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Global Risk Management: How SAS® Manages Financial Risk According to Diverse Financial Regulations

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ABSTRACT

Banks need to measure risks according to local regulations, such as Basel II/III, Capital Requirements Directive, etc. Multinational Banks are facing the challenge of global compliance of diverse risk regulations. SAS provides various solutions to help banks solve this challenge. This paper depicts a simulated scenario: Analysis environment is set up with instruments, portfolio data and market data in different language for different subsidiary; a set of methods and analyses is defined according to requirements of European Central Bank, Federal Reserve Board, and China Banking Regulatory Commission respectively.; After the project is run, capital is calculated for subsidiaries with corresponding regulation and local market data; stress testing is then applied. From the demo, you will learn that SAS Risk Management solutions perfectly supports the measurement of quantitative risk based on multiple regulations and can be implemented for Multinational banks.

INTRODUCTION

The primary focus of this paper is risk management for banking with diverse regulations. Multinational banks have been growing fast; they set up subsidiaries in many regions and countries. As the regulations in countries and regions are different, multinational banks are facing the challenge of compliance with home regulations as well as host regulations. Non-compliance can cause enormous reputational damage and heavy monetary penalties, and even worse, may lead to a cessation of business.

Addressing problems individually through sole compliance systems does not provide an enterprise-wide view and results in procedure replication along with an increase in cost and complexity. With a myriad of regulations for multiple business units across multiple geographies, it brings up challenges to monitor and manage compliance. These challenges include:

- Diverse regulation compliance
- Regulation adjustments
- Economic fluctuation
- Stress testing

To respond to these challenges, multinational banks are forced to reform the technology to measure and manage risk. SAS provides Risk Management solutions to not only ensure diverse regulation compliance, but to also generate a perspective on risk. The main steps include:

1. ETL process
   Load and transform transaction data from the source system. The ETL process is not discussed in this paper as it is not the point of the topic.
2. Risk environment preparation
   Set up risk management environment including data, method, analysis, and so on.
3. Risk calculation

Define projects to implement risk analysis

4. Data reporting
   Render the analysis result with reports, dashboards.

With these steps, multinational banks are able to implement risk management analysis according to different regulations. Moreover, the same steps can be applied to handle the regulation changes, to implement stress testing on economic fluctuation, and to meet other risk management requirements.

In this paper, we bring a schematic view of how SAS Risk Solutions can help resolve the above challenges by analyzing several general scenarios for a multinational bank “Bank International” and its subsidiaries. Although we mainly focus on credit risk management cases, the methodologies shown here can also be applied to market risk and operational risk management.

In the following sections, first we will introduce SAS Risk Solutions and the overall analysis process. Then, four scenarios will be analyzed to demo SAS risk management process. Some practical examples and output will be provided for illustration purposes.

SAS RISK SOLUTIONS

SAS RISK SOLUTIONS FAMILY

SAS delivers unified, quantitative risk management software that includes:

- Integrated, comprehensive data management
- Powerful predictive analytics
- User-friendly self-service reporting
- A transparent environment that lets you manage the entire process – from identifying risk to measuring, mitigating and monitoring it on an ongoing basis.

The following risk solutions are used in this paper:

1. SAS Risk Management for Banking supports a bank's risk management activities by delivering functionality for all major risk types, as well as data management and reporting. The solution allows business units to calculate risk measures independently and separately. It also allows the bank to manage risk from a firm-wide perspective using models and correlated aggregation techniques.
2. SAS Risk Dimensions enables users to perform firm-wide risk management. It provides them with an open, flexible, and extensible means of measuring and managing market or credit risk in a manner that is the most appropriate for an institution's unique needs.
   In addition, SAS offers a set of BI platform products including ETL, metadata management, reporting, and BI Dashboard.

With these solutions, you have a decision support environment for firm-wide risk management.

WORKFLOW OF SAS RISK SOLUTIONS

The following diagram displays the general workflow of SAS Risk Solutions.

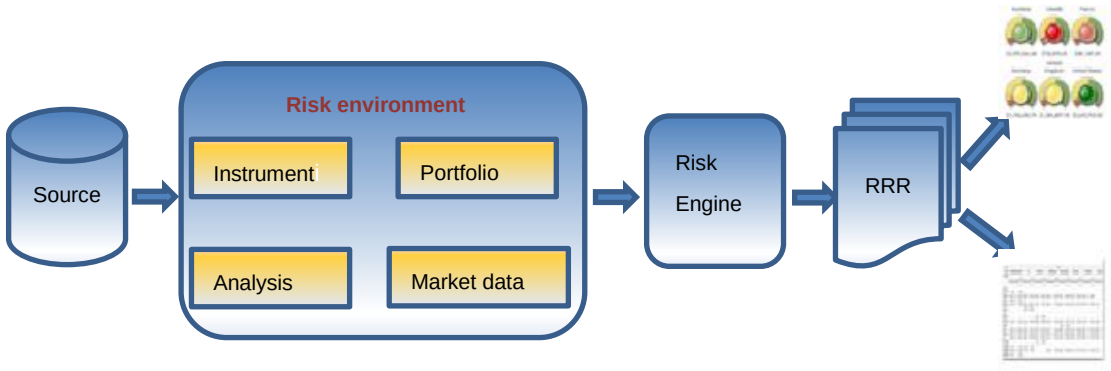


Figure 1. Workflow of SAS Risk Solutions

This is also the workflow used in the following scenarios. In detail: firstly, a risk environment is created based on user requirements containing instrument type, instrument methods, portfolio data, market data, and analysis method. Then, the project is run through the backend risk engine and the result is output to Risk Report Repository. The result could be displayed in many forms, such as table, chart, PDF, and document. The figure below shows a more detailed workflow.

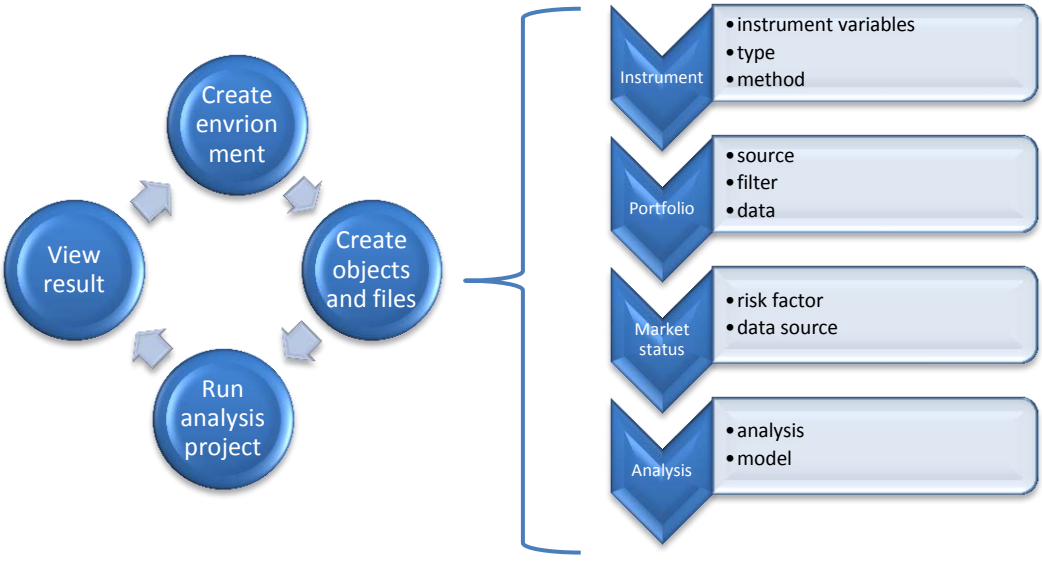


Figure 2. More detailed workflow

Scenarios

To demonstrate how to use SAS Risk Solutions to address the challenges above, we simulate the following scenarios for a global bank:

1. Each subsidiary reports to the regulation according to the local regulation.
2. One subsidiary refreshes the report when the regulation changes.

3. One subsidiary refreshes the report when the market status changes.
4. One subsidiary implements the stress testing with the requirements of local regulation.

Below is an example of the global bank and regulation in each region.

Bank International is a global commercial bank launched in the United States; it has three subsidiaries, in China, in Germany, and in the U.S. All of the three subsidiaries operate business according to their local regulations. Moreover all the subsidiaries are in government of the home company and need to produce reports according to the regulation used in their home company either.

Bank International provides various businesses as shown in the following diagram.

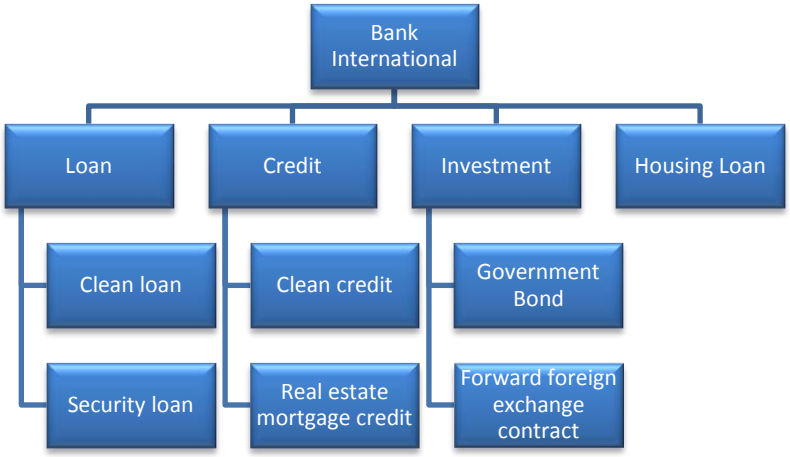


Figure 3. Business line of Bank International

As on Dec. 31, 2011, the business details of each subsidiary is as follows:

Business Region	Loan	Credit	Investment	Housing Loan
United States	1. 1 year clean loan: $50,000,000.00 to Company (Company rating A+ according to S&P) 2. 1 year Clean loan: $500,000.00 to subsidiary in China 3. 2 years clean loan: $500,000.00 to Greek Bank, from May. 01, 2010 to May. 01, 2012 4. 5 year Security loan: $100,000 to B (Company with	Real estate mortgage credit: $1,000,000 to C (Company has a machine as mortgage, it was sold at $1,500,000, by valuation, it has 75% of its age).	1. United States government bond: 100 holds of U.S. government bonds, par value is 10,000 USD per holding, maturity is 52 weeks, buy it in this month, February 2012. With 95 USD per holding, will not give interest. 2. Short position on Forward exchange contract USD/EUR.(on June 1, 2012 ,rate	$100,000.00

	10000 holds of bonds as mortgage, mark-to-market value is 13/bond and coupon rate is 3%, will assign bonus on Dec. 31 every year.)		0.7611, amount of 50,000,000.00 USD) 3. Long position on Forward exchange contract USD/CNY.(on June 1, 2012 ,rate 6.3165, amount of 10,000,000.00 USD)	
China	1. Clean loan: ¥50,000,000.00 to CA (Company rating B+ according to S&P) 2. Security loan: ¥100,000 to CB (Company with 1000 holds of Chinese government bond as mortgage, 1000/hold, coupon rate is 3%, will assign bonus every year, over due in December 2013.) 3. 1 year Clean loan: $500,000.00 to subsidiary in German 4. 1 year loan ¥8,000,000.00 to Bank of Beijing （ risk weight 25% in CEBS / 50% in FDICIA)	Real estate mortgage credit: ¥7,000,000 to CC (Company, has a business house building as mortgage, par value is ¥6, 500,000, totally new).	1. Chinese government bond: 10000 holds of Chinese government bonds, par value is 100 Chinese Yuan per holding, maturity is 10 years, buy it in June 2011. Coupon rate is 3.99%, will give interest very half year, Jun. 16 and Dec. 16. Overdue Jun. 16, 2021. 2. Short position on Forward exchange contract CNY/USD.(on June 1, 2012 ,rate 0.1587, amount of 70,000,000.00 RMB) 3. Long position on Forward exchange contract CNY/EUR.(on June 1, 2012 ,rate 0.1176, amount of 90,000,000.00 RMB) 4. U.S. government	¥1,500,000.00

			bond (T-BONDS): 1000 holds of U.S. government bonds, Nominal value is $1,000 per holding by it in Jan. 01, 2011, maturity is 5 years, and coupon rate is 2.5% will give interesting at the maturity date.	
Germany	1. Clean loan: €500,000.00 to GA (Company rating A+ according to S&P) 2. Security loan: €100,000 to GB (Company with 100 holds of Span government bond as mortgage, par value is €1,000 coupon rate is 5.433%, will assign bonus every year, over due in May 2021.)	Real estate mortgage credit: €1,000,000 to GC (Company, has a business house building as mortgage, par value is $1, 500,000, totally new).	1. Greek government bond: 10000 holds of Greek government bonds, par value is €100 per holding, maturity is 2 years, buy it in May 2011. Coupon rate is 6.99%, will give interest at maturity, Overdue May 23, 2013. 2. Short position on Forward exchange contract EUR/ USD.(on June 1, 2012 ,rate 1.3137, amount of 35,000,000.00 EUR) 3. Long position on Forward exchange contract EUR/ CNY.(on June 1, 2012 ,rate 8.2944, amount of 15,000,000.00 EUR) 4. U.S. government bond (T-BONDS): 1000 holds of U.S. government bonds,	€500,000.00

			Nominal value is $1,000 per holding by it in Jan. 01, 2011, maturity is 5 years, and coupon rate is 2.5% will give interest at the maturity date.	

Table 1. Detail Business of each subsidiary

THE FOLLOWING SECTIONS DESCRIBE HOW SAS IS DEALING WITH THE CHALLENGES OF RISK MANAGEMENT WITH MULTIPLE REGULATIONS.

1. CHALLENGE: DIVERSE REGULATION COMPLIANCE

Solution: Flexible Analysis Environment

In different countries and regions, the regulations are different. The subsidiaries need to comply with diverse regulations. We assume that Home Company enforces the FDICIA (Federal Deposit Insurance Corporation Improvement Act) to manage risk; the subsidiary in China enforces the CBCR (Commercial Bank Capital Management Rules); the European subsidiary enforces the CRD (Capital Requirements Directive: DIRECTIVE 2006/48/EC and DIRECTIVE 2006/49/EC). Additionally, all three subsidiaries should also submit reports in accordance with the regulatory rules of the home company which is the FDICIA. The Chinese subsidiary and the Germany subsidiary are both required to comply with two different regulations. The two subsidiaries are the focus in this scenario.

It's important to know the difference among regulations. The following table shows the differences among FDICIA, CBCR and CRD.

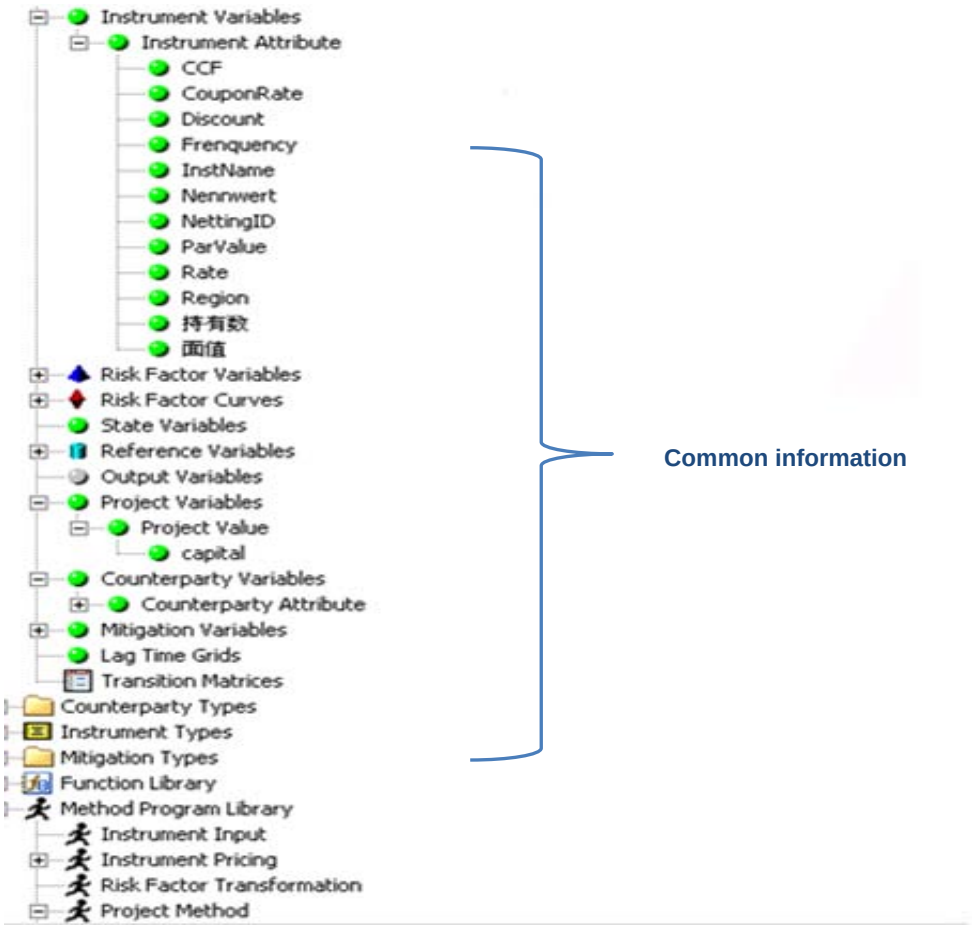
Difference	**CBCR***	**FDICIA****	**CRD (DIRECTIVE 2006/48/EC 2009/111/EC)*****
Exposure	Mark-to-market value	Mark-to-market value	Mark-to-market Method Original-Exposure method Standardized method Internal-Model Method
Risk weight of CBB	25%	50%	50%
Full protection	$W_{r\_f} = W_{pm}$	$E^* = \max\{0, [E \cdot (1 + H_e) - C \cdot (1 - H_c - H_{fx})]\}$	$E^* = \max\{0, [E \cdot (1 + H_e) - C \cdot (1 - H_c - H_{fx})]\}$
Part protection	$W_{r\_p} < W_{pm}$	$E^* = \max\{0, [E \cdot (1 + H_e) - C \cdot (1 - H_c - H_{fx})]\}$	$(E - G_A) \cdot r + G_A \cdot g$

Table 2. Differences among regulations

Many companies have an organization that consists of different layers and reporting hierarchies. SAS

Risk Solutions support multi-entity analysis environments, which enables you to segment subsidiary specified data, (such as analysis, pricing method, transaction data,)into several entities, by user defined dimensions(by business unit, geography, product line cost center and so on). In this scenario, the analysis environment is created like this: The main entity stands for the home company and covers the worldwide business; one entity is created for each subsidiary. The security mechanism is embedded within the entity. For the China entity, only the transaction data for the Chinese subsidiary is visible and used to calculate capital. Other common general definitions, instrument types, market data, and analyses are shared in the environment across all entities. This flexibility facilitates the capital calculation in terms of security and data integration. Below are the detail steps.

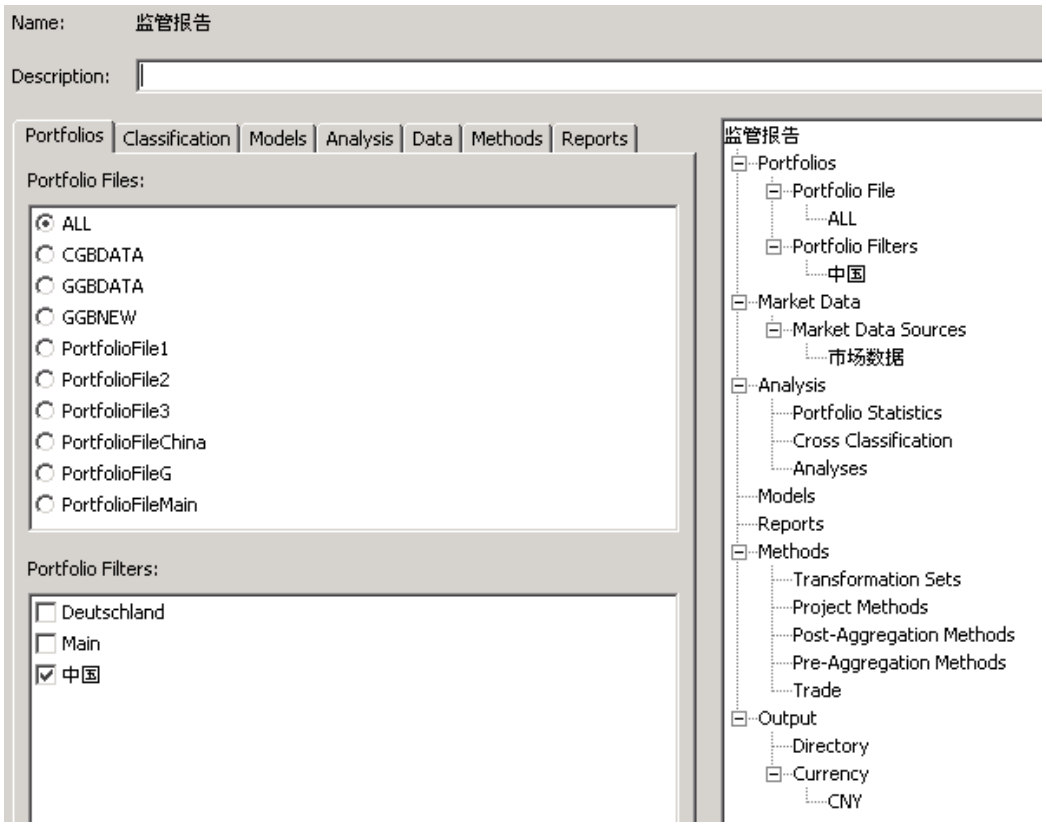
The first step to implement this scenario with the SAS solution is to set up environments for different entities. Next, common information such as instrument types, market data, and analyses are defined. The sample environment containing common information is displayed below:



Display 1. Environment with common information

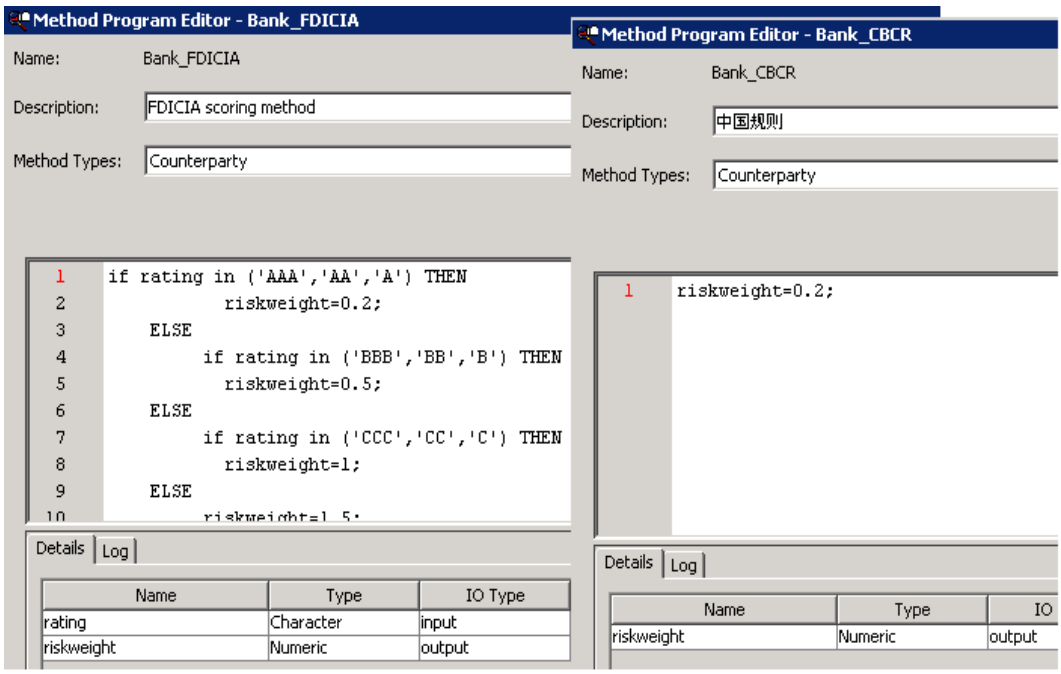
The next step is to create one project for each subsidiary with each regulation. The corresponding common information is also configured. For example, as the Chinese subsidiary has to comply with the Chinese regulation and FDICIA respectively. Both projects were created to reflect the difference. The same steps are followed for the subsidiary in Germany.

The following example is the project for Chinese subsidiary with Chinese regulation.



Display 2. Project for Chinese regulation

The following display the method for scoring bank with the CBCR and the FDICIA.

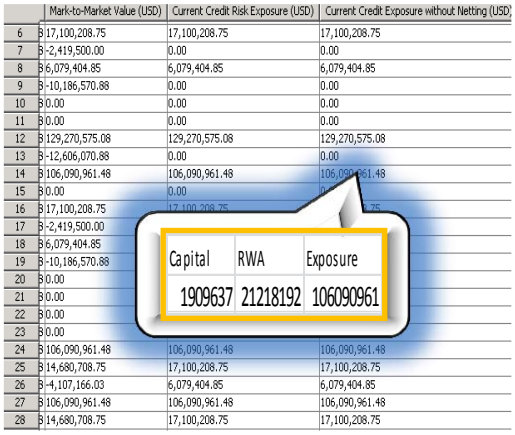


Display 3. Method for scoring bank

Next, a project for the FDICIA needs to be defined.

Finally, after running each project, the capital is calculated according to both CBCR and FDICIA.

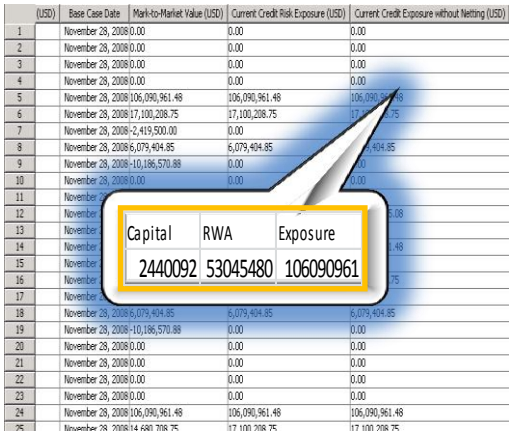
The following displays show the results for the CBCR and the FDICIA.



	Mark-to-Market Value (USD)	Current Credit Risk Exposure (USD)	Current Credit Exposure without Netting (USD)
6	17,100,208.75	17,100,208.75	17,100,208.75
7	-2,419,500.00	0.00	0.00
8	6,079,404.85	6,079,404.85	6,079,404.85
9	-10,186,570.88	0.00	0.00
10	0.00	0.00	0.00
11	0.00	0.00	0.00
12	129,270,575.08	129,270,575.08	129,270,575.08
13	-12,606,070.88	0.00	0.00
14	106,090,961.48	106,090,961.48	106,090,961.48
15	0.00	0.00	
16	17,100,208.75		
17	-2,419,500.00		
18	6,079,404.85		
19	-10,186,570.88		
20	0.00		
21	0.00		
22	0.00		
23	0.00		
24	106,090,961.48	106,090,961.48	106,090,961.48
25	14,680,708.75	17,100,208.75	17,100,208.75
26	-4,107,166.03	6,079,404.85	6,079,404.85
27	106,090,961.48	106,090,961.48	106,090,961.48
28	14,680,708.75	17,100,208.75	17,100,208.75

Capital	RWA	Exposure
1909637	21218192	106090961

Display 4.1. Result for the CBCR



	(USD)	Base Case Date	Mark-to-Market Value (USD)	Current Credit Risk Exposure (USD)	Current Credit Exposure without Netting (USD)
1		November 28, 2008	0.00	0.00	0.00
2		November 28, 2008	0.00	0.00	0.00
3		November 28, 2008	0.00	0.00	0.00
4		November 28, 2008	0.00	0.00	0.00
5		November 28, 2008	106,090,961.48	106,090,961.48	106,090,961.48
6		November 28, 2008	17,100,208.75	17,100,208.75	17,100,208.75
7		November 28, 2008	-2,419,500.00	0.00	
8		November 28, 2008	6,079,404.85	6,079,404.85	
9		November 28, 2008	-10,186,570.88	0.00	
10		November 28, 2008	0.00	0.00	
11		November			
12		November			
13		November			
14		November			
15		November			
16		November			
17		November			
18		November 28, 2008	6,079,404.85	6,079,404.85	6,079,404.85
19		November 28, 2008	-10,186,570.88	0.00	0.00
20		November 28, 2008	0.00	0.00	0.00
21		November 28, 2008	0.00	0.00	0.00
22		November 28, 2008	0.00	0.00	0.00
23		November 28, 2008	0.00	0.00	0.00
24		November 28, 2008	106,090,961.48	106,090,961.48	106,090,961.48
25		November 28, 2008	14,680,708.75	17,100,208.75	17,100,208.75

Capital	RWA	Exposure
2440092	53045480	106090961

Display 4.2. Result for the FDICIA

Once the capital is calculated, the reports with different regulations can be generated. An additional feature provided is that it's convenient for the users to compare the results with different regulations. By contrast, users could easily find the difference between regulations.

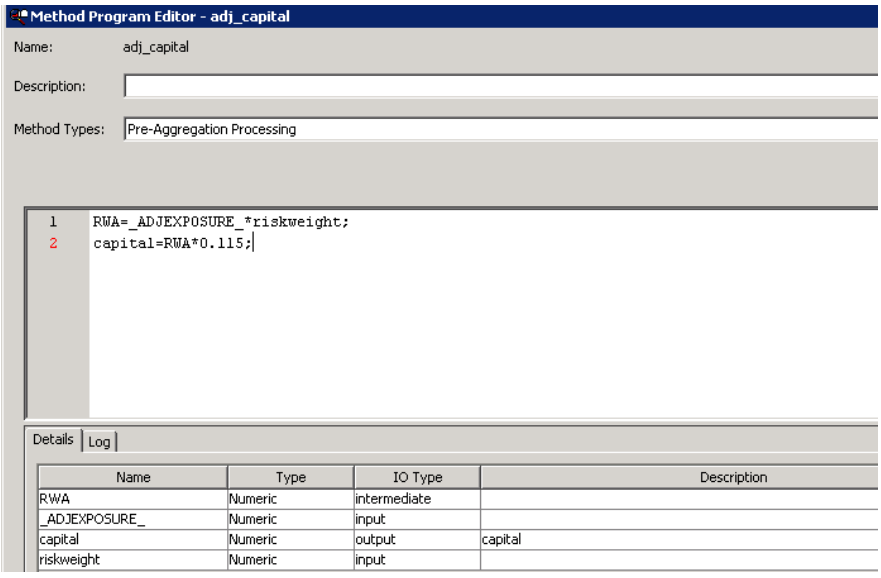
2. CHALLENGE: REGULATION ADJUSTMENT

Solution: Update the specific analysis environment with updating method

The subsidiary needs to refresh the report once there is an adjustment in the regulation. With SAS Risk Solutions, the customer only needs to update the method on the original environment according to the new regulatory rule. An alternative is to add new methods into the original environment.

Assume that on Jan. 01, 2012, the Chinese subsidiary of Bank International received the notification that from this month, the minimum capital ratio would increase from 9% to 11.5%.

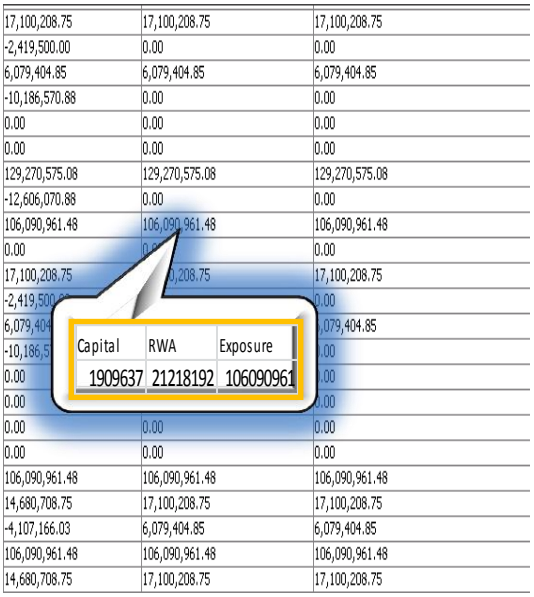
A project has been created for the regulation before Jan. 01, 2012, in which the minimum capital was calculated with 9 %. To support this change an additional project would be created, with the updated method in which capital is to be calculated at 11.5%. The market data, instrument data, and transaction data would remain unchanged.



Display 5. Updated method

After running this new project, we get the capital for the new regulatory requirement. Also, it allows the user to keep the previous result before Jan. 01, 2012 and to compare the two results.

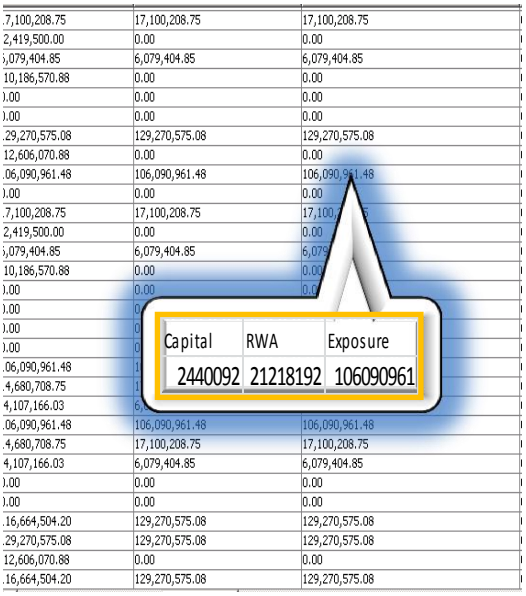
Before Jan. 01, 2012



17,100,208.75	17,100,208.75	17,100,208.75
-2,419,500.00	0.00	0.00
6,079,404.85	6,079,404.85	6,079,404.85
-10,186,570.88	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
129,270,575.08	129,270,575.08	129,270,575.08
-12,606,070.88	0.00	0.00
106,090,961.48	106,090,961.48	106,090,961.48
0.00	0.00	0.00
17,100,208.75	17,100,208.75	17,100,208.75
-2,419,500.00	0.00	0.00
6,079,404.85	6,079,404.85	6,079,404.85
-10,186,570.88	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
106,090,961.48	106,090,961.48	106,090,961.48
14,680,708.75	17,100,208.75	17,100,208.75
-4,107,166.03	6,079,404.85	6,079,404.85
106,090,961.48	106,090,961.48	106,090,961.48
14,680,708.75	17,100,208.75	17,100,208.75

Capital	RWA	Exposure
1909637	21218192	106090961

After Jan. 01, 2012



.7,100,208.75	17,100,208.75	17,100,208.75
2,419,500.00	0.00	0.00
,079,404.85	6,079,404.85	6,079,404.85
10,186,570.88	0.00	0.00
.00	0.00	0.00
.00	0.00	0.00
.29,270,575.08	129,270,575.08	129,270,575.08
12,606,070.88	0.00	0.00
.06,090,961.48	106,090,961.48	106,090,961.48
.00	0.00	0.00
.7,100,208.75	17,100,208.75	17,100,208.75
2,419,500.00	0.00	0.00
,079,404.85	6,079,404.85	6,079,404.85
10,186,570.88	0.00	0.00
.00	0.00	0.00
.00	0.00	0.00
.00	0.00	0.00
.00	0.00	0.00
.06,090,961.48	106,090,961.48	106,090,961.48
.4,680,708.75	17,100,208.75	17,100,208.75
4,107,166.03	6,079,404.85	6,079,404.85
.06,090,961.48	106,090,961.48	106,090,961.48
.4,680,708.75	17,100,208.75	17,100,208.75
4,107,166.03	6,079,404.85	6,079,404.85
.00	0.00	0.00
.00	0.00	0.00
.16,664,504.20	129,270,575.08	129,270,575.08
.29,270,575.08	129,270,575.08	129,270,575.08
12,606,070.88	0.00	0.00
.16,664,504.20	129,270,575.08	129,270,575.08

Capital	RWA	Exposure
2440092	21218192	106090961

Display 6.1. Result for original project

Display 6.2. Result for updated project

With this process, users can easily recalculate capital when regulatory changes occur. Additionally, by comparing the results, you can easily understand the impact of the changes in regulatory rules on the subsidiary. In this scenario, it's clear that with the ration increase, the required capital increased significantly, which translates for the subsidiary that the capital available for operating is decreased.

3. CHALLENGE: ECONOMIC FLUCTUATION

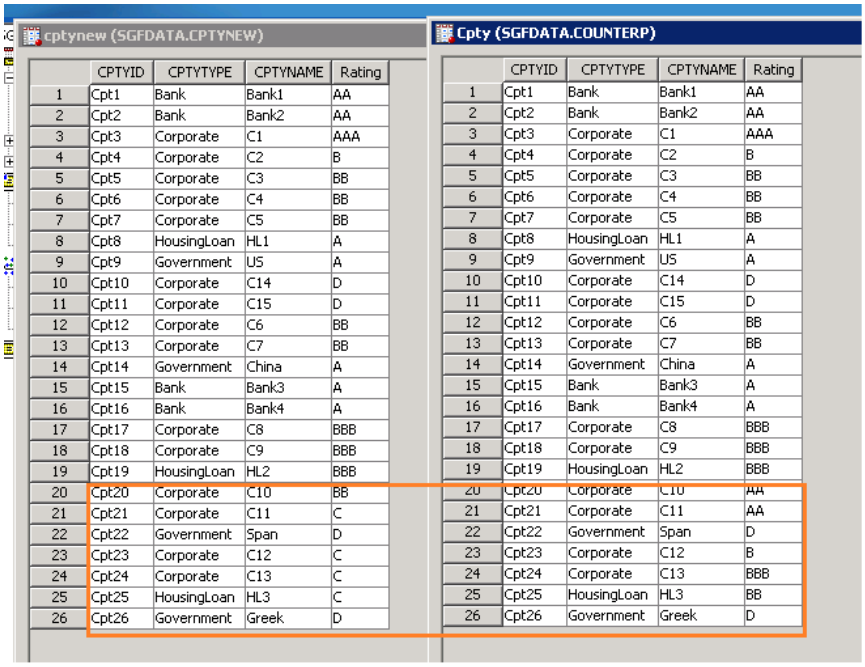
Solution: Update the Specific Analysis Environment with Replacement of Data

The value of financial instruments is subject to the fluctuation of risk factors. A tiny change of the economic environment may result in a significantly loss to the bank. SAS Risk Solutions can provide information on this fluctuation in a timely manner.

In the European debt crisis, some of the Germany subsidiary counterparty's credit rates were reduced. Next we will demonstrate how this event is supported by the SAS solutions.

With SAS Solutions, users only need to update the counterparty data in line with market changes and while other components remain unchanged in the environment.

Firstly, a new counterparty table is added containing the new credit rate as shown below.



cptynew (SGFDATA.CPTYNEW)

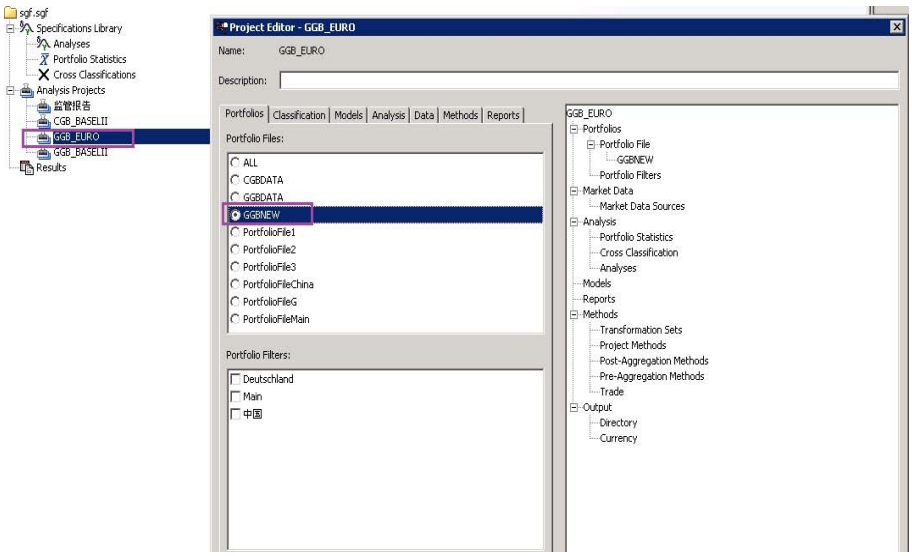
	CPTYID	CPTYTYPE	CPTYNAME	Rating
1	Cpt1	Bank	Bank1	AA
2	Cpt2	Bank	Bank2	AA
3	Cpt3	Corporate	C1	AAA
4	Cpt4	Corporate	C2	B
5	Cpt5	Corporate	C3	BB
6	Cpt6	Corporate	C4	BB
7	Cpt7	Corporate	C5	BB
8	Cpt8	HousingLoan	HL1	A
9	Cpt9	Government	US	A
10	Cpt10	Corporate	C14	D
11	Cpt11	Corporate	C15	D
12	Cpt12	Corporate	C6	BB
13	Cpt13	Corporate	C7	BB
14	Cpt14	Government	China	A
15	Cpt15	Bank	Bank3	A
16	Cpt16	Bank	Bank4	A
17	Cpt17	Corporate	C8	BBB
18	Cpt18	Corporate	C9	BBB
19	Cpt19	HousingLoan	HL2	BBB
20	Cpt20	Corporate	C10	BB
21	Cpt21	Corporate	C11	C
22	Cpt22	Government	Span	D
23	Cpt23	Corporate	C12	C
24	Cpt24	Corporate	C13	C
25	Cpt25	HousingLoan	HL3	C
26	Cpt26	Government	Greek	D

Cpty (SGFDATA.COUNTERP)

	CPTYID	CPTYTYPE	CPTYNAME	Rating
1	Cpt1	Bank	Bank1	AA
2	Cpt2	Bank	Bank2	AA
3	Cpt3	Corporate	C1	AAA
4	Cpt4	Corporate	C2	B
5	Cpt5	Corporate	C3	BB
6	Cpt6	Corporate	C4	BB
7	Cpt7	Corporate	C5	BB
8	Cpt8	HousingLoan	HL1	A
9	Cpt9	Government	US	A
10	Cpt10	Corporate	C14	D
11	Cpt11	Corporate	C15	D
12	Cpt12	Corporate	C6	BB
13	Cpt13	Corporate	C7	BB
14	Cpt14	Government	China	A
15	Cpt15	Bank	Bank3	A
16	Cpt16	Bank	Bank4	A
17	Cpt17	Corporate	C8	BBB
18	Cpt18	Corporate	C9	BBB
19	Cpt19	HousingLoan	HL2	BBB
20	Cpt20	Corporate	C10	AA
21	Cpt21	Corporate	C11	AA
22	Cpt22	Government	Span	D
23	Cpt23	Corporate	C12	B
24	Cpt24	Corporate	C13	BBB
25	Cpt25	HousingLoan	HL3	BB
26	Cpt26	Government	Greek	D

Display 7. Updated counterparty data

Then, the business data in the project is replaced with the updated information. The project is executed again to get the new result and a new report. The previous result can also be preserved. By comparison, users would be able to analyze and understand how the changes impact the bank.



Display 8. New project

Run projects and calculate the results, users are also able to compare the results of before the crisis and after the crisis. By contrast, it's clear that with lower rate of the counterparty, a higher capital is required.

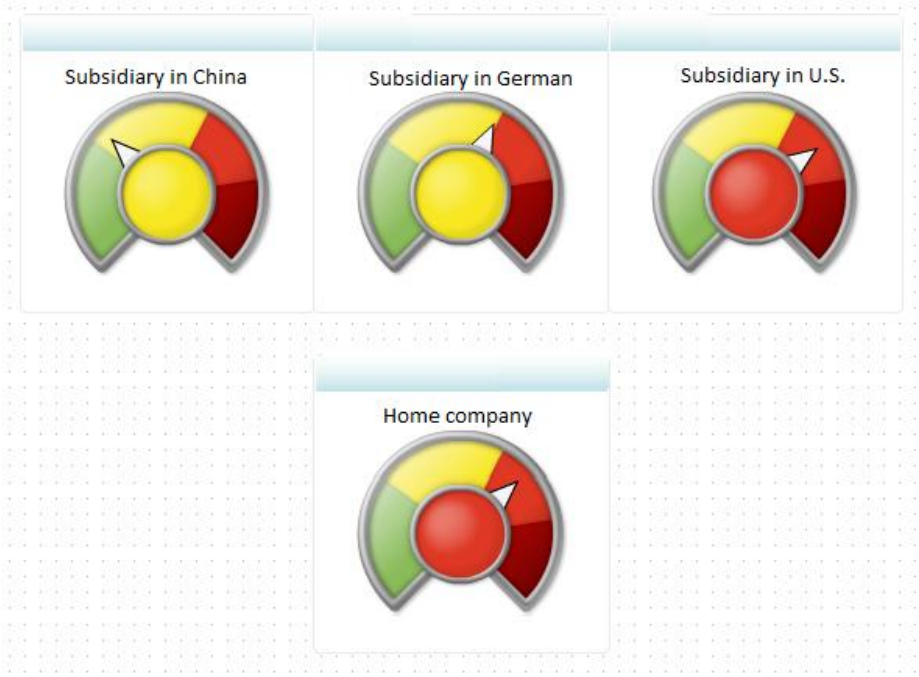
4. CHALLENGE: STRESS TESTING

Solution: Various stress testing analyses

Stress testing is an important element in the risk management process. It helps financial institutions to identify, analyze, and manage the risk in different situations. SAS Risk Solutions provide many types of

stress testing analysis, including sensitivity analysis and scenario analysis. Furthermore, with the integration of value at risk (VAR), the user understands the entire picture of risk analysis methodology. There is a stress testing scenario: what would happen if the foreign exchange rate USD/CNY increases from 6.29 to 7.5 suddenly?

The movements of exchange rates have an impact on many aspects of the bank's business, some positive, some negative. For instance, the appreciation of the US dollar will reduce the dollar value of RMB assets, while the dollar value of RMB liabilities reduces as well. How does this change impact on each subsidiary and the home company? Let's see the result.



Display 9. Result of stress testing

The above indicator reflects if the reserved capital could cover the risk along with the change of foreign exchange rate. The dynamic dial in green indicates that the required capital in the stressed scenario is much less than the reserved capital; in yellow indicates the required capital in the stressed scenario is almost the same with the reserved capital ; red indicates that in stressed scenario, the required capital exceeds the reserved capital significantly and it might be high risk. We can see that in this stressed scenario, the Chinese subsidiary is in a safe situation; while there might be risky with the U.S. subsidiary. The home company is also in a relatively high risk level whereas the reserved capital might not be enough if the loss occurs.

The above scenarios are simple examples of risk management; they just want to provide an idea of how SAS manage risk according to diverse regulations, besides that, you can use SAS Risk Dimensions to analyze almost any type of financial instrument, to integrate the measurement of market and credit risk. Also SAS Risk Management for Banking provides an integrated framework for credit risk, market risk, asset liability management and liquidity management.

CONCLUSION

The subsidiaries of global financial institutions are facing the challenge of complying with diverse

regulations. The examples in this paper demonstrate how SAS solutions are used to manage risk according to different regulatory rules; most importantly, how SAS Risk solutions perfectly support the measurement of quantitative risk based on multiple regulations and well resolves the problems.

REFERENCES

The following references or sources can be used for additional information and research activities:

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