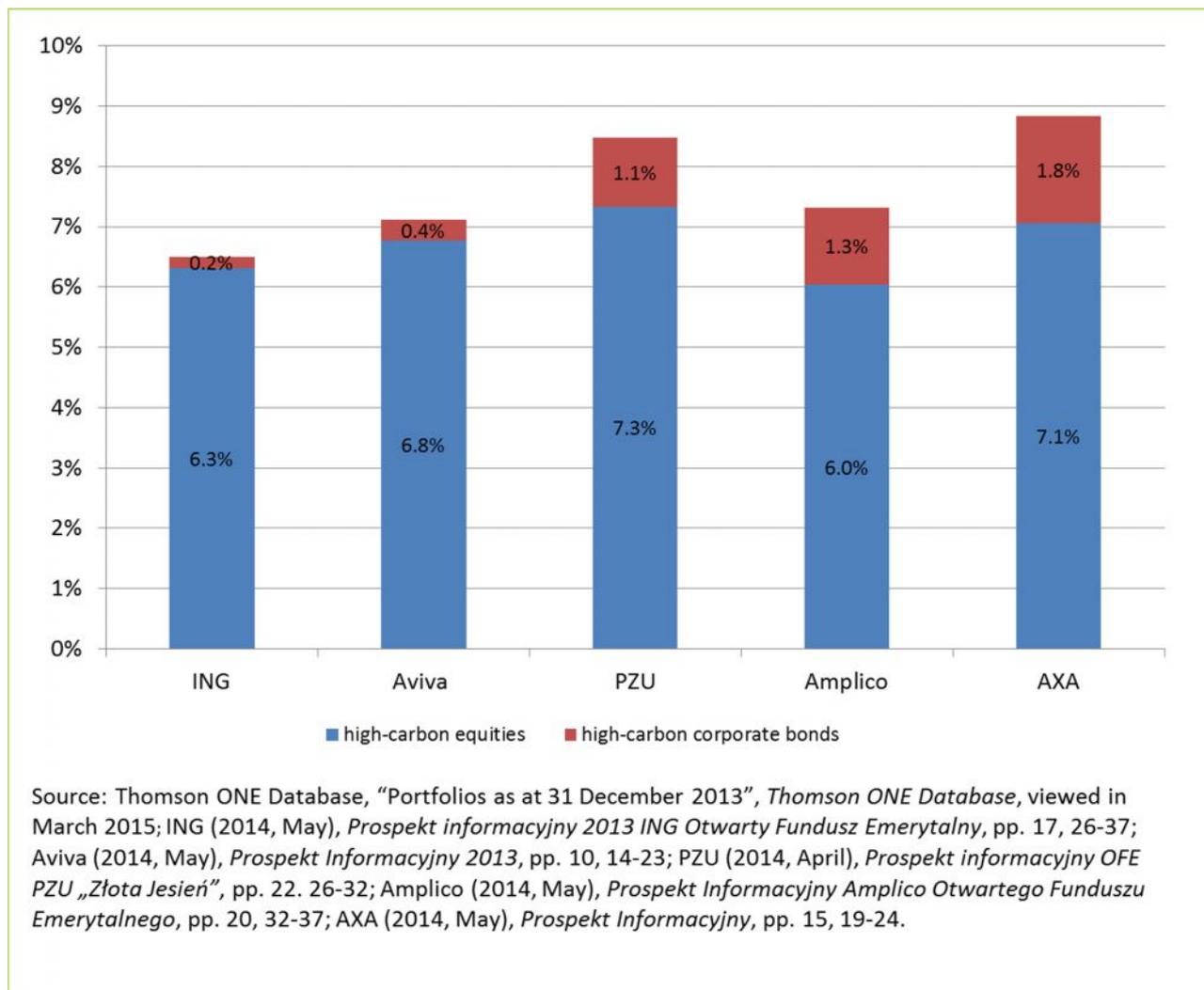
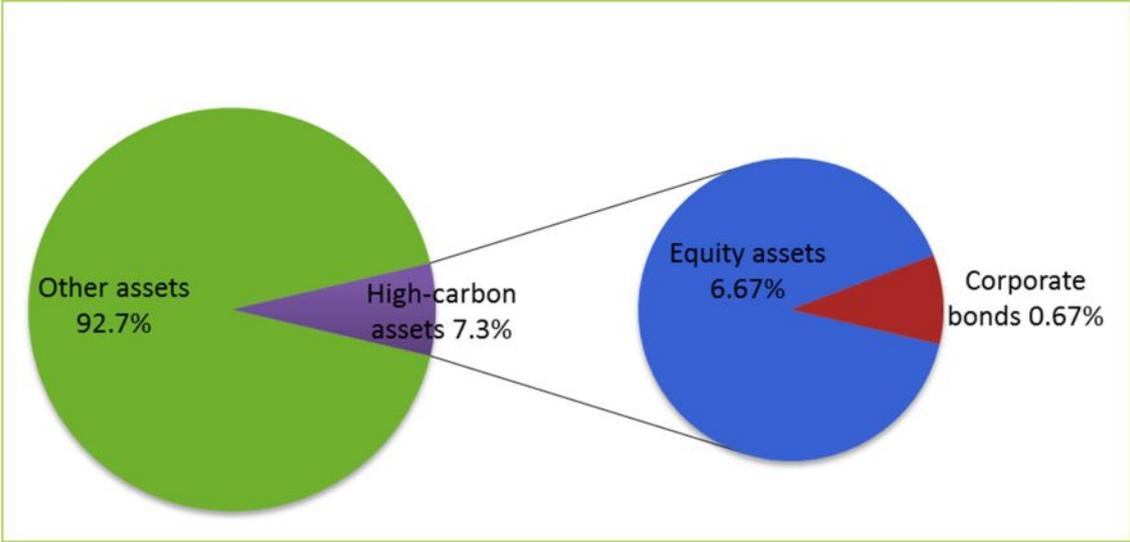


Figure 4 illustrates the estimated share of high-carbon assets across the five selected Polish pension funds. The contribution to total assets of high-carbon equities and corporate bonds varies between 6.5% and 8.9%, with a weighted average of 7.3%. The EU weighted average is, with 5%, considerably lower than the 7.3%.⁹ The estimated value of all high-carbon investments of the analysed pension funds is € 3.9 billion.

Figure 4 Estimated share of high-carbon assets



Chapter 3 Exposure of Polish banks to carbon bubble risks

3.1 Selection of banks

For the in-depth investment analysis of the Polish banking sector's exposure to high-carbon assets, the top-5 banks of Poland were selected. They were chosen based on their total assets in 2013 as reported in their annual reports.

Table 3 lists the top-5 Polish banks and banking groups measured by total assets at the end of December 2013. The combined total assets of the five largest Polish banks have a value of € 157.8 billion.

Table 3 Top 5 Polish banking groups by total assets as at 31 December 2013

Banking group	Total assets (€billion)	Source
PKO Bank Polski	48.00	10
Bank Pekao	38.19	11
Bank Zachodni WBK	25.56	12
mBank	25.12	13
ING Bank Polski	20.90	14
Total	157.77	

3.2 General asset distribution

Typical asset classes of commercial banks include loans and advances to banks and customers (including corporate, public and retail customers), “held-for-trading” assets, “available-for-sale” assets, “held-to-maturity” investments, financial assets at fair value through profit or loss and hedging derivatives. For this analysis, corporate loans and asset classes including corporate bonds and equities held by banks themselves are of particular interest as these expose the banks to high-carbon companies.

Figure 5 and Table 4 show the share of corporate bonds, equities and corporate loans in the total assets of the banks. The distribution of the shares of different asset classes in the total assets of the analyzed banks differs, but the differences are often not very large. The share of investments in equities differs between 0.0% (Bank Pekao) and 0.8% (BZ WBK), while the share of corporate bond holdings varies between 0.2% (Bank Pekao) and 1.4% (ING Bank Polski). Overall holdings in debt securities, including corporate bonds, government bonds and other fixed interest securities, vary between 15.8% (PKO Bank Polski) and 30.7% (ING Bank Polski) of total assets. The share of corporate loans in total assets varies between 21.6% (ING Bank Polski) and 32.3% (BZ WBK). Other assets account for 46.4% (Bank Pekao) to 57.0% (PKO Bank Polski) of total assets and include real estate financing, loans to public institutions, interbank financing, and derivatives.

Across the banks, the weighted average of assets invested in equities is 0.2%, while 0.7% of assets are invested in corporate bonds and 28.4% of assets are accounted for by corporate loans. The exposure of the banks to companies holding high-carbon assets, i.e. oil, gas and coal producing companies, was assessed on the basis of two different indicators: outstanding corporate loans to high-carbon companies on the one hand, and investments in equities and debt securities on the other.

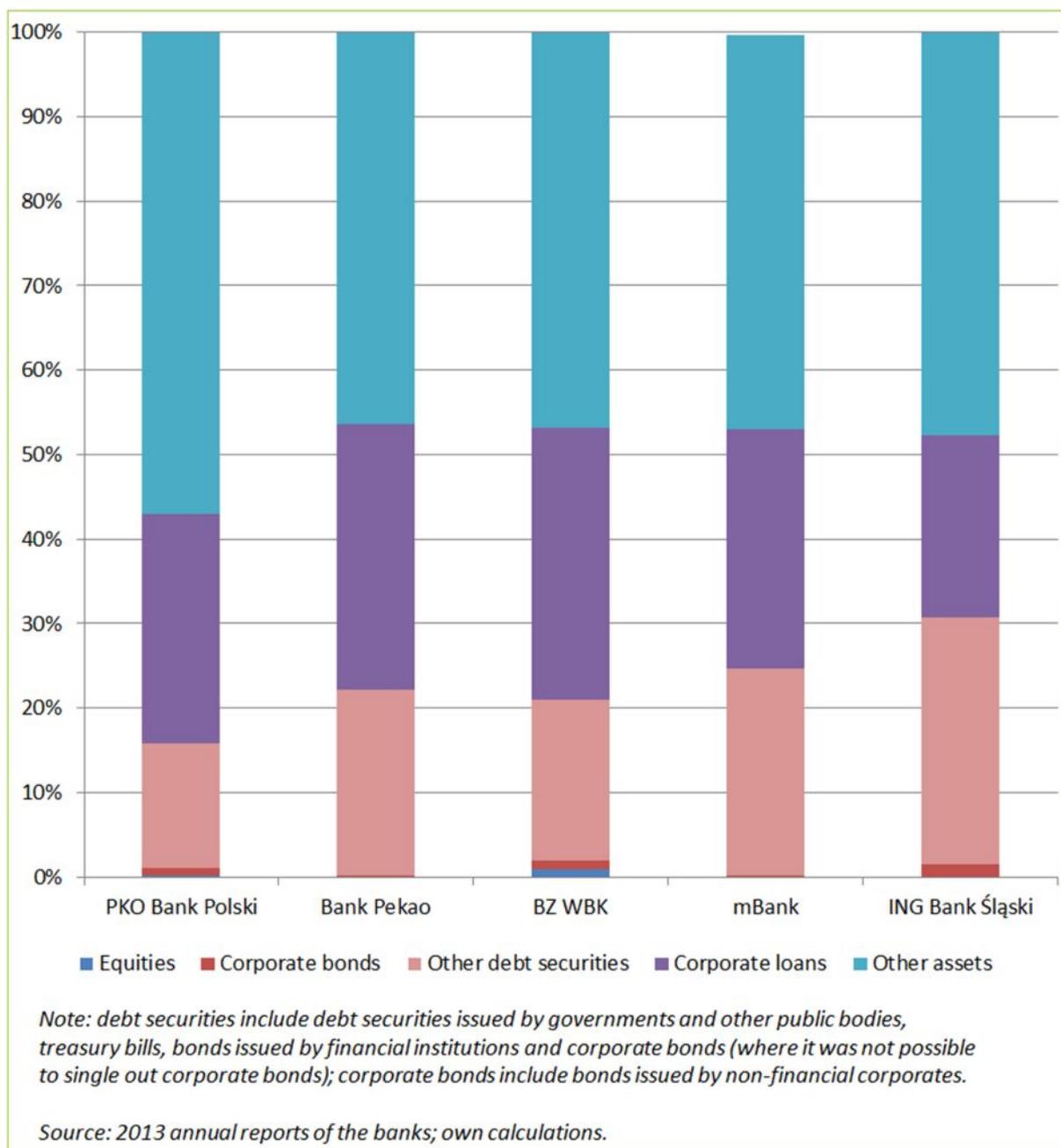
Table 4 Share of different assets classes in total assets

Asset class	PKO Bank Polski	Bank Pekao	BZ WBK	mBank	ING Bank I ski
Equities	0.11%	0.01%	0.83%	0.29%	0.03%
Corporate bonds	0.94%	0.16%	1.13%*	0.15%	1.43%
Other debt securities	14.82%	22.03%	18.95%	24.60%	29.23%
Corporate loans	27.16%	31.46%	32.29%	28.27%	21.63%
Other assets	56.98%	46.35%	46.80%	46.70%	47.67%

Source: 2013 annual reports of the banks.

* BZ WBK did not break down its commercial bonds in non-financial and financial bonds, so therefore we estimated that half of the commercial bonds were financial, and the other half was non-financial.

Figure 5 Shares of different asset classes in total assets



3.3 Exposures to high-carbon assets in corporate loan portfolio

3.3.1 Calculation of corporate loan exposures

In order to calculate the corporate loan exposures of the selected Polish banks to high-carbon companies, the financial statements of the banks were analyzed to extract the total value of all outstanding corporate loans provided by the banks. Only loans to non-banking and non-financial corporates have been considered, thus excluding banks, insurance companies and other financial institutions. The next step was to analyze in detail outstanding loans (as of 1 January 2014), which involve the participation of one or more of the analyzed banks as reported in the financial database Thomson ONE Banker. The following industry sectors, which are directly related to the production of oil, gas and coal, were used as criteria in the search:

- crude petroleum and natural gas extraction;
- natural gas liquid extraction;
- drilling oil and gas wells;
- petroleum refineries;
- bituminous coal and lignite surface mining;
- bituminous coal underground mining.

These categories also include some activities, which are directly linked to the production of fossil fuels, including for example large-scale oil and gas pipeline projects, oil tanker construction projects or the construction of LNG-terminals. As the categorization is not always correct, companies that have obtained loans were screened for potentially erroneous categorizations that had to be removed. Next, a correction factor was applied to companies with substantial business activities in other sectors. In some cases this had to be based on estimates, as private companies in particular tend not to publish detailed figures on their asset distributions.

This analysis did not find many loans. This could be the case because of a lack of data in the Thomson ONE Banker database on Polish carbon companies or on Polish banks, or because some companies were classified in different industry sectors and therefore did not show up in the results. It could also have to do with the fact that apart from syndicated loans (provided by a banking syndicate), banks also provide bilateral loans to fossil fuel companies. These type of loans are not included in the Thomson ONE Banker database. However this is not seen as a major problem, as bilateral loans are generally much smaller than syndicated loans and large fossil fuel companies seldom use bilateral loans.

Noteworthy is that some Polish banks are part of larger banking groups (Bank Pekao is part of the UniCredit Group (Italy), mBank is part of the Commerzbank Group (Germany), ING Bank I ski is part of the ING Group (Netherlands) and BZ WBK is part of the Santander Group (Spain)). A substantial part of the loans to high-carbon companies are supposedly provided in the name of the banking group and not the Polish subsidiary. This does expose the entire group, including the Polish subsidiaries, to high-carbon risk, but these loans do not show up when focusing on the Polish banking subsidiaries.

In an effort to find (bilateral) loans provided by the selected Polish banks to high-carbon companies that did not show up in the Thomson ONE Banker database, we also examined the annual reports of the high-carbon companies identified while analyzing the holdings of the Polish pension funds.

Applying these criteria resulted in a list of 19 high-carbon companies that have received one or more loan(s) involving one or more of the analyzed Polish banks. This includes different kinds of facilities provided any time before 1 January 2014 and maturing any time after this date.

The assessment focuses on loans still outstanding at the research date (i.e. on the bank's balance sheet as at 31 December 2013). This way a reliable estimate can be made of the selected Polish banks' exposure to producers of oil, gas and coal. This exposure is expressed in value terms, but also as a percentage of the banks' total exposure to corporate loans and as a percentage of their total assets.

3.3.2 Total corporate loan exposures

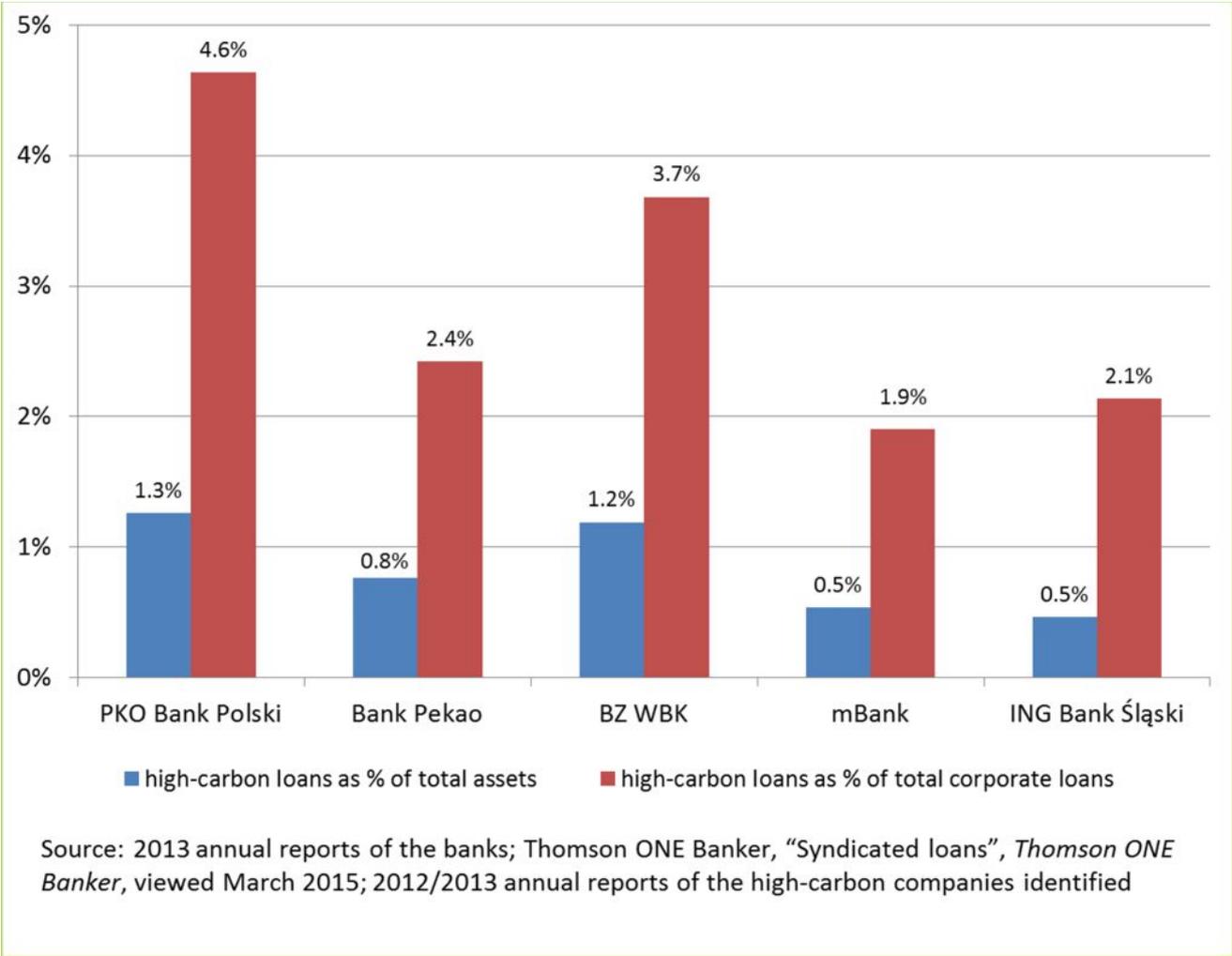
The loans to oil, gas and coal mining companies worldwide that were still (partially) outstanding as of 31 December 2013 and which involved one or more of the analyzed Polish banks were extracted from the database and annual reports of the high-carbon companies identified while analyzing the holdings of the Polish pension funds.

For each loan, the share of one or more of the analyzed banks in the provision of the loan, depending on their role as bookrunner or common participant, was estimated (if the exact values were unknown). Depending on the total years to maturity, the outstanding share as of the end of December 2013 was calculated.

The financing provided to fossil fuel producers in the form of loans can be expressed in value terms, as a percentage of the total corporate loans provided by the bank outstanding as of 31 December 2013, and as a percentage of the total assets of the banks. The total corporate loans outstanding per bank at the date of reporting were taken from their annual financial statements. A complete breakdown of loans by sector (singling out public sector, banks and other financial institutions as recipients of loans) is usually provided in the balance sheet and related notes.

Figure 6 illustrates the estimated share of loans to high-carbon companies in total assets as well as the share of loans to high-carbon companies in total outstanding corporate loans provided by the analyzed banks at the end of 2013.

Figure 6 High-carbon share of outstanding corporate loans (as of 31 Dec. 2013)



The total estimated value of the outstanding loans to high-carbon companies for the five Polish banks is € 1.4 billion. The share of outstanding high-carbon loans in the total assets of the banks varies between 0.5% and 1.3%, with a weighted average of 0.9%. This is equal to the EU weighted average.¹⁵ When calculating the share of high-carbon loans in the estimated

value of overall outstanding corporate loans, this share varies between 1.9% and 4.6%, with a weighted average of 3.2%.

PKO Bank Polski has the highest share of outstanding loans to carbon-intensive industries with a 1.3% share of total assets, followed by BZ WBK at 1.2% and Bank Pekao at 0.8%. The exposure of the lowest-scoring banks mBank and ING Bank I ski stands at 0.5% of total assets, which is less than half of the exposure of PKO Bank Polski and BZ WBK. However, it must be recalled that the narrow industry classification applied in this analysis could affect the outcome as, for example, although mBank may be participating less in loans to fossil fuel producing companies, it could be involved in loans to downstream companies like leading commodity and oil trader Trafigura.

When looking solely at their share of the corporate loans portfolio, PKO Bank Polski and BZ WBK also claim the highest percentage. Based on the absolute value of high-carbon loans, PKO Bank Polski stands out with an estimated €604 million outstanding, followed by BZ WBK (€309 million), Bank Pekao (€291 million), mBank (€130 million) and ING Bank I ski (€96 million).

3.3.3 Breakdown of corporate loan exposures by type and maturity

Loans can be either short-term or long-term in nature. Short-term loans (including trade credits, current accounts, leasing agreements etc.) have a maturity of less than a year. They are mostly used as working capital for day-to-day operations. Short-term debts are often provided by a single commercial bank, which does not ask for substantial guarantees from the company. A long-term loan has a maturity of at least one year, but generally of three to ten years. Long-term corporate loans are particularly useful for financing expansion plans, which only generate rewards after a certain period of time. The proceeds of corporate loans can be used for all a company's activities. Long-term loans are often extended by a loan syndicate, which is a group of banks brought together by one or more arranging banks. The loan syndicate will only undersign the loan agreement if the company can provide certain guarantees that interest and repayments on the loan will be fulfilled.

A revolving credit facility is a specific type of loan that provides a company with the option to take up a loan from a bank (or more often, a banking syndicate) when it urgently requires finance. Revolving credits are often contracted for a five year period and then renewed; but many companies renegotiate their revolving credit facility every year with the same banking syndicate. Amounts, interest rates, fees and participating banks can change slightly every year. As such renegotiations by larger companies are often reported in the financial press, the impression could be given that banks are lending huge sums of money to the same company every year. However, these are essentially only renegotiations of the same facility. A revolving credit facility is hardly ever (fully) called upon for a loan, but if a company experiences financial distress, it is likely to make maximum use of the credit facility, turning it into a risky exposure for the banks involved. The analysis in this report therefore uses the total committed amounts.

Project finance is another specific type of long-term loan. The proceeds can only be used to finance a specific project: a mine, pipeline, an oil rig, a vessel etc. Project finance is often extended by a banking syndicate, like corporate loans. Unlike corporate loans, the repayment of a project finance loan is dependent upon the revenues that a project is expected to generate once it is up and running. To guarantee the payment of interest and repayments as much as possible, the banks usually demand that the revenues of the project must be used first to pay interest and repayment. Only if the revenues are large enough, will the remainder be paid out as dividends to the owner(s) of the project. Banks run a fairly high risk on these loans: if the project is not successful and does not generate (sufficient) revenues, they will not receive interest and repayments (or less than agreed). In that case, the banks do not have the option

(or only to a very limited extent) to call upon the owner(s) of the project to pay interest and repayments from the revenues generated by other activities of the owner(s). This is called non-recourse or limited-recourse financing.

Because banks run a higher risk with a project finance loan, they will carefully evaluate the project in advance and will demand to be closely involved in the day-to-day running of the project. Also, banks will demand a higher interest rate for project financing loans. This makes project financing loans less attractive for most companies planning to develop a project. Project finance is a niche market for financing projects under specific circumstances, e.g. if the project is very large compared to the size of the owner, or if some of the owners of the project do not have cheaper financing options available.

The outstanding amounts of individual deals are calculated based on the share of outstanding years to maturity as of the end of 2013, in relation to the total maturity of the loans. In order to establish the contribution of the individual banks to the analyzed corporate loans and revolving credit facilities, estimates are used based on the following rules of thumb: generally it is assumed that 40% of the total amount is committed by bookrunners and 60% by other participants of the syndicate. If, however, the number of bookrunners is (almost) equal to, or higher than, the number of participants, the reverse is used: 60% for the bookrunners and 40% for the arrangers. Thus, if there are, for example, 5 bookrunners and 4 participants and the amount of the loan is € 100, the estimate will be that the bookrunners commit 60% (€ 12 each) and the participants 40% (€ 10 each). The amount provided by the bookrunners is always higher than the amount provided by participants.

Figure 7 breaks down the facilities provided to high-carbon companies by type of loan based on total value. With 57%, revolving credit facilities and standby loans take up the largest share. The assumption that revolving credit facilities are outstanding may exaggerate the actual exposure to high-carbon as it cannot be predicted whether these credits will actually be drawn down or not. However, this approach better reflects the potential maximum exposure, and therefore the actual risk the banks are facing. Another very important instrument is term loans, which are usually used for general corporate purposes and as working capital. These type of loans account for nearly 30% of the total value of loans. The share of project finance is 13%.

Figure 7 Types of financing provided to high-carbon companies

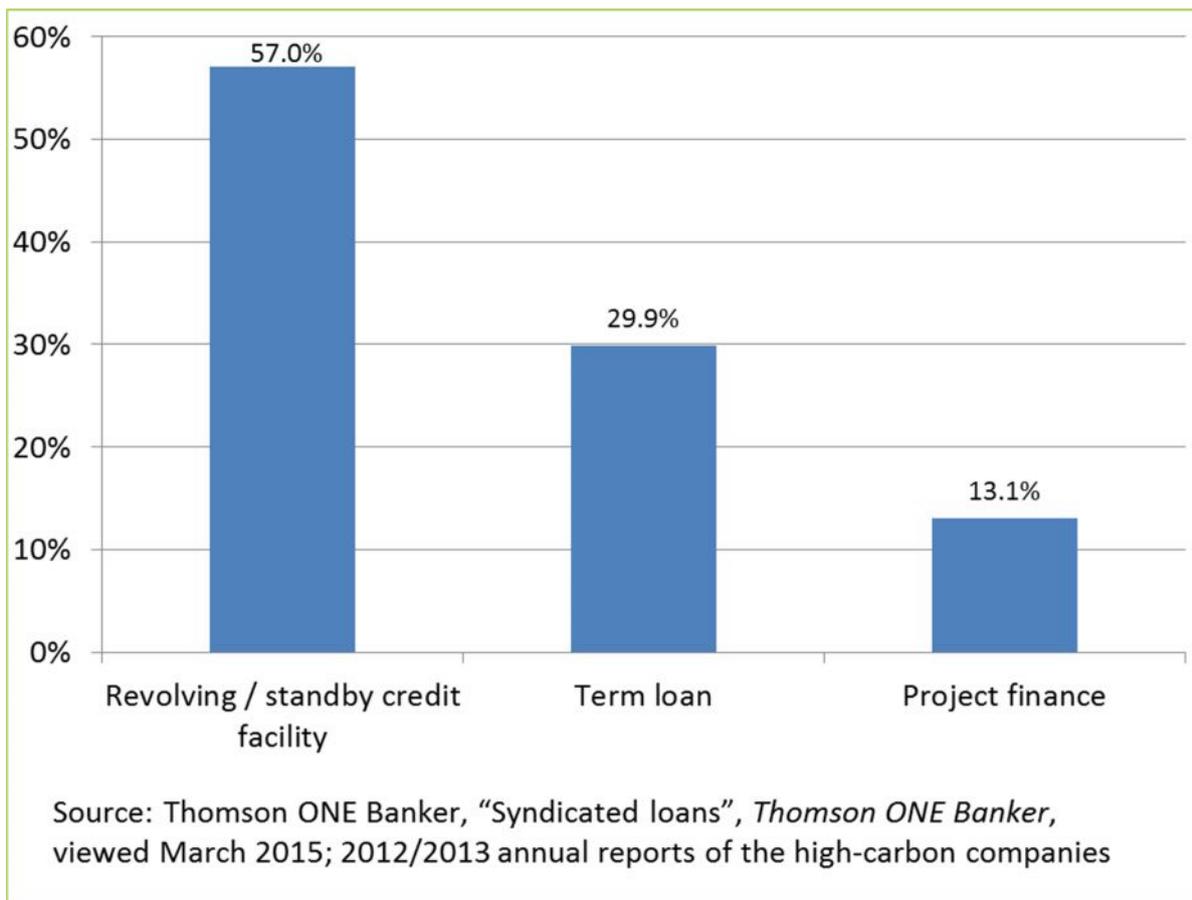


Figure 8 shows the distribution of value among different types of outstanding loan facilities for the individual selected Polish banks. While for all banks revolving credit facilities and term loans play the most important role, you can see a clear difference among the banks. PKO Bank Polski and Bank Pekao are more involved in revolving/standby credit facilities, while mBank and ING Bank Polski are more involved in providing term loans. It is also worth noting that we did not find any project finance loans provided by mBank.

The outstanding years to maturity of the analyzed facilities based on their value as of end of year 2013 are analyzed in Figure 9. It was not possible to analyze the total years to maturity, since we retrieved quite some loans from annual reports which did not state the starting date of the loan, but only the maturity date. Two companies did also not mention the maturity date of the loans, so the analysis of the outstanding years to maturity is not including these two companies.

The outstanding years to maturity of the analyzed loans ranges between less than two years and 10 years. The majority of loans (60%) by value have outstanding years to maturity between two and five years. Short outstanding years to maturity of less than two years apply for 15%. 25% have outstanding years to maturity between six and nine years.

Figure 8 Types of outstanding loans to high-carbon companies as of 31 Dec 2013

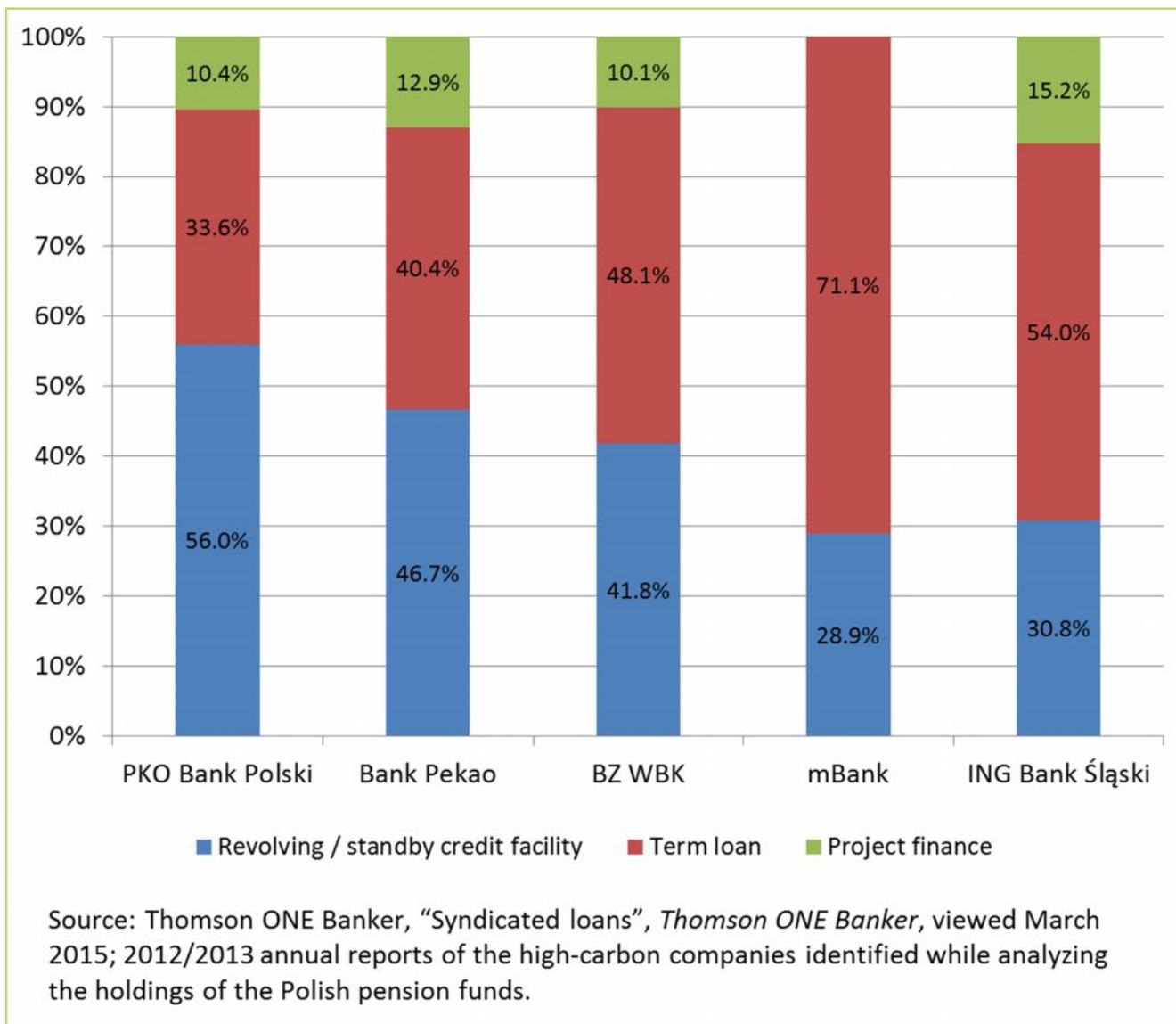


Figure 10 breaks down the outstanding value of loans provided by five selected Polish banks by remaining years to maturity as of the end of 2013. The years to maturity were clustered in three categories: less than two years, two to five years and six to nine years.

Although not all loans could be included in this analysis due to lack of transparency in the maturity dates, Figure 10 illustrates that some banks have a much higher exposure to long-term loans to high-carbon companies than others. Bank Pekao stands out with a large share of long-running high-carbon loans, with 70% of its outstanding loans having an outstanding maturity between six to nine years. For PKO Bank Polski also more than 30% of its loans have a maturity between six to nine years. PKO Bank Polski, BZ WBK and mBank all have the most loans with a two to five years outstanding maturity. ING Bank Śląski only has loans with an outstanding maturity of less than two years, although it has to be taken into account that the figures for ING Bank Śląski are based on a limited amount of analyzed loans.

Figure 9 Remaining maturities of loans to high-carbon companies as of 31 Dec 2013

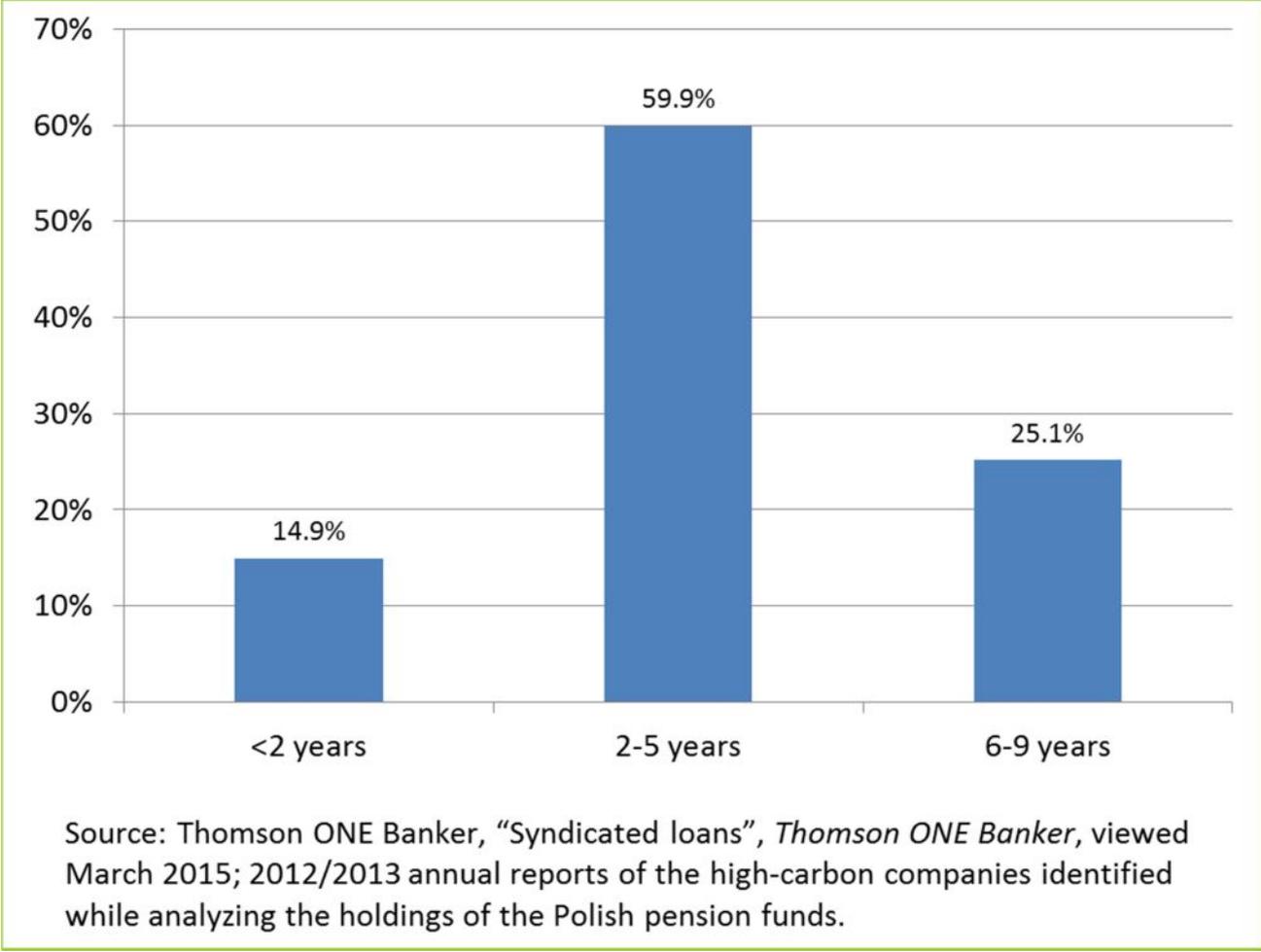
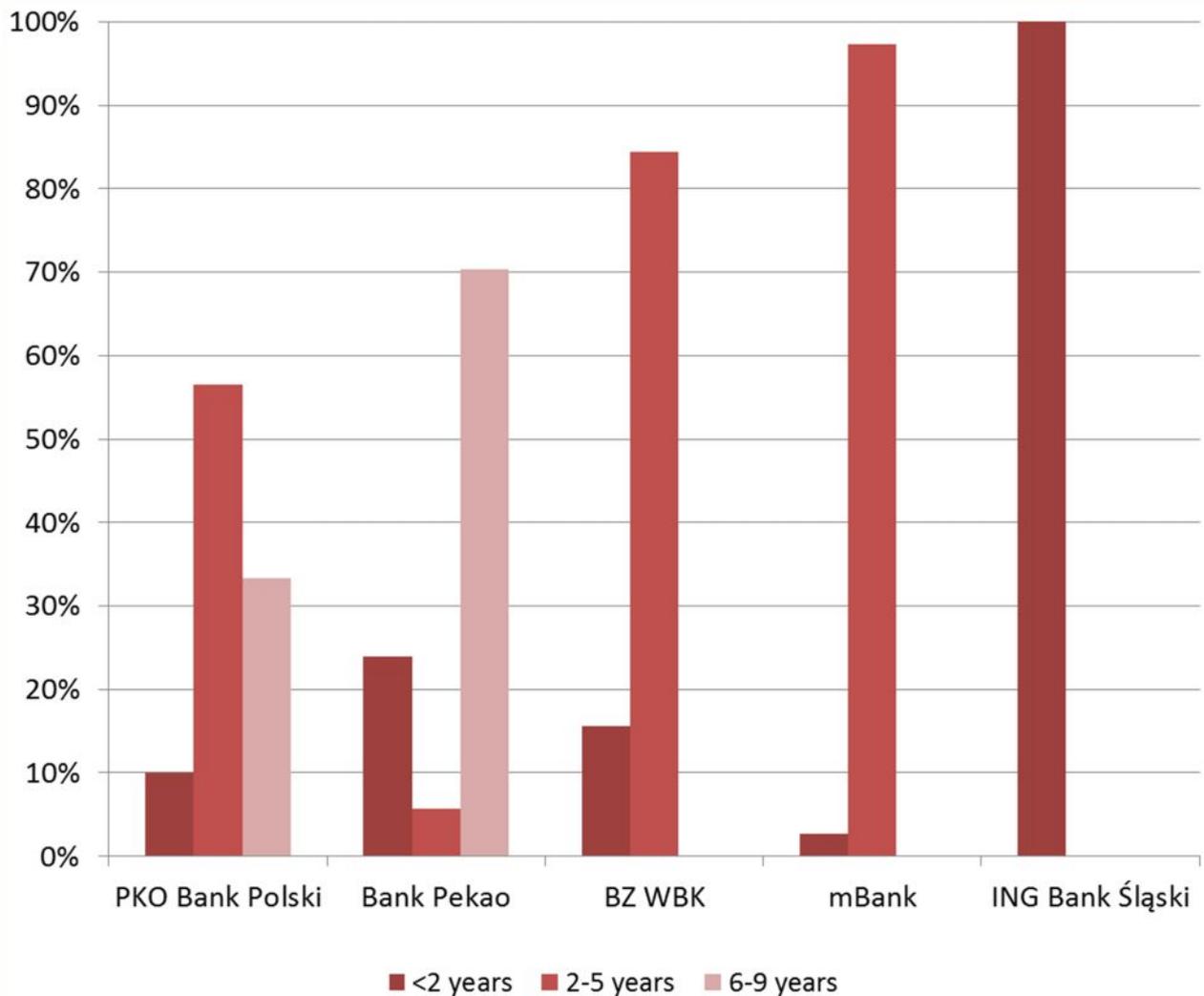


Figure 10 Remaining maturity of loans to high-carbon companies per bank as of 31 Dec 2013



Source: Thomson ONE Banker, "Syndicated loans", *Thomson ONE Banker*, viewed March 2015; 2012/2013 annual reports of the high-carbon companies identified while analyzing the holdings of the Polish pension funds.

3.4 Exposures of high-carbon assets in holdings of equities and bonds

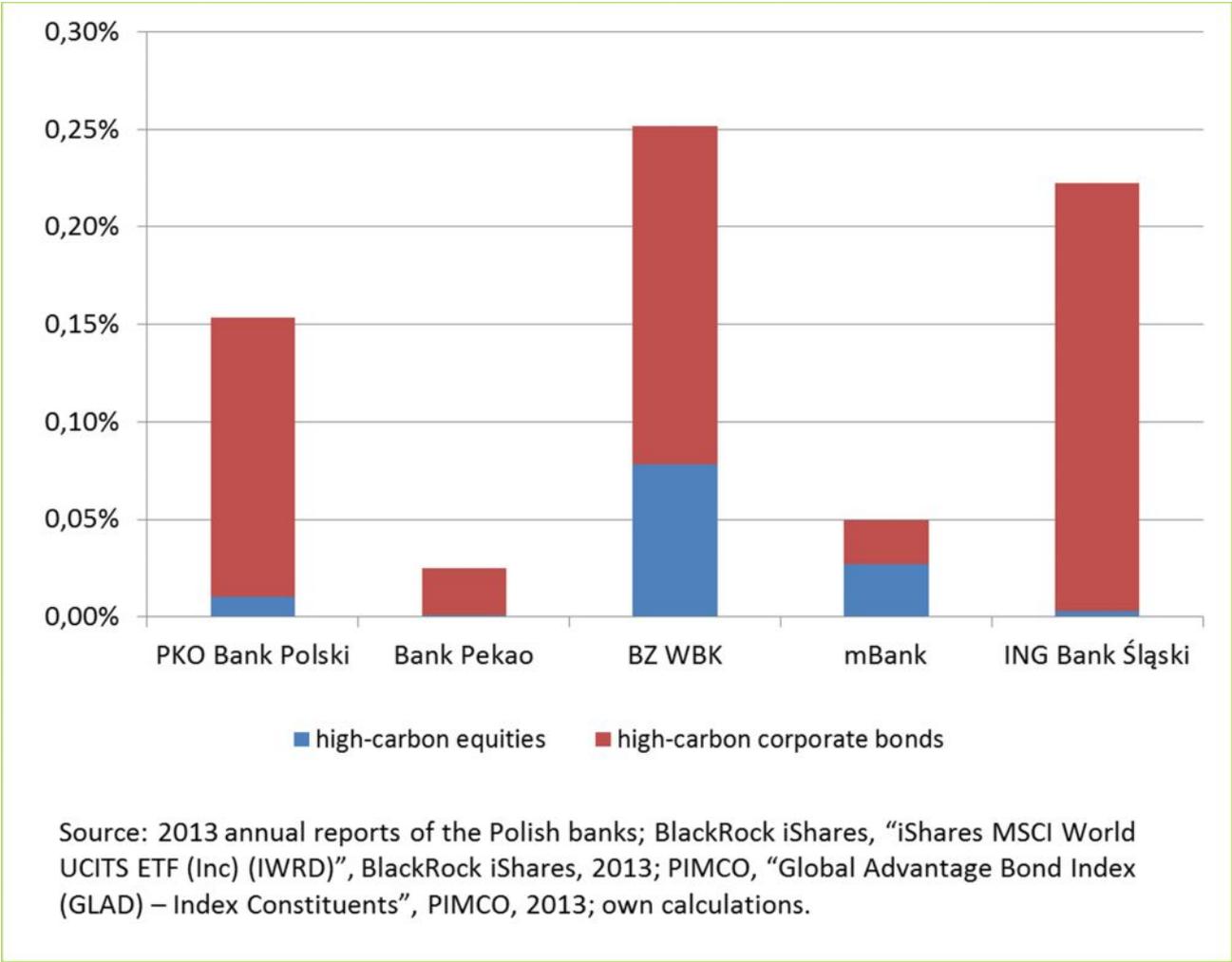
Apart from loans, banks are also exposed to equities and corporate bonds issued by oil, gas and coal mining companies. Banks hold varying amounts of shares and bonds for their own account and are exposed to high-carbon companies in their trading portfolio. These holdings show up in the balance sheet under different headings, including financial assets held for trading, financial assets designated at fair value through profit and loss, financial assets available for sale and investments held to maturity. For this analysis, equity holdings and corporate bond holdings falling under these categories were extracted from the annual reports of the selected Polish banks.

Available data on the composition of trading portfolios are insufficient to track exposures to specific companies. Instead, the exposure to high-carbon companies in leading stock and

bond indices is used as a reference value. Based on these values the relative importance of potential losses via trading portfolios is indicated. For equity holdings, the composition of BlackRock’s iShares MSCI World UCITS as of December 2012 is used as a reference, for bond holdings the PIMCO Global Advantage Bond Index is used as a benchmark.¹⁶ For equities, the assumed average high-carbon share applied is 9.4%. For bonds, the share of high-carbon companies in the corporate bonds contained in the bond index is applied; this percentage is 15.3%.

Figure 11 shows the high-carbon shares of banks’ equity and bond portfolios. High-carbon equity holdings have an estimated value of €32.8 million for the five combined selected Polish banks. On average, they account for 0.02% of total assets. The value of corporate bond holdings has a value of €173.6 million. On average, holdings of corporate bonds account for 0.11% of total assets. Adding up the two asset classes, this leads to shares ranging from 0.03% (Bank Pekao) to 0.25% (BZ WBK) of total assets, with a weighted average across the five Polish banks of 0.13%.

Figure 11 Share of high-carbon equity and bond holdings in total assets



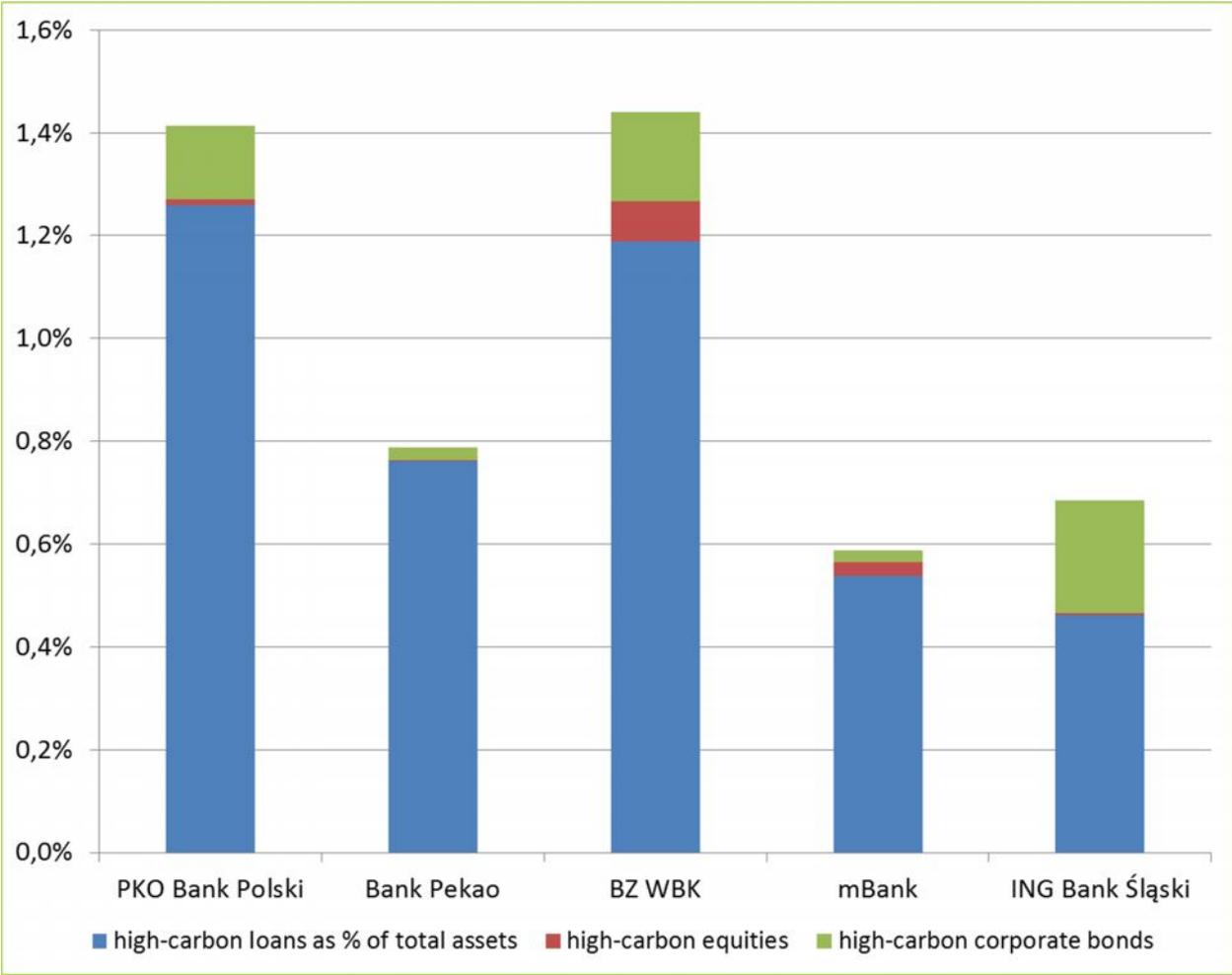
3.5 Combined exposure to high-carbon assets

Corporate loans and investments in equities and corporate bonds form the key exposure of Polish banks to high-carbon companies. When adding up the estimated exposures through

these three asset classes, a statement can be made on the estimated total exposure of the analyzed Polish banks to high-carbon investments.

Figure 12 shows the combined exposure of the selected Polish banks to high-carbon companies. BZ WBK stands out with the highest share of high-carbon exposure, standing at an estimated 1.44% of its total assets. This is followed by PKO Bank Polski with 1.41% of total assets, Bank Pekao with 0.79%, ING Bank Polski with 0.68% and mBank with 0.59% of its total assets. The weighted average for the five Polish banks is 1.04% and the total value of these assets adds up to € 1.6 billion. The EU weighted average is, with 1.4%, somewhat higher than the 1.04%.¹⁷

Figure 12 Combined exposure to high-carbon assets as share of total assets

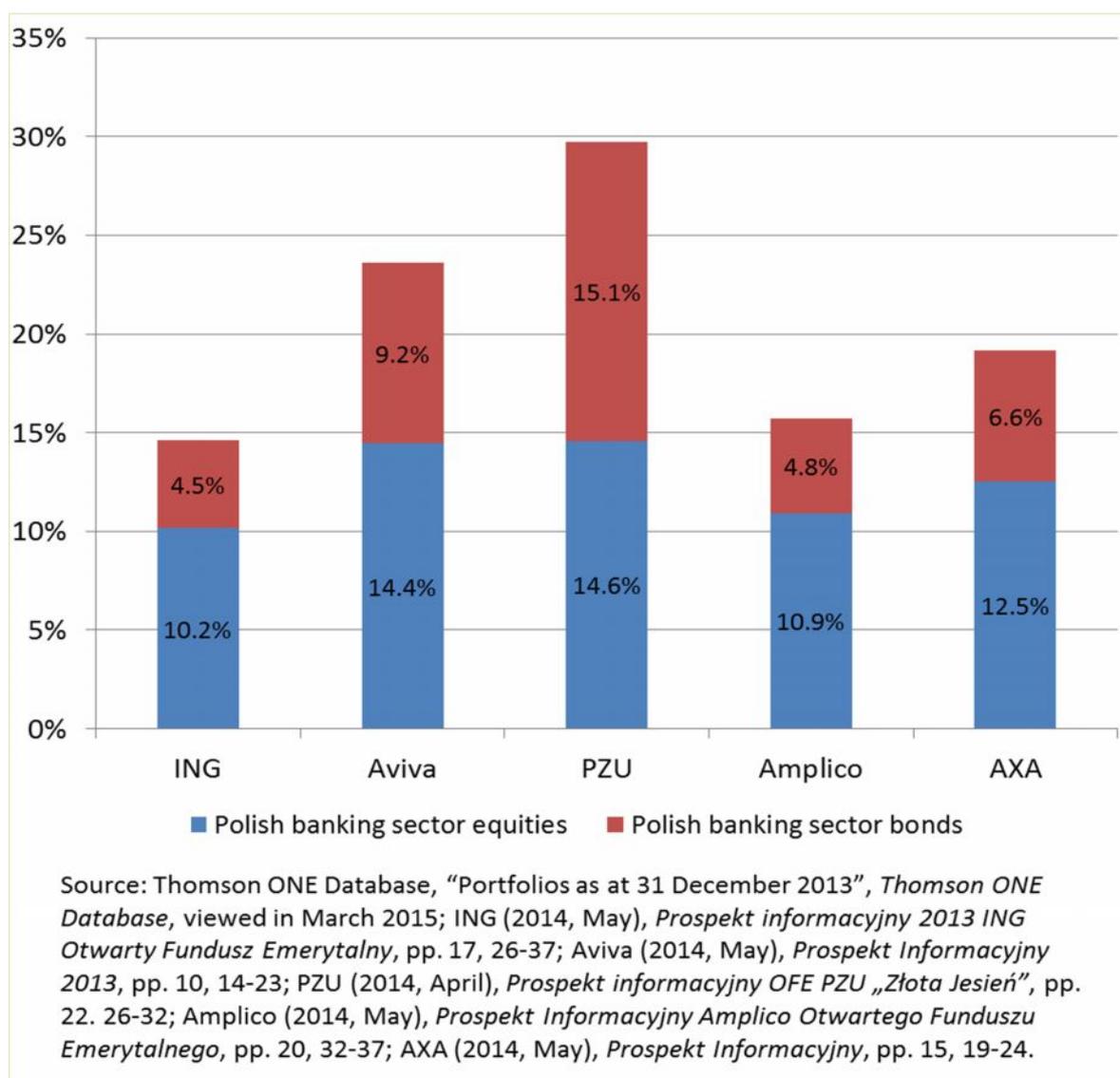


Chapter 4 Feedback loop from Polish banks to pension funds

If substantial shocks occur to various financial institutions at the same time or to a whole sector, which would happen in case of a carbon bubble shock, harmful feedback loops may occur. One of the potential feedback loops is the way in which the high-carbon risks faced by Polish banks could affect the Polish pension funds - because of their exposure to the Polish banking sector. In order to assess the importance of this feedback loop, we calculate the holdings of the five selected Polish pension funds in Polish bank equities and bonds, in the same way as we calculated the Polish pension funds' exposure to high-carbon companies. For this research, a bank is considered Polish if the entity held by the pension funds in their equity portfolio itself (and thus not only a subsidiary or parent company) is located in Poland.

Figure 13 shows the exposure of the five selected Polish pension funds to the Polish banking sector. As can be seen, PZU stands out with the highest share of exposure to the Polish banking sector, with an estimated 29.7% of its total assets. This is followed by Aviva with 23.6% of its total assets, AXA with 19.1%, Amplico with 15.7% and ING with 14.6% of its total assets. The weighted average exposure of the five Polish pension funds to the Polish banking sector is 20.6% and the total value of these assets adds up to € 11.0 billion.

Figure 13 Exposure of Polish pension funds to Polish banking sector



Chapter 5 Impact of the carbon bubble on pension funds and banks

5.1 Potential shocks to Polish pension funds and banks

The previous chapters analyzed the exposures of the selected Polish pension funds and banks to high-carbon companies. The total estimated exposures are roughly € 3.9 billion for the five selected pension funds and € 1.6 billion for the five selected banks. These large figures raise serious concerns about the potential consequences should these investments end up as stranded assets.

Should a carbon bubble shock occur, these exposures will generate losses for the individual financial institutions. The size of the losses depends on the amount and type of exposures as well as on the magnitude of the shock and the time period over which it occurs. In the case of a sudden crash, financial institutions will immediately bear the full cost of downward adjustments in equity and bond prices and required loan loss provisions. In the case of rapid change that occurs over a period of several months, financial institutions may be able to take certain measures to reduce their losses. For example, some pension funds may be able to rebalance their portfolio during the adjustment, actively reducing their exposure to high-carbon firms during the transition period, resulting in somewhat lower losses.

Furthermore, some types of exposures will generate larger losses than others. Equity investments are one of the most affected types of exposures, because shareholders bear the largest risks and absorb the first losses, before bondholders and other creditors. The value of equity investments in high-carbon firms is also directly based on the expected cash flows from fossil fuel reserves. Equity investments are most important for pension funds, but also substantial for banks with investment banking businesses. High-carbon equities account for an estimated average of 6.7% of total assets across the five selected Polish pension funds.

Longer-term bond exposure would then be hit. In the benchmark bond index, the average remaining maturity of bonds issued by high-carbon companies is approximately 11 years. This means that the risk profile and valuation of these bonds depends on the capacity of fossil fuel companies to meet their financial obligations over long time horizon, beyond the point where actual production will need to be scaled down due to stranded assets. Thus, depending on the balance between lower cash flow generation and lower investment needs, the capacity of fossil fuels companies to fully repay their long-term debt may be reduced, resulting in falling bond prices.

Corporate loans are a key source of vulnerability for the selected Polish banks. The individual exposure of banks varies considerably, ranging from 0.5% to 1.3% of total assets, with an average exposure of approximately 1%. The impact of a carbon bubble shock on corporate loans depends on the type of loans provided to fossil fuel companies. The main types were found to be revolving credit facilities and term loans, followed by project finance. Revolving credit facilities may pose a comparatively small risk in normal times. In a carbon bubble shock scenario, however, fossil fuel firms may draw the full amounts of these facilities for as long as possible and may prioritize paying off other maturing loans first. The risk attached to term loans depends on the outstanding years to maturity. With an estimated 25.1% of the outstanding loans provided by European banks to fossil fuel companies having at least 10 years to maturity, cash flows at the time may not be sufficient to repay these loans. Banks will continue to receive interest payments – as the cash flows will not be affected directly – but they will need to make provisions for expected losses. Project-related financing could be especially critical as there is a high likelihood that banks will face losses if individual projects are abandoned, for example due to higher carbon taxes. The risks depend on the nature of the projects, however, as low-cost projects may continue to be commercially viable.

It is important not to look at losses at the sector level only, but to consider large individual institutions as well. The reason is that the commercial banking and pension fund sectors as a whole may be able to handle considerable losses, but if the losses are concentrated at specific institutions, this may cause immediate distress for those institutions, resulting in a larger overall impact. The reason is that many institutions may be able to absorb small losses as part of their normal operations, but a single institution confronted with a large concentrated loss may experience acute distress and pass on shocks to others. The mechanisms through which shocks are passed on are discussed below.

5.2 Potential propagation channels and feedback loops

If an individual financial institution faces a relatively large shock, this may trigger further shocks elsewhere in the financial system and the broader economy. The following overview briefly outlines the main propagation channels for the individual Polish financial institutions.

What could occur if an individual Polish pension fund suffers losses:

- If the loss is large, or the funding ratio of the pension fund was already low, the employer may be required to make an additional one-off contribution to the pension fund to cover the funding shortfall. Whether such an obligation exists depends on the pension contract; for most pension funds, the employer may be under pressure to make a higher contribution but there is no automatic obligation. The cost of an extra contribution may cause an unexpected loss for the employer;
- If the loss is large or the funding ratio of the pension fund was already low, the pension premiums for employees may be increased or the pension entitlements for employees and pensioners reduced. This could have an effect on consumer confidence and demand and hence the economic cycle. Increasing premiums has a direct effect on the net income of employees. Decreasing entitlements has a smaller direct effect on the income of pensioners only, but may reduce confidence among a broader group of consumers;
- If the loss is large, the pension fund may lower its risk profile to reduce the risk of further losses. In general, pension funds do this by increasing the proportion of their assets in relatively safe assets, especially low-risk sovereign bonds, at the expense of high-risk asset classes such as listed equities, private equity and real estate. To some extent, such a shift happens automatically if the share values of fossil fuel companies fall and a pension fund does not rebalance its asset mix. However, a pension fund may also actively reduce its equity investments and investments in other high-risk assets categories. Such behavior could have a broader effect on specific financial markets.

If an individual bank suffers losses:

- The market value of the bank will fall, generating losses for shareholders of the bank;
- If the loss is large, the risk premium for the bank's market funding will increase and the credit rating of the bank could be adjusted downwards. This reduces the value of the bonds issued by the bank, generating losses for bondholders;
- If the loss is large, the bank may try to restore its capital ratio by reducing the size of its balance sheet. In other words, the bank could restrict new lending, especially to high-risk segments such as small and medium enterprises, to reduce its overall risk exposure as its capacity to bear risks has been decreased. This could lead to higher borrowing costs or even unavailability of credit for small businesses that are dependent on the bank and cannot easily switch to another source of credit;
- If a bank with investment banking operations suffers large losses on financial investments for its own account, traders may try to quickly sell the high-carbon assets to limit their losses. In contrast to pension funds, it is likely that the behavioral response would be quick

and only affect the market for high-carbon assets, but it could potentially have a broader effect on stock markets.

- If the loss is very large and the bank's capital buffers were already low, this may trigger the need for recapitalization. Depending on the bank's funding structure and the market situation, private recapitalization could take place through a claim emission, imposing further losses on existing shareholders, or the conversion of subordinated debt, imposing losses on holders of subordinated debt securities, including pension funds and insurance companies. When the EU Bank Recovery and Resolution Directive comes into force, the bail-in of senior bondholders will become a possibility. (The compromise text of the directive was agreed upon in December 2013 and is to be formally adopted by the EU Parliament and the Council).
- If further recapitalization is needed and a private solution is not possible, the government of the bank's home country may need to provide a capital injection. This may be the case if uninsured corporate and institutional depositors start to withdraw their money and the bank faces difficulties in obtaining market funding, depleting the bank's liquidity buffers and creating a real danger that the bank cannot survive on its own. In the current situation, the government may then need to step in to restore confidence. This will increase the government's debt burden and exposes the government to large financial risks. (The EU's single resolution fund that was agreed on in December 2013 will initially consist of national compartments. In the coming years, the capacity of the fund therefore mainly depends on contributions from the national banking sector, which will be insufficient to recapitalize large banks).

If substantial shocks occur to various Polish financial institutions at the same time or to a whole sector, which would happen in case of a carbon bubble shock, harmful feedback loops may occur. One of these feedback loops was already discussed in more detail in Chapter 4. Another feedback loop that may occur is that if many banks and institutional investors start actively selling high-carbon assets, this could put more pressure on the market prices of these assets, triggering further sales. This could result in a negative price spiral, similar to what happened in the market for mortgage-backed securities. Thus, markets could overreact. If stranded assets were to reduce the market value of oil and gas companies by 40%, a negative price spiral could then temporarily increase the fall in share prices to, for instance, 60%. Note that large market effects will occur only if a broad range of market participants, not just investors that divest from fossil fuels for ethical reasons, change their risk perception of high-carbon assets.¹⁸

Also, if many pension funds and insurers start reducing their risk profile this could increase the price of low-risk sovereign bonds. This, in turn, would drive down the risk-free returns that institutional investors can obtain on safe assets and therefore lower the risk-free interest rate that institutional investors use to determine the value of their future obligations. Because of incomplete matching of assets and liabilities, this would exacerbate pension funds' funding shortfalls and further reduce the solvency of insurers. The result could be a flight-to-quality spiral, similar to what happened over the past years in the Eurozone and in other EU countries like Sweden. The result could also be lower pensions.

Furthermore, if many commercial banks suffer large losses and restrict lending to businesses to rebalance their exposures and risk-bearing capacity, investment would become constrained, harming the overall economy. This could lead to further losses on corporate loans, create a negative deleveraging spiral, or reinforcing the deleveraging dynamics that already exist in some EU countries.

Moreover, if many pension funds need to substantially reduce pension payments, this would reduce the income of pensioners and probably lead to lower consumption. Similarly, if pension funds need to substantially raise pension premiums, this would raise employment cost or reduce net wages (depending on how the rise in premiums is distributed between employers and employees). The result would be lower economic growth as well as various potential feedback effects. Lower growth also worsens the financial position of the government, which negatively affects the value of government bonds held by all financial institutions.

Finally, if it turns out that several large financial institutions have underestimated carbon bubble risks, this may reduce consumer confidence and increase the risk perception of market participants. Due to the resultant fall in consumer confidence, the effect of reducing pension entitlements could be much larger than the direct consequences for pensioners of specific funds. There could also be a strong negative effect on consumer confidence if the government needs to support banks or insurance companies. In fact, even the signal that large financial institutions could be more vulnerable than they appear and have not managed large risks appropriately may already reduce consumer confidence. This, in turn, could reduce consumption and short-term economic growth. In addition to the feedback effects for pension funds mentioned above, lower growth could generate a negative spiral for banks through increased domestic credit losses. Creditors and counterparties of financial institutions may also react to negative signals about the vulnerability and risk management of these institutions. This could lead to increased funding costs for banks and insurance companies, which would be largely passed on to customers and could therefore also generate feedback effects through lower growth.

The vulnerability of individual institutions, the likelihood of knock-on effects through the passing on of shocks, and feedback effects at the macro level all depend on the broader economic scenario in which a carbon bubble shock occurs. With a weak economic outlook and capital buffers that are low to start with, losses due to high-carbon exposures will be more difficult to absorb. The propagation of shocks, and thus also the harmful feedback effects triggered by such shocks, depend on whether an institution is able to recover on its own. For all financial institutions, this in turn depends on broader economic developments and expectations about future economic developments. Moreover, the ability of banks to recover also depends on how their creditworthiness is perceived by market participants. Even if a carbon bubble shock by itself only generated a modest shock, in the case of continued economic fragility in the Eurozone, that shock would come on top of other causes of financial instability and could be trigger harmful feedback loops. Moreover, this report estimated only the potential losses on exposures to fossil fuel related firms and commodities. The impact of a carbon bubble shock will be larger, because it also affects other sectors and investments.

5.3 Scenario 1: “Low-carbon Breakthrough”

A carbon bubble shock can be defined as a quick and large fall in the value of fossil fuels. To assess the potential impact of a carbon bubble shock on the EU financial system, the magnitude of losses for individual financial institutions will be roughly estimated on the basis of a particular shock scenario. The main scenario assumes a quick and definite transition towards a low-carbon EU economy. This breakthrough could result from decisive global politics determined to limit climate change or from quick changes in technologies. An example of a recent new kind of technology is Tesla’s Powerwall: a home battery that charges using electricity generated from solar panels, and powers your home in the evening. The average home uses more electricity in the morning and evening than during the day when solar energy is plentiful. Without a home battery, excess solar energy is often sold to the power company and purchased back in the evening. This mismatch adds demand on power plants and

increases carbon emissions. Powerwall bridges this gap between renewable energy supply and demand by making the home's solar energy available to when it's needed.¹⁹

Policy changes are not necessarily driven by concerns about climate change alone, but can also be a response to concerns about air pollution or dependence on energy imports. China, for example, which is currently the main source of increasing greenhouse gas emissions, is taking strong measures to increase the use of gas as fuel for vehicles and industrial production because it is cleaner than oil and coal. Decisive politics probably require a trigger, such as a catastrophic drought or flooding that can in part be attributed to climate change due to the increased probability of their occurrence under changing climate conditions.

The low-carbon breakthrough scenario assumes the following shocks to the exposures of financial institutions:

- The value of equity investments in oil, gas and coal businesses falls by 60%. This is in line with HSBC's analysis of oil and gas companies, which assumes a low oil price of US\$ 50 per barrel.²⁰ For diversified mining companies, the fall in value only applies to coal mining operations;
- The value of the long-term bonds of oil, gas and coal businesses falls by 30%. This assumption takes into account the long remaining maturities of average bond holdings, which implies a substantial increase in credit risk. For some firms, cash flows from production of fossil fuels compatible with a strict carbon budget and low oil prices will be insufficient to repay long-term bonds. For other firms, reducing dividend payouts and immediately ceasing all investments in projects that would be unsustainable under a low-carbon scenario may be sufficient to ensure full repayment of outstanding bonds. However, even for these firms credit risks will increase, for example due to uncertainty over the successful completion of the transition and the downsizing of the firm;
- Losses on the project financing of individual oil, gas and coal projects of 30%. As discussed above, project financing can be a high-risk type of exposure because banks will face large losses if individual projects are abandoned;
- Losses on term financing provided to oil, gas and coal projects of 30%. These credit losses are similar to the losses on long-term bonds;
- Losses on revolving and stand-by credit facilities to oil, gas and coal projects of 20%. Due to the shorter remaining maturities of these loans, typically up to five years, smaller losses would be expected.

Note that these assumptions specify average losses only, which are applied to all financial institutions. In reality, the precise nature of high-carbon exposures differs among institutions. For example, one bank may have more unsustainable unconventional oil projects or loans to coal mining companies in its oil, gas and mining credit portfolio than another bank. The estimates in this analysis do not account for such differences between institutions within a single type of exposure.

Figure 14 provides an overview of the estimated losses of the five selected Polish pension funds, expressed as a share of total assets. The weighted average loss for these five pension funds is approximately 4.2%. This implies a loss of €2.3 billion on €53.7 billion of the five pension funds' total assets. The estimated loss is considerable larger than the estimated weighted average loss of 2.5% for the entire EU pension funds.²¹ AXA has the highest estimated loss with 4.8% of its total assets, followed by PZU with 4.7%, Aviva with 4.2%, Amplico with 4.0% and ING with 3.9%.

Figure 14 Estimated losses of pension funds (% of total assets)

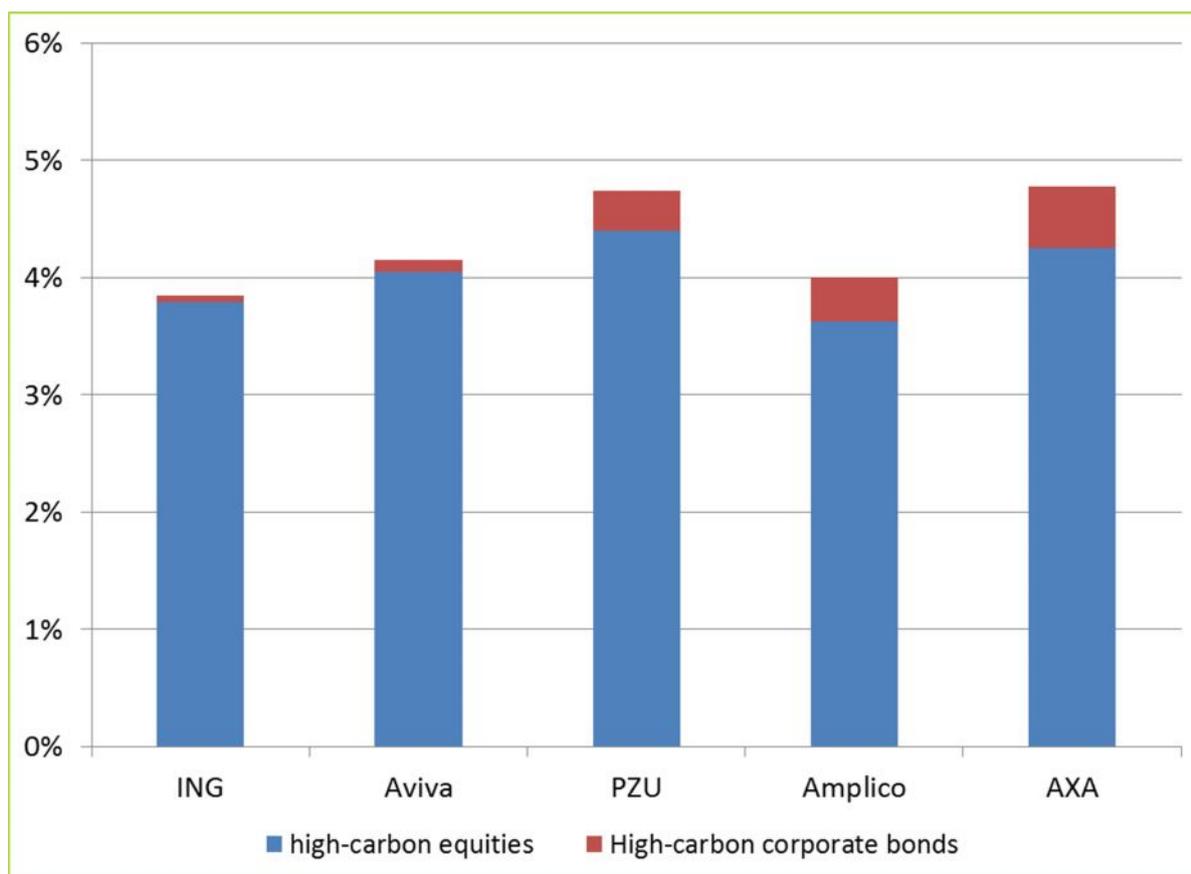
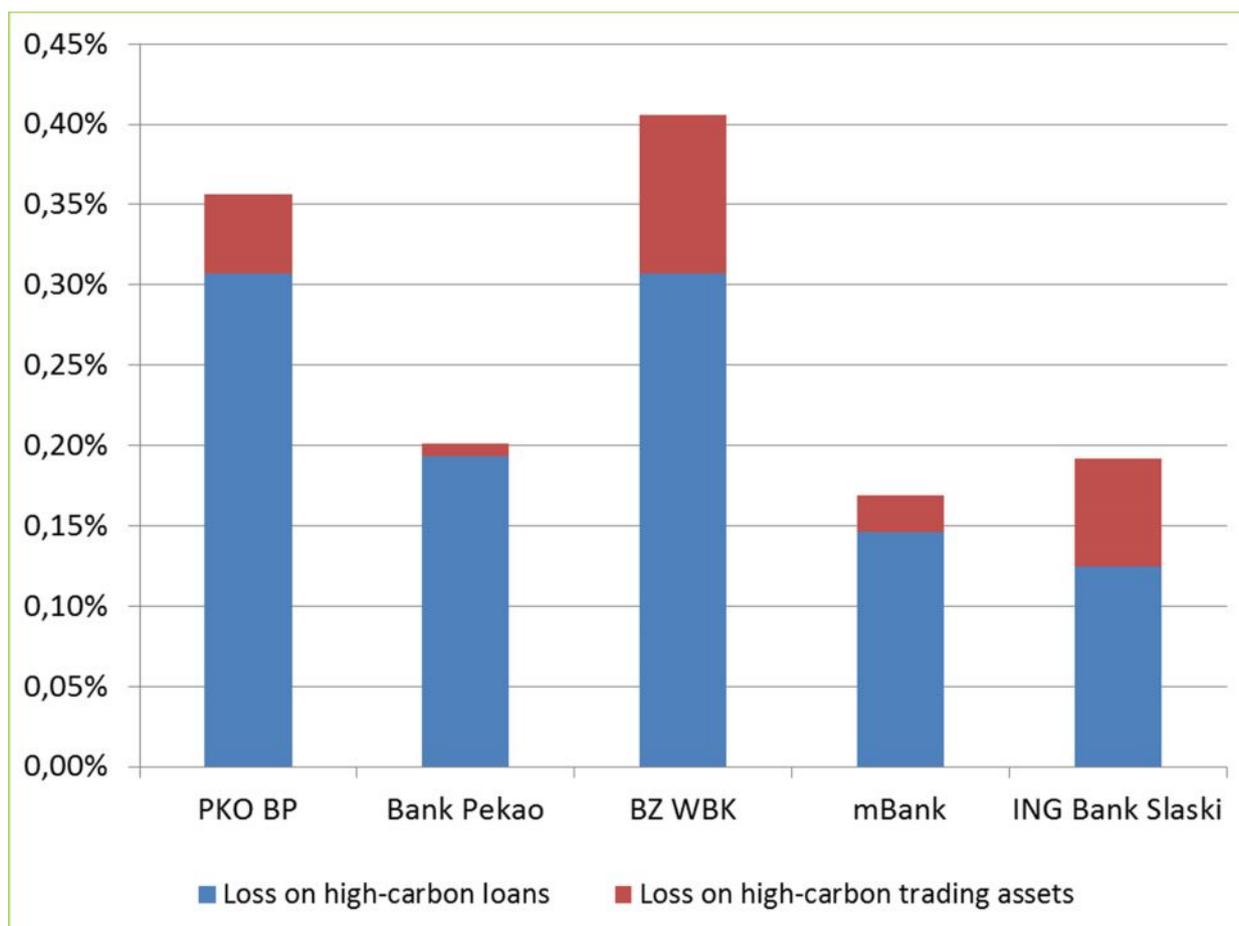


Figure 15 provides an overview of the estimated losses of the five selected Polish banks, also expressed as a share of total assets. The weighted average loss for these five banks is approximately 0.3% of total assets (€ 434 million of losses on € 158 billion of total assets). Note that this figure should not be compared to pension funds. For banks, the impact of a concentrated loss depends on the capacity of the bank to offset the loss with other income streams and then to absorb the remaining shock through its capital buffer. Many commercial banks report an annual income before tax equal to 0.3-0.6% of total assets and have capital buffers of 3-5% of total assets. Thus, a 0.3% concentrated loss could wipe out the annual income of the five selected Polish banks. However, a one-off 0.3% loss may not trigger negative feedback loops in the EU or the Eurozone as a whole.

On average, the estimated losses for the five Polish banks in investment banking are smaller than those in corporate lending. This can be explained by the small amount of high-carbon trading assets held by the five selected Polish banks. This also explains why the 0.3% estimated loss for the five selected Polish banks is slightly lower than the 0.4% estimated loss for the entire EU banking sector.²² The average percentage of trading assets held by the selected Polish banks is lower than the average percentage of trading assets held by the entire EU banking sector. The Polish banks especially hold less high-carbon equities than the average EU bank.

The impact differs considerably between the selected Polish banks. The most vulnerable banks (BZ WBK and PKO Bank Polski) could face losses of 0.4% of total assets, whereas the less vulnerable banks (mBank, ING Bank i Polski and Bank Pekao) could face losses of 0.2% of total assets. BZ WBK and ING Bank i Polski face serious high-carbon trading asset losses, while the other banks mainly face losses related to their high-carbon loans.

Figure 15 Estimated losses of banks (% of total assets)



The estimates in this section are conservative, because an overall assessment of carbon intensity requires a much broader analysis, including assessing the exposure of the financial sector to companies in, for instance, the car industry, the steel industry and the transport sector, as well to asset classes such as real estate. Moreover, within sectors such as the electricity industry, one might need to assess exposure to high-carbon producers versus exposure to low-carbon producers to get a full picture of the vulnerability of financial institutions. Effects on the revenues of the Polish government related to its coal reserves would be relevant as well. Finally, the potential overreaction of markets, resulting in larger short-term losses, has not been taken into account.

Concluding, it can be stated that the selected Polish pension funds would encounter greater losses than the average EU pension fund, while the selected Polish banks are slightly less exposed to the carbon bubble than the average EU bank which reduces their losses. The high exposure of the selected Polish pension funds is mainly attributable to their high-carbon equity holdings. In order to reduce the carbon bubble risk, these pension funds should thus rebalance their equity portfolio, for instance by focusing more on Polish high-tech companies instead of Polish high-carbon companies.

5.4 Scenario 2: “Uncertain Transition”

The main scenario above assumed a quick and definite transition towards a low-carbon EU economy, resulting from decisive political action or a major technological breakthrough. The transition may not be quick and certain, though. This section, therefore, will discuss the effects of a second scenario featuring a slower and uncertain transition. These effects are more difficult to quantify and will therefore be mainly discussed qualitatively. However, by comparing

these effects with the low-carbon breakthrough scenario, it becomes clear that the risks to financial stability are potentially larger.

In this scenario, catastrophic climate change will eventually still be avoided, which means that CO₂ emissions cannot exceed the carbon budget for global warming of two degrees. However, it is assumed that EU policies remain insufficient to restrict greenhouse gas emissions, focused on short-term interventions and partial solutions, for a prolonged period (five years or more). During this period, an overall policy framework is lacking. Measures are mainly adopted at the national level and are sometimes inconsistent; various measures are reversed or replaced after a few years. Thus, climate action is always taking two steps forward, one step back. The dangers of climate change are increasingly being recognized over the years and policies become gradually more ambitious but, due to the short-term nature of politics, the transition path remains highly uncertain initially. The uncertain transition may also be driven by slow and uncertain technological advances rather than short-term policies. Instead of a major technological breakthrough, competing technologies may emerge, or there may be major technological setbacks after an apparent breakthrough. Thus, whether driven by politics or technology, the timeframe and path of the energy transition remain highly uncertain for a longer period. Ultimately, the adjustments required to limit global warming will need to be stronger, however, because they will take effect after years of uncertainty during which greenhouse gas emissions will have risen much higher than in the low-carbon breakthrough scenario.

The effects on the financial system and the selected Polish pension funds and banks differ from the main scenario in three ways. First, as the transition occurs slowly, the selected Polish financial institutions will not be hit by a sudden shock but incur investment and credit losses over a period of several years. This means that financial institutions will be better equipped to absorb losses on high-carbon exposures. The Polish banks will be able to offset the losses against profits generated over a longer period, limiting the impact on existing capital buffers. Moreover, the financial institutions will have time to restore or strengthen their capital buffers after the first losses on high-carbon assets, if necessary. Thus, compared to a low-carbon breakthrough, it is less likely that the selected Polish banks and pension funds will experience immediate distress due to sudden losses and this reduces the risk that they will pass on shocks through the financial system.

Second, as initial progress towards a low-carbon economy is slow and lacks credibility, fossil fuel firms will continue to develop new reserves. Current capital expenditures stand at approximately €500 billion per year, mainly for oil and gas projects. To put these annual capital expenditures into context, the market capitalization of large fossil fuel firms is approximately € 3,000 billion and annual dividend payments are roughly € 100 billion.²³ Annual capital investments are therefore large compared to the market value of the companies and several times as large as annual dividend payments.

The fossil fuel assets owned by listed companies, of which only 20-40% of can be sold if they have a proportional share in the global carbon budget, reflects current proven reserves (so-called P1 oil and gas reserves, and coal reserves). Their potential reserves, including fossil fuel assets that are still being developed (so-called P2 oil and gas reserves, and coal resources), are twice as large.²⁴ The capital investments of fossil fuel firms are mainly aimed at increasing the amount of proven, marketable reserves. Thus, until the implications of the carbon bubble are fully realized, fossil fuel firms will initially continue to make large investments in developing reserves that will only increase the total amount of stranded assets.²⁵ They finance new investments partly with retained profits (equity capital) and partly with debt (bonds and loans). If fossil fuel firms were to stop investing in the development of new reserves, which would happen in the low-carbon breakthrough scenario, they would not need to obtain new loans and issue new bonds to finance those investments. They would also have a larger cash flow available to repay existing loans and bonds (or to increase dividend payments or buy back

shares). This would limit future losses for shareholders and creditors resulting from the carbon bubble.

By contrast, in an uncertain transition scenario, the ongoing capital expenditures would eventually generate larger losses on equity as well as on bonds and loans. For the fossil fuel sector as a whole, capital expenditures related to the development of new reserves would be fully lost if global warming were to be eventually contained, as the total carbon budget is fixed. Even if only €300 billion out of the annual investments were related to the development of new reserves, that would be equivalent to 10% of the current stock market value of oil, gas and coal mining businesses. Thus, the additional losses will be significant compared to the existing exposures of the selected Polish financial institutions.

Third, due to uncertainty about future developments, it will be difficult for the Polish financial institutions to assess the climate-related risks of their loan and investment portfolios. It will not be clear if, how and at what pace a transition to a low-carbon economy will take place. Institutional investors may therefore take little action to mitigate losses on high-carbon assets. They will have sufficient time to divest from these assets before they finally lose a large part of their value but, initially, there will be no clear future vision that would justify such divestments from a purely financial perspective. However, the unpredictable adjustment path of two steps forward, one step back, will gradually increase volatility in the value of high-carbon assets. As a consequence, the selected Polish financial institutions will find high-carbon assets more risky. The same applies to investment in renewable energy and energy savings, however. Thus, it is likely that after a few years of increasing volatility and uncertainty, financial institutions will start to restrict the financing of both high-carbon and low-carbon businesses.

If uncertainty about the value of high-carbon (and low-carbon) assets becomes very high, a particularly grim outcome is possible, with higher risks for financial stability. Financial institutions may no longer trust how other financial institutions value their exposures to fossil fuel firms and some banks and insurance companies could become stigmatized. This is similar to what happened regarding exposures to the mortgage-backed securities and bonds of certain Euro countries during the debt crisis. The stigmatized institutions could then run into funding and liquidity problems, not because of actual losses but because other financial institutions suspect they may be hiding losses. Some financial markets could stop functioning altogether, such as the market for the corporate bonds of high-carbon fossil fuel and low-carbon sustainable energy companies, similar again to what happened in the mortgage-backed security and sovereign bond markets. The lack of reliable market prices would further increase uncertainty over valuations and fears over hidden losses. Stock markets are very unlikely to become illiquid, as these continued to function even during worst of the debt crisis, but large losses on equity exposures would add to the distress of financial institutions and provoke a general loss of confidence. This could trigger various types of shocks, including a credit squeeze due to banks' funding constraints, a flight to low-risk investments with overreacting markets, government support for troubled banks and insurance companies, or restructurings involving the bail-in of other financial institutions. A credit squeeze or flight to low-risk investments is likely to produce negative feedback loops, as described in the previous sections.

On balance, the uncertainty in this scenario worsens the impact on the Polish financial system compared to a quick and definite transition. This is in line with the famous Stern Review on the economics of climate change, an extensive report which states that the benefits of strong, early action on climate change outweigh the costs.²⁶ Although Polish financial institutions have more time to absorb losses on high-carbon investments, they are unlikely to take timely action to reduce their exposures. In the end, the total losses for Polish banks, pension funds and insurance companies will be much larger because of ongoing capital expenditures by fossil fuel firms that increase the amount of stranded assets. Furthermore, if uncertainty becomes

very high, this could lead to panic in financial markets, triggering large shocks and negative feedback loops.

5.5 Scenario 3: “Carbon Renaissance”

The previous two scenarios have in common that the carbon budget is largely respected and greenhouse gas emissions are reduced sufficiently to prevent catastrophic climate change. This third scenario briefly outlines what could happen if no transition to a low-carbon economy occurs, but instead a roll back of climate measures takes place.

In this scenario, quickly increasing demand for cheap energy from emerging economies leads to a carbon renaissance and resource-rich countries compete to develop unconventional reserves, such as Arctic oil and shale gas. Existing measures to reduce greenhouse gas emissions are reversed and the Emissions Trading System effectively ceases to function. The Polish financial institutions will not suffer losses due to stranded assets and oil, gas and coal mining companies may even generate larger than expected returns due to rising fossil fuel prices. However, climate change will have profound impacts on the global economy that will cause large losses to the financial sector.

A relatively predictable effect of global warming is the rise in sea levels, which will increase flooding in coastal areas and river deltas, potentially affecting various large cities in the US and China, such as New York, Miami, New Orleans and Guangzhou. This may cause large losses for insurers covering damages in flooded areas, but also for financial institutions with exposures to affected property, infrastructure and businesses. One study estimates that global flood losses could increase from US\$ 6 billion per year in 2005 to US\$ 52 billion per year in 2050.²⁷ More generally, floods in densely populated areas will negatively affect economic output.

Global warming will also increase droughts and water shortages in some regions, reducing agricultural productivity, while increasing crop yields in other regions. In addition, global warming in excess of two degrees Celsius is projected to cause substantial region-specific changes in rainfall and temperature, as well as increasing weather variability and extreme weather events. These changes would have further impacts on agricultural output, both positive and negative, and extreme storms and rainfall could cause substantial damage to economies at large.²⁸ Finally, coping with climate change will involve large adaptation costs for businesses as well as governments and households.

The Stern review, a hallmark report on the effects of climate change, estimated in 2006 that the overall costs of unmitigated climate change could reach 5% of GDP per year.²⁹ DARA, a climate change monitoring group, estimated in 2012 that climate change already causes losses in the order of 1% of GDP.³⁰ Another report by the United Nation’s Intergovernmental Panel on Climate Change stated that the combined cost of crop losses, rising sea levels, higher temperatures and fresh water shortages could amount of to between US\$ 70 and US\$ 100 billion a year.³¹

It can be concluded that the financial losses caused by climate change will likely be severe and far outweigh the gains. It is very difficult to estimate the size and distribution of these losses. Nonetheless, existing studies indicate that unmitigated climate change, which would on balance have a negative effect on the economy at large, poses larger risks to the EU financial system than stranded assets, which would negatively affect high-carbon businesses only.

Chapter 6 Financial situation of Polish coal and energy companies

6.1 Introduction

This chapter analyses the financial situation of seven selected large Polish coal and energy companies and the potential risk for the Polish government finances. Poland is heavily relying on coal for its energy needs and mining is an important employer, but the industry has suffered serious losses recently. These losses are threatening the financial stability of Poland.

This chapter is organized as follows: Sections 6.2 to 6.8 analyze the financial situation of the individual companies. After that, section 6.9 compares the financial situation of the coal and energy companies and discusses the risks for the Polish government.

6.2 Jastrzbska Spółka W głowa

6.2.1 Company profile

The Jastrzbska Spółka W głowa (JSW) group was established in April 1993 and is the largest producer of hard (type 35) coking coal and a major producer of coke in the European Union. JSW has been listed on the Warsaw Stock Exchange since 2011 and currently it is state-owned with 55.2% of its shares being held by the State Treasury of Poland. It employs over 35,000 people, of which over 27,000 are employed by the parent company directly, rendering the JSW group as one of the largest employers in Poland.³²

Together with its subsidiaries, the JSW group holds 81.2% and 43.0% of the Polish market in the production of coking coal and coke, respectively. The principal clients for the group's products are located primarily in Poland, Germany, Austria, the Czech Republic, Slovakia, and also in India and Brazil.³³

6.2.2 Financial analysis

Table 5 provides some key income indicators for JSW for the years 2012 and 2013. As can be seen, JSW's sales revenue and EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) have decreased by 13.5% and 40.9% respectively. The decrease on the revenue is due to lower prices of coal and coke in 2013. More specifically, although the company's production and sales volume of coal and coke increased in 2013, its sales revenue decreased due to a decline on the prices of coal and coke. JSW's profitability is strongly influenced by the volatility of the prices of coal and coke, as its net profit margin declined by 90.2%.³⁴

Table 5 Key income indicators, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
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Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Sales	8,821.0	7,632.2	-13.5%
EBITDA	2,374.8	1,403.4	-40.9%
Operating Profit	1,308.2	201.9	-84.6%
Net Profit	988.1	82.2	-91.7%
Net Profit Margin %	11.2%	1.1%	-90.2%
Net income to shareholders	985.1	77.3	-92.2%

Sources: Jastrzbska Spółka Włowska (2014, March), *Management Board Report on the Activity of Jastrzbska Spółka Włowska S.A. Capital Group*, p. 52; Bloomberg, viewed in March 2015.

Table 6 gives an overview of the development of JSW's market capitalization and the main balance sheet categories in the period of 2012-2013. Market capitalization depreciated by 42.5% while JSW's cash position improved by 36.6%. Equity and assets dropped by 2.6% and 1.5% respectively, while liabilities increased slightly by 0.3%.

Table 6 Market capitalization and balance sheet, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Market capitalization	10,848.8	6,238.1	-42.5%
Cash & equivalents	1,490.7	2,036.9	36.6%
Total Assets	14,067.1	13,862.0	-1.5%
Total Liabilities	5,493.2	5,510.4	0.3%
Total Equity	8,573.9	8,351.6	-2.6%

Sources: Jastrzbska Spółka Włowska (2014, March), *Management Board Report on the Activity of Jastrzbska Spółka Włowska S.A. Capital Group*, p. 52, 54; Bloomberg, viewed in March 2015.

Table 7 further analyses JSW's financing structure, showing a breakdown of JSW's equity and liabilities by groups of financial stakeholders at the end of FY2013. Shareholders are the most important financial stakeholders of JSW, financing 59.0% of its total equity and liabilities at the end of 2013. Bank loans accounted for 1.9%, and bondholders accounted for 0.3%. JSW's relatively low dependence on debt provides the company adequate financial flexibility.

Table 7 Breakdown of equity & liabilities by financial stakeholders, end FY 2013

Financial stakeholders	Amount (PLN million)	%
Shareholders	8,185.0	59.0
Joint-venture partners (non-controlling interests)	166.6	1.2
Bank loans	265.8	1.9
Bondholders	51.3	0.4
Others	5,193.3	37.5
Total equity & liabilities	13,862.0	100.0

Source: Jastrzbska Spółka Włowska (2014, March), *Management Board Report on the Activity of Jastrzbska Spółka Włowska S.A. Capital Group*, p. 54, 56.

Table 8 provides an overview of JSW's profitability ratios. The table shows that JSW's profitability ratios have dropped. The net income margin decreased to 1.0% in 2013 (from 11.2% in 2012), Return on Assets dropped to 0.6% in 2013, while the Return on Equity (0.9% in 2013) is significantly lower compared to 11.8% in 2012.

Table 8 Profitability ratios

Ratio	FY2012	FY2013
Net income margin %	11.2%	1.0%
Return on assets (ROA) %	7.0%	0.6%
Return on equity (ROE) %	11.5%	0.9%

Source: Jastrzbska Spółka Włowska (2014, March), *Management Board Report on the Activity of Jastrzbska Spółka Włowska S.A. Capital Group*.

Table 9 provides an overview of JSW's liquidity and leverage ratios. The development of the liquidity ratios (current and quick ratios) shows that the company is still able to pay off its short-term obligations, but the liquidity ratios show a decrease from 2012 to 2013. The debt ratios did not move much in 2013, and show that JSW still has a sound credit profile, with only a moderate amount of debt to finance its operations.

Table 9 Liquidity and leverage ratios

Ratio	FY2012	FY2013
Current ratio (current assets / current liabilities)	1.74	1.43
Quick ratio (current assets - inventories / current liabilities)	1.41	1.21
Debt ratio (total liabilities / total equity + total liabilities)	0.39	0.40
Debt-equity ratio (total liabilities / total equity)	0.65	0.67

Source: Jastrzbska Spółka Włowska (2014, March), *Management Board Report on the Activity of Jastrzbska Spółka Włowska S.A. Capital Group*.

6.3 Katowicki Holding Włowski

6.3.1 Company profile

Katowicki Holding Włowski (KHW), based in Katowice, Poland, was established in 1993 as a result of a merger of eleven mines that were joint stock companies owned by the State Treasury of Poland. Today, KHW consists, among others, of four modern coal mines and is one of the biggest Polish and European producers of typical steam coal. The State Treasury of Poland is the sole shareholder of the company, holding 100% of its shares. At the end of December 2013, KHW had 18,587 employees.³⁵

6.3.2 Financial analysis

Table 10 provides some key income indicators for KHW for the years 2012 and 2013. As can be seen, KHW's sales revenue stayed almost on the same level as it was in 2012. The operating profit increased by 18.6%, while the net profit decreased by 38.3%. This was mainly caused by an increase in the finance cost in 2013. Since the net profit decreased and the sales stayed on the same level, the net profit margin decreased by almost the same percentage as the net profit (37.7%).³⁶

Table 10 Key income indicators, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Sales	3971.1	3988.6	0.4%
EBITDA	N/A	N/A	N/A
Operating Profit	78.5	93.1	18.6%
Net Profit	-39.9	-55.2	-38.3%
Net Profit Margin %	-1.0%	-1.4%	-37.7%
Net income to shareholders	-39.9	-55.2	-38.3%

Source: The Katowicki Holding W glowy S.A. Capital Group (2014), *Consolidated Financial Statements For The Year Ended 31 December 2013*, p. 3.

Table 11 gives an overview of the main balance sheet categories in the period of 2012-2013. KHW's cash position improved by 29.9%. Total assets and total liabilities slightly increased with 1.3% and 4.0% respectively, while total equity decreased with 3.9%.

Table 11 Market capitalization and balance sheet, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Market capitalization	N/A	N/A	N/A
Cash & equivalents	162.0	210.5	29.9%
Total Assets	5,954.1	6,032.1	1.3%
Total Liabilities	3,918.2	4,075.5	4.0%
Total Equity	2,035.9	1,956.6	-3.9%

Source: The Katowicki Holding W glowy S.A. Capital Group (2014), *Consolidated Financial Statements For The Year Ended 31 December 2013*, p. 4, 5.

Table 12 further analyses KHW's financing structure, showing a breakdown of its equity and liabilities by groups of financial stakeholders at the end of FY2013. Shareholders are the most important financial stakeholders of KHW, financing 32.4% of its total equity and liabilities at the end of 2013. Bondholders accounted for 15.9%, while bank loans only play a marginal role with 0.3%.

Table 12 Breakdown of equity & liabilities by financial stakeholders, end FY 2013

Financial stakeholders	Amount (PLN million)	%
Shareholders	1,956.6	32.4
Joint-venture partners (non-controlling interests)	0.0	0.0
Bank loans	17.3	0.3
Bondholders	960.3	15.9
Others	3,098.0	51.4
Total equity & liabilities	6032,1	100.0

Source: The Katowicki Holding W glowy S.A. Capital Group (2014), *Consolidated Financial Statements For The Year Ended 31 December 2013*.

Table 13 provides an overview of the company's profitability ratios. Return on Assets and Return on Equity both depreciated to -2.8% and -0.9% respectively, and the net income margin also decreased to -1.4%. This is all caused by the net loss that was realized in the FY 2013.

Table 13 Profitability ratios

Ratio	FY2012	FY2013
Net income margin %	-1.0%	-1.4%
Return on assets (ROA) %	-0.7%	-0.9%
Return on equity (ROE) %	-2.0%	-2.8%

Source: The Katowicki Holding W glowy S.A. Capital Group (2014), *Consolidated Financial Statements For The Year Ended 31 December 2013*.

Table 24 provides an overview of KHW's liquidity and leverage ratios. Both liquidity ratios dropped during 2013, showing that the company would not be able to pay off all of its short-term obligations at the end of 2013. The debt ratios slightly increased, and show that the company is financed with a lot of debt instead of equity, which could become troublesome.

Table 14 Liquidity and leverage ratios

Ratio	FY2012	FY2013
Current ratio (current assets / current liabilities)	0.53	0.49
Quick ratio (current assets - inventories / current liabilities)	0.37	0.29
Debt ratio (total liabilities / total equity + total liabilities)	0.66	0.68
Debt-equity ratio (total liabilities / total equity)	1.92	2.08

Source: The Katowicki Holding W glowy S.A. Capital Group (2014), *Consolidated Financial Statements For The Year Ended 31 December 2013*.

6.4 Kompania W glowa

6.4.1 Company profile

Kompania W glowa (KW), based in Katowice, Poland, is the biggest hard coal producer in Poland and also in the entire European Union. The company is also the most important hard coal supplier for the domestic commercial power-engineering sector. KW is state-owned, with 100% of its shares being held by the State Treasury of Poland. The company was established in February 2003, by bringing together 23 operational mines of five different coal companies. KW currently has 53,756 employees.³⁷

Currently, the company is under a government restructuring plan, which aims in turning KW profitable again. The plan involves the transferring of all the company's loss-making mines to Spółka Restrukturyzacji Kopal , a special restructuring company, while the rest of the company, which will include 11 coal mines, will operate under the new state-controlled entity, Nowa Kompania Weglowa.³⁸

6.4.2 Financial analysis

Table 15 provides some key income indicators for KW for the years 2012 and 2013. As can be seen, KW's sales revenue has decreased by 9.8% in 2013. Since the cost of sales slightly

increased in 2013, the operating profit and net profit both show enormous drops, of 438.9% and 354.7% respectively. This leads to a net loss for the FY 2013, and therefore a negative net profit margin of -6.8%.³⁹

Table 15 Key income indicators, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Sales	11,020.1	9,936.6	-9.8%
EBITDA	N/A	N/A	N/A
Operating Profit	185.9	-630.0	-438.9%
Net Profit	265.3	-675.7	-354.7%
Net Profit Margin %	2.4%	-6.8%	-382.5%
Net income to shareholders	268.7	-675.1	-351.3%

Sources: Grupa Kapitałowej Kompanii W głowej (2014, March), *Skonsolidowany rachunek zysków i strat*.

Table 16 gives an overview of the development of KW's main balance sheet categories in the period of 2012-2013. KW's cash position improved by 30.0%. The total assets of the company increased by 7.3% and the total liabilities increased with 18.7%, while there was a drop in total equity of 55.4%.

Table 16 Market capitalization and balance sheet, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Market capitalization	N/A	N/A	N/A
Cash & equivalents	308.9	401.8	30.0%
Total Assets	12,494.7	13,409.7	7.3%
Total Liabilities	10,592.1	12,575.3	18.7%
Total Equity	1,862.5	830.4	-55.4%

Source: Grupa Kapitałowej Kompanii W głowej (2014, March), *Skonsolidowany bilans jednostek*.

Table 7 further analyses KW's financing structure, showing a breakdown of KW's equity and liabilities by groups of financial stakeholders at the end of FY2013. The available data was not detailed enough to break down the liabilities in bank loans and bondholders. Only the shareholder value is known. The shareholders finance 6.1% of KW's total equity and liabilities at the end of 2013. This means that a large part of the total assets is financed by other financial stakeholders.

Table 17 Breakdown of equity & liabilities by financial stakeholders, end FY 2013

Financial stakeholders	Amount (PLN million)	%
Shareholders	823.6	6.1
Joint-venture partners (non-controlling interests)	6.8	0.0
Bank loans	N/A	N/A
Bondholders	N/A	N/A
Others	N/A	N/A
Total equity & liabilities	13,409.7	100.0

Source: Grupa Kapitałow Kompania Wegłowa (2014, March), *Skonsolidowany bilans jednostek*.

Table 18 provides an overview of KW's profitability ratios. The table shows that KW's profitability ratios have dropped and have all become negative for the FY 2013. The net income margin decreased to -6.8% in 2013 (from 2.4% in 2012), Return on Assets dropped to -5.0% in 2013, while the Return on Equity, with -81.3% in 2013, is significantly lower compared to the 14.4% in 2012. The decrease in KW's profitability ratios depicts the net loss that was realized in the FY 2013.

Table 18 Profitability ratios

Ratio	FY2012	FY2013
Net income margin %	2.4%	-6.8%
Return on assets (ROA) %	2.2%	-5.0%
Return on equity (ROE) %	14.4%	-81.3%

Sources: Grupa Kapitałow Kompania Wegłowa (2014, March), *Skonsolidowany bilans jednostek*; Grupa Kapitałowej Kompanii W głowej (2014, March), *Skonsolidowany rachunek zysków i strat*.

Table 19 provides an overview of KW's liquidity and leverage ratios. The decrease of the liquidity ratios (current and quick ratios) shows that the company is not able to pay off all of its short-term obligations at the end of 2013. The debt ratio increased from 0.84% to 0.94%, which indicates that the company is heavily leveraged. This is also indicated by the sharp rise in the debt-equity ratio, which shows that the total assets are even more financed by liabilities instead of shareholders. Both debt ratios indicate that the company is in serious trouble because it is too heavily leveraged.

Table 19 Liquidity and leverage ratios

Ratio	FY2012	FY2013
Current ratio (current assets / current liabilities)	1.02	0.83
Quick ratio (current assets - inventories / current liabilities)	0.69	0.61
Debt ratio (total liabilities / total equity + total liabilities)	0.85	0.94
Debt-equity ratio (total liabilities / total equity)	5.74	15.27

Sources: Grupa Kapitałow Kompania Wegłowa (2014, March), *Skonsolidowany bilans jednostek*.

6.5 Lubelski W giel Bogdanka

6.5.1 Company profile

Lubelski W giel Bogdanka (LWB) is a coal mining company. It was created in 1990 as result of the privatization of the state enterprise Kopalnia W gla Kamiennego Bogdanka. LWB is listed on the Warsaw Stock Exchange, and the Polish pension fund OFE Aviva is the major shareholder, holding 15.2% of shares. The Polish pension funds OFE PZU Złota Jesie and ING OFE are holding 9.8% and 9.6% respectively. The remaining shares are held by minority shareholders.⁴⁰

As at the end of 2013, LWB had 5,377 employees and its market share in the Polish power coal market and the market of power coal for commercial power industry reached 14.8% and 19.3% respectively.⁴¹

6.5.2 Financial analysis

Table 20 provides some key income indicators for LWB for the years 2012 and 2013. As can be seen, LWB's sales and EBITDA have increased by 3.5% and 12.9% respectively. Over the same period, net profits have appreciated by 6.7%, resulting in a slightly higher net profit margin (3.6% increase). Operating profit and net income to shareholders also increased by 9.1% and 6.3% respectively.

Table 20 Key income indicators, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Sales	1,835.8	1,899.8	3.5%
EBITDA	695.9	786.0	12.9%
Operating Profit	389.2	424.8	9.1%
Net Profit	309.0	329.7	6.7%
Net Profit Margin %	16.8%	17.4%	3.6%
Net income to shareholders	308.6	329.4	6.3%

Sources: Lubelski W giel Bogdanka (2014, March), *Consolidated Financial Statements 2013*, p. 5; *Bloomberg*, viewed in March 2015.

Table 21 gives an overview of the development of LWB's market capitalization and the main balance sheet categories in the period of 2012-2013. Besides market capitalization, which declined by 7.5%, all other indicators increased. The increase in the total assets is due an investment plan that the company carried out, increasing their current assets by 35.1% in 2013. Equity increased by 6.9% as a result of the distribution of profit from the previous year. Liabilities and cash and equivalents also increased by 16.8% and 53.7% respectively.⁴²

Table 21 Market capitalization and balance sheet, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Market capitalization	4,625.9	4,279.0	-7.5%
Cash & equivalents	188.6	289.9	53.7%

Indicator	FY2012	FY2013	Change
Total Assets	3,485.2	3,844.1	10.3%
Total Liabilities	1,188.8	1,388.6	16.8%
Total Equity	2,296.4	2,455.5	6.9%

Source: Lubelski W giel Bogdanka (2014, March), *Consolidated Financial Statements 2013*, p. 4, 41; *Bloomberg*, viewed in March 2015.

Table 22 further analyses LWB's financing structure, showing a breakdown of its equity and liabilities by groups of financial stakeholders at the end of FY2013. Shareholders are the most important financial stakeholders of LWB, financing 63.6% of its total equity and liabilities at the end of 2013. Bank loans and bondholders accounted for 11.0% and 5.2% respectively.

Table 22 Breakdown of equity & liabilities by financial stakeholders, end FY 2013

Financial stakeholders	Amount (PLN million)	%
Shareholders	2,445.2	63.6
Joint-venture partners (non-controlling interests)	10.3	0.3
Bank loans	421.0	11.0
Bondholders	200.0	5.2
Others	767.6	20.0
Total equity & liabilities	3,844.1	100.0

Sources: Lubelski W giel Bogdanka (2014, March), *Consolidated Financial Statements 2013*, p. 4, 7, 43-44; *Bloomberg*, viewed in March 2015.

Table 23 provides an overview of the company's profitability ratios. Return on Assets and Return on Equity did not change much in 2013, and the net income margin also only slightly increased to 17.3%.

Table 23 Profitability ratios

Ratio	FY2012	FY2013
Net income margin %	16.8%	17.3%
Return on assets (ROA) %	8.9%	8.6%
Return on equity (ROE) %	13.4%	13.4%

Sources: Lubelski W giel Bogdanka (2014, March), *Consolidated Financial Statements 2013*, p. 5; *Bloomberg*, viewed in March 2015.

Table 24 provides an overview of LWB's liquidity and leverage ratios. Both liquidity ratios dropped during 2013, showing that the company would not be able to pay off all of its short-term obligations. The debt ratios slightly increased, but still show a sound credit profile with only a moderate amount of debt.

Table 24 Liquidity and leverage ratios

Ratio	FY2012	FY2013
Current ratio (current assets / current liabilities)	1.01	0.70
Quick ratio (current assets - inventories / current liabilities)	0.88	0.57
Debt ratio (total liabilities / total equity + total liabilities)	0.34	0.36

Ratio	FY2012	FY2013
Debt-equity ratio (total liabilities / total equity)	0.52	0.57

Sources: Lubelski W giel Bogdanka (2014, March), *Consolidated Financial Statements 2013*; Bloomberg, viewed in March 2015.

6.6 Polska Grupa Energetyczna

6.6.1 Company profile

Polska Grupa Energetyczna (PGE) is Poland's largest energy sector company with respect to sales revenues and net profit. The company was established in 1990, and its core operations are the extraction of lignite, the production, distribution and sale of electricity, and the production and distribution of heat. It is a vertically integrated company engaged in the entire value chain of electricity generation. PGE supplies electricity to over 5 million households, businesses and institutions.⁴³

Currently, the State Treasury of Poland controls 58.4% of the shares of PGE. By the end of 2013, PGE held 40% of the Polish market share in power generation and 30% in electricity retail and it was employing 41,623 people.⁴⁴

6.6.2 Financial analysis

Table 25 provides some key income indicators for PGE for the years 2012 and 2013. As can be seen, PGE's sales revenue and EBITDA dropped by 1.1% and 12.8% respectively. The reason for the drop in sales and EBITDA is the poor performance of PGE's conventional energy generation segment, which includes the extraction of lignite and generation of electricity and heat from conventional sources. While all other segments presented growth in sales, the sales revenue from conventional energy generation dropped by 19% from end 2012 to end 2013. PGE's operating profit increased by 10.7% due to significantly growing operating profits from the wholesale trading and retail sale segments, which represented 24.2% and 28.3% of the company's total revenues in 2013. Finally, PGE's net profit margin increased by 10%.⁴⁵

Table 25 Key income indicators, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Sales	30,481.1	30,145.0	-1.1%
EBITDA	9,421.6	8,220.0	-12.8%
Operating Profit	4,377.8	4,847.0	10.7%
Net Profit	3,644.2	3,971.0	9.0%
Net Profit Margin %	12.0%	13.2%	10.0%
Net income to shareholders	3,616.3	3,948.0	9.2%

Sources: Polska Grupa Energetyczna (2014, March), *Consolidated Financial Statements 2013*, p. 3-5; Polska Grupa Energetyczna (2015, February), *Consolidated Financial Statements 2014*, p. 5-6; Bloomberg, viewed in March 2015.

Table 26 gives an overview of PGE's development of market capitalization and the main balance sheet categories between 2012-2013. Besides PGE's market capitalization, which depreciated by 10.6%, all other indicators appreciated. PGE's liabilities increased by 11.2% as a result of an increase in bonds issued in 2013 and an increase in short-term provisions

(purchase of CO₂ emission rights).⁴⁶ The company's cash position, assets and equity increased with 24.1%, 8% and 6.8% respectively.

Table 26 Market capitalization and balance sheet, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Market capitalization	34,048.3	30,439.7	-10.6%
Cash & equivalents	4,795.5	5,952.0	24.1%
Total Assets	56,703.6	61,252.0	8.0%
Total Liabilities	15,692.3	17,444.0	11.2%
Total Equity	41,011.3	43,808.0	6.8%

Sources: Polska Grupa Energetyczna (2014, March), *Consolidated Financial Statements 2013*, p. 3-5, 72; Polska Grupa Energetyczna (2015, February), *Consolidated Financial Statements 2014*, p. 4-8; *Bloomberg*, viewed in March 2015.

Table 27 further analyses PGE's financing structure, showing a breakdown of its equity and liabilities by groups of financial stakeholders at the end of FY2013. Shareholders are the most important financial stakeholders of PGE, financing 71.1% of its total equity and liabilities at the end of 2013, while bank loans and bondholders are only financing 2.5% and 1.6% respectively.

Table 27 Breakdown of equity & liabilities by financial stakeholders, end FY 2013

Financial stakeholders	Amount (PLN million)	%
Shareholders	43,540.0	71.1
Joint-venture partners (non-controlling interests)	268.0	0.4
Bank loans	1,518.0	2.5
Bondholders	1,000.0	1.6
Others	14,926.0	24.4
Total equity & liabilities	61,252.0	100.0

Source: Polska Grupa Energetyczna (February 2015), *Consolidated Financial Statements 2014*, p. 5-6, 71.

Table 28 provides an overview of the company's profitability ratios. In 2013, net income margin increased to 13.1%. Besides the increase on the net income margin, Return on Assets and Return on Equity also increased. The reason for this is that the increases on assets and equity were smaller than the increase on the net income.

Table 28 Profitability ratios

Ratio	FY2012	FY2013
Net income margin %	11.9%	13.1%
Return on assets (ROA) %	6.4%	6.5%
Return on equity (ROE) %	8.8%	9.0%

Sources: Polska Grupa Energetyczna (2014, March), *Consolidated Financial Statements 2013*; Polska Grupa Energetyczna (2015, February), *Consolidated Financial Statements 2014*.

Table 29 provides an overview of the liquidity and leverage ratios of PGE between the end of 2012 and the end of 2013. Both liquidity ratios (current ratio and quick ratio) increased during

2013, which shows that the company has an adequate management of working capital and is able to pay off its short-term obligations. The debt ratios both stayed on the same level, showing that PGE has a sound credit profile with only a limited amount of debt to finance its operations.

Table 29 Liquidity and leverage ratios

Ratio	FY2012	FY2013
Current ratio (current assets / current liabilities)	1.57	1.67
Quick ratio (current assets - inventories / current liabilities)	1.26	1.45
Debt ratio (total liabilities / total equity + total liabilities)	0.28	0.28
Debt-equity ratio (total liabilities / total equity)	0.39	0.40

Source: Polska Grupa Energetyczna (2014, March), *Consolidated Financial Statements 2013*; Bloomberg, viewed in March 2015.

6.7 Tauron Polska Energia

6.7.1 Company profile

The Tauron Group, with parent company Tauron Polska Energia (Tauron), is the largest distributor and supplier of electricity in Poland, and also the second largest electricity generator of the country. Tauron is listed on the Warsaw Stock Exchange since 2010. Its major shareholder is the Polish State Treasury, which holds 30.1% of Tauron's shares. By the end of 2014, Tauron, together with its subsidiaries, was employing 25,953 people.⁴⁷

Tauron's core business includes hard coal mining, generation, distribution and supply of electricity and heat. The company controls approximately 20% of the Polish hard coal resources and has over 5.3 million customers to which it supplies electricity. Besides using carbon by-products, Tauron engages in generation of electricity from renewable sources, such as biomass, wind and hydro.⁴⁸

6.7.2 Financial analysis

Table 30 provides some key income indicators for Tauron for the years 2012 and 2013. As can be seen, most of the indicators declined. This was caused by a worse economic climate than in 2012, which translated mainly into only a small increase in demand for electric energy and a further decrease of its prices. Sales dropped by 22.7% as a result of a change of the trade model for the electric energy generated by the group. In 2012, the greater part of energy was sold through the power exchange, while 2013 saw limitation of energy sales outside the group in favor of sale directly between the group's companies, which is excluded from consolidation.⁴⁹ EBITDA and operating profit dropped mainly due to poor performance of the hard coal mining and conventional generation segments.⁵⁰ The net profit decreased as well by 13.2%. The increase in the net profit margin is 11.1% and results from the fact that the drop in the sales is larger than the drop in the net profit. Net income to shareholders depreciated by 11.4%.

Table 30 Key income indicators, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
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Indicator	FY2012	FY2013	Change
	PLN million		2012-2013
Sales	24,753.0	19,131.1	-22.7%
EBITDA	3,851.6	3,661.5	-4.9%
Operating Profit	2,165.1	1,934.1	-10.7%
Net Profit	1,550.8	1,346.5	-13.2%
Net Profit Margin %	6.3%	7.0%	11.1%
Net income to shareholders	1,476.4	1,308.3	-11.4%

Sources: Tauron Polska Energia (2014, March), *Annual Report 2013*, p. 5, 10, 36-37; *Bloomberg*, viewed in March 2015.

Table 31 gives Tauron's market capitalization and the main balance sheet categories for the period 2012-2013. Market capitalization and cash and equivalents declined by 8.0% and 38.2% respectively. The reason for the company's deterioration in cash and equivalents is capital expenditures incurred during 2013.⁵¹ Tauron's assets and liabilities increased with 3.5% and 0.6% respectively. The company's equity increased by 5.9%.

Table 31 Market capitalization and balance sheet, 2012-2013

Indicator	FY2012	FY2013	Change
	PLN million		2012-2013
Market capitalization	8,324.6	7,658.6	-8.0%
Cash & equivalents	1,030.9	636.9	-38.2%
Total Assets	31,273.7	32,355.6	3.5%
Total Liabilities	14,473.7	14,562.1	0.6%
Total Equity	16,800.0	17,793.5	5.9%

Sources: Tauron Polska Energia (2014, March), *Annual Report 2013*, p. 6-7; *Bloomberg*, viewed in March 2015.

Table 32 further analyses Tauron's financing structure, showing a breakdown of its equity and liabilities by groups of financial stakeholders at the end of FY2013. Shareholders are the most important financial stakeholders of Tauron, financing 53.6% of its total equity and liabilities at the end of 2013, while bank loans and bondholders are financing 4.6% and 13.3% respectively.

Table 32 Breakdown of equity & liabilities by financial stakeholders, end FY 2013

Financial stakeholders	Amount (PLN million)	%
Shareholders	17,327.2	53.6
Joint-venture partners (non-controlling interests)	466.3	1.4
Bank loans	1,484.6	4.6
Bondholders	4,300.5	13.3
Others	8,777.0	27.1
Total equity & liabilities	32,355.6	100.0

Source: Tauron Polska Energia (2014, March), *Annual Report 2013*, p. 7, 61.

Table 33 presents Tauron's profitability ratios for the period 2012-2013. Net income margin grew due to a drop in sales that was larger than the drop in net income. Return on Assets and return on equity both declined as besides the drop in the net income, the assets and equity of the company increased.

Table 33 Profitability ratios

Ratio	FY2012	FY2013
Net income margin %	6.0%	6.8%
Return on assets (ROA) %	4.7%	4.0%
Return on equity (ROE) %	8.8%	7.4%

Source: Tauron Polska Energia (2014, March), *Annual Report 2013*, p. 8.

Table 34 gives an overview of Tauron's liquidity and leverage ratios for the period 2012-2013. Both liquidity ratios dropped, caused by the capital expenditures in 2013. The debt ratios of Tauron did not change much in 2013, and are still on a reasonable level, with not too much debt to finance the companies' operations.

Table 34 Liquidity and leverage ratios

Ratio	FY2012	FY2013
Current ratio (current assets / current liabilities)	1.10	0.90
Quick ratio (current assets - inventories / current liabilities)	0.94	0.81
Debt ratio (total liabilities / total equity + total liabilities)	0.46	0.45
Debt-equity ratio (total liabilities / total equity)	0.89	0.84

Source: Tauron Polska Energia (2014, March), *Annual Report 2013*, p. 8.

6.8 Zespół Elektrowni P tńów Adamów Konin (ZE PAK)

6.8.1 Company profile

Zespół Elektrowni P tńów Adamów Konin (ZE PAK) is a Polish company that produces energy from conventional sources and by the combustion and co-firing of biomass. It was a state-owned company until 1999, the year that its privatization-restructuring period came to an end. Currently, the company operates as a public limited company and has been listed on the Warsaw Stock Exchange since 2012. Its main shareholder is the billionaire and second richest person in Poland, Zygmunt Solorz- ak. He indirectly holds 51.6% of the shares of ZE PAK. The Polish pension fund OFE ING is the other substantial shareholder and holds 9.7% of the shares. ZE PAK is the second largest Polish manufacturer of electricity from coal and in 2013, had a total of 7,994 employees.⁵²

ZE PAK's power plants produce 7.2% of the electricity in Poland. For the production of electric energy, the company's power plants are using 96.8% non-renewable energy sources (lignite and mazut). For the production of thermal energy ZE PAK uses solely non-renewable energy sources. ZE PAK also engaged in other activities such as the extraction of lignite, which is used to supply its own power plants.⁵³

6.8.2 Financial analysis

Table 35 presents ZE PAK's key income indicators for 2012-2013. Sales increased by 1.5% while all other indicators declined. The improvement on the sales results from an increase in the electric energy from trade revenue, which outbalanced the small decline in the revenues

from sales of electricity.⁵⁴ EBITDA and operating profit decreased by 6.3% and 25.9% respectively. Net profit and net profit margin dropped by 42.5% and 43.3% respectively, with net income to shareholders falling by 46.6% at the same time.

Table 35 Key income indicators, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Sales	2,723.4	2,763.8	1.5%
EBITDA	763.8	715.9	-6.3%
Operating Profit	483.6	358.5	-25.9%
Net Profit	402.8	231.5	-42.5%
Net Profit Margin %	14.8%	8.4%	-43.3%
Net income to shareholders	406.5	216.9	-46.6%

Sources: ZE PAK (2014, March), *Annual Report 2013*, March 2014, p. 6-7, 53-54; *Bloomberg*, viewed in March 2015.

Table 36 gives an overview of the development of ZE PAK's market capitalization and the main balance sheet categories in the period of 2012-2013. Market capitalization declined by 13.9% while on the other hand the company's cash position improved by 35.5%. Besides the improvement of its cash position, the company, during 2013, proceeded into the acquisition of CO₂ allowances rendering in an increase of its assets.⁵⁵ Thus, ZE PAK's assets increased by 3.4% overall. In addition to this there was an increase of the company's equity by 6.8% and a drop on its liabilities by 1.1%.

Table 36 Market capitalization and balance sheet, 2012-2013

Indicator	FY2012	FY2013	Change 2012-2013
	PLN million		
Market capitalization	1,477.3	1,271.6	-13.9%
Cash & equivalents	318.0	431.0	35.5%
Total Assets	6,259.2	6,470.9	3.4%
Total Liabilities	2,717.2	2,688.3	-1.1%
Total Equity	3,542.0	3,782.6	6.8%

Sources: ZE PAK (2014, March), *Annual Report 2013*, p. 8-9; *Bloomberg*, viewed in March 2015.

Table 37 further analyses ZE PAK's financing structure, showing a breakdown of ZE PAK's equity and liabilities by groups of financial stakeholders at the end of FY2013. Shareholders are the most important financial stakeholders of Tauron, financing 58.5% of its total equity and liabilities at the end of 2013, while bank loans are financing 16.4%. At the end of 2013, the company did not have any outstanding bonds.

Table 37 Breakdown of equity & liabilities by financial stakeholders, end FY 2013

Financial stakeholders	Amount (PLN million)	%
Shareholders	3,782.6	58.5
Joint-venture partners (non-controlling interests)	0.0	0.0

Financial stakeholders	Amount (PLN million)	%
Bank loans	1,058.0	16.4
Bondholders	0.0	0.0
Others	1,630.3	25.2
Total equity & liabilities	6,470.9	100.0

Source: ZE PAK (2014, March), *Annual Report 2013*, p. 9, 85-89.

Table 38 presents the company's profitability ratios for the years 2012 and 2013. Net income margin almost halved to 7.9% due to a drop on the net income accompanied by the increase of the sales. Since net income dropped, while assets and equity increased in 2013, return on assets (ROA) and return on equity (ROE) also dropped to 3.4% and 5.7% respectively.

Table 38 Profitability ratios

Ratio	FY2012	FY2013
Net income margin %	14.9%	7.9%
Return on assets (ROA) %	6.5%	3.4%
Return on equity (ROE) %	11.5%	5.7%

Sources: ZE PAK (2015, March), *Annual Report 2013*.

Table 39 gives an overview of ZE PAK's liquidity and leverage ratios for the period of 2012-2013. Both liquidity ratios (current ratio and quick ratio) increased, which shows that the company is now able to pay off its short-term obligations. The debt ratios of ZE PAK did not change much in 2013, and are still on a reasonable level, with not too much debt to finance the companies' operations.⁵⁶

Table 39 Liquidity and leverage ratios

Ratio	FY2012	FY2013
Current ratio (current assets / current liabilities)	0.84	1.22
Quick ratio (current assets - inventories / current liabilities)	0.66	0.99
Debt ratio (total liabilities / total equity + total liabilities)	0.43	0.42
Debt-equity ratio (total liabilities / total equity)	0.77	0.71

Sources: ZE PAK (2014, March), *Annual Report 2013*; Bloomberg, viewed in March 2015.

6.9 Comparison between companies and risks for Polish government

6.9.1 Comparison between the selected coal and energy companies

Table 40 compares the total assets, number of employees and some of the profitability and leverage ratios of the selected Polish coal and energy companies discussed in the previous sections. It also shows the ownership of the State Treasury of Poland in each of the companies.

Table 40 Comparison between selected Polish coal and energy companies, FY 2013

Company	Total assets (PLN million)	% state-owned	Number of employees	Return on Assets %	Return on Equity%	Debt ratio	Debt-equity ratio	Net profit margin %
JSW	13,862.0	55.2%	35,000	0.6%	0.9%	0.40	0.67	1.1%
KW	13,409.7	100%	53,756	-5.0%	-81.3%	0.94	15.27	-6.8%
KHW	6,032.1	100%	18,587	-0.9%	-2.8%	0.68	2.08	-1.4%
LWB	3,844.1	0.0%	5,377	8.6%	13.4%	0.36	0.57	17.4%
PGE	61,252.0	58.4%	41,623	6.5%	9.0%	0.28	0.40	13.2%
Tauron	32,355.6	30.1%	25,953	4.0%	7.4%	0.45	0.84	7.0%
ZE PAK	6,470.9	0.0%	7,994	3.4%	5.7%	0.42	0.71	8.4%

The table provides some interesting insights. Based on total assets, PGE and Tauron, which can both be classified as energy companies, are the largest companies. When looking at the net profit margin, it can be concluded that the coal mining companies (KW, JSW and KHW) are doing worse than the energy companies. The exception is LWB, which has the highest net profit margin of all the selected companies. The negative net profits for KW and KHW indicate that these two coal companies reported a net loss for the FY 2013. The profitability ratios (ROA and ROE) confirm that except for LWB, the coal energies are doing worse than the energy companies. Finally, when looking at the leverage ratios, the table shows that KW and KHW are heavily leveraged, with a debt level that is higher than the value of its equity. In combination with their net loss, this makes that these two companies are encountering severe problems.

6.9.2 Risks for the Polish government and recommendations

The Polish government is highly dependent on its domestic coal and energy companies. Over 80% of Poland's economy is based on its electricity being produced by domestic coal-fired power stations. The Polish coal sector is huge, with over 100,000 thousand miners and over 240 well-organized mining trade unions. However, Poland's coal-mining sector has growing, unsolved problems. There is about seven million tons of unsold coal in Poland, and since 2008 Poland has imported more coal than it has exported. The Russian coal price is lower than the Polish price and therefore Polish coal companies are forced to sell coal cheaper than it's quarried. In the first half of 2014, Polish coal companies lost over € 250 million. For Kompania W glowa, the biggest hard coal company in Europe, only three out of 15 coal mines are profitable. Some mines haven't earned anything in years.⁵⁷

In response to these problems, the Polish government provides state aid to collapsing coal mines. According to the report by the Centre for Social and Economic Research (CASE), between 2010 and 2013 the coal mining sector was given PLN 22 billion (€5.5 billion) of state aid. A Greenpeace Poland report shows that from 1990 to 2012, the coal mining sector got PLN 136 billion (€32 billion) of public support. Furthermore, in the last year two special legal acts aiming at giving support for coal mines were prepared.⁵⁸

Despite all these efforts there is no certainty the Polish coal sector will actually be profitable again. At the same time, Polish energy companies present plans for building new coal-based energy plants, which will consolidate the coal-dependency of the Polish economy.⁵⁹

The continued support for coal-dependency in Poland is amplified by the fact that the electricity produced from indigenous resources like coal is presented as the key element of energy security of Poland. Since Russia's aggression in Ukraine energy security has been considered

one of the biggest threats to the Polish economy. For this reason, coal is seen as a safeguard of partial energy independence from Russia.⁶⁰

Taking all of the above into account when analyzing Table 40, it can be seen that the total number of employees of the selected coal and energy companies adds up to 188,290. This shows the huge amount of people working in the high-carbon sector, and the incentive for the Polish government to continue the coal-dependency. Furthermore, when looking at the ownership structure of the selected companies, it can be noted that five of the seven companies are (partially) state-owned, and that all of the troubled companies (KW, JSW, KHW) fall into this category. This puts pressure on the government of Poland to provide state aid.

All in all, it can be concluded that when the 2 degrees goal causes the selected Polish coal and energy companies to write off part of their high-carbon assets, this will likely force the Polish government to provide even more state aid or bail-out the troubled companies because of the size of the industry and its ownership in most of the companies. This will cost the Polish government an enormous amount of money and leaves the government with a lot of high-carbon assets that can't be used anymore, which is likely to have a big influence on the entire Polish economy. Therefore, the carbon bubble poses a very severe risk for the Polish government. In order to lower this risk, the Polish economy should become less coal-dependent and diversify into other energy sources.

In order to reduce the impact of the carbon bubble and to be more prepared for a sudden drop in the value of carbon-related assets, several steps could be taken. One of them could be the stress-testing of Polish financial institutions, to see how their policies would cope with a sudden drop in the value of carbon-related assets. This would provide more insight and could help in constructing a framework on how to deal with a sudden drop in the value of carbon-related assets. In relation to this the Polish government could create, in collaboration with coal and energy companies, "transition strategies" or "exit strategies" so as to ensure the move towards a more low-carbon economy. This could reduce potential losses and a possible unorganized individual approach when carbon-related assets drop in their value, potentially harming the Polish economy as a whole.

While working on the aforementioned "transition strategies" or "exit strategies", the Polish government could also put into place rules that would require financial institutions to publish their exposure to the climate risk in a more transparent way. This could create the public awareness necessary to realize a break away from the Polish carbon-dependency. The French parliament has already passed amendments with these type of requirements. Amongst others, the amendments state that listed companies shall disclose in their annual reports financial risks related to the effects of climate change and measures adopted by the company to reduce those risks, by implementing a low-carbon strategy in every component of their activities.⁶¹ It is important for the Polish government to also take these kind of steps and follow these type of initiatives.

The transparency requirements above are in some way also related to the fiduciary duty for pension funds. Since the Polish pension funds are highly exposed to the carbon bubble, as we have seen in Chapter 2, these carbon bubble risks and the related possible losses are in the end automatically transferred to the employers and employees represented by the pension funds. It is the fiduciary duty of each pension fund to act in the best interest of their fiduciaries (employers/employees), so if the carbon risk poses a realistic threat to the value of the holdings of pension funds, the pension funds should inform their fiduciaries about this threat and try to reduce this risk by divesting from carbon-related assets and diversifying into other (high-tech) assets.

Another step could be to advance in a public debate on divestment. Notable financial institutions, such as Allianz Austria, the Swedish pension fund AP2, the Norwegian pension funds KLP and Storebrand, the Norwegian Sovereign Wealth Fund and French asset manager AXA have already divested from coal assets or promised to do.⁶² This divestment debate should also be taken into the public arena in Poland, preferably by the government itself.

Finally, the Polish government could promote the diversification of its economy by providing support to the high-tech/low-carbon industry and focus more on investing in research and development with the aim to find other sources of employment and energy and make the Polish economy less coal-dependent. This would reduce the impact of the carbon bubble on the Polish economy.

Chapter 7 Methodological limitations

The estimates in this report are conservative as it is not possible to analyze all relevant equity and corporate bond holdings. Due to the vast amount of data it is possible that some relevant high-carbon companies have not been identified. The value of equity holdings covered in financial databases often does not represent 100% of pension fund shareholdings. For example, investments in private equity funds are not included in detail. The actual high-carbon share of these investments is difficult to estimate, as certain index funds or funds of funds could hold a considerably higher-than-average share of oil, gas and coal mining companies depending on their investment strategy.

When interpreting the figures for the exposure of banks, it is important to consider that the analysis of loans is limited to industries involved in the extraction of fossil fuels but does not completely cover industries which are involved in downstream activities such as the trading of fossil fuels or the production and sale of energy from fossil fuel feedstock, for example. These companies as well as many other downstream industries are also heavily exposed to the carbon bubble.

In addition, the coverage of loans to the analyzed industry sectors is not complete. Firstly, only syndicated loans are included in financial databases and the coverage is likely to be incomplete. Secondly, relevant loans may not all be recognized due to erroneous categorization or categorization in a different industry sector due to diverse business activities. Thirdly, the value of the banks' participation in the loans is based on estimates, which may be too low.

On the other hand, considering revolving credit facilities as outstanding values may exaggerate the actual exposure to high-carbon assets as it cannot be predicted whether these credits will actually be drawn down or not. However, this approach was chosen as it better reflects the potential maximum exposure, and therefore the actual risk the banks are facing.

Fossil fuel-related investments in private equity and infrastructure cannot be considered in the estimates due to a lack of information. In some cases these assets may account for another couple of percentage points.

The approach taken is based on the best available data and provides a conservative estimate of the total investments and potential resultant risks for Polish pension funds and banks. We believe the dataset to be of sufficient quality to allow for a solid estimate of the overall exposure of these financial institutions.

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