



CEMS Work Project

Hedging currency risk associated to the financing of production relocation

based on the CEMS Business Project

**Analysis of the several impacts of currency risks
and identification of the main levers to reduce them**

INDESIT COMPANY

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I. Brief context of the Business Project

During this last semester, I was involved in a Business Project proposed by **Indesit Company** – an Italian public multinational corporation that operates on the home appliances market. With EUR 2,671 million in revenues in 2013, the group is present in two main regions: **Western Europe**, which, among other countries includes Italy, France and the UK; **Eastern Europe**, mainly in Turkey, Poland, Russia and Ukraine. In terms of sales, these geographies represent 56% and 38%, respectively (Indesit annual report, 2013). From 2012 until 2013, overall sales decreased 7.7% taking into account exchange rate effects and 4.6% at constant exchange rates (for further information see appendix 1). At this point, one can conclude that currency exposure has been a negative common denominator within the company's profitability framework. With a currency hedging strategy mostly based on financial instruments, the group's internationalization has fostered currency exposures mostly on Ruble, Zloty, Lira, Pound, Dollar and Hryvnia, leading to high hedging costs and negative impact both revenue and profitability wise (appendix 2). Hence, the goal of this Business Project was to **reduce Indesit's currency vulnerability by suggesting innovative and flexible operational hedging tools to deal with transaction and economic risk, which would decrease hedging costs.**

With no access to internal data, the structure of the project was designed to link theory to practice. To begin with, theory was based on two pillars. The first of which corresponded to a 'two-steps' framework that will change the hedging mindset. First, companies must reduce their currency exposure through the usage of operational tools. Second, they have the possibility of hedging the remaining exposure through financial instruments. This ensures a decrease of currency exposure and a lower dependence on expensive hedging solutions. The second pillar is based on the inclusion of this new framework in a generic decision-tree designed for companies to conclude what are the most appropriate methods when dealing with translation, transaction and economic risk (appendix 3). It takes into account different markets, needs and profiles and its solutions are arranged according to different levels of flexibility and complexity (appendix 4). In order to clarify all the tools, we then described each concept, requirements with advantages and disadvantages.

To guarantee the bridging between theory and Indesit's reality, it was important to build a macro overview, complemented by currency forecasts for the company's six aforementioned currency exposures. At this point, all the ingredients were gathered to

simulate four different hedging alternatives (spot contracts, only reducing the exposure, only hedging the exposure or a combination of the last two). To achieve wider conclusions, we assumed different types of risks, requirements from customers/suppliers and corresponding levels of liquidity. After simulating future spot rates, one could extract conclusions from a payoff, but most importantly from a volatility point of view (appendix 5). Looking at the top four largest exposures, all of which assumed to be transaction risk (Ruble, Lira, Zloty and Pound), we achieved interesting results. We concluded that when hedging the **Ruble**, Indesit is better off by first splitting the risk with a customer and second buying a forward contract rather than only buying a forward, as it would normally do (appendix 6). This statement holds true from a payoff point of view in 60% of the cases and from a volatility point of view in 82% of the cases. Similar conclusions were reached for the **Lira** (appendix 7). With different assumptions, we concluded that lagging a payment combined with a forward contract is by far the best solution from both perspectives, specially when comparing with only buying a forward contract, which under our assumptions never yields the best outputs. As for the **Zloty**, Indesit must split the risk and then use a currency loan to hedge a payment exposure as opposed to only use a currency loan, both from a volatility and payoff point of view (appendix 8). Concerning the **Pound**, leading a payment and hedging the remaining exposure through an option yields the best result in 78% of the cases, although only in 20% of the cases it has the lowest volatility (appendix 9). However, in this particular currency, volatility may be considered a secondary issue. For volatile currencies such as the **Hryvnia**, hedging becomes a complicated task, although from a volatility perspective splitting the risk and cross hedging the EUR/UAH makes sense in 46% of the cases (appendix 10). We also concluded that hedging economic risk in **US Dollars** with a layered strategy yields a trade-off between risk and return (appendix 11). Although risk-averse profiles prefer to be exposed to less volatility by using a layered strategy, they will achieve a lower return (layering yields the best payoff only in 28% of the sample).

To sum up, we found our decision-tree to yield superior results both in terms of payoff and volatility when applied to Indesit's top four exposures. Hence, the conclusions to be drawn from this analysis are not straightforward, specially when hedging uncertain currencies and economic risk, but overall we believe that these innovations have the capacity to bring within reach the results that Indesit's risk management department has been looking for.

II. Addressing a specific topic

As explained in the previous chapter, our Business Project focused on transaction and economic risk. The majority of the numerical examples were related to the first one, as it was more feasible to quantify the benefit of using our innovative approaches for certain cash-flows. But when looking at economic risk, one of the solutions we described was **production relocation**. This alternative was not numerically exemplified due to the complexity involved in its quantification. Also, it was not within the scope of the operational and flexible tools that the company was looking for. Relocating production is a decision often taken by companies that are interested in gaining from increased volatility between currencies. In other words, by allowing the shift of production from one geography to another, companies will “always produce at the cheapest cost regardless of how exchange rates move.” (Mello, Parsons, and Triantis, 1996, pp. 18). It is typically implemented by large multinational corporations with budgets and financing capacity sufficient to bear such a significant investment. It also alters the company’s risk and profitability profile (Mello et al., 1996) and involves an extensive list of requirements such as financial resources, legal fulfillments, competitive labor force, etc. In terms of advantages, it provides (1) high flexibility, (2) low long-term dependence on traditional financial instruments, which might translate into hedging savings and (3) diversification of the supply chain risks. Yet, it is probably the most expensive alternative, with lengthy applicability when compared to traditional financial tools, while it can damage credit ratings and/or foster translation risk.

For the purpose of this project, I will highlight financial availability as a key requirement. Still, it might represent another source of currency risk, depending on where the company finances the investment. But when trying to manage that risk, Indesit might incur in higher financing costs. Hence, **this work project will analyze both (1) the existence of this trade-off and if it does not exist, (2) the best solution from a financing and currency impact point of view**. Naturally, if production relocation was somehow beyond the scope of the Business Project, analyzing currency risk related to its financing was not covered. Therefore, there is neither a first approach nor limitations for this topic. Similarly to the Business Project, this chapter will kick-off with a theoretical approach, followed by numerical examples and some findings & conclusions.

a) Theory: To finance a project, Indesit can either borrow in domestic or in foreign currency. If it borrows in domestic currency, currency exposure will be involved in the repayment both of the interest and loan amortization through profits that the investment will generate. For this scenario, four hedging alternatives were considered: (1) spot contracts; (2) forward contract; (3) entering into a currency swap or (4) buying zero collar options. The usage of regular **spot contracts** (i.e., no hedging) implies full currency exposure and is considered exclusively for comparison purposes, as it is an extreme scenario that carries significant currency risk. **Forward contracts** are traditional non-standardized hedging tools traded over-the-counter that force both parties to buy or sell the underlying currency at a specific point in the time. On one hand, they are tailored to any exposure/term and do not involve commissions since banks profit from bid-ask spreads (Eiteman, Stonehill, and Moffett, 2010, pp. 200). On the other hand, the obligation might become a liability and therefore tie capital. **Currency swaps** are another alternative that allows Indesit to swap the repayment of the domestic loan from domestic to foreign currency and therefore eliminates currency risk, although it still involves some credit risk. Last but not least, **zero collar options** are a derivative instrument in which investors long a European put option and short a European call option, both out-of-the-money. Moreover, not only the premiums associated to each option offset each other but also it establishes an upward and downward range (Bodnar, G., 2014). Contrasting with these solutions is **borrowing in foreign currency**, which assures no currency risk but potentially higher interest payments.

b) Numerical examples: Having understood the theory, it is now relevant to add some practicality, which includes (1) defining a methodology and (2) gathering solid assumptions. In terms of methodology, and since all the examples involve both future cash-flows and the need to be compared among each other, conclusions will be based on Net Present Values (NPVs), always denominated in the foreign currency. Subsequently, I decomposed each NPV in two items: (1) the present value (PV) of financing impact and (2) the present value (PV) of currency impact, both incrementally measured. Each solution's total NPV fluctuation is calculated by converting each cash-flow according to each interest rate swap/strike/spot/forward rate discounted at the appropriate rate, being afterwards subtracted from the total investment. Regarding the PV of financing impact, a loan in Italy is calculated by converting each future discounted cash-flow (which includes the interest and the loan

repayment) at the spot rate in $t=0$, therefore excluding currency exposure. It is then subtracted from the initial investment denominated in the foreign currency, so that one reaches the incremental impact. If Indesit borrows in Russia, the financing impact corresponds to the total NPV fluctuation, as there is no such thing as currency exposure. Concerning currency impact, it is by definition the effect Indesit would bear by being exposed to the foreign currency. It corresponds to the difference between each alternative's total NPV and the respective PV of financing impact already detailed. Lastly, conclusions will be based on fixed-assumptions scenario, which will be complemented by several sensitivity analyses as well as some comparisons with borrowing in Russia – an alternative that I considered as the benchmark. **Ideally, this methodology intends to conclude what is the solution with the lowest financing impact and the lowest absolute currency impact.**

The next step is to perform numerical examples. With no access to corporate data, it was necessary to build **assumptions**, both transversal and specific to each of the five hedging alternatives. Starting with the transversal ones, and in order to analyze the level of currency risk involved on the financing of production relocation, I had to assume that Indesit already decided to adopt this solution. In this case, **Russia** was chosen to be the relocation destination and the **Ruble the foreign currency** used to compare all solutions, while the **Euro is considered the domestic currency**. Not only Russia is one of “Indesit's main markets” (Indesit annual report, 2013, pp. 40), but also it has a currency that is expected to depreciate (Indesit annual report, 2013, pp.30). Therefore, importing from Europe will become more expensive and it would be beneficial for the Russian subsidiary to produce locally. For the group as whole, this depreciation would also be beneficial if the other subsidiaries would import more from Russia (appendix 12). Furthermore, the total investment was assumed to be **RUB 10 billion**, fully repaid in five years through annual payments, each including an interest and a loan amortization.

Valuation wise, traditional methods such as DCF or (comparable and transaction) multiples are used to discount free-cash flows, which do not take into account financing cash-flows. Instead, I discounted these using the cost of debt, as it represents the level of remuneration that debt-holders require when lending capital to a company. Since the sum of all future financing-flows will be denominated in Rubles, hence already incorporating currency risk, it is accurate to apply the same discount rate for all the alternatives. Still, that discount rate has to reflect the Russian

subsidiary risk – information that is not available as Indesit is an Italian company. For this purpose, I assumed the Russian Sovereign rating as a suitable proxy, which according to Moody's has a Baa1 credit rating (Bloomberg as of 13.06.2014). Furthermore, and according to Cooper and Davydenko (2007), “the cost of debt is the promised yield, adjusted for expected default losses” (appendix 13). In this case, I used the 10-year Government bond yield and the respective recovery rate and probability of default that the aforementioned rating agency associates to the sovereign rating (Corporate Default and Recovery Rates 1920-2010, 2011). Given these assumptions, the cost of debt was of 8.3% (appendix 14).

Regarding assumptions specific to each alternative, and starting with a loan in Italy converted through spot contracts (i.e., no hedging), it was necessary to forecast future EUR/RUB spot rates, in this case through Monte-Carlo simulation. Each rate was estimated by taking the average of 10,000 simulations, each with 30 intermediate steps (appendix 15). Moreover, the loan would bear an interest rate that would correspond to the 12-months Euribor increased by a spread that “represents the credit risk specific to the borrower” (Eiteman et al., 2010, pp. 246). To estimate 12-months Euribor, I made use of Monte-Carlo simulation with the same number of simulations and intermediate steps as the future spot rates (appendix 16). I assumed that the spread would be quantified by Indesit's Credit Default Swap (CDS), in this case 2.68% (Bloomberg as of 13.06.2014) (appendix 17).

Concerning **currency swaps**, Indesit would agree with a bank to pay interest plus loan amortization in Rubles and receive in Euros. Each party's notional principal used to calculate the interest rate is converted at the spot rate in $t=0$. The interest rate swap paid in Rubles is 8.72% (Bloomberg as of 12.06.2014) and is used as a reference to the interest paid by Indesit.

In case of borrowing in Italy and buying **forward contracts** in $t=0$ to hedge each cash-flow, I assumed that Indesit would have to convert the future cash-flows at Bloomberg's quoted rates (appendix 18). The interest rates related to the loan in Italy would be the same used on the spot contracts previously estimated (appendix 17).

I also analyzed the possibility of buying a **zero collar option**. However, Bloomberg, Philadelphia and Chicago Exchanges do not quote strikes for the maturities and currencies required. Thus, I made use of the Black-Scholes model to price the options, in this case all out-of-the-money. Since both premiums have to be symmetric, and by assuming a strike for each call option, one can use the goal-seek tool to reach strikes

for the respective put options (appendix 19). Combining this data with the interest and spot rates allowed to calculate the NPVs described on the methodology subchapter.

For a **loan in Russia**, the payment structure would be similar to borrowing in Italy, although with different interest rates. In this case, the benchmark rate would correspond to the Russian refinancing rate, which was also simulated through Monte-Carlo simulation, with the same number of observations and intermediary steps (appendix 20). Regarding the spread that should reflect the credit risk of the Russian subsidiary, I assumed the CDS of the 5-year Russian Government Bond as a suitable proxy, in this case being 1.83% (Bloomberg as of 13.06.2014). The total estimated interest rate of a loan in Russia can be seen in appendix 21.

c) Findings & conclusions: At this stage, the methodology and assumptions that supported my work project are clear and all the ingredients are gathered to extract conclusions. If all the assumptions described in the previous subchapter would in fact happen (from now on defined as the base-scenario), **there would be a trade-off between financing and currency impact**. In other words, the solution(s) with the lowest absolute currency impact would not be the one(s) with the lowest financing impact (appendix 22). In this case, asking for a loan in Russia or entering into a currency swap would obviously guarantee that the company would have a zero currency impact. However, these alternatives would translate into an increase of the PV of financing impact (which would mean that the total present value of the liability would be higher and therefore would not be beneficial for the company) of approximately RUB 104 million and RUB 603 million, respectively. These results are a consequence of higher loan interest rates and interest rate swaps in Russia when compared with those that Indesit would pay in case of borrowing in Italy. Looking at the other alternatives, the same financing incremental impact would be advantageous for the company with equal figures for spot contracts, forwards and zero collar options (RUB 1.22 billion). Taking into account that each payment was calculated with a positive sign, in some contexts the discount rate is higher than the interest rate and therefore the PV of financing impact might be lower than the notional amount, but that does not equate to an inflow. It simply means that from a present value perspective, financing costs are more beneficial to Indesit when adjusted to foreign currency and therefore create value. Still, they would yield higher and therefore less attractive absolute PV of currency impact than the first two solutions, since they

would be exposed to a depreciated currency (RUB 731 million, RUB 2.34 billion and RUB 661 million, respectively) (appendix 23).

When comparing each solution versus borrowing in Russia, there is again a trade-off. Through appendix 24, one can conclude that the solution with the lowest absolute currency impact (currency swap) is not the one with the highest value creation from a financing impact point of view (no hedging, forwards and zero collars).

I further performed some sensitivity analyses over the Euribor and Russian refinancing rate, as these are the only rates that would vary in the future. Thus, they would fluctuate the total interest rates paid both in Italy and Russia. Among each simulation, each hedging alternative was ranked in terms of financing and currency impacts. In order to understand the consequences that each benchmark would have individually, the first analysis only varies the Euribor. In this particular case, while the currency impact never fluctuates with changes in the interest rate, the present value of financing impact does, although without modifying the conclusions of the base-scenario. Since the gap between the interest rates in Italy and Russia is so wide, the best solutions from an interest perspective would keep being spot contracts, forwards and zero collar options, each representing 33.3% among the number 1 ranked solutions (appendix 25). **Looking at the whole sample, the best solution from a financing impact point of view is never the best from a currency impact perspective.** I further analyzed the existence of a second best solution (ranking 1st in one of the impacts and 2nd on the other), but the absence of conclusions is persistent. When simulating the Russian refinancing rate, **the results were exactly the same as varying the Euribor from both types of impacts.** In fact, the simulations of the Russian refinancing rate increased by the spread were not sufficiently competitive with the total interest rate in Italy. Once again, there were no first and second best options from both perspectives (appendix 26). Finally, simultaneously fluctuating both rates should also be considered to get a better proxy for reality. The trade-off and the absence of a first and second best solution keeps being a reality (appendix 27).

All in all, I concluded that there is a trade-off between financing and currency impact along the five solutions presented without one best alternative. This bottom line is common to fluctuations on future European and Russian 12-months rates, as well as when comparing with borrowing in Russia. Despite not achieving revolutionary results, I believe that the greatest amount of value relates to the methodology and solid assumptions used to duel with a rather challenging topic.

III. Reflection on learning

This Business Project with Indesit ended up being a personally enriching experience. To begin with, the currency risk topic brought the project within the reach of some of the finance knowledge I was provided with during the Masters. Designing the decision-tree required notions about risk that were included in courses such as Investments and Risk Management. These courses gave me an overview of the most popular solutions that companies typically use to hedge currency risk. Also, the simulations that were performed to estimate future spot rates required some statistics and risk knowledge, which were developed during the Masters. Last but not least, the problem-solving mindset used throughout the Masters to crack case-studies was a helpful skill. Structuring real case projects was of assistance, particularly when identifying the challenge, defining a methodology, understanding the theory and applying it to practice.

New insights and methodologies should also be highlighted. First, it increased my awareness about the variety of risks that this topic includes. My previous contact with the most popular tools in this area had unconsciously focused my attention on transaction risk. But that changed. It was interesting to observe how large the scope of currency risk is and how important it is to the corporate world. In addition, the decision-tree ended up being a very innovative methodology to address this topic. It not only rationally structured all the pieces of the puzzle but also made use of the two-steps idea that were introduced. Although at a first glance one could think that this is a saturated field with little room for innovation, we just proved otherwise. Among the solutions we suggested, I would highlight splitting the risk and leading & lagging as the most suitable ideas for Indesit to apply. Moreover, the practical approach and the way it was implemented were refreshing. Literature is not very rich in regards to finding the best hedging solutions, but rather focusing on deciding on whether to hedge or not. Hence, the two perspectives we analyzed for each solution, both in terms of payoff and volatility, generated conclusions and consequently brought value to the table. Most importantly, this approach allowed for a comparison between our innovations and what Indesit typically has been doing. Not only did it take into account real market data, but also the uncertainty of future spot rates, something that in my opinion added credibility.

Despite these positive aspects, I personally felt lack of commitment from the company. Due to internal policies, we did not have access to any internal data and this

was a huge obstacle when dealing with such a numerical topic as currency risk. Furthermore, it is my opinion that the company was not completely sure about the bottom line of the project, which led to few feedbacks and very little guidance, even in spite of the fact their final opinion was very positive.

The contribution each group member made to the project was also unbalanced. Among five people, only two were truly committed – a situation fostered by the differing incentives of each individual member. Having said this, I humbly believe my involvement in the project was crucial. By leading the group, I was responsible for defining the next steps, deciding about the content of each chapter and underlying the overall structure of the presentation, while making sure there was a fluent storyline justified with solid arguments. This contribution had much to do with the hard-working spirit that the Masters required and to the professionalism and disciplined culture that the three internships I took part cultivated. However, I would highlight my nervousness as my main weakness. My result-oriented mindset was in conflict both with the company's lack of commitment and with the timing of the BP kick-off. This stress could have had a negative impact as we might have skipped some analyses and therefore reached unjustified conclusions. It is a lesson I take from this project, which I will try to invert in the future by adopting a calmer approach.

Personally, I believe that the greatest amount of value came from me and the other group member who also actively contributed. We were able to leverage our finance backgrounds to contribute to the final outcome. Apart from the posture that the company adopted, the academic advisor was also not very helpful. Even though he was present whenever requested, his area of expertise was not really risk management.

If the project would start today, I would make sure there would be full commitment from all parties, which would include regular meetings with solid feedback, the absence of which was an aspect that brought some skepticism about the usefulness of the project. Not only should the academic advisor have been an expert on the topic, but also the Business Project kick-off should also occur earlier in order to better distribute the workload throughout the semester.

All in all, and despite the obstacles we faced, I believe we were able to add value to the company, while I managed to transform weaknesses into strengths and to finish this Business Project more knowledgeable about the topic of currency risk.

IV. Reference list

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VI. Appendixes

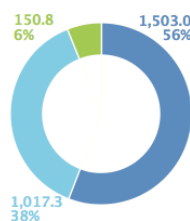
Appendix 1 – Indesit's products and services

The company sells four main products' categories: cooking, refrigeration, laundry and dishwashing, which are complemented by a services' segment of revenue.

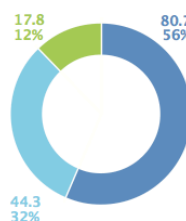
Sales breakdown per region (2013)

Year 2013 (million euro)	Western Europe	Eastern Europe	International	Costs not allocated	Total
Total revenue	1,503.0	1,017.3	150.8	0.0	2,671.1
Operating costs	(1,422.3)	(973.0)	(133.0)	(74.7)	(2,602.9)
Operating profit	80.7	44.3	17.8	(74.7)	68.1

Revenue by segment 2013 (mEur & %)



Operating profit by segment * 2013 (mEur & %)



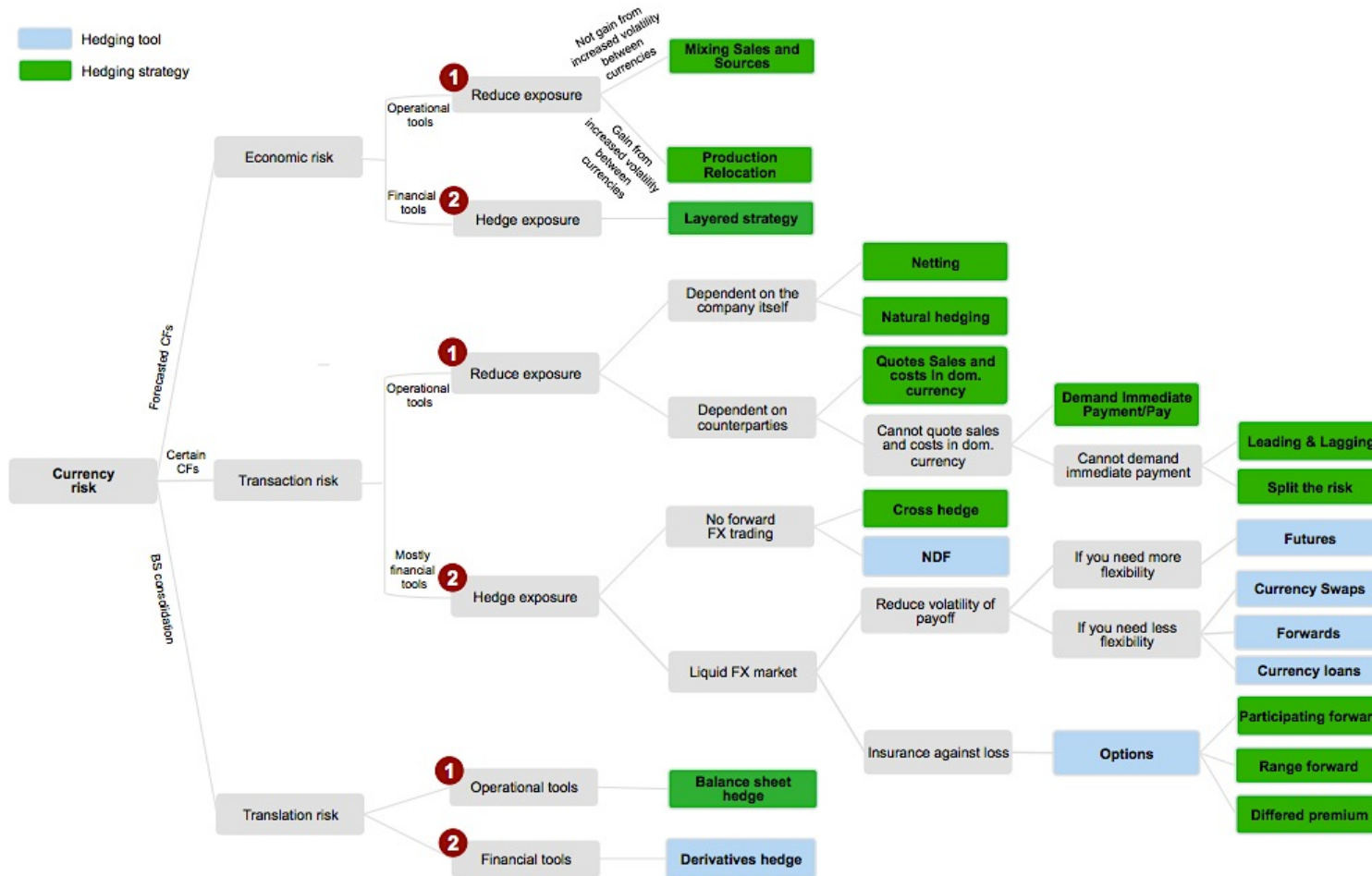
Source: 2013 Indesit annual report, pp. 7

Appendix 2 – Currency impact of the top four largest exposures of Indesit (2013)

Currency impact - 2013		
Exchange rates	Effect on revenue	Effect on profitability
GBP	↓	↓
RUB	↓	↓
PLN	↓	↑
TRY	↓	↓

Source: Indesit annual report (2013)

Appendix 3 – Decision-tree (Source: CEMS Business Project)



Appendix 4 – 2x2 matrix that relates flexibility with complexity (Source: CEMS Business Project)

		Level of flexibility	
		High Flexibility	Low flexibility
Level of complexity	High complexity	Cross hedge NDF Options	Production relocation Currency loans Natural hedging Currency Swap Mixing sales
	Low complexity	Netting Leading & Lagging Split the risk Futures	Quote sales in domestic currency Demand immediate pay/Pay now Forwards

Appendix 5 – Further information about Volatility analysis

The volatility analysis is based on the difference between the cash-flow of each alternative and the conversion of each assumed exposure that we were trying to hedge at the spot rate in $t=0$.

Appendix 6 – Numerical example applied to the Ruble (Source: CEMS Business Project)

1 Context

- **Subsidiary:** Russia
- **Counterparty:** Russian Customer who will pay in 3 months
- **Total exposure:** RUB 3,000,000
- **Current spot rate EUR/RUB:** 46.86*
- **Forecasted spot rate in 3 months:** 41.2-55.8 normally distributed with a 95% confidence level
- **Splitting ratio:** 50%
- **Three months EUR/RUB forward rate:** 47.9*

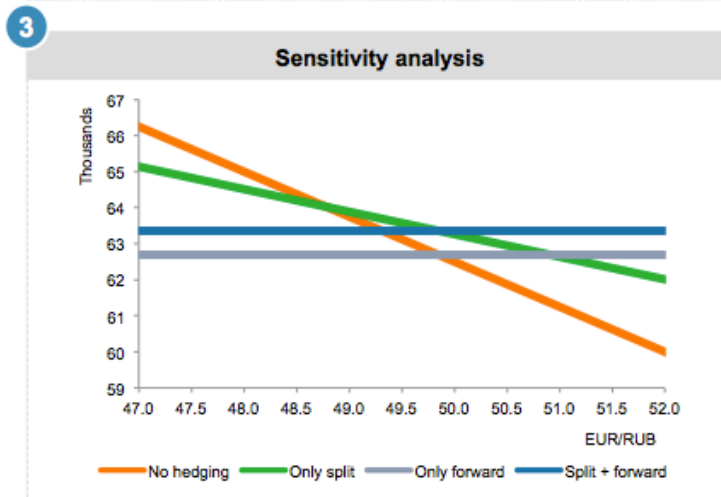
2 Decision tree solution and requirements fulfillment

A) Reduce the exposure

- Transaction risk → Reduce the exposure → The company is dependent on counterparties → It is not possible to quote the receivable in euros → It is not possible to receive now
 - Split the risk ✓
 - Leading and Lagging ✗

B) Hedge the exposure

- Transaction risk → Hedge exposure → Liquid market → Reduce payoff volatility
 - Forward ✓



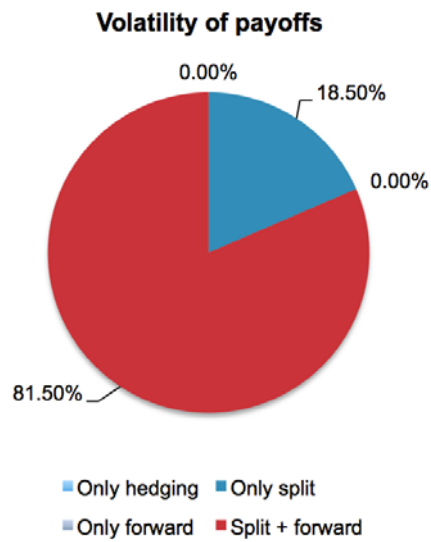
*Source: Bloomberg (as of 22.05.2014)

4 Conclusions

Payoffs' simulation

Strategy	Percentage
No hedging	30.0%
Only split	10.6%
Only forward	0.0%
Split + forward	59.4%

- ✓ Based on one thousand observations, the strategy with the highest payoff is a **combination between splitting the risk and buying a forward contract**
- ✓ This statement holds true for 59.4% of the possible scenarios, far more efficient than the current hedging strategy

Lowest Volatilities – Ruble example (Source: CEMS Business Project)

Note: In 82% of the cases, splitting the risk combined with a forward have the lowest volatility

Appendix 7 – Numerical example applied to the Lira (Source: CEMS Business Project)

1 Context

- **Subsidiary:** Italy
- **Counterparty:** Turkish supplier and customer
- **Total exposure:** Payable 3 months (TRY 1mn) and receivable 6 months (TRY 1,500,000)
- **Current spot rate EUR/TRY:** 2.86*
- **Forecasted spot rate in 3/6 months:** 2.63-3.31/2.68-3.72 normally distributed with a 95% confidence level
- **Three months/six months EUR/TRY forward rate:** 2.93/2.99*
- **Lagging penalty:** 8%

2 Decision tree solution and requirements fulfillment

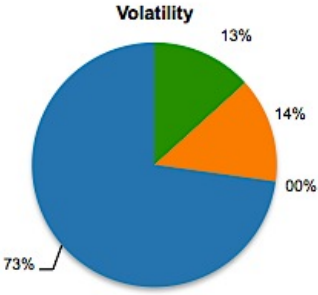
A) Reduce the exposure

- Transaction risk → Reduce the exposure → The company is dependent on counterparties → It is not possible to quote the receivable in euros → It is not possible to receive now
 - Split the risk ✗
 - Lagging ✓

B) Hedge the exposure

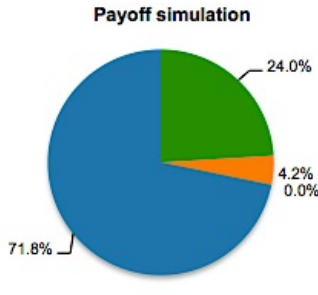
- Transaction risk → Hedge exposure → Liquid market → Reduce payoff volatility
 - Forward ✓

3 Sensitivity analysis



- ✓ When looking at the volatility of each solution versus the current exposure, it is clear that **forward contracts do not seem efficient in this context**
- ✓ Overall, **lagging is an interesting solution to reduce both volatility and hedging costs**

4 Conclusions



- ✓ Based on one thousand observations, **lagging the payable combined with a forward contract yields the highest payoff on 71.8% of the observations**
- ✓ In 24% of the cases, no hedging is still the best solution, although it depends on the company's risk profile

*Source: Bloomberg (as of 22.05.2014)

Appendix 8 – Numerical example applied to the Zloty (Source: CEMS Business Project)

1 Context

- **Subsidiary:** Italy
- **Counterparty:** Polish supplier
- **Total exposure:** Payable 3 months (PLN 1,000,000)
- **Current spot rate (EUR/PLN):** 4.18*
- **Forecasted spot rate in three months:** 3.8-4.4 normally distributed with a 95% confidence level
- **3 months home loan interest rate:** Euribor + Indesit spread = 1.8%*
- **Annual local deposit interest rate:** 0.6% (Source: BPH Bank)

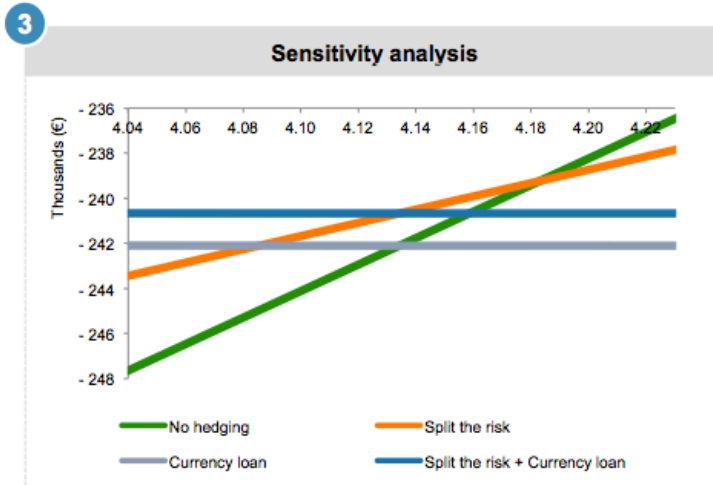
2 Decision tree solution and requirements fulfillment

A) Reduce the exposure

- Transaction risk → Reduce the exposure → The company is dependent on counterparties → It is not possible to quote the receivable in euros → It is not possible to receive now
- Split the risk ✓
- Leading and Lagging ✗

B) Hedge the exposure

- Transaction risk → Hedge exposure → Liquid market → Reduce payoff volatility
- Currency loan ✓



*Source: Bloomberg (as of 22.05.2014)

4 Conclusions

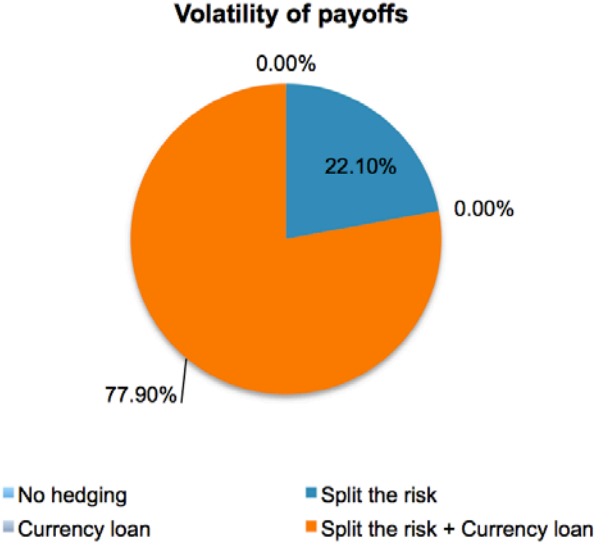
Payoffs' simulation

Strategy	Percentage
No hedging	31.1%
Split the risk	11.2%
Currency loan	0.0%
Split the risk + Currency loan	57.7%

- ✓ Based on one thousand observations, **splitting the risk combined with a currency loan provides the lowest payable amount with zero volatility** based on this context
- ✓ Not hedging yields the second best result in only 31.1% of the cases

Note: For further statistics about volatility of payoffs, see appendix 9

Lowest Volatilities – Zloty example



Appendix 9 – Numerical example applied to the Pound (Source: CEMS Business Project)

1 Context

- **Subsidiary:** Italy
- **Counterparty:** UK customer and supplier
- **Total exposure:** Receivable (GBP 3mn), Payable (GBP 500k)
- **Current spot rate EUR/GBP:** 0.81*
- **Forecasted spot rate EUR/GBP in 3/6 months:**
0.75-0.85/0.74-0.86 normally distributed with a 95% confidence level
- **Strike call/put option assumed (EUR/GBP):** 0.85/0.79

2 Decision tree solution and requirements fulfillment

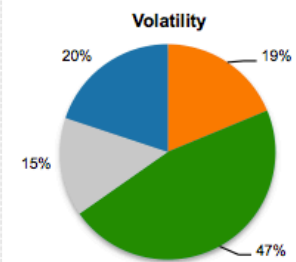
A) Reduce exposure

- Transaction risk → Reduce exposure → Dependent on counterparty → Not possible to quote in domestic currency → Not possible to demand payment/pay now
 - Split the risk ✗
 - Leading ✓

B) Hedge exposure

- Transaction risk → Liquid market → Insure against loss
 - Options
 - Range forward ✓

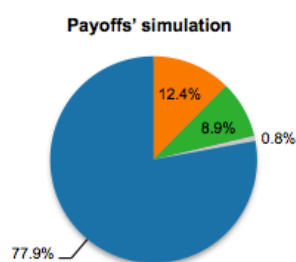
3 Sensitivity analysis



- ✓ When looking at payoffs' volatility, **leading the payable is the best solution** (47% of the cases), followed by no hedge (19% of the cases)
- ✓ However, in a relatively stable currency such as the GBP, volatility can be considered a secondary issue

- No hedging
- Leading
- Leading+Option
- Option

4 Conclusions



- ✓ In terms of payoffs, **leading combined with a range forward is clearly the best strategy that yields the best outcome** (77.9% of the observations)
- ✓ Even though the chosen option requires no premium, this solution has a low payoff due the limited upside

- No hedging
- Leading
- Leading+Option
- Option

*Source: Bloomberg (as of 22.05.2014)

Appendix 10 – Numerical example applied to the Hryvnia (Source: CEMS Business Project)

1 Context

- **Subsidiary:** Italy
- **Counterparty:** Ukrainian customer
- **Total exposure:** Receivable 3 months (UAH 3,000,000)
- **Current spot rate EUR/UAH:** 16.3*
- **Forecasted spot rate EUR/UAH in 3 months:** 13.9-18.8 normally distributed with a 95% confidence level
- **Forecasted spot rate EUR/RUB in 3 months:** 41.3-55.8 normally distributed with a 95% confidence level
- **Three months EUR/RUB forward rate:** 47.9*

2 Decision tree solution and requirements fulfillment

A) Reduce the exposure

- Transaction risk → Reduce the exposure → The company is dependent on counterparties → It is not possible to quote the receivable in euros → It is not possible to receive now
- Split the risk ✓
- Leading and Lagging ✗

B) Hedge the exposure

- Transaction risk → Hedge exposure → Illiquid market
- Cross hedge ✓
- NDF ✗

3 Sensitivity analysis

Strategy	Percentage
No hedging	0.0%
Split the risk	54.1%
Cross hedge	0.0%
Split risk + cross hedge	45.9%

- ✓ In an uncertain market such as the Ukrainian, **splitting the risk is the best strategy in 54.1% of the cases from a volatility point of view**
- ✓ Even in an illiquid market, cross hedging combined with a risk split is the best solution in 45.9% of the cases

4 Conclusions

Strategy	Percentage
No hedging	47.7%
Only split	6.4%
Only cross hedge	39.8%
Split + cross hedge	6.1%

- ✓ Given the uncertainty around Ukrainian's political context, forecasts imply high volatility and therefore **not hedging poses serious risks on cash flows**
- ✓ **Cross hedging can still be considered as an alternative in case the Ukrainian economy aligns with the Russian**

*Source: Bloomberg (as of 22.05.2014)

Appendix 11 – Numerical example applied to the US Dollar (Source: CEMS Business Project)

1 Context

- **Subsidiary:** Italy
- **Counterparty:** American commodity suppliers
- **Total expected exposure:** Payable 1y (USD 1.8-4.2mn), payable 2y (USD 2.0-8.0mn), payable 3y (USD 1.6-14.4mn) and payable 4y (USD 0-14.4mn), normally distributed at 95% c.l
- **Current spot rate EUR/USD:** 1.36*
- **1y/2y/3y/4y forward rates:** 1.36/1.37/1.39/1.42*
- **Percentages hedged:** Payable 1y (100%), payable 2y (90%), payable 3y (80%), payable 4y (70%)

2 Decision tree solution and requirements fulfillment

A) Reduce exposure

- Economic risk → Reduce exposure
 - Mixing sales ❌
 - Production relocation ❌

B) Hedge exposure

- Economic risk → Hedge exposure
 - Layered strategy ✅

3 Sensitivity analysis

Strategy	Percentage
Layered strategy	46%
Full hedge	40%
No hedging	14%

✓ From a volatility point of view, a **layered strategy composed by forward contracts is better than a full hedge** due to high hedging costs and to uncertainty of future cash flows

4 Conclusions

Strategy	Percentage
Layered strategy	36.4%
Full hedge	36.1%
No hedging	27.5%

✓ There is a trade off between volatility and potential payoff

✓ If the company adopts a 'risk-taker' profile, not hedging carries more volatility but higher payoff

✓ Given the uncertainty of long term horizon, **hedging economic risk via financial instruments becomes less efficient from a payoff point of view**

*Source: Bloomberg (as of 22.05.2014)

Appendix 12 – Assumption about choosing Russia

This Project was based on a pre-Ukraine crisis situation. It is possible that these circumstances suffer changes as a consequence of Russia fearing sanctions from the US.

Appendix 13 – Formula used to calculate the cost of debt

$$r_d = (1 - \text{probability of default}) \cdot (1 + \text{yield}) + (\text{recovery rate} \cdot \text{probability of default}) - 1$$

Appendix 14 – Calculating the cost of debt

Discount rates (cost of debt)	
Russia	
10yr Yield Russia	8,43%
Recovery rate	41,5%
Prob. default	0,19%
Russia Rating	Baa1
Cost of debt	8,30%

Appendix 15 – Average of the EUR/RUB spot rates estimated by Monte-Carlo simulation

Spot rates EUR/RUB estimated by MC	
Spot rate t=1	46,9
Spot rate t=2	47,4
Spot rate t=3	49,4
Spot rate t=4	53,0
Spot rate t=5	59,3

Appendix 16 – Average of the 12-months Euribor estimated by Monte-Carlo simulation

12-months Euribor estimated by MC	
Euribor 1y	0,592%
Euribor 2y	0,638%
Euribor 3y	0,766%
Euribor 4y	1,002%
Euribor 5y	1,247%

Appendix 17 – Total interest rates of a loan in Italy

Total interest rate of a loan in Italy	
Interest rate 1y	3,28%
Interest rate 2y	3,33%
Interest rate 3y	3,46%
Interest rate 4y	3,69%
Interest rate 5y	3,94%

Appendix 18 – EUR/RUB forward rates (Bloomberg as of 04.06.2014)

EUR/RUB forward rates	
Forward rate 1y	51,9
Forward rate 2y	56,0
Forward rate 3y	60,0
Forward rate 4y	64,0
Forward rate 5y	68,0

Appendix 19 – Strikes of Out-of-the-money Call and put options calculated by the Black-Scholes model

Call/put	Strikes
EUR/RUB Spot rate t=0	46,69
Call strike 1y	57,0
Put strike 1y	46,7
Call strike 2y	65,0
Put strike 2y	45,8
Call strike 3y	77,0
Put strike 3y	45,2
Call strike 4y	88,0
Put strike 4y	46,3
Call strike 5y	105,0
Put strike 5y	45,5

Appendix 20 – Average of the Russian refinancing rates estimated by Monte-Carlo simulation

Russian ref. Rate estimated by MC	
Russian ref. rate 1y	7,7%
Russian ref. rate 2y	8,1%
Russian ref. rate 3y	9,4%
Russian ref. rate 4y	11,2%
Russian ref. rate 5y	14,0%

Appendix 21 – Total interest rate when borrowing in Russia

Total interest rate of a foreign loan	
Interest rate 1y	9,5%
Interest rate 2y	10,0%
Interest rate 3y	11,3%
Interest rate 4y	13,0%
Interest rate 5y	15,8%

Appendix 22 – NPV breakdown per solution

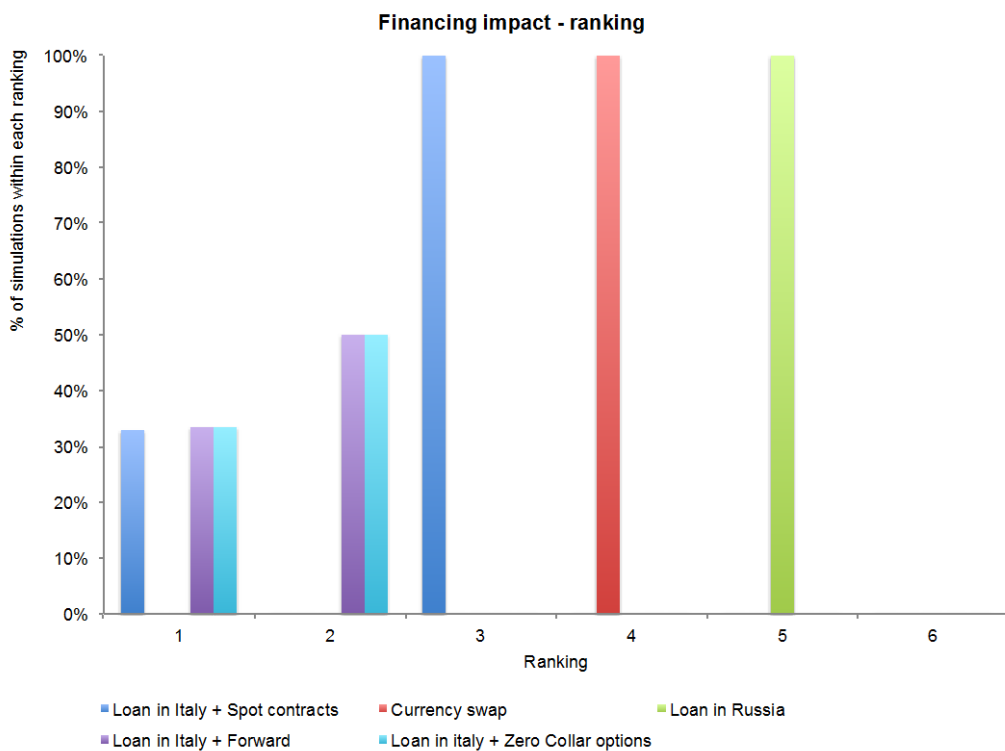
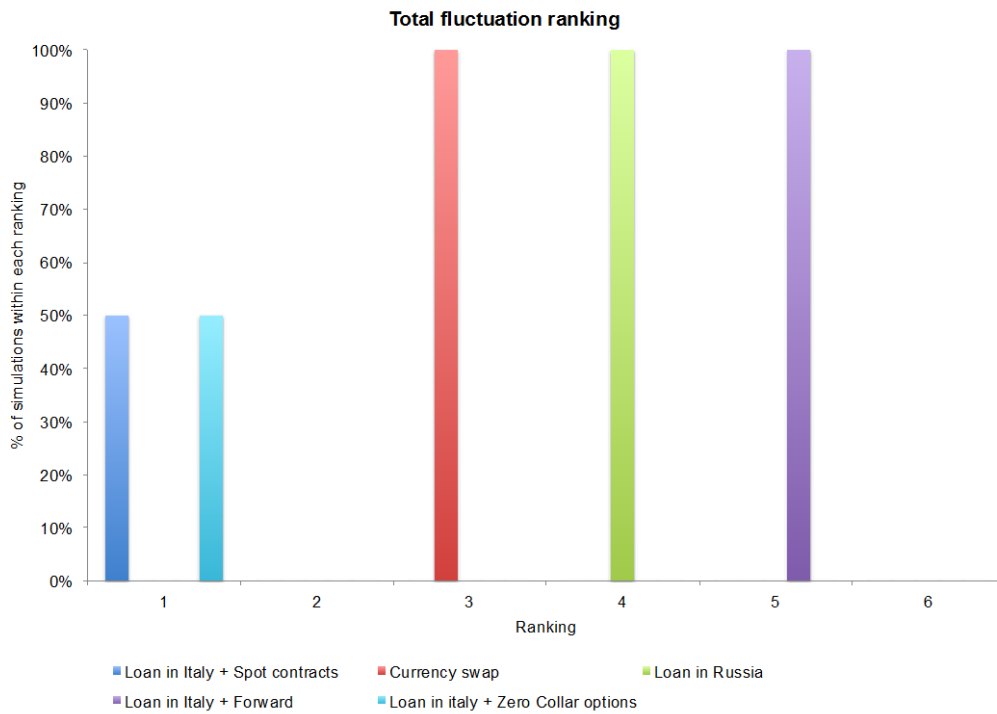
Individual analysis			
Hedging solution	Total fluctuation	Fin.cost impact	Currency impact
Loan in Italy + Spot contracts	-493,037,335.6	-1,224,930,105.0	731,892,769.3
Currency swap	103,906,484.4	103,906,484.4	0.0
Loan in Russia	603,022,820.3	603,022,820.3	0.0
Loan in Italy + Forward	1,111,121,561.3	-1,224,930,105.0	2,336,051,666.3
Loan in Italy + zero collar option	-563,055,755.3	-1,224,930,105.0	661,874,349.7

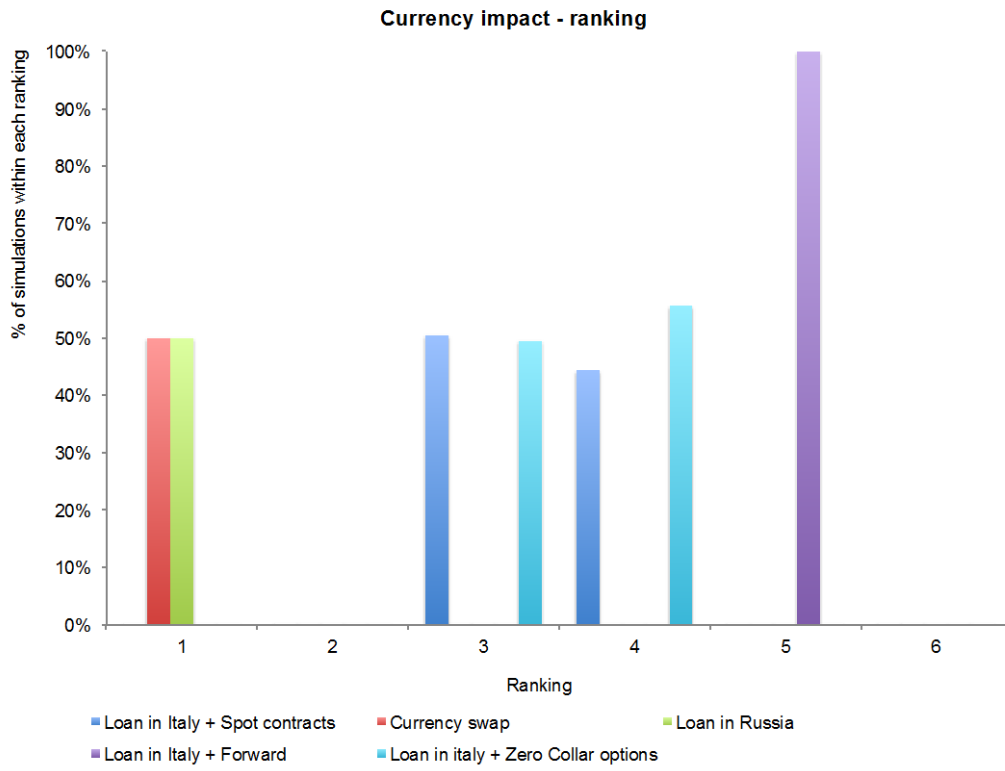
Appendix 23 - Even though a final decision cannot be extracted from a total fluctuation point of view, as it does not ensure the lowest absolute PV of currency impact, using zero collar options yields the most beneficial NPV (RUB 563 million).

Appendix 24 – Comparison with borrowing in Russia

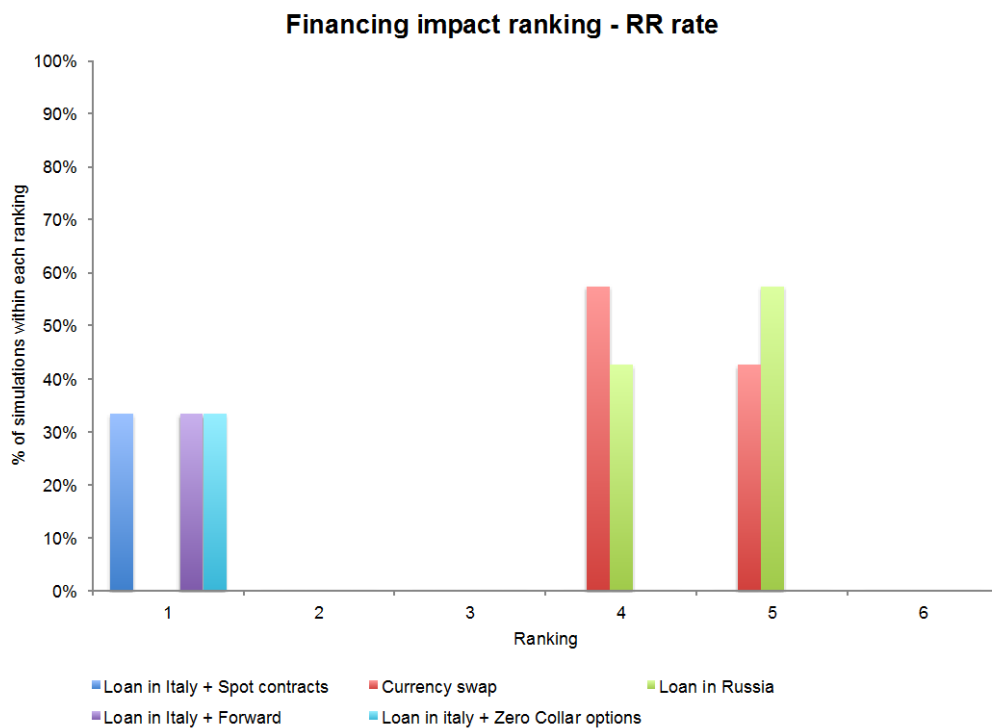
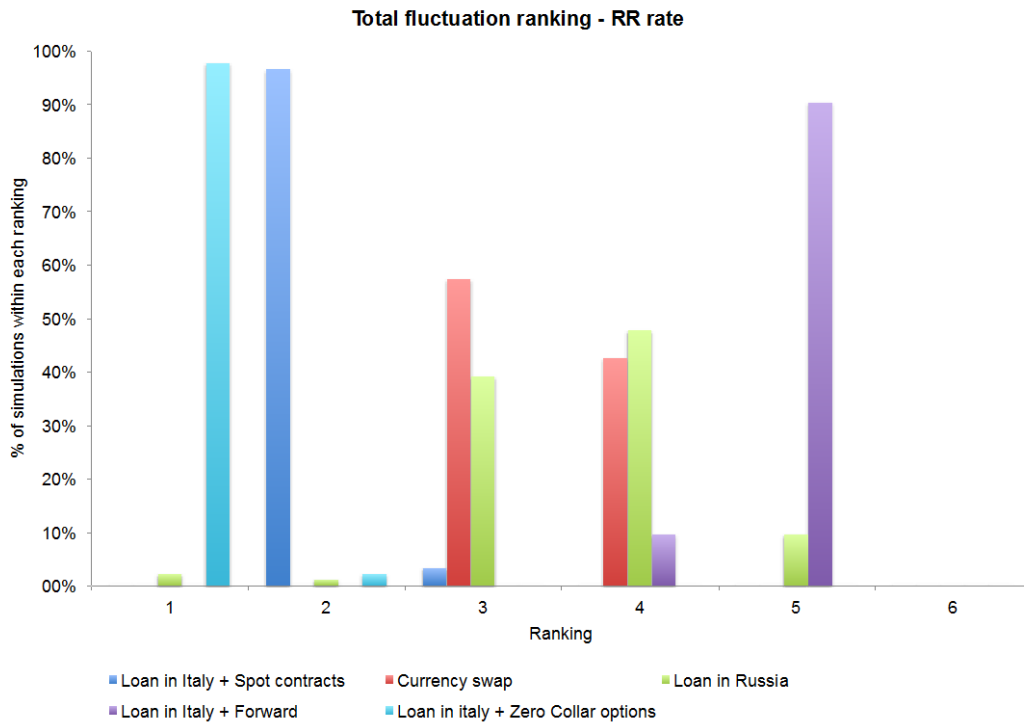
Comparative analysis (vs Borrowing in Russia)			
Hedging solution	Δ NPV	Δ Financing impact	Δ Currency impact
Loan in Italy + Spot contracts	-1,096,060,156.0	-1,827,952,925.3	731,892,769.3
Currency swap	-499,116,335.9	-499,116,335.9	0.0
Loan in Russia	0.0	0.0	0.0
Loan in Italy + Forward	508,098,741.0	-1,827,952,925.3	2,336,051,666.3
Loan in Italy + zero collar option	-1,166,078,575.6	-1,827,952,925.3	661,874,349.7

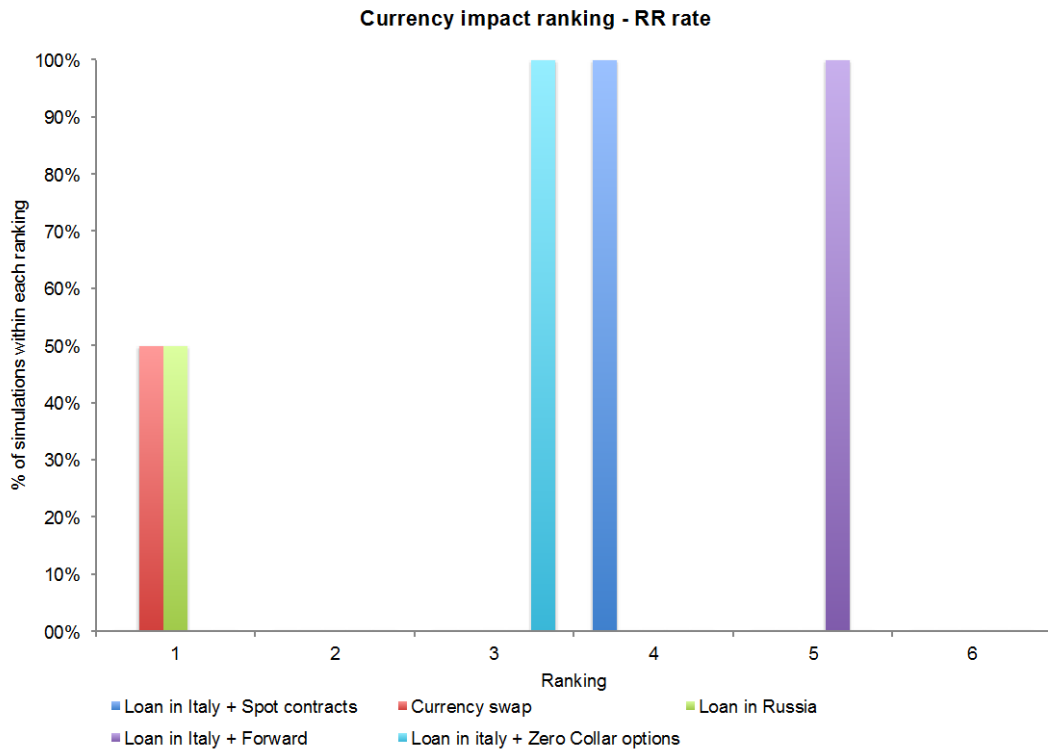
Appendix 25 – 12-months Euribor sensitivity analysis





Appendix 26 – Russian refinancing rate: sensitivity analysis





Appendix 27 – Varying the 12-Months Euribor and Russian refinancing rate simultaneously sensitivity analysis

